

# **SYLLABUS**

## **FOR**

# **AUTOMOBILE ENGINEERING**

Prepared by  
A.P. Patra (Sr.Lecture) Deptt. of Automobile Engineering  
BOSE, Cuttack

3<sup>rd</sup>  
SEMESTER

AUTO ENGG

## ENGINEERING MATERIAL

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Material Classification	05
2.	Imperfection in crystal Ferrous metal & Alloys	12
3.	Iron carbon system	10
4.	Heat Treatment	16
5.	Nonferrous metal & Alloys	12
6.	Bearing material	04
7.	Spring material	03
8.	Polymers	06
9.	Composites & Ceramic	07
Total =		75

### **RATIONALE:**

Entire field of engineering deals with use of host of materials for making objects for human consumption. These materials include wide spectrum of elements, metals, alloys and compounds with diverse properties. It is imperative that an engineer from any field should have a good knowledge of such materials and their properties.

### **OBJECTIVES:**

On completion of the subject students will be able to

1. Classify the material into ferrous and nonferrous alloys and select proper material considering the requirement of service condition.
2. Explain crystal imperfection and effect of imperfection on metal properties as well as deformation of metals, properties change by deformation.
3. Explain the iron carbon equilibrium diagram.
4. Explain the purposes and methods of heat treatment.
5. Explain the predominating elements of nonferrous alloys and their properties as well as uses.
6. Comprehend the predominating elements of bearing material and their uses.
7. Comprehend the predominating elements of spring material and their uses.

### **COURSE CONTENTS:**

#### **1. Material Classification (5 periods)**

- 1.1 Classify material into ferrous and nonferrous metals and alloys.
- 1.2 Understand factors affecting the selection of materials for engineering.  
Purposes such as
  - (a) Properties of materials
  - (b) Performance requirements
  - (c) Materials reliability
  - (d) Safety
  - (e) Physical attributes.

- (f) Environmental conditions
- (g) Availability
- (h) Disposability
- (i) Economic factors

## **2. Imperfection in crystal (12 periods)**

- 2.1 Explain crystal, idea crystal and crystal imperfection.
- 2.2 Classify crystal imperfections or defects such as point defects, line defects, surface or grain boundaries defect and volume defects.
- 2.3 Explain types of point defects such as vacancies, interstitialies and impurities.
- 2.4 Explain types of line defects such as edge dislocation and screw dislocation.
- 2.5 State various causes of dislocation.
- 2.6 Explain effect of imperfection on metal properties.
- 2.7 Explain deformation by slip.
- 2.8 Explain deformation by twinning.
- 2.9 Explain property changes by deformation.

## **3. Iron carbon system. (10 periods)**

- 3.1 Understand basic concept of phase diagram cooling curves.
- 3.2 Explain the iron carbon equilibrium diagram with salient micro constituent of iron and steel.

## **4. Heat treatment. (16 periods)**

- 4.1 Explain purpose of heat treatment.
- 4.2 Describe processes of heat treatment and elaborate the method of annealing, normalizing, hardening, tempering, mar tempering, age hardening and surface hardening methods.
- 4.3 List effect of heat treatment on the properties of steel.
- 4.4 Explain hardenability of steel.

## **5. Non ferrous alloys. (12 periods)**

- 5.1 Describe composition, properties and the uses of
  - 5.1.1 Aluminium alloys such as duralumin,  $\gamma$ -alloy.
  - 5.1.2 Copper alloys such as
    - 5.1.2.1 Copper Aluminium (the Aluminium bronzes)
    - 5.1.2.2 Copper-tin-antimony (babbit metal)
    - 5.1.2.3 Copper-tin (tin bronzes)
    - 5.1.2.4 Copper-tin-phosphorous (phosphor bronzes)
    - 5.1.2.5 Copper Zinc (brass)
    - 5.1.2.6 Copper nickel (the cupro-nickels)
  - 5.1.3 Predominating elements of lead alloys
  - 5.1.4 Predominating elements of zinc alloys.
  - 5.1.5 Predominating elements of nickel alloys.
- 5.2 Name the alloys for high temperature service & metals for nuclear energy.

## **6. Bearing material. (4 periods)**

- 6.1 Classify bearing metals.
- 6.2 Describe composition, properties and use of copper-base bearing metal, tin-base bearing metal, lead-base bearing metal and cadmium-base bearing metal.

## **7. Spring material (3 periods)**

- 7.1 List types and properties of iron-base spring material.
- 7.2 List types and properties of copper-base spring material.

**8. Polymers (6 periods)**

- 8.1 List properties and application of thermo-plastic and thermo-setting plastics.
- 8.2 List properties of elastomers.

**9. Composites and ceramics. (7 periods)**

- 9.1 Classify of composite material.
- 9.2 Explain particle-reinforced & fiber reinforced composites and their properties.
- 9.3 Classify and state application of ceramics.

**RECOMMENDED BOOKS:**

- 1. Materials science & processes by S.K.Hazra Choudhury
- 2. A text book of material science and metallurgy by O.P.Khanna.
- 3. A text book of material science by G.B.S.Narang.
- 4. Science of engineering materials by Srivastava and Srinivasan.
- 5. Engineering Materials & Metallurgy By R.K Rajput. S.Chand

## HYDRAULICS AND PNEUMATIC CONTROL

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Properties of fluids.	06
2.	Bernoulli's equation and its application	06
3.	Flow through pipes	07
4.	Impact of jet	07
5.	Centrifugal pumps	07
6.	Reciprocating pumps	08
7.	Pressure Control Valves	08
8.	Hydraulic Symbols – ANSI Symbols	02
9.	Hydraulic Circuits	08
10.	Fundamentals of Pneumatics	08
11.	Logic Controls in Fluid Power Systems	08
		Total = 75

### **RATIONALE:**

The study of Hydraulic and Pneumatic Controls in engineering field is of great importance. It is therefore necessary to study the physical properties and characteristics of fluids and air which have very important use and application in automobile engineering.

Actual use of or action by various liquids like water and oil can be realized by a group of machines called fluid machines. Automobile students should be conversant with design, operation and use of these hydraulic/ Pneumatic machines.

On the completion of the subject students will be able to learn.

### **OBJECTIVES:**

1. Understand various properties of fluids and pressure of fluid with pressure measuring devices.
2. Understand the behaviour of fluids in motion through closed Condit.
3. Evaluate fictional loses during flow of liquid through pipes.
4. Analyse forces during impact of jet.
5. Explain the working of centrifugal pumps.
6. Explain the working of reciprocating pumps.
7. To understand Pressure Control Valves
8. To understand Hydraulic Symbols – ANSI Symbols
9. To understand Hydraulic Circuits
10. To understand Fundamentals of Pneumatics
11. To understand Logic Controls in Fluid Power Systems

### **COURSE CONTENTS:**

#### **1. Properties of a fluid (6 periods)**

- 1.1 Define a fluid.
- 1.2 Classify fluids.
- 1.3 Define various fluid properties such as density, specific weight, specific gravity, viscosity and surface tension and state the units.
- 1.4 Define fluid pressure.
- 1.5 Classify fluid pressure.
- 1.6 Explain working of various measuring devices for pressure.
- 1.7 Solve numerical problem involving the principle manometers of simple, differential and inverted types.

## **2. Bernoulli's equation & its application (6 periods)**

- 2.1 State various types of flow
- 2.2 State & prove equation of continuity for one-dimensional flow.
- 2.3 State various energies of fluid.
- 2.4 State & prove Bernoulli's theorem.
- 2.5 State the limitations of same
- 2.6 Specify application of Bernoulli's equation.
- 2.7 Explain the working of ventury meter, Pitot tube.
- 2.8 Derive equation of flow rate and velocity with respect to ventury meter and Pitot tube respectively.
- 2.9 Explain the working of flow meter: current meter
- 2.10 Solve numerical problem on above.

## **3. Flow through pipes. (7 periods)**

- 3.1 Define a pipe.
- 3.2 State laws of fluid friction.
- 3.3 Mention the equation of loss of head through pipe due to friction.
- 3.4 State Darcy's formula and Chazy's formula.
- 3.5 Explain hydraulic gradient and total energy line.
- 3.6 Define nozzle & state its application.
- 3.7 Derive the expression of power transmission through nozzle.
- 3.8 Compute the condition of maximum power transmission through nozzle.
- 3.9 State the expression for diameter of nozzle for maximum power transmission.
- 3.10 Solve numerical problems on above.

## **4. Impact of Jet. (7 periods)**

- 4.1 Estimate impact of jet on flat surface.
  - 4.1.1 Determine impact of jet on fixed flat plate,
  - 4.1.2 Solve numerical problems on above.
- 4.2 Estimate impact of jet and work done on moving flat surface.
  - 4.2.1 Estimate impact of jet and work done on series of flat plates fixed on rim of a cylinder.
    - 4.2.1.1 Derive the condition for maximum hydraulic efficiency out of such system.
  - 4.2.2 Solve numerical problems on above.
- 4.3 Draw velocity triangle for jet impinging tangentially in curved vane.
  - 4.3.1 Estimate work done and efficiency of above system.

## **5. Centrifugal pump. (7 periods)**

- 5.1 Classify pumps.
  - 5.1.1 Centrifugal pumps.
- 5.2 Describe construction and working of centrifugal pump.
  - 5.2.1 Explain various types of Casings, such as volute, vortex and different user types.
- 5.3 Draw velocity triangle for a single vane of impeller.
- 5.4 Compute the work done for same.
  - 5.4.1 Define various heads of centrifugal pumps.
  - 5.4.2 Define manometric efficiency, mechanical efficiency and over all efficiency of centrifugal pump.
  - 5.4.3 Solve numerical problems on above.
- 5.5 Define manometric starting speed.
  - 5.5.1 Derive the expression for minimum starting speed.
- 5.6 explain the working of multistage pumps.
- 5.7 Explain priming of centrifugal pumps with various priming procedure used.
- 5.8 state the method of prevention of air intake for centrifugal pumps.

## **6. Reciprocating pumps. (8 periods)**

- 6.1 Describe construction and working of single acting reciprocating pump.
  - 6.1.1 Describe construction and working of double acting reciprocating pump.
- 6.2 Define Slip.
  - 6.2.1 State positive and negative slip.
  - 6.2.2 Establish relationship between slip & coefficient of discharge.
- 6.3 Derive the formula for HP required to drive.
  - 6.3.1 Single acting reciprocating pump.
  - 6.3.2 Double acting reciprocating pump.
- 6.4 Solve numerical problems on above.

## **7. Pressure Control Valves. (8 Periods)**

- Relief Valves
  - Simple Type
  - Pilot Operated (Compound) Relief Valve
  - Poppet Relief Valve
  - Pressure Sequence Valve
  - Pressure Reducing Valve
  - Unloading Valve
  - Counter Balance Valve
  - Brake Valve
- Exercise on Pressure Control Valves
- Direction Control Valves
  - Poppet Valves
    - Operation of Simple Poppet Valve
      - 7.13.1 Spool Valves
      - 7.13.2 Sliding Spool Type DCV
      - 7.13.3 Check Valves
  - 7.14 Two-way Direction Control Valve – Spool Type
  - 7.15 Four- way Valves
  - 7.16 Pilot Operated DCV
  - 7.17. Flow Control Valves
  - 7.18 Non-Pressure Compensated Pressure Control Valves
  - 7.19 Pressure/ Temperature Compensated Flow Control Valves
  - 7.20 Flow Control Methods
    - 7.20.1 Meter-in Circuit
    - 7.20.2 Meter-out Circuit
    - 7.20.3 Bleed-off Circuit

## **8 .Hydraulic Symbols – ANSI Symbols (02 Periods)**

- 8.1 Flow Lines
- 8.2 Reservoirs
- 8.3 Pumps
- 8.4 Direction Control Valves
- 8.5 Flow Control Valves
- 8.6 Pressure Control Valves
- 8.7 Motors
- 8.8 Check Valves
- 8.9 Cylinders
- 8.10 Filters
- 8.11 Heat Exchangers

## **9. Hydraulic Circuits (08 Periods)**

- 9.1 Single Acting Cylinder Circuit
- 9.2 Double Acting Cylinder Circuit
- 9.3 Regenerative Circuit
- 9.4 Pump Unloading Circuit
- 9.5 Counter Balance Valve Application
- 9.6 Machine Tool Applications
- 9.7 Application of Check Valves
- 9.8 Application of Sequencing Valves
- 9.9 Application of Unloading Valve and Two Pumps
- 9.10 Application of Pressure Intensifier (Punching Press)
- 9.11 Design of Circuits to Achieve Synchronization
  - 9.11.1 Synchronizing Cylinders by Connecting them in Parallel
  - 9.11.2 Synchronizing Cylinders by Connecting them in Series
  - 9.11.3 Cylinders by Connected in Series will Operate in Synchronization if  $A_{p2} = A_{p1} - A_{r1}$
- 9.12 Fail Safe Circuits/ Industrial Safety Circuits
- 9.13 Accumulator Circuits
  - 9.13.1 Accumulator as Leakage Compensator
  - 9.13.2 Accumulator as Emergency Power Source
  - 9.13.3 Accumulator as Hydraulic Shock Absorber
- 9.14 Design of Hydraulic Circuits
- 9.15 Hydraulic Intensifier
- 9.16 Hydraulic Accumulator
- 9.17 Cylinder Cushioning
- 9.18 Regeneration Circuit
- 9.19 Synchronizing Circuits
- 9.20 Hi – Lo Circuit

## **10. Fundamentals of Pneumatics (08 Periods)**

- 10.1 Physics Fundamentals
- 10.2 Characteristics of Air
- 10.3 Pneumatic System Components
  - 10.3.1 Air Generation and Distribution
  - 10.3.2 Air Preparation
  - 10.3.3 Air Compressors
- 10.4 Reservoirs or Air Receiver
  - 10.4.1 Inlet Filters
  - 10.4.2 Inter Coolers
  - 10.4.3 After Coolers
- 10.5 Safety Relief Valve
- 10.6 Pressure Switches
- 10.7 Air Dryers
- 10.8 Air Distribution
- 10.9 Loop System
- 10.10 Decentralised System
  - 10.10.1 Service Unit
  - 10.10.2 Air Filters
- 10.11 Air Regulators
- 10.12 Air Lubricator
- 10.13 Actuators and output Devices
- 10.14 Motors
- 10.15 Directional Control Valves
  - 10.15.1 Configuration and Construction
- 10.16 Pneumatic Circuits

- 10.16.1 Control of Single Acting Cylinder
- 10.16.2 Manual Controlled Double Acting Cylinder
- 10.16.3 Air Pilot Control of Double Acting Actuator
- 10.16.4 Semi Automatic control of a Double Acting Actuator
- 10.16.5 Two step Speed Control of a cylinder
- 10.16.6 Two Handed Safety Circuit
- 10.17 Combination Circuits
  - 10.17.1 Hydropneumatic or Pneumohydraulic Circuits
  - 10.17.2 Air – over – Oil Circuit
  - 10.17.3 Comparison of Hydraulics, Pneumatics and Hydropneumatics
  - 10.17.4 Mechanical Hydraulic Servo System
  - 10.17.5 Electrohydraulic Servo System
  - 10.17.6 Electro - hydraulic Servo Valve – Two Stage

## **11. Logic Controls in Fluid Power Systems (08 Periods)**

Position Sensors  
 Back Pressure Sensor  
 Pressure Sensors  
 Switching Elements  
 Pneumatic Valves  
 AND Gate Function  
 NOT Gate Function  
 OR Gate Function  
 Moving Part Logic Elements  
 AND MPL Elements  
 OR MPL Elements  
 NOT MPL Elements  
 Fluidic Elements  
 Basic Bistable Flip – Flop  
 Diaphragm Amplifier  
 Application of Fluidics  
 Pneumatic Cylinder Sequencing Circuit Using Logics  
 Control of Pneumatic Cylinder Using Flip – Flops  
 Cascade Method of Designing Fluid Power Circuits  
 Electrical Control of Fluid Power  
 Switches  
 Solenoids  
 Relays  
 Timers  
 Electrohydraulic Circuits  
 PLC in Fluid Power Applications

### **RECOMMENDED BOOKS:**

1. Hydraulics & Hydraulic Machines by Modi & Seth, Standard Book.
2. Hydraulics & Hydraulic Machines by R.K.Bansal.
3. Fluid Mechanics by A.K.Jain, Khanna publishers.
4. Hydraulics and Fluid Mechanics by Jagadish Lal, Metropolitan Book.
5. Hydraulics, Fluid Mechanics and Hydraulics Machines by R.S. Khurmi.
6. Hydraulic and Pneumatic Controls by K.Shanmugas Sundaram. S.Chand

## STRENGTH OF MATERIAL

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End Exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Simple stress and strain	05
2.	Two dimensional stress system	07
3.	Stress in composite selection	07
4.	Thin cylindrical and spherical shells	07
5.	Bending moments and shear force	09
6.	Theory of simple bending	09
7.	Combined axial and bending stress	09
8.	Torsion	09
9.	Spring	07
10.	Testing of materials	06
Total =		75

### **RATIONALE:**

Strength of material deals with the internal behaviour of solid bodies under the action of external forces. The subject focuses on mechanical properties of materials, analysis of stress, strain and deformations. Therefore, it is an important basic subject of the students for mechanical and automobile engineering.

### **OBJECTIVES:**

On completion of the subject students will be able to

1. Define stress, strain, elastic constants and compute the relationship between the elastic constants and their application in solution of simple problems.
2. Understand the concept of principal stress, planes and their application in solution of simple problems.
3. Find out the stress, and strain due to various types of loading and solve the problems.
4. Understand the hoop stress, longitudinal stress of thin cylinder and sphere and solve the problems.
5. Draw the shear force and bending moment diagram of various types of loaded beams.
6. Define bending stress, section modulus, flexural rigidity and moment of resistance and solve the simple problems.
7. Find out the total stress developed in column under eccentric loading.
8. Establish the relationship between torques, polar moment of inertia, angle of twist, and solve the problems.
9. To study about different types of Springs.
10. Develop concept of various types of testing of materials.

### **COURSE CONTENTS:**

#### **1. Simple stress and strain (5 periods)**

- 1.1 Recall the various types of loads, stresses, strain, elastic constant, Poisson's ratio.
- 1.2 Establish the relation between free elastic constants (E, G, K)

#### **2. Two dimensional stress systems. (7 periods)**

- 2.1 Determine normal stress, shear stress and resultant stress on oblique plane.
- 2.2 Define principal plane.
- 2.3 Define principal stress.

- 2.4 Determine principal plane, principal stresses analytically.
- 2.5 Determine principal stresses from mohr's circle.
- 3. Stresses in composite section. (7 periods)**
- 3.1 Solve simple problems using principle of super position.
- 3.2 Determine stresses in composite bar.
- 3.3 define temperature stress.
- 3.4 Determine temperature stress in composite bar (single core only)
- 3.5 Define strain energy and resilience.
- 3.6 Determine stresses due to gradually applied, suddenly applied and impact load.
- 4. Thin cylinder and spherical shells under internal pressure. (7 periods)**
- 4.1 State assumptions for thin shells.
- 4.2 Define hoop stress and longitudinal stress.
- 4.3 Define hoop strain and longitudinal strain.
- 4.4 Compute hoop stress, longitudinal stress, hoop strain, longitudinal strain and volumetric strain.
- 4.5 Compute the change in length, diameter and volume.
- 5. Bending moment and shear force. (9 periods)**
- 5.1 State types of beam and loading.
- 5.2 Define and explain shear and bending moment, shear force diagram and bending moment diagram.
- 5.3 Determine the B.M. and S.F. by analytical method. Subjected to concentrated load, uniformly distributed load for:
- 5.3.1 Cantilever beam.
- 5.3.2 Simply support beam.
- 5.3.3 Over hanging beam
- 5.3.4 Draw the S.F and B.M diagram for clauses in 5.3.1., 5.3.2., 5.3.3
- 5.4 Define point of contraflexure.
- 5.4.1 Determine the point of contra flexure.
- 6. Theory of simple bending. (9 periods)**
- 6.1 State various types of sections (symmetrical, unsymmetrical and built up sections)
- 6.2 State the assumption for simple bending.
- 6.3 Derive the relation  $M/I = F/y = E/R$ .
- 6.4 Define the section modulus, flexural rigidity and moment of resistance.
- 6.5 Explain the distribution of bending stress across T, & I sections.
- 6.6 Solve simple problems on above.
- 7. Combined axial and bending stress. (9 periods)**
- 7.1 Define columns (long and short)
- 7.2 Derive the maximum stress developed in short column under eccentric loading.
- 7.3 Define crippling load.
- 7.4 State the formula (no derivation) for crippling load under various end conditions.
- 8. Torsion. (9 periods)**
- 8.1 Define torsion.
- 8.2 State the assumption of pure torsion.
- 8.3 Derive the relation  $T/P = fs/r = G\theta/l$ .
- 8.4 Differentiate between the strength of hollow and solid shaft.
- 8.5 Solve simple problems on above.
- 8.6 Determine the stresses under twisting and bending moments.

**9. Spring.(7 Periods)**

- 9.1 Introduction
- 9.2 Stiffness of a Spring
- 9.3 Types of Springs
- 9.4 Bending Springs
- 9.5 Torsion Springs
- 9.6 Forms of Springs
- 9.7 Carriage Springs or Leaf Springs(Semi - elliptical Type)
- 9.8 Leaf Springs (Quarter - elliptical Type)
- 9.9 Helical Springs
- 9.10 Closely Coiled Helical Springs
- 9.11 Closely Coiled Helical Springs Subjected to an Axial Load
- 9.12 Closely Coiled Helical Springs Subjected to an Axial Twist
- 9.13 Open - Coiled Helical Springs
- 9.14 Springs in Series and Parallel

**10. Testing of material. (6 periods)**

- 10.1 Explain with neat sketch the following tests for mild steel specimen
  - 10.1.1 Tensile test.
  - 10.1.2 Hardness test.
  - 10.1.3 Torsion test.
  - 10.1.4 Creep and fatigue.

**RECOMMENDED BOOKS:**

- 1. Strength of material by S. Ramamrutham, Dhanpat Rai pub. Co.
- 2. Strength of material by I.B.Prasad
- 3. Elements of strength of materials by Timoshenko and young, Affiliated East west press.
- 4. Theory and problems of strength of materials by W.A. Nash Shaum's Outline Series, Mc Graw Hill Inc.
- 5. Strength of Materials by R.S. Khurmi.
- 6. Strength of Materials by R.K.Rajput, S.Chand.

# MANUFACTURING TECHNOLOGY - 1

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

## TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Forging	10
2.	Metal Forming	10
3.	Foundry	20
4.	Welding	18
5.	Soldering & brazing	05
6.	Rivetting	05
7.	Sheet metal works	07
		Total = 75

### **RATIONALE:**

Engineering basically means production of goods and services for human consumption. The major function of mechanical engineering is to manufacture various products using machineries, production processes and production management techniques. Therefore, this is one of the most important subjects to be learned by a mechanical and automobile engineer.

### **OBJECTIVES:**

On completion of the subject the students will be able to

1. Describe various hearth and furnaces, tools and appliances, various forging process.
2. Explain different metal forming process such as rolling and extrusion.
3. Describe the various foundry tools and process such as pattern making, moulding, melting and pouring.
4. Understand the purpose of welding and explain various welding process with welding defect and safety precautions.
5. Define soldering and brazing and describe same processes.
6. Classify rivets, differentiate between cold rivet and hot rivet and describe the procedure.
7. Describe the different types of metal used in sheet metal works with their engineering application and explain different sheet metal hand tools and operation.

### **COURSE CONTENTS:**

#### **1. Forging (10 periods)**

- 1.1 Describe open and closed hearth heating furnaces.
- 1.2 Explain different forging hand tools with size, specification and uses.
- 1.3 Describe various forging process such as hand forging, machine forging, drop forging, stamping, bending and wire drawing.

#### **2. Metal forming (10 periods)**

- 2.1 Explain fundamentals of rolling & extrusion.
- 2.2 Describe various rolling process and specify the field of application with limitation.
- 2.3 Describe different types of extrusion process such as direct, indirect and impact extrusions with field of application.

#### **3. Foundry (20 periods)**

- 3.1 Describe various foundry tools and their uses.
- 3.2 Describe construction of core and core boxes.
- 3.3 Classify different pattern and state various pattern allowances.
- 3.4 Describe different method of moulding and core making.

- 3.5 Explain different types of moulding sands with their composition and properties and specify different binding material.
- 3.6 Describe construction and working cupola furnace and induction furnace.
- 3.7 Describe construction and working of furnaces such as crucible and pit furnace.
- 3.8 Explain different methods of pouring with pouring equipments such as ladle and lifting tackles.
- 3.9 List various casting defects with their causes and remedies.

#### **4. Welding (18 periods)**

- 4.1 Define welding, classify various welding process and explain fluxes in welding.
- 4.2 Describe oxy acetylene welding process with equipments required.
- 4.3 Explain various types of flames, their adjustments and precautions in flame cutting.
- 4.4 Specify arc welding electrodes.
- 4.5 Explain welding current and voltage rating.
- 4.6 Describe arc welding equipments such as welding transformer and welding generator set.
- 4.7 Classify resistance welding process.
- 4.8 Describe various resistance welding process such as butt welding, spot, flash welding, projection welding and seam welding.
- 4.9 list various safety measures to be taken in welding.
- 4.10 State different welding defects with causes and remedies.
- 4.11 Explain TIG and MIG welding process and elaborate their specific field of application.

#### **5. Soldering and Brazing. (5 periods)**

- 5.1 Define soldering.
- 5.2 Classify solders.
- 5.3 Explain different procedure of soldering.
- 5.4 Define brazing.
- 5.5 State different filler materials.
- 5.6 Explain different procedure of brazing.

#### **6. Rivetting. (5 periods)**

- 6.1 Describe different types of rivets.
- 6.2 Explain various riveting procedure.
- 6.3 Differentiate between cold and hot rivets.

#### **7. Sheet metal works. (7 periods)**

- 7.1 Describe different metals used in a sheet metal works with their engineering application.
- 7.2 Describe various sheet metal hand tools.
- 7.3 Explain different operation in sheet metal working.
- 7.4 State different types of joints and allowances.

#### **RECOMMENDED BOOKS:**

- 1. Work shop tech (part-1) by Hazra Choudhry, media promoters and publications Pvt. Ltd.
- 2. Workshop technology by Raghubansi, Dhanpat rai & Sons.
- 3. Production process by O.P.khanna.
- 4. Manufacturing technology by P.N. Rao, TMH.
- 5. Manufacturing engineering and technology by S. Kalpakjian, Addison Wesley publishing co.
- 6. Manufacturing Technology – 1 by P.C. Sharma , S.Chand

## MAINTENANCE ENGINEERING & MANAGEMENT

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Introduction & Objectives	02
2.	PQRM-Productivity, Quality, Reliability & Maintainability	06
3.	Maintenance and Repair Jobs ad Technologies	06
4.	Defect /Failure List Generation & Failure Analysis	05
5.	Maintenance Strategies/Types/ Systems	06
6.	Condition Monitoring	05
7.	Maintenance Planning & Scheduling	05
8.	System Approach To Maintenance	05
9.	Computerized Maintenance Management System (CMMS)	06
10.	Total Productive Maintenance (TPM)	04
11.	Other Concepts of Maintenance Types/ Systems	04
12.	Maintenance Organization	06
13.	Maintenance Effectiveness, Performance Evaluation/ Indices & Audit	05
14.	Maintenance Budgeting, Costing and Cost Control	05
15.	Training (HRD) for Maintenance Personnel	05
		Total = 75

### **RATIONALE:**

Engineering basically means the maintenance engineering & management for production of goods and services for human consumption. The major function of automobile engineering is to maintain the various equipments and machineries and it's management in the process of production. Management techniques, therefore, one of the most important subjects to be learned by automobile engineer.

### **OBJECTIVES:**

- On completion of the subject the students will be able to know
1. To describe PQRM-Productivity, Quality, Reliability & Maintainability .
  - 1 To explain different types of Maintenance and Repair Jobs ad Technologies Defect /Failure List Generation & Failure Analysis
  - 2 To describe the various Condition Monitoring, Maintenance Planning & Scheduling & System Approach To Maintenance.
  - 3 To understand the purpose of Computerized Maintenance Management System (CMMS), Total Productive Maintenance (TPM).
  - 4 To define Maintenance Organization Maintenance & Effectiveness, Performance Evaluation/ Indices & Audit
  - 5 To classify Maintenance Budgeting, Costing and Cost Control.
  - 6 Objectives of Training (HRD) for Maintenance Personnel.

### **COURSE CONTENTS:**

- 1. Introduction & Objectives (02 Periods)**
  - 1.1 Purpose, Functions, Objectives, System Approach to Maintenance Functions.
- 2. PQRM-Productivity, Quality, Reliability & Maintainability (05 Periods)**
  - 2.1 Productivity.
  - 2.2 Maintenance Productivity.
  - 2.3 Quality & Quality Circle in Maintenance.
  - 2.4 Reliability & Reliability Engineering.
  - 2.5 Importance of Reliability.
  - 2.6 Difference between Reliability & Quality.
  - 2.7 Reliability Testing.
  - 2.8 Reliability Process.
  - 2.9 Tools & Techniques.
  - 2.10 Reliability & Block Diagram.

- 2.11 Reliability Prediction.
- 2.12 Reliability Growth Analysis.
- 2.13 Reliability through Redundancy.
- 2.14 Stand-by & Load-sharing Redundancy.
- 2.15 Reliability through Redundancy.
- 2.16 Maintainability.
- 2.17 Maintainability Improvement.
- 2.18 Design for Maintainability.
- 2.19 Maintainability Prediction.
- 2.20 Maintainability vis-à-vis Reliability.
- 2.21 Reliability.
- 2.22 Availability and Maintainability (RAM)
- 3. Maintenance and Repair Jobs and Technologies(06 Periods)**
- 3.1 Dismantling & Assembling.
- 3.2 Maintenance Cleaning.
- 3.3 Lubrication.
- 3.4 Function, failure causes & few tips on lubrication.
- 3.5 Maintenance Machining.
- 3.6 Thread Inserts.
- 3.7 In-situ Machining.
- 3.8 Electro-Disintegration Machine (EDM) Drills.
- 3.9 Metal Stitching.
- 3.10 Maintenance Welding.
- 3.11 Steps involved in Maintenance Welding.
- 3.12 Repairing Heat Treated Parts.
- 3.13 Surfacing.
- 3.14 Hard-facing & Coating.
- 3.15 Cladding.
- 3.16 Micro-Welding & Micro-joining Technologies.
- 3.17 Plating.
- 3.18 Selective Immersion-free Electroplating.
- 3.19 Repair of Metallic Materials.
- 3.20 Coating and Surface Modification Technology for Repair.
- 3.21 Composite Structural Repair — Material Systems.
- 3.22 Composite Patches on Metallic Components.
- 3.23 Cold Welding.
- 3.24 Vulcanizing (Hot & cold).
- 3.25 Conveyor Belt Repair.
- 3.26 Material Improvement.
- 3.27 Good Maintenance Repair Practices.
  
- 4. Defect /Failure List Generation & Failure Analysis (04 Periods)**
- 4.1 Failure Mode.
- 4.2 Failure Code.
- 4.3 Few Basic of Failure.
- 4.4 Failure Generation.
- 4.5 Failure Reporting & Collection.
- 4.6 Failure Analysis.
- 4.7 Fault Tree Analysis (FTA).
- 4.8 Event Tree Analysis.
- 4.9 Root Cause Analysis (RCA).
- 4.10 RCFA.
- 4.11 Difference between FA (Failure Analysis).
- 4.12 RCA and RCFA.
- 4.13 Failure Modes & Effects Analysis (FMEA).
- 4.14 FMECA.

- 4.15 FRACAS.
- 4.16 Finite Element Analysis (FEA).
- 4.17 Weibull analysis (or Life data analysis).
- 4.18 Electrical Stress Analysis.
  
- 5. Maintenance Strategies/Types/ Systems (05 Periods)**
  - 5.1 Basis of Selecting Maintenance Strategies.
  - 5.2 Breakdown or Emergency Maintenance.
  - 5.3 Corrective Maintenance.
  - 5.4 Opportunistic Maintenance.
  - 5.5 Preventive Maintenance.
  - 5.6 Predictive Maintenance (Pd M).
  - 5.7 Condition Based Maintenance System(CBMS or CBM).
  - 5.8 CM vis-à-vis CBM.
  - 5.9 Proactive Maintenance.
  - 5.10 Risk Based Maintenance.
  - 5.11 Quality Assured Maintenance Management (QAMM).
  - 5.12 Design-out Maintenance.
  - 5.13 Review/Improvement of Maintenance Strategies.
  - 5.14 Comparison of Maintenance Strategies.
  - 5.15 Evolution of Maintenance Strategies.
  - 5.16 Total Maintenance Management (TMM or TM<sub>2</sub>).
  
- 6. Condition Monitoring (05 Periods)**
  - 6.1 On-line & off-line Monitoring.
  - 6.2 Visual & Temperature Monitoring.
  - 6.3 Leakage Monitoring.
  - 6.4 Vibration-Characteristics & Analysis.
  - 6.5 Kurtosis & Spike Energy; Lubricant Monitoring-Methods, equipments.
  - 6.6 Ferrography.
  - 6.7 Spectrography.
  - 6.8 Crack Monitoring.
  - 6.9 Thickness Monitoring.
  - 6.10 Corrosion Monitoring.
  - 6.11 Noise/ sound Monitoring.
  - 6.12 Smell /odour Monitoring.
  - 6.13 Themography.
  - 6.14 Vibration Monitoring – causes, identification & measurement of machine vibration.
  - 6.15 Few typical of CM.
  
- 7. Maintenance Planning & Scheduling (04 Periods)**
  - 7.1 Planning.
  - 7.2 Steps in Job Planning.
  - 7.3 Job manuals.
  - 7.4 Scheduling.
  - 7.5 Schedules & Techniques.
  - 7.6 Weekly General Schedule & Daily Schedule.
  - 7.8 Gantt chart & Bar Chart.
  - 7.9 PERT.
  - 7.10 CPM & CPA Networks.
  - 7.11 PERT vis-à-vis CPM.
  - 7.12 Job Scheduling Within Limited Resources.
  - 7.13 Short Term Plan.
  - 7.14 Long Term Plan.
  - 7.15 Capital Repair & Major Repair.

**8. System Approach To Maintenance (05 Periods)**

- 8.1 Codification & Cataloguing.
- 8.2 Drawing Codification.
- 8.3 History Cards.
- 8.4 Instruction Manual & Operating Manual.
- 8.5 Standard Operating Practice & Work Instructions.
- 8.6 Maintenance Manual & Departmental Manual.
- 8.7 Maintenance Time Standard.
- 8.8 Maintenance Operation Liaison.
- 8.9 Maintenance Work-order & Work Permit.
- 8.10 Job Card & Job Procedure.
- 8.11 Job Monitoring.
- 8.12 Feed Back & Control.
- 8.13 Maintenance Records & Documentation.
- 8.14 Other Codification & Cataloguing.
- 8.15 Systematic Flow Diagram of Total Maintenance Function.

**9. Computerized Maintenance Management System (CMMS) (05 Periods)**

- 9.1 Objectives.
- 9.2 Approach Towards Computerization.
- 9.3 Selection & Scope of Computerization.
- 9.4 Equipment Classification.
- 9.5 Preventive Maintenance & Repair Planning Module—Job Catalogue.
- 9.6 Codification of Breakdowns.
- 9.7 Material & Facilities.
- 9.8 Job Sequencing & Preparation of Work-Orders & Schedules.
- 9.9 Material Management Module—Cataloguing & Codification of Spares & Consumables.
- 9.10 Spares Classification & Requirement Planning.
- 9.11 Standardization & Rationalization.
- 9.12 Captive Engineering Shop Module—Work Centre.
- 9.13 Process Planning.
- 9.14 Route Card.
- 9.15 Codification of Work-order & Route Card.

**10. Total Productive Maintenance (TPM) (03 Periods)**

- Development & Scope of Concept.
- TPM vis-à-vis Technology.
- Basic Systems of TPM.
- Procedure & Steps of TPM.
- Productivity Circles.
- TPM vis-à-vis TQP.
- Benefits of TPM.
- Pillars of TPM.
- TPM Introduction Stages.

**11. Other Concepts of Maintenance Types/ Systems (03 Periods)**

- Reliability Centered Maintenance (RCM).
- Difference between of RCM & RCA.
- Enterprise asset Management (EAM).
- Six Sigma Maintenance.
- Six Sigma Maintenance Process.
- Lean Maintenance.
- Five Zero (5-Zero) Maintenance Concept.
- 5-S Concept in Maintenance.

- 12. Maintenance Organization (05 Periods)**  
 Factors Affecting Maintenance Organization.  
 Aims/ Objectives.  
 Formal & Informal Organization.  
 Line & Staff Organization.  
 Functional Organization.  
 Centralized & Decentralization Organization.  
 Advantages.  
 Disadvantages.  
 Responsibilities of Centralized Maintenance Group.  
 External Maintenance Services.  
 Captive Shop Facilities.  
 Working Arrangement—Engineer.  
 Scheduler & Executer Concept.  
 Delegation & Multi-trade Concept.  
 Multi-Skilling.  
 Identifying Friction Areas & Multi-Skill Opportunities.  
 Outsourcing in Maintenance.  
 Types of Outsourcings in Maintenance.
- 13. Maintenance Effectiveness, Performance Evaluation/ Indices & Audit (05 Periods)**  
 Overall Equipment Effectiveness (OEE).  
 Equipment Availability.  
 Maintenance Effectiveness Assessment/ Survey.  
 Key Performance Indicators (KPI).  
 Maintenance Performance Analysis/ Evaluation.  
 Maintenance Performance Measuring Indices (Quality based, Performance based & Cost based).  
 Maintainability Index (MI).  
 Maintenance Audit.  
 Technical Audits.  
 Benefits of Audits.
- 14. Maintenance Budgeting, Costing and Cost Control (05 Periods)**  
 Sources of Maintenance Costs.  
 Classification/ Types of Maintenance Costs (Fixed & Variable, Direct & Indirect, Revenue & Capital).  
 Maintenance Cost Iceberg.  
 Maintenance Cost Components.  
 Maintenance Cost Analysis.  
 Maintenance Cost-Benefit Analysis.  
 Cost Control in Maintenance.  
 Maintenance Budget.  
 Budgetary Control.
- 15. Training (HRD) for Maintenance Personnel (05 Periods)**  
 Human Factor in Maintenance.  
 Broad Maintenance Training Levels & Profile of Persons.  
 Objectives of Maintenance Training.  
 Types of Maintenance Training Programmes.  
 Training Sources/ Agencies/ Institutions in India.  
 Training tool.  
 Modes & Methods.  
 Assessments/Identification of Training.  
 Needs & Determining Priority.  
 Evaluation of Training.

**RECOMMENDED BOOKS:**

1. Maintenance Engineering & Management by Sushil Kumar Srivastava , S.Chand

**MECHANICAL ENGINEERING LAB-1**

Periods / week: 6  
Total period: 90

Exam: 4 Hours  
Practical: 60 Marks  
Sessional: 40 marks  
Total: 100 marks

**RATIONALE:**

Engineering is a practical, field oriented professional. It is essential that the mechanical and automobile engineering students should realize their knowledge and understanding of various subjects through practical experiments in the laboratories.

**OBJECTIVES:**

To identify, specify, handle, start (where applicable) different equipment and laboratory set up and perform respective experiments in the laboratories pertaining to engineering mechanics, strength of materials and thermal engineering.

**1. Engg. Mechanics lab.**

Determination of M.A. and V.R. and efficiency of  
Single and double purchase winch crab.  
Screw jack.  
Worm and worm wheel.

Determination of reactions at support of loaded beam.

**2. Strength of material lab.**

Determine young's modulus by searl's apparatus.  
Perform tensile test of given specimen using in universal testing machine.  
Perform compression test of given specimen by compression testing machine.  
Determine hardness of different metals by Rockwell/brinell hardness testing m/c.  
Determine impact strength of ductile materials by izod/charpy's method test.  
Determine rigidity modulus by torsion testing machine

**3. Thermal engineering lab.**

Study and demonstration of  
Perform experiments on air compressor: valve application & H.P. mgt.  
Study of ice plant.  
Study of domestic refrigerator.

N.B.: /minimum 8 experiments to be performed taking at least 2 from each group.

**WORKSHOP PRACTICE-II**

Periods / week: 6  
Total period: 90

Exam: 4 Hours  
Practical: 50 marks  
Sessional: 50 marks  
Total: 100 marks

### **RATIONALE:**

Manufacturing of products is done through use of various machineries and processes in industry. It is therefore, essential for mechanical and automobile engineers to have practical training in these manufacturing processes and operation of the machineries.

### **OBJECTIVES:**

To identify, specify and use various tools, instruments and materials and make appropriate jobs with own hands in fitting, smithy, carpentry & pattern making and lathe machine.

#### **1. Fitting (25 Periods).**

- 6.1 Study and use common precision measuring tools.
  - 6.1.1 Sine bar.
  - 6.1.2 Combination square slip gauge
  - 6.1.3 Dial test indicator.
  - 6.1.4 Height gauge.
  - 6.1.5 Go and no go gauges.
- 6.2 Do jobs.
  - 6.2.1 Preparation of caliper.
  - 6.2.2 Preparation of try square.
  - 6.2.3 Preparation hammer.

#### **2. Smithy (15 Periods).**

- 2.1 Study of smithy hand tools, machine and their uses.
- 2.2 Observe demonstration types of job.
- 2.3 Perform jobs.
  - 2.3.1 Door ring with hook.
  - 2.3.2 Octagonal flat chisel.
- 2.4 Observe safety procedures.

#### **3. Carpentry and pattern making (25 Periods).**

- 3.1 Carpentry
  - 3.1.1 Study carpentry hand tools, machine tools & their use.
  - 3.1.2 Study timber and their uses.
  - 3.1.3 Perform different carpentry operations such as planning, sawing & chiseling.
  - 3.1.4 Do jobs.
    - 3.1.4.1 Cutting of slot, notch, mortise & Tenon.
    - 3.1.4.2 Single Dovetail joints.
- 3.2 Pattern making.
  - 3.2.1 Study of pattern making tools and their uses.
  - 3.2.2 Observe demonstration of wood turning machines.
  - 3.2.3 Perform jobs.
    - 3.2.3.1 Solid pattern
- 3.3 Comply with safety norms.

#### **4. Turning(25 Periods).**

- 4.1 Study a lathe machine and its accessories.
- 4.2 perform jobs involving the various operations.
  - 4.2.1 Plain turning.
  - 4.2.2 Step turning.
  - 4.2.3 Taper turning.
  - 4.2.4 Grooving.
  - 4.2.5 Chamfering.
  - 4.2.6 Knurling.
  - 4.2.7 External threading.

Period / Week : 02  
Total Period : 30

Exam. : 01 hrs.  
EndExam.: 25marks  
Sessional : 25marks  
Total Marks: 50marks

#### TECHNICAL SEMINAR:-

To expand the professional services to the engineering community. Comprehensive and focused on practical problem solving techniques for the engineering professional, Now a days technical seminars are highly interactive between instructor and attendee. All of the instructors are active consultants and authors who bring current real world experience and problem solving know-how to their course instruction. In only a short time, Seminars for Engineers has emerged as a quality source for the training and continuing education of today's engineers.

#### **Communication Skills**

Regardless of the size of business you are in – whether a large corporation, a small company, or even a home-based business – effective communication skills are essential for success.

The inclusion of this subject help the students to understand how to communicate your message in the best possible way.

We start with a look at some of the key ideas behind successful communication, and offer a brief quiz that helps a students to evaluate how effectively a person could communicate, so that one can identify the areas that should focus on improvement. The articles that help the students to develop the skills that need to produce effective and inspiring spoken, written and electronic communications to individuals and groups to be studied in the communication lab.

4<sup>th</sup>  
SEMESTER

AUTO ENGG

## MECHATRONICS

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Introduction, Sensors	15
2.	Actuation, System (Mechanical, Electrical Pneumatic & Hydraulics)	15
3.	Basic System Models, Input/ Output System	15
4.	Programmable Logic Controller	15
5.	Design Application in Mechatronics	15
		Total = 75

### **RATIONALE:**

“Mechatronics” deals with the mechanical engineering, electronic control and basic system model in the design of products and manufacturing processes. Therefore, it is an important basic subject of the students for mechanical and automobile engineering.

### **OBJECTIVES:**

On completion of the subject students will be able to

16. Define different types of Systems and Sensors and solve the simple problems.
17. Understand the concept of Mechanical actuation, Electrical actuation and Pneumatic & Hydraulics and solve the simple problems.
18. Find out the various types of System Models & Input/ Output parts and solve the problems.
19. Understand the programmable Logic Controller and draw the various types of diagram of PLC.
20. To study about Design process stages and Mechatronics control in Automated Manufacturing and solve the simple problems.

### **COURSE CONTENTS:**

- 1. Introduction, Sensors (15 Periods)**
  - 1.1 System
    - 1.1.1 Measurement system
    - 1.1.2 Control system
    - 1.1.3 Microprocessor based controllers
  - 1.2 Sensor
    - 1.2.1 Position & Proximity Sensors
    - 1.2.2 Velocity & Motion Sensor
    - 1.2.3 Force Sensor
    - 1.2.4 Fluid Pressure Sensor
    - 1.2.5 Flow Sensor
    - 1.2.6 Liquid Level Sensor
    - 1.2.7 Temperature Sensor
    - 1.2.8 Light Sensor
  - 1.3 Selecting System

## **2. Actuation System (15 Periods)**

- 2.1 Mechanical Actuation
  - 2.1.1 Types of motion
  - 2.1.2 Freedom & Constraints
  - 2.1.3 Loading
  - 2.1.4 Mechanical aspects of motor selection
- 2.2 Electrical Actuation
  - 2.2.1 Switches and relay
  - 2.2.2 Solenoid
  - 2.2.3 D.C. Motors
  - 2.2.4 A.C. Motors
  - 2.2.5 Stepper Motors
  - 2.2.6 Specification and control of stepper motor
  - 2.2.7 Servo motors: D.C & A.C
- 2.3 Pneumatic & Hydraulic
  - 2.3.1 Power Supplies
    - DCV
    - PCV
    - Cylinders
    - Rotary Actuators

## **3. Basic System Model (15 Periods)**

- 3.1 Mathematical Model
  - 1.1.1 Introduction
  - 1.1.2 Mechanical system building block
  - 1.1.3 Electrical system building block
  - 1.1.4 Thermal system building block
- 3.2 System Model
  - 3.2.1 Engineering system
  - 3.2.2 Rotational – Translational System
  - 3.2.3 Electro Mechanical system
  - 3.2.4 Hydro Mechanical system
- 3.3 Interfacing
  - 3.3.1 Input/ output parts
  - 3.3.2 Interface requirements: Buffer, Hand shaking, Polling and Interrupts. Serial interfacing
  - 3.3.3 Introduction to PIA

## **2. Programmable Logic Controller.(PLC) (15 Periods)**

- 2.1 Definition
- 2.2 Basic Block Diagram and Structure of PLC
- 2.3 Input Output Processing
- 2.4 PLC Programmable
  - 2.4.1 Ladder diagram
  - 2.4.2 PLC Mnemonics: Timer, Internal relays and Counters
  - 2.4.3 Shift register
  - 2.4.4 Master and jump controls
  - 2.4.5 Data handling

## **5. Design, Application in Mechatronics (15 Periods)**

- 5.1 Design Process Stages
  - Traditional Vs Mechatronics design
  - Possible design solution
  - Case studies.

- A pick – and – place robot, car park barrier. Automatic camera, Automatic Washing M/C
- 5.2 Sensors for Condition Monitoring System of Production System
  - 5.2.1 Example Vibration Monitoring, Temp. Monitoring
- 5.3 Mechatronics Control in Automated Manufacturing
  - i. Monitoring of Manufacturing Process
  - ii. On – line quality Monitoring

**RECOMMENDED BOOKS:**

1. W.Bolten Mechatronics.
2. R.K.Rajput A Text book of Mechatronics.

## **THERMAL ENGINEERING**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### **TOPIC WISE DISTRIBUTION OF PERIODS**

<u><b>Sl. No.</b></u>	<u><b>Topic</b></u>	<u><b>Periods</b></u>
1.	Thermodynamic concepts and properties	06
2.	Laws of thermodynamics	10
3.	Properties & process of ideal gases	08
4.	Internal combustion engine	15
5.	Air compressors	08
6.	Refrigeration	20
7.	Air Conditioning	08
		Total = 75

### **RATIONALE:**

Thermal engineering is the field of applied science which deals with the energy possessed by heated gases and vapours, and the laws which govern the conversion of this energy into mechanical energy and vice versa. This is the fundamental subject for understanding the process of producing vast amount of mechanical energy from heat energy and therefore necessary to be learned by all engineering students.

### **OBJECTIVES:**

On completion of the subject students will be able to

2. Understand the different thermodynamic properties.
3. Explain the first two laws of thermodynamics and its application.
4. Find out the various properties of gases on PV & T-S diagram of various thermodynamic process.
5. Understand the different types of I.C. engines and their working principle with the help of thermodynamic cycle. Find out the performance of the I.C. engine.
6. Describe the working principle of reciprocating air compressor and find out the efficiency.
7. Understand the basic concepts of air refrigeration system.
8. Understand the different types of air conditioning.

### **COURSE CONTENTS:**

#### **1. Thermodynamic concept and properties. (6 periods)**

- 1.1 Explain energy
- 1.2 Describe the sources of energy.
  - 1.2.1 Conventional energy (thermal, mechanical)
  - 1.2.2 Non-conventional energy
- 1.3 Explain various thermodynamic systems.
  - 1.3.1 Closed system.
  - 1.3.2 Open system.
  - 1.3.3 Isolated system.

- 1.3.4 Explain thermodynamic equilibrium condition.
- 1.3.5 Explain quasistatic process.
- 1.3.6 Define thermodynamic properties, process and cycle.
- 1.4 Classify thermodynamic properties (intensive, extensive)
- 1.5 Explain point function & path function.
- 1.6 Define thermodynamic properties (pressure, volume, temp, internal energy enthalpy)
- 1.7 Define heat, work & state their units.
- 1.8 Explain mechanical equivalent of heat.
- 1.9 Derive P-v work transfer on P-v diagram.
- 1.10 Explain specific heat
  - 1.10.1 Specific heat at constant vol. ( $C_v$ )
  - 1.10.2 Specific heat at constant pressure ( $C_p$ )
- 1.11 Derive relationship between  $C_v$  and  $C_p$ .

## **2. Laws of thermodynamics. (10 periods)**

- 2.1 State and explain Zeroth laws of thermodynamics.
- 2.2 State and explain first law thermodynamics.
- 2.3 Explain application of first law of thermodynamics to non flow process & solve simple problems on:
  - 2.3.1 Const. pr. Process
  - 2.3.2 Const. vol. process
  - 2.3.3 Adiabatic process
  - 2.3.4 Isothermal process
- 2.4 Application of first law of thermodynamics to steady flow process & general energy equation applied to condenser, nozzle, turbine.
- 2.5 Explain the limitations of 1<sup>st</sup> law of thermodynamics.
- 2.6 State and explain second law of thermodynamics.
  - 2.6.1 Define heat engine, efficiency, heat pump, refrigerator & c.o.p.
  - 2.6.2 State Kelvin-planks statement.
  - 2.6.3 State clausius statement.
  - 2.6.4 Show equivalence of two statements.
- 2.7 Explain reversible and irreversible process and highlight causes of irreversibility.
- 2.8 State clausius inequality.
- 2.9 Define entropy.
- 2.10 explain principle of increase of entropy.

## **3. Properties, processes of ideal gas. (8 periods)**

- 3.1 Explain difference between ideal gas & real gas.
- 3.2 Explain difference between gas & vapour.
- 3.3 State boyel's law, Charles law, guy lussac law & combined gas equation (with problems)
- 3.4 Derive and explain characteristic gas const., universal gas constants (with problems)
- 3.5 Explain various non-flow thermodynamic processes and solve problems on
  - 3.5.1 Isothermal process.
  - 3.5.2 Isobaric process
  - 3.5.3 Isochoric process
  - 3.5.4 Isentropic process
  - 3.5.5 Polytrophic process
- 3.6 Explain free expansion & throttling process.

## **4. Internal combustion engine. (15 periods)**

- 4.1 Explain air standard cycle
  - 4.1.1 Otto Cycle
  - 4.1.2 Diesel cycle
  - 4.1.3 Dual-combustion cycle

- 4.2 Derive the air standard efficiency of above cycle, do some related problems.
- 4.3 Explain classification of I.C. Engine.
- 4.4 Identify various I.C. engine parts & their functions.
- 4.5 Explain the terminology of I.C. engine such as bore, dead centers, stroke compression ratio, clearance vol., stroke vol., piston speed and R.P.M.
- 4.6 Explain the working principle of 2-stroke, 4-stroke C.I. and S.I. engine with valve timing diagram.
- 4.7 Differentiate between 2-stroke, 4-stroke engine.
  - 4.7.1 Explain difference S.I & C.I. engine
- 4.8 Explain performance testing of I.C. engine.
  - 4.8.1 Describe how to determine of I.H.P., B.H.P and F.H.P & mechanical efficiency, indicated thermal efficiency, brake thermal efficiency, specific fuel consumption.
  - 4.8.2 Draw heat balance sheet.

## **5. Air compressor (8 periods)**

- 5.1 Explain the function of compressor and industrial use of compressed air.
- 5.2 Classify air compressor.
- 5.3 Describe the construction and working principle of reciprocating air compressor.
- 5.4 Explain the terminology of reciprocating processor such as bore, stroke, clearance vol, swept vol, piston speed, pressure ratio, free-air delivered and volumetric efficiency.
- 5.5 Derive the work done of a single stage & two stage compressor with and without clearance.
- 5.6 Derive the volumetric efficiency of reciprocating compressor.
- 5.7 Determine the dimension (stroke length, diameter) of two stroke compressor.
- 5.8 Solve related simple problems.

## **6. Refrigeration. (20 periods)**

- 6.1 Air refrigeration cycle.
  - 6.1.1 Define refrigeration.
  - 6.1.2 Explain methods of refrigeration.
  - 6.1.3 State unit of refrigeration, C.O.P.
  - 6.1.4 Explain camot cycle, reversed camot cycle, bell Coleman cycle and derive the C.O.P with simple problems.
  - 6.1.5 Explain open air and closed air refrigeration system.
- 6.2 Vapour compression system.
  - 6.2.1 Explain the principle and analysis of vapour comp., refrigeration system with help of P-H, t-S diagram, simple problem.
  - 6.2.2 Write down different types of refrigerant with their properties (Ammonia, CO<sub>2</sub>, F-11, F-12)
  - 6.2.3 Explain the working principle of ice-plant, cold storage, domestic refrigerator.
- 6.3 Vapour absorption system.
  - 6.3.1 Explain the working principle of vapour absorption system.
  - 6.3.2 Understand the working principle of Electrolux refrigeration.

## **7. Air conditioning (8 periods)**

- 7.1 Explain the purpose of air conditioning.
- 7.2 Define the Pshychrometric terms (dry air, moist air, saturated air, humidity, absolute humidity, D.B.T, W.B.T, D.P.T)
- 7.3 Study Pshychrometric chart.
- 7.4 Explain Pshychrometric process.
  - 7.4.1 (Sensible cooling, sensible heating, humidification, dehumidification)
- 7.5 Comfort air conditioning.
- 7.6 Explain working principle of summer air conditioning system and winter air conditioning system.

## **RECOMMENDED BOOKS:**

1. Thermal engineering: A.S. sarao

2. Engineering thermodynamics: P.K. nag.
3. Thermal engineering: A. Basu.
4. Refrigeration and air conditioning: R.S. Khurmi & Gupta.
5. Thermal Engineering : P.L. Ballancy
6. Refrigeration and air conditioning: Manohar Prasad.

### **THEORY OF MACHINES**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

#### **TOPIC WISE DISTRIBUTION OF PERIODS**

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Simple mechanism	10
2.	Friction	15
3.	Power Transmission	15
4.	Governors and flywheels	12
5.	Balancing of machine parts	12
6.	Vibration of machine parts	11
Total =		75

#### **RATIONALE:**

Mechanical and Automobile engineering is involved with design, manufacture and use of various types of machines. Each machine consists of a large number of static and moving parts of sub assemblies called mechanisms. There exist a large number of different types of mechanisms. Each of these mechanisms can generate a particular type of output motion with some other kind of input motion. Theory of machines is study of such different kinds of mechanisms. It is, therefore, necessary to study and understand functions of different type of mechanisms for design, manufacture and use of various machines.

#### **OBJECTIVES:**

On completion of the subject the students will be able to

1. Understand link, kinematic pair, kinematic chain, various mechanisms and velocity, acceleration diagram for simple link mechanism.
2. Understand friction on horizontal and inclined planes and explain friction between nut and screw for square and v\_threads, principle of thrust bearings and antifriction bearings.
3. Explain the concept of power transmission with mode of drives.
4. Describe the working principle of governors and flywheels.
5. Understand the concept of balancing of machine parts.
6. Explain concept of vibrations different modes.

#### **COURSE CONTENTS:**

##### **1. Simple Mechanisms (10 periods)**

- 1.1 Understand the subject of theory of machine.
- 1.2 Define
  - 1.2.1 Link
  - 1.2.2 Kinematic pair
  - 1.2.3 Kinematic chain

- 1.2.4 Mechanism
- 1.2.5 Inversio
- 1.3 Explain
  - 1.3.1 Lower pair
  - 1.3.2 Higher pair
  - 1.3.3 For bar link mechanism with their inversions.
  - 1.3.4 Explain the concept of velocity and acceleration diagram for simple link mechanism of crank and connecting rod mechanism.
  - 1.3.5 Cam and Followers.
- 2. State Friction (15 periods)**
  - 2.1 Laws of dry friction
  - 2.2 Explain
    - 2.2.1 Friction on horizontal plane.
    - 2.2.2 Friction on inclined plane.
    - 2.2.3 Angle of repose.
    - 2.2.4 Friction between nut and screw for square and v\_threads.
  - 2.3 Explain principle of single and multiple collar bearings.
    - 2.3.1 Derive the formula for torque transmission and power for.
      - 2.3.1.1 Flat pivot bearing.
      - 2.3.1.2 Conical pivot bearing.
      - 2.3.1.3 Flat collar bearing of single and multiple types.
  - 2.4 Explain the friction in.
    - 2.4.1 Screw jack.
    - 2.4.2 Plate clutches
  - 2.5 Derive the formula for torque and power transmission in single and multiple clutches.
  - 2.6 Solve numerical problems on above.
  - 2.7 Explain the concept of rolling friction.
  - 2.8 Describe
    - 2.8.1 Roller bearings.
    - 2.8.2 Needle roller bearings.
    - 2.8.3 Ball bearings.
  - 2.9 Classify the bearings
  - 2.10 State function of bearings.
  - 2.11 Explain the working of
    - 2.11.1 Simple frictional brakes.
    - 2.11.2 Absorption type of dynamometers.
- 3. Power Transmission (15 periods)**
  - 3.1 Explain the concept of
    - 3.1.1 Power transmission
    - 3.1.2 Type of drives
      - 3.1.2.1 Belt drive
      - 3.1.2.2 Gear drive
  - 3.2 Derive the formula for
    - 3.2.1 Velocity ratio
    - 3.2.2 Length of belt of
      - 3.2.2.1 Open belt drive
      - 3.2.2.2 Cross belt drive
    - 3.2.3 Ratio of tensions
    - 3.2.4 Centrifugal tensions.
    - 3.2.5 Initial tensions.
    - 3.2.6 Power transmitted by belt.
    - 3.2.7 Width of belt required.
  - 3.3 Explain the use of

- 3.3.1 Idle pulleys.
- 3.3.2 Jockey pulley.
- 3.3.3 V\_belts and V\_belts pulleys.
- 3.3.4 Fast and loose pulleys.
- 3.4 Explain the concept of crowning of pulleys.
- 3.5 Gear Drives.
- 3.6 Classify Gears.
- 3.7 Define velocity ratio for
  - 3.7.1 Simple gear train
  - 3.7.2 Compound gear train.
  - 3.7.3 Epicyclic gear train
- 3.8 Solve numerical problems on
  - 3.8.1 Circular pitch
  - 3.8.2 Diametral pitch.
  - 3.8.3 Module.
- 3.9 Explain the working principle of
  - 3.9.1 Simple gear train
  - 3.9.2 Compound gear train
  - 3.9.3 Reverted gear train
  - 3.9.4 Epicyclic gear train

#### **4. Governors and Flywheels (12 periods)**

- 4.1 State the function of governors.
- 4.2 Classify governors
- 4.3 Describe working of (Ono mathematical treatment)
  - 4.3.1 Watt governor.
  - 4.3.2 Porter governor.
  - 4.3.3 Proel governor.
  - 4.3.4 Hartnell governor
- 4.4 Define
  - 4.4.1 Sensitivity.
  - 4.4.2 Stability
  - 4.4.3 Isochronism.
- 4.5 Explain function of a flywheel.
- 4.6 Define and write the formula.
  - 4.6.1 Fluctuation of energy.
  - 4.6.2 Coefficient of fluctuation of speed.

Find out required weight of flywheel.

#### **5. Balancing of machine parts (12 periods)**

- 5.1 Explain the concept of balancing.
- 5.2 Explain static balancing of rotating parts.
- 5.3 Explain the principle of balancing of reciprocating masses.
- 5.4 State the causes and effect of unbalance.
- 5.5 Differentiate between static and dynamic balancing.

#### **6. Vibration in machine parts. (11 periods)**

- 6.1 Introduction to Vibration.
- 6.2 Classify vibrations.
- 6.3 Explain the basic concept of
  - 6.3.1 Natural Vibration.
  - 6.3.2 Forced vibration.
  - 6.3.3 Damped Vibration.

- 6.3.4 Longitudinal Vibration.
- 6.3.5 Torsional Vibration.
- 6.4 Define with respect to vibration.
  - 6.4.1 Cycle.
  - 6.4.2 Amplitude.
  - 6.4.3 Time period.
- 6.5 State the causes of vibration.
- 6.6 state the points for remedies of vibration.

**RECOMMENDED BOOKS:**

1. The Theory machines by Thomas Bevan, CBS publishers & Distributors.
2. Theory of machine by Saha Jadavani.
3. Theory of machine by R.S. Khurmi.
4. Theory of machine by Abdulla Shariff, Dhanpat Rai & Sons.

## MANUFACTURING TECHNOLOGY - II

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
10.	Lathe Machine	20
11.	Shaper	06
12.	Planing M/C	06
13.	Milling	15
14.	Slotter	06
15.	Grinding	10
16.	Drilling	06
17.	Surface finish, Lapping	06
		Total = 75

### **RATIONALE:**

Engineering basically means production of goods and services for human consumption. The major function of mechanical engineering is to manufacture various products using machineries, production processes and production management techniques. Therefore, this is one of the most important subjects to be learned by a mechanical and automobile engineer.

### **OBJECTIVES:**

On completion of the course the student will be able to

1. Describe the different parts and functions of a lathe machine and state the specification of different lathe machines.
2. Describe the parts and functions involved in shaping operation.
3. Describe the parts and functions including table drive of planner.
4. Describe different types of milling machine with attachment and explain various types of indexing method.
5. Acquire knowledge on parts, functions and tools of a slotter.
6. Acquire knowledge on manufacturing, selection and specification of grinding wheels as well as various types of grinding machines.
7. Describe the parts and functions of drilling machine.
8. Acquire knowledge on super finishing process.

### **COURSE CONTENTS: (In terms of specific objectives):**

1. **Lathe machines (20 periods)**
  - 1.1 S.S. and S.C. Lathe.
    - 1.1.1 Define S.S. and S.C. Lathe

- 1.1.2 Identify the different components of lathe and their functions.
  - 1.1.3 Enlist the different operations on lathe.
  - 1.1.4 State and explain the plain turning, grooving, step turning, thread cutting, taper turning, parting off.
  - 1.1.5 State the safety precautions needed.
- 1.2 Capstan lathe
- 1.2.1 Explain the function of different components.
  - 1.2.2 Define multiple tool holder.
- 1.3 Turret lathe.
- 1.3.1 Explain the functions of different components
- 1.4 Differentiate between capstan and turret lathe.
- 1.5 Explain the indexing arrangement for turret head.
- 1.6 Draw the tooling layout for preparation for a hexagonal bolt and bush.
- 1.7 State the advantages of capstan/ turret lathe over S.S. and S.C. lathe.
- 1.8 Explain with neat sketch the bar feeding mechanism.
- 2. Shaper (6 periods)**
- 2.1 List out the different parts.
  - 2.2 Describe the functions of above parts.
  - 2.3 Explain the automatic table feed mechanism.
  - 2.4 Explain the construction and working of tool head.
  - 2.5 Explain the quick return mechanism through sketch.
  - 2.6 State the specification of a shaping machine.
- 3. Planning Machine (6 periods)**
- 3.1 Enlist different parts.
  - 3.2 Describe explain the function of parts.
  - 3.3 explain the table drives mechanism.
  - 3.4 explain the working of tool and tool support.
  - 3.5 Explain the clamping of work through sketch.
- 4. Milling Machine (15 periods)**
- 4.1 Describe various types of milling machines and operations performed by them.
  - 4.2 Explain work holding attachment.
  - 4.3 Describe construction & working of simple dividing head, universal dividing head.
  - 4.4 Explain the procedure of simple indexing.
  - 4.5 Explain the procedure of compound indexing.
  - 4.6 Describe the different numerical indexing procedure.
  - 4.7 Show one example from each indexing method.
- 5. Slotter (6 periods)**
- 5.1 Enlist the different parts
  - 5.2 Explain the construction & working.
  - 5.3 Specify various tools.
- 6. Grinding (10 periods)**
- 6.1 Define grinding.
  - 6.1.1 Explain abrasive, bond, grit, grade, structure.
  - 6.2 Explain manufacturing of grinding wheels
  - 6.3 state criteria for selection of grinding wheels.
  - 6.4 Explain specification of grinding wheels with example.

- 6.5 explain working of
  - 6.5.1 Cylindrical grinder.
  - 6.5.2 Surface Grinder.
  - 6.5.3 Centre less Grinder.

**7. Drilling (6 periods)**

- 7.1 State classification of drilling machine.
- 7.2 Explain the working of
  - 7.2.1 Bench drilling machine
  - 7.2.2 Pillar drilling machine
  - 7.2.3 Radial drilling machine.

**8. Surface finish, Lapping (6 periods)**

- 8.1 Define surface finish
  - 8.1.1 Define super Finishing
- 8.2 Describe lapping and honing explain their utility.

**RECOMMENDED BOOKS:**

- 2. Metrology by A.K.Jain.
- 3. Workshop Technology-II Hazra Choudhry, Media promoters & publishers Pvt. Ltd.
- 4. Workshop Technology, part-I & II by W.A.S. Chapman, ELBS.
- 5. All about machine tools by H. Gerling, New Age International (P) Ltd.
- 6. Manufacturing Technology – II by P.C. Sharma , S. Chand.

## **MECHANICAL ENGINEERING DRAWING - I**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
Sessional: 20  
Total: 100 marks

### **RATIONALE:**

Drawing is the language of engineer for learning and practicing mechanical and automobile engineering mechanical engineering is most important.

### **OBJECTIVES:**

Students after completing the course will be able to understand and produce drawings of various mechanical components and devices.

### **COURSE CONTENTS:**

#### **1. Orthographic views**

- 1.1 Draw three orthographic views from the isometric drawing
- 1.2 Complete third view from given two views.
- 1.3 Draw missing lines from the given views.
- 1.4 Give dimensions of views.

#### **2. Draw different types of**

- 2.1 Bolts, Nuts, Thread.
- 2.2 Screw, Rivets
- 2.3 Joints
  - 2.3.1 Cotter joints
  - 2.3.2 Knuckle joints
  - 2.3.3 Pipe joints

#### **3. Draw Coupling**

- 3.1 Box Coupling
- 3.2 Flange Coupling

#### **4. Draw Bearings**

- 4.1 Rigid pedestal foot step bearing
- 4.2 Ball bearing mounted on shaft journal.

#### **5. Draw machine parts**

- 5.1 Stuffing box
- 5.2 Crank.
- 5.3 Piston

#### **6. Draw flat belt pulley.**

### **RECOMMENDED BOOKS:**

- 1. A text book of machine drawing by R.K.Dhawan, S.Chand & Co.
- 2. Machine Drawing by T.jones and J.Jones.
- 3. Engineering and machine drawing by N.D. Bhatt, Charotar Book Stall.

## AUTO SERVICING AND MAINTENANCE LAB.I

Period / Week : 06  
Total Period : 90

Examn. : 4 hrs.  
End Exam. 60marks  
Sessional : 40

marks

Total Marks: 100

marks

### RATIONALE:

Automobile students should have practical knowledge and skill about servicing and maintenance work of various automobile parts. This will positively help them in practical field of work.

### OBJECTIVES:

To be able to do servicing and maintenance of various systems and components of a four wheeler.

### COURSE CONTENTS:

Sl.No.	Contents	Period
1	Identifying various units of transmission system of vehicles.	03
2	Operating various Workshop equipment such as: Air Compressor, Hydraulic Hoist, Mechanical /Hydraulic Jack. Mechanical press, Hydraulic Press etc.	03
3	Servicing of different kinds of clutch, riveting clutch facing and Assembling, clutch pedal adjustment.	06
4	Servicing of different types of gear box such as sliding mesh, constant mesh, Synchromesh & selector mechanism. Servicing of propeller shaft, universal joint & sliding joint	06
5	Servicing of differential and rear axle assemblies	03
6	Study of power transmission of different types of two wheelers	06
7	Servicing of front axle assemblies.	03
8	Servicing of independent suspension system , stabilizer bar and shock absorber.	06
9	Servicing of steering mechanism and wheel alignment through computerized wheel alignment machine and balancing of wheel by wheel balancer.	06
10	Servicing of brakes, re-conditioning of brake shoe, testing of brake shoe, Return spring, brake pedal adjustment, servicing of hydraulic/ air (Power) brake system and Bleeding of brakes	06
11	Servicing & rotation of tyres, retrading of tyres cold patch and hot patch	03
12	Study of Battery: Specific gravity test through cell tester & hydrometer. Charging of battery through battery charger	06
13	Study of Generator: Cleaning of commutator, re-winding field & armature Replacing carbon brushes, adjustment of regulator, cut-out relays.	06
14	Study of Self starter – servicing of starter motor, replacement of brushes, servicing of bendix drive.	06
15	Study of Ignition system:- Ignition coil, condenser, rotor, spark advance / retard mechanism, distributor, setting of C.B. points, testing & cleaning of spark plug & Setting gap, setting of ignition timing & firing of magnet ignition system.	06
16	Adjustment and repair of horns, wind screen wiper, indicator, repairing wiring for ignition & lighting, setting of head lights. Preparation of wiring diagrams of different cars.	06
17	Pollution testing with the aid of exhaust gas analyzer, smoke tester.	06
18	Aligning head lamps of given vehicle.	03

## AUTO MACHINE SHOP - I

Period / Week : 06  
Total Period : 90

Examn. : 4 hrs.  
**End Exam.** :  
Practical : 60 Marks  
Sessional : 40 Marks  
Total Marks: 100 Marks

### RATIONALE:

Automobile engineers should know the use of measuring tools for automobile parts, they should also know about intricate machining and finishing of automobile parts.

### OBJECTIVES:

Students should be able to operate different machine tools required in an automobile machine shop and use relevant measuring instruments.

### COURSE CONTENTS:

Sl.No.	Content	Periods
1	Checking flatness and squareness using a try square and filing the same if not leveled	06
2	Sharpening of cutting tools like chisels, twist drill bit and punch through double ended grinder.	06
3	Drilling through hole by drilling machine both pillar and hand drill.	12
4	Internal threading of through hole / blind holes using hand taps.	12
5	External threading using dies	12
6.	a) Study of micrometer, dial gauge, Vernier caliper, filler gauge, inside and outside Micrometer. Vernier height gauge etc.	06
	b) <b>Measure</b>	24
	i) Measuring hole and slots using telescopic gauges and inside micrometer	
	ii) Measuring the size / depth and roundness of a object with a Vernier caliper	
	iii) Measurement of crank pins, main journal of crank shaft.	
	iv) Measurement of cylinder bore by inside micrometer	
	v) Determination of ovality and taper by using dial gauge.	
	vi) Measurement of fillet radius.	
7	Operating various Workshop equipment such as: Drilling Machine, Grinding M/c, Valve refacing M/c., Cylinder Honing M/c., Twin head m/c, Horizontal Boring bar, Surface grinding m/c., Crank shaft and Can shaft grinding M/c, Mechanical press, Hydraulic Press etc	12

## TECHNICAL SEMINAR & COMMUNICATION SKILL

Period / Week : 02  
Total Period : 30

Exam. : 01 hrs.  
End Exam.: 25 marks  
Sessional : 25 marks  
Total Marks: 50 marks

### TECHNICAL SEMINAR:-

To expand the professional services to the engineering community. Comprehensive and focused on practical problem solving techniques for the engineering professional, Now a days technical seminars are highly interactive between instructor and attendee. All of the instructors are active consultants and authors who bring current real world experience and problem solving know-how to their course instruction. In only a short time, Seminars for Engineers has emerged as a quality source for the training and continuing education of today's engineers.

### Communication Skills

Regardless of the size of business you are in – whether a large corporation, a small company, or even a home-based business – effective communication skills are essential for success.

The inclusion of this subject help the students to understand how to communicate your message in the best possible way.

We start with a look at some of the key ideas behind successful communication, and offer a brief quiz that helps a students to evaluate how effectively a person could communicate, so that one can identify the areas that should focus on improvement. The articles that help the students to develop the skills that need to produce effective and inspiring spoken, written and electronic communications to individuals and groups to be studied in the communication lab.

5<sup>th</sup>  
SEMESTER

AUTO ENGG

## **AUTOMOTIVE ENGINE**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### **TOPIC WISE DISTRIBUTION OF PERIODS**

<u><b>Sl. No.</b></u>	<u><b>Topic</b></u>	<u><b>Periods</b></u>
18.	Petrol engines & its constructional details	12
19.	Diesel engine & its constructional details.	09
20.	Fuel & Combustion	09
21.	Fuel feed system for petrol & diesel engine	27
22.	Cooling system	06
23.	Lubrication system	06
24.	Engine development testing & performance	06
		Total = 75

### **RATIONALE:**

Automobile engineers must have the knowledge of auto engines which is the heart of any automobile. The subject deals with function & constructional details of automobile engines, properties of fuel, lubricants and cooling systems.

### **OBJECTIVES:**

On completion of the subject students will be able to explain

1. Principle and working of petrol engine.
2. Principle and working of diesel engine.
3. Properties of fuel, details of combustion and control of knocking.
4. Process of fuel being supplied to petrol & Diesel engine.
5. Types of engine cooling and working principle of cooling system.
6. Types, properties, requirement of lubricants & process of lubrication.
7. Performance of engine.

### **COURSE CONTENTS:**

#### **1. Petrol engines and its constructional details (12 periods)**

**2.**

- 1.0 Working principle of two stroke & four stroke petrol engine.
- 1.1 Constructional details of petrol engine with materials. Engine components like piston, cylinder block, valve, connecting rod, crank shaft, crank slot.
- 1.2 Cylinder arrangement: inline and v-type engine, firing order of multi cylinder engine.
- 1.3 Side valve actuating mechanism, over head valve actuating mechanism.
- 1.4 I, F & T type valve arrangement, valve clearance.
- 1.5 Timing gear, vibration damper, inlet & exhaust manifold.

#### **2. Diesel engine and its constructional details (9 periods)**

- 2.0 Working principle two strokes & four strike diesel engine.
- 2.1 Types, advantages & limitations of diesel engine over petrol engine.
- 2.2 Function & types of combustion chamber.
- 2.3 Direct injection type combustion chamber, pre combustion chamber, turbulence chamber. Their advantages & disadvantages.

#### **3. Fuel & combustion (9 periods)**

- 3.0 Properties & additive of fuel.
- 3.1 Cetane & Octane nos.
- 3.2 Combustion stages in S.I.Engine, Flame propagation, pre-ignition, detonation & its control.
- 3.3 Combustion stages in C.I.Engine, delay period, diesel knock & its control.
- 3.4 Methods of Scavenging & super charging, super charging of CI & SI engines.
- 3.5 Super charger, blower, turbo charger.

#### **4. Fuel feed system for petrol & diesel engine (27 periods)**

- 4.0 Line diagram of petrol engine fuel supply system.
- 4.1 Components of petrol engine fuel supply system like fuel tanks, fuel lines, fuel pumps, (mechanical & electrical), fuel filter, carburetor, up draught carburetors.
- 4.2 Requirements and working principle of carburetors. Air fuel ratios for different conditions in carburetors.
- 4.3 Circuits of various types of carburetor, like down draught carburetor, up draught carburetor, side draught Carburetor.
- 4.4 Description of carter, zenith, solex, S-U & motorcycle carburetors.
- 4.5 Line diagram of diesel engine fuel supply system.
- 4.6 Requirements and types of fuel injection system.
- 4.7 Air injection, solid injection, individual pump system injection, common rail system injection.
- 4.8 Constructional details of fuel pump.
- 4.9 fuel injectors.
- 4.10 Governing system of fuel: Mechanical governor, pneumatics governor, hydraulic governor.

#### **5. Cooling System (6 periods)**

- 5.0 Necessity & types of engine cooling.
- 5.1 Constructional details of air cooling & water cooling (thermo siphon & pump air circulation).
- 5.2 Advantages and limitations of air cooling.
- 5.3 Water pump, thermostat, radiator.
- 5.4 Anti-freezing and anti-corrosive additives.

#### **6. Lubrication System (6 periods)**

- 6.0 Types, requirements and properties (flash point & fire points) of lubricants.
- 6.1 Types of lubrication system: gravity type, splash type, pressure type, dry sump type, semi pressure type etc.
- 6.2 Parts of lubricating system like oil sump, oil pump, oil cooler, oil filter, oil pressure gauge, oil pressure indicating light, oil label indicator.
- 6.3 Oil filters and its types- full flow filter and bypass filter.
- 6.4 Crank case ventilation.

#### **7. Engine development testing & performance (6 periods)**

- 7.0 Principle, advantages and disadvantages of WANKEL engine.  
Clearance volume, swept volume stroke, bore, compression ratio, efficiency.  
Mechanical efficiency, volumetric efficiency, thermal efficiency.  
Specific fuel consumption, BHP, IHP.  
Morse-test and preparation heat balance sheet.

#### **BOOKS RECOMMENDED:**

- 1. Automobile engineering Vol, Vol-II by Kirpal Singh std. Publishers.
- 2. Automobile engineering by N.H. Crouse, Mc. Graw Hills.
- 3. Automobile engineering by G.B.S. Narangs, Khanna pub.

4. The Automobile- by H.S. Reyat, S.Chand & Co.
5. Automotive engineers by W.H. Course, Mc. Graw Hill
6. I.C.engine by Mathur and Sharma.
7. Automobile engineering by R.B. Gupta, Satya Prakashan.
8. Automobile engineering by C.P.Nakra.

### **AUTOMOTIVE TRANSMISSION**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

#### **TOPIC WISE DISTRIBUTION OF PERIODS**

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Clutch	10
2.	Gear Box	10
3.	Propeller Shaft	10
4.	Differential	10
5.	Rear Axle	10
6.	Two Wheeler	10
7.	Performance of automobile	15
Total =		75

#### **RATIONALE:**

The power developed by automobile engine is transmitted to the rear axle through many parts & mechanism such as clutch, gear Box, propeller shaft and differential. The entire system is called power transmission mechanism in automobile. Knowledge of automobile transmission is of vital importance for an automobile engineer.

#### **OBJECTIVES:**

On completion of the course students will be able to understand and explain

1. Functions, types, requirements & adjustment of clutch.
2. Function, types & operation of gear box.
3. Functions of propeller shaft & types of joints.
4. Functions & types of differentials.
5. Types & operation of rear axle.
6. Transmission of power in two wheelers.
7. Various resistances for vehicles & calculation of tractive effort.

#### **COURSE CONTENTS:**

##### **1. Clutch (10 periods)**

- 1.0 Introduction, requirement of clutch, types of clutch
- 1.1 Clutch operation
- 1.2 Clutch components, clutch facing.
- 1.3 Clutch problems & adjustment.
- 1.4 Fluids fly wheel & coupling.

##### **2. Gear Box (10 periods)**

- 2.0 Introductions, functions & types of transmission
- 2.1 Sliding mesh & constant mesh gear box
- 2.2 Epicyclic gear box, over drive
- 2.3 Free-wheel drive, selector mechanism
- 2.4 Fluid torque converter

### **3. Propeller shaft (10 periods)**

- 3.0 Introduction, definition & types of propeller shaft
- 3.1 Universal joints & its types.
- 3.2 Sliding joint

### **4. Differential (10 periods)**

- 4.0 Function of a differential gear box
- 4.1 Types of differential
- 4.2 Constructional details of a differential
- 4.3 Study & inspection of differential

### **5. Rear Axle (10 periods)**

- 5.0 Definition of rear axle, supporting of rear axle
- 5.1 Rear axle drives such as Hotchkiss drive, torque tube drive etc.
- 5.2 Types of rear axle
- 5.3 Rear axle casing

### **6. Two wheeler (10 periods)**

- 6.0 Power transmission system of moped
- 6.1 Power transmission system of scooter.
- 6.2 Power transmission system of motor cycle
- 6.3 Power transmission system of bullet.

### **7. Performance of Automobile (15 periods)**

- 7.0 Power for propulsion, resistances for vehicle
- 7.1 traction & tractive effort, road performance curves
- 7.2 Acceleration gradiability & draw-bar pull.
- 7.3 Calculation of equivalent weight.
- 7.4 Calculation of maximum traffic effort.

### **RECOMMENDED BOOKS:**

- 1. Automotive mechanics by Heitner, CBS publishers.
- 2. The automobile by Harbans Singh Reyat, S. chand & Co.
- 3. Automobile Engineering by G.B.S Narang. Khanna publishers
- 4. Automobile Engineering Volume-1 by Dr. kupal singh, Std. Publishers
- 5. Automotive Transmission & power Yrain by W.H. Crouse, Mc Graw Hills
- 6. Motor manual (Transmission) by A.N. Judge
- 7. Motor manual (Car mechanism) by A. N. Judge

# AUTOMOTIVE CHASIS SUSPENSION & CONTROLLING SYSTEM

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

## TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Front Axle	07
2.	Steering & Steering geometry	16
3.	Suspension system	12
4.	Brake System	24
5.	Wheel & Tyres	08
6.	Chassis & Frames	08
	Total	75

## **RATIONALE:**

The modern automobile is made up of many components and parts. The parts under the body are referred to as chassis. Engine and several other systems are mounted on the chassis. The system through which wheels are connected to the frame is called suspension. Steering arrangement and brake system are for controlling a vehicle system.

These form an important part of automobile and hence should be learned by an automobile engineer.

## **OBJECTIVES:**

On completion of the subject a student will be able to understand and explain

1. Function & assembly of axle.
2. Steering mechanism & steering geometry.
3. Objectives, principle & types of suspension system.
4. Principle, types & Functioning of brake.
5. Types & properties of wheels & Tyres.
6. Tyres & layout of chassis.

## **COURSE CONTENTS:**

### **1. Front Axle (7 periods)**

Introduction & study of front axle assemblies  
Front axle & stub axle.  
Front wheel assembly

### **2. Steering & steering geometry (16 periods)**

Introduction, types of steering, steering column  
Steering mechanism, power steering  
Steering geometry i.e. camber, caster king-pin inclination, under steer, over steer, combined angle.  
Toe in, Toe –out, steering angle, wheel alignment & factors affecting wheel alignment.

### **3. Suspension system (12 periods)**

- 3.0 Introduction principle & objectives of suspension system.
- 3.1 Types of suspension springs like leaf spring, coil spring, rubber bushes, torsion bar.
- 3.2 Types of suspension system such as independent suspension system, rigid axle suspension system, stabilizer & shock absorber.

### **4. Brake System (24 periods)**

- 4.0 Principle, of operation and requirements of brakes.
- 4.1 Fading of brake, types of brakes such as drum brakes and its leading & trailing shoes, disk brakes
- 4.2 Hydraulic brakes and its components like master cylinder, tandem master cylinder, wheel cylinder, brake fluid
- 4.3 Servo-brakes, air brake & hand brake
- 4.4 Adjustment and bleeding of brake
- 4.5 common brake problems

### **5. Wheel & Tyres (8 periods)**

- 5.0 Introduction, types of wheel & wheel dimensions
- 5.1 Types and properties of tyres, tubeless tyres, tube.
- 5.2 Tyre manufacturing, tyre specification, precaution regarding tyres.

### **6. Chassis & Frames (8 periods)**

- 6.0 Introduction and lay out of chassis showing its main components
- 6.1 Types of chassis frame and important chassis layouts

### **RECOMMENDED BOOKS**

- 1. Automobile engineering vol -1&2 by Kirpal Singh, Std. publishers
- 2. Automobile engineering by G.B.S Narang, Khanna publishers
- 3. Automotive mechanics by W.H.Crouse, McGraw Hill
- 4. Automotive Chassis & Body by W.H.Crouse, McGraw Hill.

## **AUTO ELECTRICITY**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th :80  
I.A. 15+5  
Total: 100 marks

### **TOPIC WISE DISTRIBUTION OF PERIODS**

<u><b>Sl. No.</b></u>	<u><b>Topic</b></u>	<u><b>Periods</b></u>
1.	Storage Battery	08
2.	Starting System	08
3.	Generating System	12
4.	Alternator	06
5.	Ignition System	18
6.	Light	08
7.	Accessories & Control	08
8.	Wiring System	07
	Total:	75

### **RATIONALE:**

Electrical system in automobile is necessary for starting and generating power for ignition and lighting purposes. Automobile students should know about the operation maintenance of wiring systems for automobiles.

### **OBJECTIVES:**

On completion of the subject students will be able to understand and explain:

1. Types, construction, charging, testing and maintenance of battery.
2. Construction, drive arrangement, principle and operation of starter.
3. Principle, construction and maintenance of generator.
4. Principle, construction and maintenance of alternator.
5. Types and components of ignition system.
6. Setting and mechanism of lights.
7. Mechanism of several electrical accessories.
8. Types of wiring and wiring diagram.

### **COURSE CONTENTS:**

#### **1. Storage Battery (8 periods)**

- 1.0 Purpose and types of battery.
- 1.1 Construction, capacity and charging of battery.
- 1.2 Testing, servicing and maintenance of battery.

#### **2. Starting System (8 periods)**

- 2.0 Principle and construction of starter motor.
- 2.1 Drive arrangement and control.
- 2.2 Servicing and maintenance of starter motor.

#### **3. Generating System**

- 3.0 Flemings right hand rule and lenz's law.
- 3.1 Principle and constructional details of generator.
- 3.2 Current and voltage regulator.
- 3.3 Cut-out relay, routine maintenance of generator.

#### **4. Alternator**

- 4.0 Principle and construction of alternator.
- 4.1 Maximum R.M.S. and average value.
- 4.2 Maintenance of alternator.

#### **5. Ignition system**

- 5.0 Principle and components (induction coil, contact breaker, spark plug, distributor, condenser) of spark ignition system.
- 5.1 Advance and retarding of ignition timing.
- 5.2 Centrifugal and vacuum spark advance mechanism.
- 5.3 Types of ignition system such as:- Coil ignition system, magnet ignition system, electronics ignition system, transistorised ignition system
- 5.4 Ignition system servicing and fault diagnosis.

#### **6. Light**

- 6.0 Setting of head lights.
- 6.1 Tail and stop lights.
- 6.2 Indicator and dim deeper mechanism.

#### **7. Accessories & control**

- 7.0 Electric horn and screen wiper.
- 7.1 Fuel gauge, oil pressure gauge and water, temperature gauge.

#### **8. Wiring system**

- 8.0 Types of wiring system such as :-  
Earth return and insulated return system.  
Wiring diagram of four wheelers and two wheelers.  
Elective wiring layout in a four wheeler.  
Inspection and maintenance of electrical systems.

#### **RECOMMENDED BOOKS:**

- 1. Electrical equipments of automobiles By Parker Singh.
- 2. Automobile electrical equipment By Kohil.
- 3. Basic automobile electricity By C.P.Nakra
- 4. Automobile electrical engineering by Arora 7 Das.
- 5. Automobile electrical system and equipments By M.R.Khatawata.
- 6. Motor manual (modern automobile electrical equipment) By A.W.judge.
- 7. Automobile electrical equipments by W.H. Crouse, MC Graw Hill.

## ROBOTICS & INDUSTRIAL AUTOMATION

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
1.	Fundamental of Robot	12
2.	Robot End - Effectors	09
3.	Robotic Sensors and Vision	15
4.	Robot Programming Language	09
5.	Robot Drive actuators and Control	06
6.	Electrical & Electronic Controls	06
7.	Industrial Automation	12
8.	Robot Application	06
Total = 75		

### **RATIONALE:**

Automobile engineers must have the knowledge of Robotics and Industrial Automation which is the process of following a pre determine sequence of operation with little or low human interaction, using specializing the equipments and devices that plat form and control manufacturing process. Now a day all the automotive Industries implemented Robotics technology to automate the manufacturing and materials handling process.

The Subject will help the student to recruit themselves in Automotive Industries.

### **OBJECTIVES**

On completion of the subject students will be able to explain

1. Principle and working of Robot.
2. Principle and working of Sensor & Vision.
3. How to right the programme for Robot.
4. How the Robots are working.
5. Controlling Mechanism .
6. Principle and types of Automation.
7. Different types of its applications.

### **COURSE CONTENTS:**

#### **1. Fundamental of Robot (12 Periods)**

- 1.0 Definition of robot.
- 1.1 Functions of a robot
- 1.2 History of Robots
- 1.3 Robot Classifications
- 1.4 Mechanical Design of a Robot
- 1.5 Types of Mechanical Joints
- 1.6 Robot arms
- 1.7 Robot Hands
- 1.8 Robots Kinematic Control
- 1.9 Conversion of Motion.

#### **2. Robot End – Effectors (09 Periods)**

- 2.0 Types of End - Effectors
- 2.1 Classification of End - effectors
- 2.2 Design of gripper
- 2.3 Remote Center Compliance Devices (RCCs)

#### **3. Robotic Sensors and Vision (15 Periods)**

- 3.0 Introduction to Robotic Sensors
- 3.1 Characteristics of Sensing Device
- 3.2 Types of Sensors
- 3.3 Touch or tactile Sensors

- 3.4 Position and Displacement Sensors
- 3.5 Force / Torque Sensors (FTS).
- 3.6 Proximity Sensors
- 3.7 Range Sensors
- 3.8 Selection of a Right Sensor.
- 3.9 Introduction to Robot Vision
- 3.10 Robot Vision Systems
- 3.11 Advantages & Application of Machine Vision
- 3.12 Industrial Applications of Vision-controlled Robotic Systems

#### **4. Robot Programming Language (09 Periods)**

- 4.0 Robot Programming
- 4.1 Methods to Programme the Robot's Work Cycle
- 4.2 Robot programming Languages
- 4.3 Requirements of a Robot Programming Language.

#### **5. Robot Drive Actuators and Control (06 Periods)**

- 5.0 Introduction.
- 5.1 Fluid Power- General Aspects.
- 5.2 Hydraulic actuators.
- 5.3 Pneumatic Actuators
- 5.4 Electrical Actuators
- 5.5 Single Phase Motors
- 5.6 Electronic control of A.C. (Induction) Motor
- 5.7 Synchronous Motor-types, starting, speed control and testing..

#### **6. Electrical & Electronic Controls (06 Periods)**

- 6.0 Sensors and Transducers.
- 6.1 Control System
- 6.2 Electronic Devices
- 6.3 Digital Electronics
- 6.4 Microprocessor – General aspects
- 6.5 Microprocessor system
- 6.6 Intel 8085 Microprocessor
- 6.7 Programmable Logic Controller (PLCs)

#### **7. Industrial Automation ( 12 Periods)**

- 7.0 General Aspects.
- 7.1 Advantages and Limitations of Automation
- 7.2 Applications of Automation
- 7.3 Elements of Automation
- 7.4 Aims of Automation
- 7.5 Mechanization and Automation
- 7.6 Types of Automation
- 7.7 Assembly Automation Equipment – Transfer Devices and Feeders
- 7.8 Flexible Manufacturing System (FMS)
- 7.9 Computer Integrated manufacturing (CIM)
- 7.10 Computer Aided Process Planning (CAPP) system
- 7.11 Group Technology

#### **8. Robot Application (06 Periods)**

- 8.0 Introduction
- 8.1 Applications of Robots.
- 8.2 Summary of Features and Application of Future Industrial Robots.

#### **RECOMMENDED BOOKS:**

- 1. Robotics and Industrial Automation by R.K.Rajput ( S.Chand)
- 2. CAD / CAM by Groover and Zimmer (HH).

## AUTO SERVICING AND MAINTENANCE LAB.II

Period / Week : 6  
Total Period : 90

Examn. : 4 hrs.

**End Exam.:**

Practical : 60 Marks

Sessional : 40 marks

Total Marks: 100 marks

### RATIONALE:

Automobile students should have practical knowledge and skill about servicing and maintenance work of various automobile parts. This will positively help them in practical field of work.

### OBJECTIVES:

To be able to do servicing and maintenance of various systems and components of a four wheeler.

### COURSE CONTENTS:

Sl.No.	Contents	Periods
1	Safety precaution in automobile workshop and identification of different types of tools and equipments required in a automobile Workshop.	03
2	Identification of different machines, equipment & its operation such as Air compressor, Hydraulic Hoist, Car washer, Mechanical Jack, Hydraulic Jack grease Gun, Oil gun, Mechanical press, Hydraulic Press etc.	06
3	Washing, Cleaning, Polishing & Spray painting of Cars.	03
4	Identification of various units of a Vehicle.	03
5	Study of working principle of Petrol engine and Diesel engine & its constructional details.	06
6	Study of fuel feed systems of Petrol and Diesel engine, & study of different types of carburetor used in vehicle.	03
7	Testing of fuel injection system and adjustment of pressure of a fuel injector.	06
8	Study of different types of cooling system used in a vehicle.	03
9	Study of lubrication system of vehicle.	03
10	Study of different types of Engine, adjustment of tappet clearance of valve, timing adjustment etc.	06
11	Calibrating & phasing of Fuel pump through Calibrating Machine.	06
12	Testing the valve spring tension by Spring tester.	03
13	Over hauling the piston and connecting rod assemble by connecting rod alignment fixture.	06
14	Over hauling engine block crank shaft and can shaft.	06
15	Assembling engine parts, piston connecting rod cylinder head rocker arm assemble and mini force engine.	06
16	Assembling of engine parts such as F.I. Pump injectors' fuel filter and other accessories.	06
17	Adjustment of valve tappet clearance (4 cylinder / 6 cylinder engine)	03
18	Servicing of inlet, exhaust manifolds silencers and ten pipe.	03
19	Over hauling of fuel feed pump ( both diesel and petrol)	03
20	Bleeding the fuel system in diesel engine.	03
21	Starting and stopping of diesel engine (hand operate)	03

## AUTO MACHINE SHOP - II

Period / Week : 06  
Total Period : 90

Examn. : 4 hrs.

**End Exam.:**

Practical : 60 Marks

Sessional : 40 marks

Total Marks: 100 marks

**RATIONALE:**

Automobile engineers should know the use of measuring tools for automobile parts, they should also know about intricate machining and finishing of automobile parts.

**OBJECTIVES:**

Students should be able to operate different machine tools required in an automobile machine shop and use relevant measuring instruments.

**COURSE CONTENTS:**

Sl.No.	Contents	Periods
1	i) Valve refacing by valve refacing machine.	03
	ii) Valve seat-cutting by manual and electric cutters	03
	iii) Valve lapping and testing of leakage.	03
2	Cylinder boring by using vertical boring bar	06
3	Cylinder resleeving by hydraulic press.	06
4	Crank shaft grinding by using Crank shaft grinding M/c.	09
5	Fine finishing operation of cylinder bore by using cylinder honing m/c.	09
6	Boring of main journals by using Horizontal boring bar.	06
7	Connecting rod big end and small end boring using twin head machine.	06
8	Study of crank shaft grinding, piston grinding, surface grinding, cylinder re-boring, honing and brake Drum turning (by visiting to different organization)	09
9	i) Brake shoe riveting.	06
	ii) Turning of propeller shaft.	06
	iii) Different types of metal bush turning, reaming & setting.	06
10	Removing and refitting cylinder liners on cylinder bore.	06
11	Removing of broken stud and bolt by stud extractor and tap wrench.	06

## PROJECT SEMINAR & COMMUNICATION SKILL

Period / Week : 02  
Total Period : 30

Examn. : 01 hrs.  
End Exam. :  
Practical : 25 Marks  
Sessional : 25 marks  
Total Marks: 50 marks

### RATIONALE:

Automobile students should have knowledge of communication skill and know how to prepare a project during their study. This will positively help them in practical field of work.

### OBJECTIVES:

To be able to do project related to advance technology in the field of Automobile Engg.

### COURSE CONTENTS:

#### PROJECT SEMINAR

Project monitoring consists of periodic reviews based on reports and deliverables. It may also include hearing and review procedures. Networks of Excellence (NoE) and Integrated Projects (IP) also require an update of the planning for the following 06 months.

**The periodic activity report**, containing an overview of the activities carried out during the reporting period, describes the progress in relation to the project objectives, the progress towards the milestones and deliverables set for the period, and any problem encountered and corrective actions taken.

It also includes a **Publishable executive summary** and, as an Annex, an updated **Plan for using and disseminating the knowledge**

**The periodic management report** includes a detailed justification of the costs incurred and of the resources deployed by each trainees linking them to activities implemented and justifying their necessity, the financial statements from each trainees (which may require a Post facto approval) and a summary financial report consolidating the costs of the project

The students will ask to submit their report and the end of their semester.

#### Communication Skills

Regardless of the size of business you are in – whether a large corporation, a small company, or even a home-based business – effective communication skills are essential for success.

The inclusion of this subject help the students to understand how to communicate your message in the best possible way.

We start with a look at some of the key ideas behind successful communication, and offer a brief quiz that helps a students to evaluate how effectively a person could communicate, so that one can identify the areas that should focus on improvement. The articles that help the students to develop the skills that need to produce effective and inspiring spoken, written and electronic communications to individuals and groups are as follows:

Start improving your Communication Skills.

- 1) [Communication Skills - Start Here!](#)
- 2) [How Good Are Your Communication Skills?](#) - Take our test to see how effectively you communicate and identify key areas to improve
- 3) [Making a Great First Impression](#)
- 4) [Better Public Speaking and Presentation](#) - Ensure your words are *always* understood
- 5) [Speaking to an Audience](#) - Communicate complex ideas successfully
- 6) [Presentation Planning Checklist](#)
- 7) [Questioning Techniques](#) - Asking questions effectively
- 8) [Effective Email](#) - How to communicate powerfully by email
- 9) [Writing Skills](#) - Before you write it down, know this
- 10) [Charts and Graphs](#) - Choosing the right format
- 11) [Running Effective Meetings](#)
- 12) [Ice Breakers](#) - Setting the scene for productive meetings
- 13) [Facilitation](#) - Guiding an event through to a successful conclusion
- 14) [Win-Win Negotiation](#)
- 15) [Business Story Telling](#) - Using stories to inspire
- 16) [Communications Planning](#) - Getting the right message over, in the right way
- 17) [Communicating in a Crisis](#) - Don't shut down communication
- 18) FEED BACK
- 19) [Delivering Bad News](#) - Terminating employment honestly, respectfully and with dignity

20) Making your writing credible, appealing and logical

21) Giving and Receiving Feedback - Keeping team member performance high

6<sup>th</sup>  
SEMESTER

AUTO ENGG

## **ENTREPRENEURSHIP & INDUSTRIAL MANAGEMENT**

(COMMON TO ELECT, ETC, AE&I, MECH, AUTO, CSE, CPA, MET, CHEM, TEX, CER)

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 marks

### **TOPIC WISE DISTRIBUTION OF PERIODS**

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
25.	Concept of Organisation & Enterprise Management	08
26.	Entrepreneurship & Management of S.S.I.s	14
27.	Financial Accounting & cost Control	09
28.	Stores & Financial Management	09
29.	Production Management	03
30.	Sales & Marketing Management	03
31.	Human Resource Management	04
32.	Industrial Sickness	04
33.	The Factories Act 1948	05
34.	Workmen's Compensation & Payment of wages Act	08
35.	Industrial Dispute Act	04
36.	Trade Union Act	04
Total =		75

### **RATIONALE**

The course intends to provide the fundamental aspects of entrepreneurship as a means for self employment. Management functions, in an Organisation, coordinates various resources to allow the manufacturing activities to continue on a sustained basis. It is essential that the diploma engineers are given an exposure industrial activities.

Various statutory rules acts and regulations have been instituted in India by Central/ State Govt. to ensure that the workmen are not exploited an they can earn their livelihood with respect. As a supervisor / manager have to work in an industry under binding of such rules and acts, they should have a fair idea of such rules/ acts/ regulations.

### **OBJECTIVES**

On completion of the course the student will be able to:

1. Understand the concept of different forms of organisation & management function.
2. Explain the role of an entrepreneur in industrial environment & detailed idea on SSI and various related aspects.
3. Learn about financial accounting and cost control.
4. Know the different areas of management relating to stores & Finance, production, sales and marketing and human resource in the organisation.
5. Understand about the industrial sickness & its remedies.
6. Have a comprehensive idea on some important legislations relating to factory, workmen's compensation, payment of wages, industrial disputes and trade union.

## **COURSE CONTENT**

### **1. Concept of Organisation & Enterprise Management (8 Periods)**

- Define & state the features of Business.
- Explain the components of Business.
- State the feature of different forms of Business organisation.
- Define Management & different management with Administration.
- Discuss the Functions of Management.
- Discuss the principles of “Scientific Management”.
- Explain organisation structure and delegation of authority & responsibility.
- State the principles of a sound organization.

### **2. Entrepreneurship & Management of S.S.I.s. (14 periods)**

- 2.1 Define and state the meaning of ‘Entrepreneurship’
- 2.2 Discuss the entrepreneurial characteristics.
- 2.3 Explain the role of an entrepreneur in industrial development.
- 2.4 Define S.S.I., Ancillary, Tiny, Cottage, Medium & Large Scale Industries.
- 2.5 Explain the features of SSI.
- 2.6 Discuss the criteria for selection of SSI.
- 2.7 prepare a preliminary & detailed project report of SSI.
- 2.8 Enumerate the incentives available to SSI as per IPR.
- 2.9 State the inputs required for setting up a SSI.
- 2.10 Discuss the institutional support to SSI at state and National level.  
(OSFC, OSIC, IPICOL, IDCO, SIDBI< IDBI< ICICI, & Commercial Banks)

### **3. Financial accounting & cost control. (9 periods)**

- 3.1 State the different types of Accounts & Explain the double entry system of book keeping.
- 3.2 Explain Journal, Ledger, Trial Balance & cash Book.
- 3.3 Explain the components of Final Accounts and Balance –sheet.
- 3.4 Define Cost and explain its elements.
- 3.5 prepare a simple cost sheet.
- 3.6 Explain cost-volume-profit relationship & break-even-point.

### **4. Stores & Financial Management. (9 periods)**

- 4.1 State the procedures involved in purchasing.
- 4.2 Explain the centralized & decentralized purchasing.
- 4.3 State the meaning & importance of inventory control.
- 4.4 Explain the different stores records-Bincard, Stores ledger & Goods Received Note etc.
- 4.5 State the meaning & importance of financial management in context with SSI.
- 4.6 Explain the types of capital- Fixed & Working.
- 4.7 Discuss the briefly the components of working capital Management.

### **5. Production Management (3 periods)**

- 5.1 State the importance of production, planning & Control.
- 5.2 Discuss the steps involved in Production, planning & Control.

### **6. Sales & Marketing Management (3 periods)**

- 6.1 Discuss the importance of sales & Marketing Management
- 6.2 Mention & explain different Selling methods.
- 6.3 Explain the product policy briefly  
(Types of product, packaging, Branding, Pricing, Cost plus pricing, variable pricing policy, price strategy.)

**7. Human Resource Management. (4 periods)**

- 7.1 Mention the different source of recruitment.
- 7.2 Explain the different method of selection.
- 7.3 Discuss the different training method.
- 7.4 State the need of performance appraisal.

**8. Industrial Sickness (4 periods)**

- 8.1 Define & Explain the meaning of Industrial Sickness.
- 8.2 State the causes of sickness.
- 8.3 Explain the remedial measures to avoid industrial sickness.

**9. The Factories Act. (5 periods)**

- 9.1 State the meaning & objectives of Factories Act
- 9.2 Outline the various Provisions related to Health, Safety, Welfare, hours of work, Holidays, Wage, Employment of Women, Accidents, Diseases, penalties & Procedures.
- 9.3 Explain the duties of factory Inspectors.

**10. Workmen's Compensation & payment of wages Act. (8 periods)**

State the rules regarding Workmen's compensation.  
 Explain the employees liability for compensation.  
 State the obligations and rights of employer.  
 Give the meaning of payment of wages Act.  
 State the different rules for payment of minimum wages.  
 State the provisions of E.P.F. & E.S.I.

**11. Industrial Dispute Act. (4 periods)**

- 11.1 Outline the objects & meaning of Industrial Dispute Act.
- 11.2 State the causes of Industrial Disputes.
- 11.3 Enumerate the machinery set up for settlement of Industrial Disputes.
- 11.4 Explain the measures for prevention of Industrial Disputes.

**12. Trade Union Act. (4 periods)**

- 12.1 State the meaning & Functions of Trade union.
- 12.2 Explain the features of Trade union Act 1926.

**BOOKS RECOMMENDED:**

- 1. Industrial engineering & Management-O.P. Khana
- 2. Entrepreneurial Development –Gupta & Srivastav.
- 3. Small Scale Industry- Vasant Desai.
- 4. Business Organisation- Sharma & Gupta.
- 5. Principles & Practices of management- L.M. Prasad.
- 6. Entrepreneurship for Engineers-B. Badhei.
- 7. Industrial Law- N.D. Kapoor.

## **INDUSTRIAL LAWS, MOTOR VEHICLE ACT , RULES & GARAGE SERVICE**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100

### **TOPIC WISE DISTRIBUTION OF PERIODS:**

<b>Sl. No.</b>	<b>Topics</b>	<b>Period</b>
1.	Industrial Laws	15
2.	Motor Vehicle Laws	25
3.	Automobile Maintenance and its necessity types	05
4.	Garages and Service Station	10
5.	Servicing of Motor Vehicle	10
6.	Knowledge about automobile Organisation.	10

### **RATIONALE:**

Government have made various industrial & Motor vehicle Acts, rules & regulations from time to time. An Automobile engineer should be well conversant with such rules & regulations so that they can perform their duties within the preview of such rules/acts/regulations. This is very important for them.

### **OBJECTIVES:**

On completion of the subject students will be able to learn

1. Details about various industrial rules.
2. Details about registration insurance, fitness & taxes of vehicles.
3. Different types of machines & tools required for maintenance of vehicles.

### **COURSE CONTENTS:**

#### **1. Industrial Laws. (15 periods)**

Factory Act & rules, registration of factory, safety device in factory, register maintained in factory.

- .1 Minimum wages act and rules.
- .2 Motor Transport workers act & rules
- .3 Industrial dispute act & rules
- .4 E.S.I act & rules

#### **2. Motor vehicle Act. (25 periods)**

Licensing of driver

- .1 Registration of motor vehicle.
- .2 Fitness of motor vehicle.
- .3 Penalties & Procedure
- .4 Taxes of different types of motor vehicles like stage carriage, contract carriage, invalid carriage, tractor & trailer, public carrier, private carrier, two wheeler & three wheeler.
- .5 Payment of motor vehicle tax in advance. Payment of life time tax., displaying of tax token.  
Fitness of Private vehicle of 15 years of life.
- .6 Duties of driver while facing mobile courts or checking officers.
- .7 Control of Traffic.

- .8 Construction, Equipment and maintenance of motor vehicle.
- 3. Automobile Maintenance and its necessity types (05 periods)**
  - 1.1 Preventive Maintenance
  - 1.2 Operating Maintenance
  - 1.3 Brake down Maintenance
  - 1.4 Daily, weekly & Monthly maintenance of motor vehicles.
- 4. Garages and Service Station (10 periods)**
  - .9 Introduction
  - .10 Garage
  - .11 Scope of a Garage
  - .12 Types of Garages
  - .13 Service Station
  - .14 Location and Layout of garages and Service Station
  - .15 Equipment for Garages and Service station
  - .16 Equipment required to install a Service Station
  - .17 Tools in a Garage / Service station
  - .18 Services carried Out in Service Station & its procedure.
- 5. Servicing of Motor Vehicle (10 periods)**
  - Introduction
  - Servicing and its Necessity
  - Types of Servicing
  - Cleaning of the Motor Vehicle and its Parts
  - Steam Cleaning
  - Cleaning outside of the Engine
  - Precautions to Minimize Carbon
  - Methods of Decarbonising
- 6. Knowledge about automobile Organisation.(10 periods)**
  - Garage and Fleet Management

**BOOKS RECOMMENDED:**

1. The Central Motor Vehicle Rule 1989 –Professional Book Publisher
2. Motor Vehicle Act 1988 – Central Law Agencies
3. Industrial Dispute Act 1966 – Legal Miscellany
4. Minimum Wages Act and Rules – Legal Miscellany
5. Automobile Engineering by G.B.S. Narang

## **AUTOMOTIVE HEAVY EQUIPMENT**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 Marks

### **TOPIC WISE DISTRIBUTION OF PERIODS:**

<b>Sl. No.</b>	<b>Topics</b>	<b>Period</b>
1.	Tractor	12
2.	Dump Truck (Dumper)	08
3.	Grader	06
4.	Road Roller	06
5.	Dozer	11
6.	Loader	08
7.	Cranes	08
8.	Scrapers	08
9.	Tankers/Trailers	04
10.	Battery Car & Solar Car	04

### **RATIONALE:**

Automobile engineers should know about the constructional features and operations of automotive heavy equipments like tractor, dumper, roller, bulldozer, tanker etc. which are used frequently in industry as well as in constructional/ agricultural fields. This will help the engineers a lot while dealing with such heavy equipment in their world of work.

### **OBJECTIVES:**

On completion of the subject a student will be able to understand and explain

1. Types, constructional features & working of Tractors.
2. Classification, Functions & Constructional features of Dump Truck.
3. Constructional Features & uses of graders.
4. Constructional features & functions of Road Rollers.
5. Constructional Features & functions of Dozers.
6. Types, Constructional features & uses of loaders.
7. Types, uses & Constructional truck mounted of features cranes.
8. Working Application & Construction of Scrapers.
9. Applications & Constructional details of Tankers/ Trailers.
10. Uses & Constructional features of Battery Car & Solar Car.

### **COURSE CONTENTS:**

#### **1. Tractor (12 periods)**

- 1.0 Types of Tractors & their Constructional Features.
  - 1.1 Uses and Working of Crawler Mounted tractor & wheel mounted tractor.
  - 1.2 Definitions of terms like tractive effort, traction, drawbar pull, traction efficiency slip etc.
  - 1.3 Power take up shaft, various types of drives for tractors, hydraulic steering.

#### **2. Dump truck (8 periods)**

- 2.0 Classification, description & Application of Dump truck (dumper).
  - 2.1 Constructional features of dump truck (body box, axai gate, hoist)

**3. Grader (6 periods)**

- 3.0 Types & Description of graders.
- 3.1 Constructional features & application of graders.

**4. Road Roller (6 periods)**

- 4.1 Definitions, types & application of road rollers.
- 4.2 Constructional features & description of rollers.

**5. Dozer (11 periods)**

- 5.1 Definition & types (straight bull dozers, cable bull dozers) & uses of dozers.
- 3.2 Description & Constructional features of straight bull dozer.
- 3.3 Description constructional features of cable bull dozer.

**6. Loader (8 periods)**

Definition, Types uses of Loader.  
Constructional features & Working of straight bucket loader.  
Constructional features & working of tractor loader.

**7. Cranes (8 periods)**

- 7.1 Definitions, types (wheel mounted crane, truck mounted crane) & application of crane
- 7.2 Constructional features & working of wheel mounted crane.
- 7.3 Constructional features & working of truck mounted crane

**8. Scrapers (8 periods)**

- 8.1 Definition, application & types of Scrapers.
- 8.2 Constructional features & working of self propelled scraper.
- 8.3 Description, constructional features of Damper.

**9. Tankers / Trailers (4 periods)**

- 9.1 Definition, description & application of Tanker.
- 9.2 Definition, description & application of Trailer.

**10. Battery Car & Solar Car (4 periods)**

- 10.1 Definition, Description & application of Battery Car
- 10.2 Definition, Description & application of Solar car
- 10.3 Advantages & Disadvantages of Solar Car.

**RECOMNDED BOOKS:**

- 1. Moving the Earth by H.L.Nicolas
- 2. Road making Machinery by K.Abrosimov, A.Bromberg, F.Katayev
- 3. Land reclamation by T.Borshchov, R.mansurov, V.sergaev.

## **AUTOMOTIVE SPECIFICATION, DRAWING, DESIGN AND ESTIMATION**

Periods / week: 08  
Total period: 120

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 Marks

### **TOPIC WISE DISTRIBUTION OF PERIODS:**

<b>Sl. No.</b>	<b>Topics</b>	<b>Period</b>
1.	Specifications	20
2.	Drawing	40
3.	Design	40
4.	Estimation	20

### **RATIONALE:**

An automobile engineer should know how to specify an automobile and draw and design various parts of an automobile. Estimation for cost of production is also very much essential for an automobile engineer while working in a productive unit or as an entrepreneur.

### **OBJECTIVES:**

On completion of subject students will able to

1. Specify an automobile, its engine data, dimension & performance.
2. Draw the layout of garages, service station engine parts etc.
3. Design piston, connecting rod, shaft, clutch & bearing.
4. Work-out direct cost, total cost, material and labour cost, cost of production factory cost.

### **COURSE CONTENTS:**

#### **1. Specification (20 periods)**

- How to specify a vehicle.
- 1.0 Specification of moped
- 1.1 Specification of scooter
- 1.2 Specification of motor cycle.
- 1.3 Specification of Bullet.
- 1.4 Specification of maruti 800 car
- 1.5 Specification of Ambassador Car
- 1.6 Specification of Mahindra Jeep
- 1.7 Specification of flat car

#### **2. Drawing (40 periods)**

- 2.0 Layout drawing of automobile Garage-10
- 2.1 Layout drawing of service station-10
- 2.2 Drawing of engine parts like piston connecting rod, crank shaft, valve actuating mechanism, transmission system, several automobile, wiring diagrams etc.

#### **3. Design (40 periods)**

- 3.0 Design of Shaft

- 3.1 Design of piston
- 3.2 Design of connecting rod
- 3.3 Design of bearing.
- 3.4 Design of Clutch

#### **4. Estimation (20 periods)**

- 4.0 Type of cost.
- 4.1 Direct cost, material cost, labour cost, total cost.
- 4.2 Factory cost, process cost, cost of production, Examples.

#### **RECOMMENDEDE BOOKS:**

1. Automobile Engineering by G.B.S. Narang, Khanna Publishers
2. Design Drawing by B.B. Gupta, R.S. Khurmi.
3. Motor Vehicle engines by M. Khovakh.
4. Mechanical Estimation by Banga & Sarma, Khanna Publishers.
5. Automobile Drawing by R.B.Gupta.
6. A Text book of Machine design by R.S.Khurmi & J.K.Gupta (S.Chand)

## ADVANCE MANUFACTURING PROCESS & CAD/CAM

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 Marks

### TOPIC WISE DISTRIBUTION OF PERIODS:

Sl. No.	Topics	Period
1.	CAD/CAM	05
2.	Non-Conventional machining process	25
3.	C.N.C. MACHINE	45
		Total <b>75</b> periods

### **RATIONALE:**

Indian Industries today are faced with global competition and hence the need for improving their manufacturing processes and techniques to the latest world standards. This course is offered to allow students to be acquainted with such advanced processes and manufacturing processes and systems.

### **OBJECTIVES:**

On completion of the course students will be able to

1. Describe the various types of non-conventional machining process.
2. Understand the co-ordinate systems, part programming of NC machine tools.
3. Describe the flexible manufacturing process.
4. Understand CAD/CAM..

### **COURSE CONTENTS:**

#### **1.0 CAD/CAM (5 periods)**

- 1.1 Define CAD/CAM
- 1.2 Introduction
- 1.3 The Design Process
- 1.4 The Application of Computer for Design
- 1.5 Creating the manufacturing Data Base
- 1.6 Benefits of computer-Aided Design

#### **2.0 Non-conventional machining process. (25 periods)**

- 2.1 Describe the working principle and application of various non-conventional machining processes with line diagram.
  - 2.1.0 Electro chemical
  - 2.1.1 Electro discharge
  - 2.1.2 Plasma Arc.
  - 2.1.3 Laser Beam
  - 2.1.4 Abrasive jet.
  - 2.1.5 Electron Beam.

- 3.0 C.N.C. MACHINE (45 periods)**
  - 3.1 Introduction to Numerical Control of Machine (10 periods)**
    - 2.1.0 Objectives/introduction
    - 2.2.0 N.C./ CNC Machine
    - 2.3.0 Direct Numerical Control
    - 2.4.0 Advantages / Disadvantages of CNC Machine
    - 2.5.0 Parts suitable for CNC Machine
  - 3.2 Components of Numerical Control Systems(05 periods)**
    - 2.2.0 Objectives/ Introduction
    - 2.3.0 Basic components of Numerical Control System
    - 2.4.0 Programme of Instructions
    - 2.5.0 NC Coding
    - 2.6.0 Machine Control Unit/Machine Tool
    - 2.7.0 Numerical Control Procedure
  - 3.3 Classification of Numerical Control Machines (05 periods)**
    - 3.3.0 Objectives/Introduction
    - 3.3.1 Classification based on feedback Control
    - 3.3.2 Open Loop Control
    - 3.3.3 Closed Loop Control
    - 3.3.4 Classification based on Control System
    - 3.3.5 Features
    - 3.3.6 Point to Point/ Straight line/ Contouring Control system
    - 3.3.7 Axis Identification in NC.CNC Machine
  - 3.4 Constructional Details of CNC Machine (05 periods)**
    - 3.4.0 Objectives / Introduction
    - 3.4.1 Machine Structure
    - 3.4.2 Slideways/Spindle/Drive Units
    - 3.4.3 Elements of Motion Transmission
    - 3.4.4 Location of Transducers/Control Elements
    - 3.4.5 Tool and Work Holding Devices
    - 3.4.6 Swarf Removal
    - 3.4.7 Guarding and safety
  - 3.5 Fundamentals of Part Programming (05 periods)**
    - 3.5.0 Objective/ introduction
    - 3.5.1 NC Word/Rapid Transverse Function/Linear Interpolation/Circular interpolation Function/Dwell Function
    - 3.5.2 Programming Formats
    - 3.5.3 Writing a Part Programming/Machining in Point to Point/Machining along straight Line
    - 3.5.4 Lathe Operations
    - 3.5.5 Programming for CNC Milling Machine
    - 3.5.6 Operations /Cutter Radius Compensation
  - 3.6 Part Programming using sub routines, Do loops and canned cycles. (05 periods)**
    - 3.6.0 Introduction
    - 3.6.1 Sub Routines /Do Loops
    - 3.6.2 Canned Cycles/Fixed Cycles for lathe Operations/Fixed Cycles for CNC Milling Machine and machining Centre Operations
  - 3.7 Computer Aided Part Programing (05 periods)**
    - 3.7.0 Objectives/ Introduction
    - 3.7.1 Computer aided part programming Languages APT/ COMPACT-II

### **3.8 Tooling for CNC Machines (05 periods)**

- 3.8.0 Objectives / Introduction
- 3.8.1 Cutting Tools / Indexable Inserts / Tool Holders
- 3.8.2 Work holding Devices in CNC
- 3.8.3 Automatic Tool Changers
- 3.8.4 Multi pallet Machines

#### **RECOMMENDED BOOKS:**

1. Text Book of Production Engineering by P.C.Sharma, S.Chand & Co.
2. Automation, Production systems and computer-integrated manufacturing by Mikell P. Groovex, PHI Pvt. Ltd.
3. Workshop Technology Vol-2 by Hazra and Choudhury, Media Promoters and Publishers Ltd.
4. CAD/CAM Computer Aided Design and manufacturing by Mikell P.Groover.

## **AUTO REFRIGERATION AND AIR CONDITIONING (ELECTIVE)**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 Marks

### **TOPIC WISE DISTRIBUTION OF PERIODS:**

<b>Sl. No.</b>	<b>Topics</b>	<b>Period</b>
1.	Introduction to Refrigeration and Air Conditioning and its applications.	05
2.	Air refrigeration systems.	10
3.	Vapour compression, refrigeration system & its Components & Control	15
4.	Refrigerants	05
5.	Vapour absorption refrigeration system	10
6.	Psychrometry	10
7.	Physiological Principles.	05
8.	Cooling load calculations	10
9.	Air conditioning system.	05
		Total 75 periods

### **RATIONALE:**

Refrigeration is the process of cooling below surrounding temperature. Air conditioning means distribution of air after controlling its temperature, humidity and cleanliness for human comfort.

Field of application of refrigeration and air conditioning is growing rapidly from industrial refrigeration, food preservation, manufacturing industries to human comfort in working area, places of mass gathering and even households. With steady increase in energy cost and pollution threat perception of conventional refrigerants, the subject is getting more specialized everyday. Engineers, who would like to pursue their industrial carrier in this widening field, should undertake this elective course.

### **OBJECTIVES:**

On completion of the course the students will be able to

1. Explain the different type of refrigeration & air conditioning systems.
2. Understand relationship between refrigeration and air conditioning.
3. Explain vapour compression refrigeration system vis-à-vis vapour absorption system.
4. Compare different type of refrigerants.
5. Use Psychrometric charts.
6. Explain psychological principle and state various comfort standards.
7. Calculate the cooling loads.
8. Explain working of window, split type, package air conditioner.

### **COURSE CONTENTS:**

#### **1.0 Development of refrigeration. (5 periods)**

- 1.1 Definition, purpose & application of refrigeration & air conditioning.
- 1.2 Heat pump, refrigerator, heat engine
- 1.3 C.O.P., unit of refrigerating effect.

**2.0 Air refrigeration system. (10 periods)**

- 2.1 Carnot cycle reversed Carnot cycle.
- 2.2 Brayton cycle.
  - 2.2.1 Closed system
  - 2.2.2 Open System
- 2.3 Typical Problems.

**3.0 Vapour compression refrigeration system, its components & control. (15 periods)**

- 3.1 Theoretical vapour compression cycle.
- 3.2 Calculation of C.O.P. using refrigeration tables & Charts.
- 3.3 Calculation of volumetric efficiency of reciprocating refrigerant compressor.
- 3.4 Functions, types, specification, constructional details & selection of components & controls such as compressor, condenser, expansion valves, capillary tube, evaporator.
- 3.5 Separator, accumulator, spray pond & cooling towers.
- 3.6 Control devices, such as solenoid valves, thermostat, low pressure & high pressure cut out, oil safety switch, condensing water control.

**4.0 Refrigerants (5 periods)**

- 4.1 Definition & types of refrigerants commonly used.
- 4.2 Desirable properties.
- 4.3 Nomenclature.
- 4.4 Properties of NH<sub>3</sub>, air, water, CO<sub>2</sub>, R11, R12, R22 & their applications.

**5.0 Vapour absorption refrigeration system. (10 periods)**

- 5.1 Simple vapour absorption system.
- 5.2 Practical absorption system.
- 5.3 Refrigerants absorption combinations,
- 5.4 Large absorption system for water chilling.
- 5.5 Comparison between vapour absorption & vapour compression system.
- 5.6 Electrolux system.

**6.0 Psychrometry (10 periods)**

- 6.1 Properties of air-vapour mixture.
- 6.2 Dry bulb, wet bulb, thermodynamic wet bulb, a diabatic saturation and dew point temperatures.
- 6.3 Humidity ratio, relative humidity.
- 6.4 Degree of saturation, enthalpy of moist air.
- 6.5 Sling and aspiration psychrometers.
- 6.6 Psychrometric process analysis
  - 6.6.1 Cooling and dehumidification.
  - 6.6.2 Heating and humidification.
  - 6.6.3 Mixing of two air streams.
  - 6.6.4 Sensible heating and cooling.

**7.0 Physiological factors (5 periods)**

- 7.1 Factors affecting human comfort.
- 7.2 Metabolism of human body.
- 7.3 Comfort chart.
- 7.4 Effective temperatures.

## **8.0 Cooling load calculations (10 periods)**

- 8.1 Types of loads.
  - 8.1.1 Sensible heat, latent heat, total heat.
  - 8.1.2 Calculation of loads due to different sources of solar, human beings, appliances, in filtration.
  - 8.1.3 Sensible heat factor, latent heat factor, total heat factor.
  - 8.1.4 Bypass factor, apparatus dew point.
  - 8.1.5 Fresh supply and recirculated air quantities.

## **9.0 Air conditioning system. (5 periods)**

- 9.1 Description and specification of room air conditioner and commercial conditioning system.
- 9.2 Principles of evaporative cooling.
- 9.3 Air Cooler and desert cooler.
- 9.4 Air distribution systems and ducting.
- 9.5 Air Filters, dampers, Fans, blower, diffusers.

## **RECOMMENDED BOOKS:**

1. Refrigeration and Air Conditioning by C.P.Arora, TMH
2. Refrigeration and Air Conditioning by R.S.Khurmi & J.K.Gupta
3. Refrigeration and Air Conditioning by P.L. ballaney, khanna pub.
4. Refrigeration and Air Conditioning by S.C. Domkundwara and Arora.
5. Refrigeration and Air Conditioning by M.Prasad, New age International.

## **DESIGNING AND FABRICATION OF VEHICLE BODY (ELECTIVE)**

Periods / week: 5  
Total period: 75

Exam: 3 Hours  
End exam-Th: 80  
I.A. 15+5  
Total: 100 Marks

### **TOPIC WISE DISTRIBUTION OF PERIODS:**

<b>Sl. No.</b>	<b>Topics</b>	<b>Period</b>
1.	Introduction	15
2.	Motor vehicle body	15
3.	Design of automobile body	10
4.	Body constructional details	15
5.	Interior design for passenger vehicle	10
6.	Production of method	10
		Total 75 periods

### **RATIONALE:**

Load on vehicle body, forces on structural members, seat adjusting mechanism, vehicle comfort, interior fittings, body finishing are to be taken into consideration while designing a vehicle body. An automobile engineer who wishes to design and/or fabricate an automobile must be conversant with this project.

### **OBJECTIVES:**

On completion of the subject a student will be able to learn

1. Designing of vehicle body with aerodynamic consideration.
2. Chassis construction, frame construction, and types of auto-body.
3. Functional design, loads on vehicle body and importance of body style.
4. Structural member like roof, bonnet, seat adjusting mechanism
5. Dimensions of vehicle comfort, interior fittings.
6. Body drafting, planning, body finishing, painting etc.

### **COURSE CONTENTS:**

#### **1. Introduction (15 periods)**

- 1.1 Body design for satisfactory degree of rigidity with minimum weight of material.
- 1.2 Utilisation of inner space in vehicle.
- 1.3 Legal limits and aerodynamic consideration in body design.

#### **2. Motor Vehicle body (15 periods)**

- 2.1 Types of automobile body & requirements of various types of vehicle.
- 2.2 Method of construction-Chassis construction unique construction, frame construction.
- 2.3 Testing of body frame.

#### **3. Design of automobile body (10 periods)**

- 3.1 Function & design.
- 3.2 Loads on the body & stresses in members.
- 3.3 Importance of style in body design.

**4. Body Constructional details (15 periods)**

- 4.1 Doors, windows & window regulating mechanism.
- 4.2 Seats and seat adjusting mechanism
- 4.3 Structural member & methods of flooring them.
- 4.4 Roof bonnet, grills, luggage board.

**5. Interior design for passenger vehicle (10 periods)**

Major dimension for vehicle comfort & utility.  
Sitting arrangement & interior fittings.  
Trimming, dust proofing.

**6. Production method (10 periods)**

Body drafting, planning & manufacture of body panel.  
Fabricating mechanism for body panel  
Body finishing methods-Body painting.  
Plastic components

**RECOMMENDED BOOKS:**

1. Modern coach & Motor Training by M.C. Linatoch S.O.
2. Practical motorist encyclopedia by Carrm F.G.
3. The motor vehicle by Newton & stoods.
4. Automotive Chassis by P.M.Heldt.
5. Mechanism of the car by A.W.Gudge.
6. Motor manual Vol-I Automotive mechanism by Joseph Heitner.
7. The automobile by Harban singh Reyat, S.chand & Co. Ltd.
8. Automobile engineering by G.B.S. Narang, Khanna publishers.
9. Automobile engineering by R.B.Gupta, Satya Prakashan.



- |   |  |
|---|--|
| 9. Parking errors.  | parallel, angular, perpendicular parking facing downhill, common errors.   |
| 10. Driver's responsibility competitiveness, over-while on the road | Driving behaviour, consideration for other road users, courtesy and confidence, impatience and defensive driving. Distance between cars driving at railway crossing. |
| 11. Priority for certain vehicles                                   | Emergency vehicles. Fire engines and Ambulance.  |

#### **B. TRAFFIC EDUCATION-1**

- |   |   |
|---|---|
| 1. Driving regulations  | Road use regulations made under section 118 of the motor vehicle Act, 1988. |
| 2. Hand signals   |   |
| 3. Traffic signs  | Schedule to the motor vehicles Act, 1988.                                   |
| 4. Hand signals of traffic constables / Traffic warden.   |   |
| 5. Introduction to automatic light signals.   |   |
| 6. Introduction to road markings.   |   |
| 7. Speed regulations on high ways and city roads.   |   |
| 8. Parking at objectionable places.   |   |
| 9. Some important provisions of the motor vehicles Act, 1988-section 122,123,125,126 and 128 of the motor vehicles Act, 1988. |   |
| 10. Test of competence to drive   | Sub-rule (3) of rule 15 of the central motor vehicles rules, 1989.          |

#### **C. LIGHT VEHICLES DRIVING PRACTICE**

- |   |   |
|---|---|
| 1. Identification of various parts of the vehicles.       |   |
| 2. Pre-driving checks                                     | (i) Before sitting on driver's seat &<br>(ii) After sitting on driver's seat. |
| 3. Steering practice                                      |   |
| 4. Bitting point  |   |
| 5. Moving and gear changing                               |   |
| 6. Stopping:  | -Normal stopping.<br>-Emergency stopping.                                     |
| 7. Developing judgment and anticipation to drive on road. |   |
| 8. Reversing  | -In straight.<br>-In 's' bends.   |
| 9. Turning and about parking.                             |   |
| 10. Licensing.  |   |

#### **D. VEHICLE MECHANISM AND REPAIRS**

- |   |   |
|---|---|
| 1. Layout of vehicle.                     |   |
| 2. Function of diesel and petrol engines. |   |
| 3. Fuel system                            | -Fuel lines<br>-Fuel injection pump<br>-Atomiser<br>-Air lock<br>-Oil block                             |
| 4. Cooling system                         | -Purpose<br>-Radiator<br>-Water pump<br>-Fan leaf/fan belt<br>-Radiator water boiling<br>-Rectification |

5. Lubrication system –purpose
  - Engine lubrication
  - Chassis lubrication
  - Oil grade number unitwise
6. Transmission system
  - (a) Clutch :
    - Function
    - Slip
    - Rising
    - Linkages
  - (b) Gear Box:
    - Function
    - Purpose
    - Parts
  - (c) Propeller shaft - Function / purpose
    - Yoke joint
    - CJ. Bearing slip
    - ‘U’ joint
    - Lubricant
  - (d) Differential:
    - Purpose
    - Function / Noise
7. Suspension system
  - Purpose
  - Springs
  - Shackle, shackle pin bushes
  - Shock absorber and its bushes
8. Steering System
  - Purpose
  - Steering geometry
  - Steering linkages
  - Steering box
9. Brake system
  - Purpose
  - Hydraulic brake and its know-how
  - Air assisted hydraulic brake and its know-how
  - Air brake and its know-how
  - Brake adjustment of the entire system.
10. Electrical system

#### **F. TRAFFIC EDUCATION-II**

1. Know your road.
2. Slight distance.
3. Road junctions.
4. Traffic islands.
5. Bye-pass, subway, over-bridge and fly-overs.
6. Bus-stop, Bus-terminals, Bus stand.
7. Road markings.
8. Lane selection and lane discipline.
9. Automatic light signals.
10. Road user characteristics.
11. Accidents.
12. Important provisions in motor vehicles Act, 1988 (59 of 1988), Central motor vehicle rules 1989, and the state motor vehicles rules.

#### **K. FIRST AID**

1. Introduction to first Aid.
2. Outline of First Aid.
3. Structure & Function of the body.
4. Dressing and Bandages.

5. The circulation of the Blood.
6. Wounds and haemorrhage.
7. Haemorrhage from special reason.
8. Shock.
9. Respiration.
10. Injuries to bones.
11. Burning scales.
12. Unconsciousness.
13. Poisons.

## **PROJECT WORK:**

Period / week: 08  
Total period: 120

Exam: 4 Hours  
End Exam  
Sessional: 100  
Total: 100 Marks

### **Objectives**

The group project is by far the most important single piece of work in the diploma programme. It provides the opportunity for the student to demonstrate independence and originality, to plan and organize a large project over a long period, and to put into practice some of the techniques you have been taught throughout the course. Whatever your level of academic achievement so far, a student can show his/her individuality and inspiration in this project. It should be the most satisfying piece of work in diploma level. It is worth about a quarter of the final year marks.

### **The Project Co-ordinator**

The Project Co-ordinator is responsible for the overall organization of the final year group projects. The students can contact him whenever they have any problem with the organization of their project.

### **Choosing an group Project**

The ideas of project which has already been prepared during 5<sup>th</sup> semester studies to be executed in their 6<sup>th</sup> semester

### **Assessment**

It is important when choosing a project to understand the way it will be assessed. A good first-class project involves a combination of sound background research, a solid implementation, or piece of theoretical work, and a thorough evaluation of the project's output in both absolute and relative terms. A good tip is to try to think of the project as an "investigation", rather than an effort to deliver a fully-functioning "product". Proper evaluation of the project is thus crucial to achieving high marks.

The very best projects invariably cover some new ground, e.g. by developing a complex application which does not already exist, or by enhancing some existing application or method to improve its functionality, performance etc.

A straightforward implementation project is acceptable, but you must appreciate that it is unlikely to gain high marks, regardless of how well it is done. Likewise, projects which are predominantly survey reports, unless they are backed up with experimentation, implementation, or theoretical analysis, e.g. for performing an objective comparison of

surveyed methods, techniques etc. Pure survey reports, with no supporting implementation or theory, are not acceptable.

## **The Project Report**

The project report is an extremely important aspect of the project. It serves to show what you have achieved and should demonstrate that:

- You understand the wider context of computing by relating your choice of project, and the approach you take, to existing products or research.
- You can apply the theoretical and practical techniques taught in the course to the problem you are addressing and that you understand their relevance to the wider world of computing.
- You are capable of objectively criticizing your own work and making constructive suggestions for improvements or further work based on your experiences so far.
- As a computing professional, you can explain your thinking and working processes clearly and concisely to third parties who may not be experts in the field in which you are working.

Most of the project assessors will not have followed the project throughout and will only have a short time to listen to a presentation or see a demonstration. For this reason they will rely heavily on the report to judge the project. Also, if in the end your overall degree marks put you on a boundary between two degree classifications, the final outcome can be influenced significantly by the quality of your project. You should appreciate that the external examiners, who play a crucial role in the final recommendation, have only the report by which to judge your project performance.

## **The Project Presentation and Demonstration**

One of the most important skills which the individual project aims to assess is your ability to communicate your ideas and work. As part of the assessment you will be required to give a presentation and demonstration of your project to your assessment team.

