



**UTTARAKHAND BOARD OF TECHNICAL EDUCATION**  
**JOINT ENTRANCE EXAMINATION AND TRAINING, RESEARCH DEVELOPMENT CELL, DEHRADUN**  
**STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME**

**BRANCH NAME – MECHANICAL ENGINEERING (PRODUCTION)**

**SEMESTER – IV**

Subject Code	Subject	L	T	P	T O T	EVALUATION SCHEME						Total Marks	Credit Point
						Internal		External					
		Period/Weeks		Theory	Practical	Theory		Practical					
		Max Marks	Max Marks	Max Marks	Hrs.	Max Marks	Hrs.						
144006	Strength of Materials*	4	-	3	7	30	20	80	2.5	25	3.0	155	4
144004	Metrology, Instrumentation & Control*	4	-	4	8	30	20	80	2.5	25	3.0	155	4
144005	Production Technology*	4	-	6	10	30	20	80	2.5	45	3.0	175	6
144003	Hydraulics and Hydraulics Machines**	4	-	3	7	30	20	80	2.5	25	3.0	155	5
144001	Applied Thermal Engineering**	4	-	2	6	30	20	80	2.5	25	3.0	155	5
144002	Automobile Engineering**	4	-	2	6	30	20	80	2.5	25	3.0	155	4
334052	Industrial exposure (Assessment at Institute level)	-	-	-	-	-	25	-	-	-	-	25	1
014054	General Proficiency	-	-	4	4	-	25	-	-	-	-	25	1
334053	Industrial Training	Industrial Training of 30 days done after 4th Semester will be evaluated in 5th Semester through Report and Viva-voce.										-	
<b>Total</b>		<b>24</b>	<b>-</b>	<b>24</b>	<b>48</b>	<b>180</b>	<b>170</b>	<b>480</b>	<b>-</b>	<b>170</b>	<b>-</b>	<b>1000</b>	<b>30</b>

\* Common with diploma course in 4thSem Mechanical Engg., Production Engg., Mech(auto.),Automobile.

\*\* Common with diploma course in 4th Sem Mechanical Engg, Production Engg.

# General Proficiency will comprise of various co-curricular activities like games, hobby clubs, seminars, declamation contests, extension lectures, NCC, NSS,cultural activities and discipline etc.

+ Industrial visit compulsory at minimum 2 industry or department.

**Note:** 1- Each period will be 50 minutes. 2- Eachsession will be of 16weeks. 3- Effectiveteaching will be at least 12.5 week

**Branch Code - 33**



**FOURTH SEMESTER  
MECHANICAL ENGINEERING (PRODUCTION)**



<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>-</b>	<b>3</b>

**Subject Code : 144006**

## **RATIONALE**

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

## **DETAILED CONTENTS**

### **1. Introduction to Material Properties**

**06 Periods**

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

### **2. Stresses and Strains**

**12 Periods**

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

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

2.3 Factor of safety.

2.4 Stress and strain in straight, stepped bars and taper bar of circular cross section, determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only

2.5 Stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and composite bars.

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

2.7 Volumetric strain, bulk modulus. Relation between modulus of elasticity, modulus of rigidity and bulk modulus (Without Derivation)

### **3. Shear Force and Bending Moment**

**10 Periods**

3.1 Types of beams.

3.2 Concept of shear force and bending moment.

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

#### **4. Theory of Simple Bending**

**10 Periods**

- 4.1 Concept of pure bending, neutral axis, moment of resistance, section Modulus, bending equation, bending of simple, beams of uniform strength.
- 4.2 Application of flexural formula for solid rectangular and circular section, Channel section, hollow rectangular and circular section.

#### **5. Strain Energy**

**08 Periods**

- 5.1 Concept of strain energy, proof resilience and modulus of resilience.
- 5.2 Stresses developed due to gradual, sudden and impact load.
- 5.3 Strain energy stored due to gradual, sudden and impact load.
- 5.4 Strain energy due to bending and torsion.

#### **6. Slope and Deflection**

**06 Periods**

- 6.1 Introduction, determination of slope and deflection by Macaulay's method, moment area of method
- 6.2 Simple cases of slope and deflection in simply supported beam with uniformly distributed load on whole of the length and a point load at the centre
- 6.3 Cantilever beam with uniformly distributed load on whole length and a point load at the end.

#### **7. Torsion**

**06 Periods**

- 7.1 Pure torsion, torsion equation (relation between twisting moment, shear stress and angle of twist), polar modulus of section
- 7.2 Assumptions in theory of pure torsion
- 7.3 Strength of circular solid shaft and hollow shaft in pure torsion
- 7.4 Power transmitted by shaft

#### **8. Thin Cylinder and spheres**

**06 Periods**

- 8.1 Introduction
- 8.2 Thin cylinder Vessel Subjected to internal Pressure
- 8.3 Stresses in a Thin cylinder Vessel Subjected to internal Pressure
- 8.4 Expression for circumferential stresses
- 8.5 Expression for longitudinal stresses

### **LIST OF PRACTICALS**

- 1. Perform tensile test on bars of mild steel and aluminum.

2. Perform shear test on specimen of two different metals.
3. Carry out bending tests on a steel bar or wooden beam.
4. Perform following impact test:
  - Izod impact test
  - Charpy test
5. Perform torsion test on specimen of different metals for determination of angle of twist for a given torque.

### **INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose the students to real life problems.
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

### **RECOMMENDED BOOKS**

1. Strength of Materials by Srivastava & Gope, PHI Publication.
2. Strength of Materials by R.S. Khurmi; S. Chand and Company, Delhi.
3. Strength of Materials by S. Ramamurtham; Dhanpat Rai Publishing Co.(P) Limited
4. Mechanics of Materials by Kirpal Singh; Standard Publishers, New Delhi.
5. Elements of Strength of Materials by D.R. Malhotra and H.C, Gupta; Satya Parkashan, New Delhi.
6. Mechanics of Solids by VS Prasad; Galgotia Publications, New Delhi.
7. Strength of materials Dr. B.C Puniya & S.Rama Murthi; Laxmi Publication, New Delhi.
8. Mechanics of solids by J.K.Kapoor; Bharat Bharati Prakashan, Meerut

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted(Periods)</b>	<b>Marks Allotted (%)</b>
1	06	10
2	12	20
3	10	15
4	10	15
5	08	10
6	06	10
7	06	10
8	06	10
<b>Total</b>	<b>64</b>	<b>100</b>

Subject Code : 144004

<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>-</b>	<b>4</b>

**RATIONALE**

Diploma holders in these courses are required to measure and inspect for ensuring quality of product. For this purpose, knowledge and skills about standards of measurement, limit, fits and tolerances, types of inspection and various measuring instruments are required. Hence this subject is offered.

**DETAILED CONTENTS****1. Introduction****12 Period**

- 1.1 Definition of metrology
- 1.2 Standard of measurement - Primary, secondary, Tertiary and working standards.
- 1.3 Types of errors- Controllable and random errors
- 1.4 Precision, accuracy, sensitivity, hysteresis, response time, repeatability, calibration, uncertainty of measurement

**2. Linear Measurement****12 Period**

- 2.1 Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block.
- 2.2 Construction features and use of instruments for precision measurements : vernier calipers, vernier height and depth gauges, micrometers.
- 2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.
- 2.4 Cylinder bore gauges, feeler and wire gauges.
- 2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic comparator.

**3. Angular Measurement****10 Period**

- 3.1 Construction and use of instruments for angular measurements: bevel Protector, sine bar, angle gauges, clinometers.
- 3.2 Optical instruments for angular measurement, autocollimator.

#### **4. Measurement of Surface Finish**

**10 Period**

- 4.1 Terminology of surface roughness.
- 4.2 Concept of primary texture and secondary texture.
- 4.3 Factors affecting surface finish.
- 4.4 CLA, RMS and RA value.
- 4.5 Principle and operation of stylus probe instruments for measuring surface Roughness

#### **5 Limits, Fits and Tolerances**

**10 Period**

- 5.1 Definition and terminology of limits, fits and tolerances.
- 5.2 Interchangeability
- 5.3 Hole basis and shaft basis systems.
- 5.4 Type of fits.
- 5.5 Standard and Limit gauges.

#### **6. Instrumentation**

**10 Period**

- 6.1 Brief description about the measurement of displacement, vibration, frequency, pressure, temperature and humidity by electro mechanical transducers
- 6.2 LVDT, Resistance thermometer, thermocouple, Strain measurement, Optical pyrometer

#### **LIST OF PRACTICALS**

1. Internal and external measurement with vernier - caliper and micrometer.
2. Measurement with height gauge and depth gauge.
3. Measurement of flatness with dial indicator.
4. Measurement with combination set and bevel protector.
5. Study and use of slip gauges.
6. Measurement of angle with sine bar
7. Determination of temperature by (i) pyrometer (ii) thermocouple.
8. Measurement of surface roughness of a surface

#### **INSTRUCTIONAL STRATEGY**

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Use computer based learning aids for teaching learning

## RECOMMENDED BOOKS

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by PC Sharma; S Chand and Company
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.
5. Mechanical Measurements and Control by Kumar D.S ; Metropolitan, N. Delhi
6. Mechanical Measurement by Sirohi; New Age Publishers

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	20
2	12	20
3	10	15
4	10	15
5	10	15
6	10	15
<b>Total</b>	<b>64</b>	<b>100</b>



<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>-</b>	<b>6</b>

**Subject Code : 144005**

## **RATIONALE**

This subject provides knowledge and develops skills on various machine operations viz capstan and turret Lathe, milling, grinding, gear manufacturing, broaching and automatic machines which is very essential for Mechanical diploma holders to work in manufacturing industries.

## **DETAILED CONTENTS**

### **UNIT-1**

**08 Period**

Elementary theory of metal cutting, chip formation, continuous chip, continuous chip with BUE, discontinuous chips. Mechanism of chip formation, Geometry of chip formation, forces of chip, Merchant circle diagram. Tool life, Economics of tool life. Cutting Tools and Materials, Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect, Properties of cutting tool material, Study of various cutting tool materials viz. High speed steel, tungsten carbide, cobalt steel, cemented carbides, stellite, ceramics and diamond.

### **UNIT-2**

**12 Period**

Lathe, Principle, Description and function of various parts of a lathe, Classification and specification of various types of lathe, Drives and transmission, Work holding devices, Lathe tools: Parameters/Nomenclature and applications, Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling. Cutting parameters –Speed, feed and depth of cut for various materials and for various operations, machining time. Speed ratio, preferred numbers of speed selection. Lathe accessories:- Centers, dogs, chucks, collets, face plate, angle plate, mandrel, steady rest, taper turning attachment, tool post grinder.

### **UNIT-3**

**12 Period**

Drilling, Principle of drilling. Classification of drilling machines and their description. Various operations performed on drilling machine –drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feed during drilling, machining time. Types of drills and their features, Types of reamers.

## **UNIT-4**

**12 Period**

Boring Principle of boring, Classification of boring machines and their brief description. Specification of boring machines.

## **UNIT-5**

**10 Period**

Shaping, Planing and Slotting ,Working principle of shaper, planer and slotter. Quick return mechanism applied to shaper, slotter and planer machine. Types of tools used and their geometry. Specification of shaper, planer and slotting machine. Speeds and feeds in above processes.

## **UNIT-6**

**10 Period**

Cutting fluids and Lubricants, Function of cutting fluid ,Types of cutting fluids, Difference between cutting fluid and lubricant, Selection of cutting fluids for different materials and operations, Common methods of lubrication of machine tools.

## **LIST OF PRACTICALS**

1. Single point cutting tool grinding.
2. A composite job involving turning, taper turning, thread cutting and knurling.
3. Marking and drilling practice using column and knee type drilling machine and radial drilling machine.
4. A job on drilling, reaming, counter boring and counter sinking.
5. Prepare a V- block on shaper machine.
6. Exercise on key way cutting.

## **INSTRUCTIONAL STRATEGY**

1. Teacher should lay special emphasis in making the students conversant with concept, principle, procedure and practices related to various manufacturing processes
2. Focus should be laid on preparing jobs using various machines/ equipment in the workshop
3. Aids/ Video films should be used to show operations

## **RECOMMENDED BOOKS**

1. Manufacturing technology by Rao; Tata McGraw hill Publishers, New Delhi
2. Manufacturing technology by M. Adithan and AB. Gupta; New Age International (P) Ltd.

3. Workshop Technology Vol I, II, III by Champman; Standard publishers Distributors
4. Practical hand book for Mechanical Engineers by AB Gupta; Galgotia publications, New Delhi
5. Fundamentals of metal cutting and machine tools by Juneja and Sekhon; Wiley Eastern Ltd.

#### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	08	15
2	12	20
3	12	20
4	12	15
5	10	15
6	10	15
<b>Total</b>	<b>64</b>	<b>100</b>

Subject Code : 144003

L	T	P
4	-	3

## RATIONALE

Diploma holders in Mechanical Engineering are required to deal with problems of fluid flow and use of hydraulics in power generation. For this purpose, knowledge and skill about fluid mechanics, fluid flow and hydraulic machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about various properties of fluids, measurement of various flow parameters and about various hydraulic machines.

## DETAILED CONTENTS

### 1. Introduction

06 Period

Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility.

### 2. Pressure and its Measurement

10 Period

- 2.1 Concept of Pressure (Atmospheric Pressure, gauge pressure, absolute pressure)
- 2.2 Pressure measuring devices: peizometer tube, manometers - simple U-tube, differential single column, inverted U- tube Manometer
- 2.3 Bourdon tube pressure gauge
- 2.4 Simple problems

### 3. Flow of Fluids

10 Period

Types of fluid flow- steady and unsteady, uniform and non- uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; Bernoulli's theorem (without proof) and its applications, Discharge measurement with the help of venturi meter, orifice meter and pitot tube, simple problems

### 4. Notches and Weirs

06 Period

Different type of notches, Measurement of discharge over rectangular notch. Francis and Brazin's formula for rectangular weirs, submerged weirs, broad crested weirs.

### 5. Flow through orifices

06 Period

Cc, Cv, Cd, flow through drowned, partially drowned orifices, time for emptying a tank through a circular orifice. Simple problems

## **6. Flow through pipes**

**10 Period**

Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss. Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings, Simple problems

## **7. Hydraulic Devices**

**08 Period**

Description, operation and application of hydraulic machines –hydraulic ram, hydraulic jack, hydraulic brake, hydraulic accumulator, hydraulic door closer, hydraulic press,

## **8. Water Turbines and Pumps**

**08 Period**

Concept of a turbine, types of turbines – impulse and reaction. Construction and working of pelton wheel, Francis turbine and Kaplan turbine. Concept of hydraulic pump. Construction, working and operation of reciprocating pump and centrifugal pump.

### **LIST OF PRACTICALS**

1. Measurement of pressure head by employing
  - Piezometer tube
  - Single and double column manometer
  - Pressure gauge
2. To find out the value of coefficient of discharge for a venturimeter
3. Measurement of flow by using venturimeter
4. Verification of Bernoulli's theorem
5. To determine the coefficient of friction of pipe using Darcy's equation.
6. Study the working of a pelton wheel and Francis turbine
7. Dismantling and assembly of a single stage centrifugal pump to study its constructional details, operation including fault diagnosis.
8. To demonstrate the working of a Kaplan Turbine.
9. To demonstrate the working of a single acting and double acting Reciprocating pump.
10. To determine Cd, Cv and Cc for a orifice.

### **INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose the students to real life problems.

3. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

### **RECOMMENDED BOOKS**

1. Fluid Mechanics & Hydraulics Machines by Dr. R.K. Bansal
2. Fluid Mechanics & Hydraulics Machines by Modi and Seth
3. Fluid Mechanics & Hydraulics Machines by Jagdish Lal
4. Fluid Mechanics & Hydraulics Machines by A.K. Jain
5. Refrigeration's & Air conditioning by R.S. Khurmi
6. Fluid power and trouble shooting by Hohn A.H.
7. Fluid power theory and application by James A Sullivan
8. Pneumatic control and system by Mazumdar

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	06	05
2	10	14
3	10	14
4	06	10
5	06	14
6	10	14
7	08	14
8	08	15
<b>Total</b>	<b>64</b>	<b>100</b>

<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>-</b>	<b>2</b>

**Subject Code : 144001**

## **RATIONALE**

Thermal energy is still a major means of power in the world. Knowledge of thermal contrivances and related principle is very essential for mechanical diploma holders. The subject presents an introduction to sources of heat, thermodynamics principles and their applications to thermal contrivances.

## **DETAILED CONTENTS**

- 1. IC Engines** 10 Period
  - 1.1 Introduction and classification of IC engine
  - 1.2 Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, Diesel cycle and dual cycle
  - 1.3 Location and functions of various parts of IC engines and materials used for them
  - 1.4 Concept of IC engine terms: bore, stroke, dead centre, crank throw, compression ratio, clearance volume, piston displacement and piston speed, working of carburettor, mixture requirements, carburettor types.
  
- 2. Cooling and Lubrication** 16 Period
  - 2.1 Function of cooling system in IC engine
  - 2.2 Air cooling and water cooling system, use of thermostat, radiator and forced circulation in water cooling (description with line diagram)
  
- 3. Testing of IC Engines** 14 Period
  - 3.1 Engine power - indicated and brake power
  - 3.2 Efficiency - mechanical, thermal. relative and volumetric
  - 3.3 Methods of finding indicated and brake power, Morse test.
  - 3.4 Morse test for petrol engine
  - 3.5 Heat balance sheet
  - 3.6 Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers-EURO standards, methods of reducing pollution in IC engines, alternative fuels like CNG, LPG (Simple numerical problems)

#### **4. Steam condensers**

14 Period

- Function of a steam condenser, elements of condensing plant
- Classification-Jet condenser, surface condenser
- Cooling pond and cooling towers

#### **5. Air compressors**

10 Period

Function of air compressor, type of air compressor - single stage, multi stage reciprocating compressors, inter-cooling of compressors, rotary compressor, Construction and working

### **LIST OF PRACTICALS**

1. Study of working principle of two/ four stroke petrol engines.
2. Study of simple/ compound carburettor.
3. To determine brake horse power by dynamometer.
4. To determine indicated horse power of a multi cylinder petrol/diesel engine.
5. Study of condensers.
6. Study of cooling system of I.C. engines.
7. Study of Rotary and Reciprocating compressor.

### **INSTRUCTIONAL STRATEGY**

1. Models of various components/parts should be demonstrated to develop comprehension amongst students
2. Industrial visit to thermal power plant and roadways/ private automobile workshop should be arranged
3. Video films for demonstration of working of IC engines, jet propulsion and gas turbine should be shown.

### **RECOMMENDED BOOKS**

1. Elements of heat engines by Pandey and Shah; Charotar Publishing house
2. Thermal Engineering by P.L. Ballaney; Khanna Publishers, New Delhi.
3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing company
4. Engineering Thermodynamics by C.P. Arora; Tata Mc Graw Hill Publishers
5. Thermal engineering by R.K. Purohit; Standard publishers Distributors, New Delhi.
6. Refrigeration and air conditioning by Domkundwar; Dhanpat Rai & sons, Delhi.



7. Refrigeration and air conditioning by CP Arora , Tata McGraw Hill , New Delhi.
8. Refrigeration and air conditioning by R.S Khurmi and J.K Gupta; S Chand and Company Limited, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted(Periods)</b>	<b>Marks Allotted (%)</b>
1	10	18
2	16	24
3	14	24
4	14	18
5	10	16
<b>Total</b>	<b>64</b>	<b>100</b>

<b>L</b>	<b>T</b>	<b>P</b>
<b>4</b>	<b>-</b>	<b>2</b>

**Subject Code : 144002**

## **RATIONALE**

The development of automobile industry direct and indirect dependence of the present day society on the services of its products has made the knowledge of the technology imperative, this subject deals with automotive needs.

## **DETAILED CONTENTS**

### **1. INTRODUCTION**

**06 Periods**

- 1.1 Definitions and specifying an automobile
- 1.2 Automobile development and scope
- 1.3 Components of an automobile
- 1.4 Classification of automobiles
- 1.5 Layout of chassis
- 1.6 Types of drives-front wheel, rear wheel, four wheel left hand, right hand
- 1.7 Body or super structure

### **2. TRANSMISSION SYSTEM**

**10 Periods**

- 2.1 Clutch
  - 2.1.1 Function
  - 2.1.2 Constructional details of single plate and multi plate friction clutch
  - 2.1.3 Centrifugal and semi centrifugal clutch
  - 2.1.4 Hydraulic operation of single plate clutch
  - 2.1.5 Clutch troubles
- 2.2 Gear Box
  - 2.2.1 4-speed gear box
  - 2.2.2 Gear ratios
  - 2.2.3 Working of sliding mesh, constant mesh and synchromesh 4-speed gear box
  - 2.2.4 Torque converter and overdrive
  - 2.2.5 Transfer box
- 2.3 Propeller Shaft And Rear Axle
  - 2.3.1 Function

- 2.3.2 Universal joint
- 2.3.3 Final drive and differential assembly
- 2.3.4 Front driving axles
- 2.3.5 Real axle drives and different types of rear axles

## 2.4 Wheels And Tyres

- 2.4.1 Types of wheels- disc wheel, wire wheel and alloy cast wheel
- 2.4.2 Types of tyres used in Indian vehicles
- 2.4.3 Toe in, Toe out, camber, caster, kingpin inclination
- 2.4.4 Tubeless tyres

## 3. STEERING SYSTEM

**10 Periods**

- 3.1 Function and principle
- 3.2 Ackerman and Davis steering gears
- 3.3 Types of steering gears – worm and ball nut, worm and wheel, worm and roller, rack and pinion type
- 3.4 Power steering
- 3.5 Wheel balancing
- 3.6 Wheel alignment

## 4. BRAKING SYSTEM

**08 Periods**

- 4.1 Constructional details and working of mechanical, hydraulic and vacuum brake
- 4.2 Details of master cylinder, wheel cylinder
- 4.3 Concept of brake drum, brake lining and brake adjustment
- 4.4 Air brake, Emergency and Parking brake
- 4.5 Anti-lock braking system

## 5. SUSPENSION SYSTEM

**06 Periods**

- 5.1 Function
- 5.2 Types
- 5.3 Working of coil spring, leaf spring, rubber springs
- 5.4 Shock absorber- telescopic type
- 5.5 Air suspension
- 5.6 Strut suspension

## 6. BATTERY

**08 Periods**

- 6.1 Principles of battery operation

- 6.2 Constructional details of lead acid cell battery
- 6.3 Specific gravity of electrolyte – effect of temperature on specific gravity
- 6.4 Capacity and efficiency of battery
- 6.5 Battery charging, chemical reactions during charge and discharge
- 6.6 Maintenance of Batteries

## **7. DYNAMO and ALTERNATOR**

**08 Periods**

### 7.1 DYNAMO

- 7.1.1 Function and details
- 7.1.2 Regulator – voltage current and compensated type
- 7.1.3 Cutout – construction, working and their adjustment

### 7.2 ALTERNATOR

- 7.2.1 Construction and working
- 7.2.2 Charging of battery from alternator

## **8. LIGHTING SYSTEM and ACCESSORIES**

**08 Periods**

- 8.1 Lighting system
- 8.2 Wiring circuit
- 8.3 Headlight, aiming of headlights
- 8.4 Lighting switches
- 8.5 Direction indicators
- 8.6 Windscreen wiper
- 8.7 Horn
- 8.8 Speedometer
- 8.9 Heater

## **LIST OF PRACTICALS**

1. Wheel Balancing
2. Wheel Alignment
3. Suspension System Servicing
4. Retreading and Recapping of Tyres
5. Automotive Brake Service
6. A/C System Service
7. Clutch Troubles and Clutch Service
8. Servicing of Fuel Injection Pump
9. Study of MPFI System
10. Study of steering system

## INSTRUCTIONAL STRATEGY

1. Models of various components/ parts should be demonstrated to develop comprehension amongst students.
2. Industrial visit to roadways/ private automobile workshop should be arranged.
3. Video films for demonstration of working of IC engines, jet propulsion and gas turbine should be shown.

## RECOMMENDED BOOKS

1. Heldt.P.M.- “Automotive Chassis”- Chilton Co., New York
2. K.K. Ramalingam - “Automobile Engineering” – Scitech Publication, Chennai
3. Steed W - “Mechanics of Road Vehicles”- Illiffe Books Ltd., London
4. Newton Steeds and Garrot- “Motor Vehicles”- Butterworths, London
5. Judge A.W- “Mechanism of the Car”- Chapman and Halls Ltd., London
6. Giles.J.G- “Steering, Suspension and tyres”- Iiiffe Book Co., London
7. Automobile Engineering by P.S. GILL
8. Automobile Engineering Vol. 1 & 2 by Dr. Kripal Singh; Standard Publishers Distributors
9. Automobile Engineering by R.B. Gupta; Satya Prakashan, New Delhi.
10. Automobile Engineering by K.M. Gupta, Umesh Prakashan, Delhi.

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	10	20
3	10	20
4	08	10
5	06	10
6	08	10
7	08	10
8	08	10
<b>Total</b>	<b>64</b>	<b>100</b>

## Subject Code : 334053

Industrial training provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice.

For this purpose, students at the end of fourth semester need to be sent for industrial training for a minimum of 4 weeks duration to be organised during the semester break starting after IV Semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A teacher may guide a group of 4-5 students. A minimum of one visit by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

Internal assessment and external assessment have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry, if any. The components of evaluation will include the following.

- |                                      |     |
|--------------------------------------|-----|
| a) Punctuality and regularity        | 15% |
| b) Initiative in learning new things | 15% |
| c) Relationship with workers         | 15% |
| d) Industrial training report        | 55% |