

3.1 APPLIED MECHANICS

L T P
Periods/week 4 - 2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

DETAILED CONTENTS

1. Introduction (08 period)
 - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
 - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
 - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities

2. Laws of forces (12 period)
 - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
 - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
 - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
 - 2.4 Free body diagram
 - 2.5 Equilibrant force and its determination
 - 2.6 Lami's theorem (concept only)
[Simple problems on above topics]

3. Moment (10 period)
 - 3.1 Concept of moment
 - 3.2 Moment of a force and units of moment
 - 3.3 Varignon's theorem (definition only)
 - 3.4 Principle of moment and its applications (Levers – simple and compound, steel

yard, safety valve, reaction at support)

- 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
- 3.6 Concept of couple, its properties and effects
- 3.7 General conditions of equilibrium of bodies under coplanar forces and beams, fixed support, roller, support, over hanging, Uniformly distributed load, point load, varying load
- 3.8 Position of resultant force by moment

[Simple problems on the above topics]

4. Friction (10 period)

- 4.1 Definition and concept of friction, types of friction, force of friction
- 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
- 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane, friction in simple screw jack
- 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
 - a) Acting along the inclined plane Horizontally
 - b) At some angle with the inclined plane

[Simple problems on the above topics]

5. Centre of Gravity (08 period)

- 5.1 Concept, definition of centroid of plain figures and centre of gravity of symmetrical solid bodies
- 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
- 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed

[Simple problems on the above topics]

6. Moment of Inertia (06 period)

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (*without derivations*). Second moment of area for L, T and I sections, section modulus.

7. Simple Machines (10 period)

- 7.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
- 7.2 Simple and compound machine (Examples)
- 7.3 Definition of ideal machine, reversible and self locking machine

- 7.4 Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
- 7.5 System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
- 7.6 Working principle and application of wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the Mechanical Advantage, Velocity Ratio and efficiency in case of an inclined plane.
5. To find the Mechanical Advantage, Velocity Ratio and efficiency of a screw jack.
6. To find the Mechanical Advantage, Velocity Ratio and efficiency of worm and worm wheel.
7. To find Mechanical Advantage, Velocity Ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi.
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	08
2	12	16
3	10	18
4	10	18
5	08	10
6	06	08
7	10	16
Total	64	100

3.2 MATERIAL SCIENCE AND METALLURGY

L T P

4 – 3

RATIONALE

Materials play an important role in the construction and manufacturing of equipment/tools. Right selection of materials add to the economy, working and life of machinery. A diploma holder must be conversant with the properties, uses, availability and costs of materials used for construction/fabrication to enable him to perform his functions confidently. The subject of Engineering Materials has been designed to cover the above aspects.

DETAILED CONTENTS

1. Importance of Materials

08 Period

- 1.1 Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys.
- 1.2 Crystalline and non-crystalline structures; unit cells, Bravais space lattices, cubic closed pack structures, coordination number, miller indices, crystallographic planes and directions.
- 1.3 Structural imperfections- point, line, planar and volume defects, structure property relationship.
- 1.4 Names of common metals, their alloys and non-metals used in Industry
- 1.5 Properties of metals and alloys
- 1.6 Physical properties - Appearance, luster, colour, density and melting point
- 1.7 Thermal and electrical conductivity
- 1.8 Corrosion, causes, effects and prevention.
- 1.9 Study of creep and fatigue.

2. Ferrous Metals and Alloys

12 Period

- 2.1 Flow diagram for the production of ferrous metals from their ores, constituents of iron, iron carbon diagram.
- 2.2 Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades
- 2.3 Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous on steels.
- 2.4 Composition, properties, and uses of special steels such as High speed steel, Stainless steels, Silicon steels, Heat resistant steels, Spring steel.
- 2.5 Heat Treatment: Iron-carbon diagram, objectives of heat treatment. Brief description and uses with examples of principal heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding and applications, case hardening

3. Iron Carbon Equilibrium Diagram

02 Period

- 3.1 Phase transformation
- 3.2 Nucleation and growth

4. T-T-T Diagram

02 Period

- 4.1 Importance of critical cooling rate.
- 4.2 Martensite transformation
- 4.3 Nucleation and growth

5. Non-ferrous Metals and Alloys

12 Period

5.1 Copper: Properties and uses

5.2 Composition, properties and uses of copper alloys.

5.3 Brasses: Cartridge brass, Nickel silver

5.4 Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.

5.5 Properties and uses of Aluminium.

5.6 Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium

5.7 Properties and uses of alloys of lead, tin and magnesium.

5.8 Bearing Metals: Requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals. Aluminium based bearing metals. Use of nylon/PTFE for bushes/bearings, bi-metallic and trimetallic bushes

6. Identification and Examination of Metals and Alloys

02 Period

Microscope principle and methods, Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.

7. Other Important Materials

10 Period

7.1 Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics and their uses and grades.

7.2 Composite materials.

7.3 Heat insulating materials: Properties and uses of asbestos, glass wool, thermo Cole, cork, mica.

7.4 Electrical insulating materials. Properties and uses of china clay, leather, bakelite, ebonite, glass wool, rubber, felt.

7.5 Sound insulating materials: Cork, fibre boards.

7.6 Fabrication materials: Wood, plywood, rubber – natural and synthetic, Glass – plate glass, toughened glass, safety glass.

7.7 Refractory materials: General characteristics and uses of dolomite, ceramics.

7.8 Protective coating materials: Paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, Teflon coating.

7.9 Sealant and adhesives – Application and availability of sealant and adhesives for industrial user.

7.10 Smart materials.

8. Diffusion

02 Period

Ficks Laws of Diffusion and practical examples

9. Powder Metallurgy and Mechanical Working of Metals

08 Period

9.1 Introduction of powder metallurgy

9.2 Advantage and limitations of powder metallurgy

9.3 Powder metallurgy processes

9.4 Principles of hot and cold working

9.5 Effect on properties and limitations

10. Selection, specifications and commercial availability of materials

06 Period

10.1 Practical considerations for selection of material for different purposes

10.2 ISO/Bureau of Indian standard specifications for metals, non-metals, various components and materials.

LIST OF PRACTICALS

1. Classification of about 25 specimen of materials/parts into
 - Metals and Non Metals
 - Metals and Alloys
 - Ferrous and non ferrous metals
 - Ferrous and non ferrous alloys
2. Given a set of specimen of metals and alloys (copper, brass, aluminum, cast iron, HSS, Gun metal), identify and indicate the various properties possessed by them
3. Study of heat treatment furnace
4. Study of metallurgical microscope and a specimen polishing machine.
5. To prepare specification of following materials for microscopic examination and to examine the micro structure of specimens of following materials
(i) Brass (ii) Copper (iii) Grey CI (iv) Malleable CI (v) Low carbon Steel (vi) High carbon steel (vii) HSS
6. To anneal a given specimen and find out difference in hardness as a result of annealing
7. To normalize a given specimen and to find out the difference in hardness as a result of normalizing
8. To temper a given specimen to find out the difference in hardness as a result of tempering
9. Study of Ball Mills used in preparation of powder.
10. Study of Pallet Press.

INSTRUCTIONAL STRATEGY

While imparting instructions, teacher should show various types of engineering materials to the students. Students should be asked to collect samples of various materials available in the market. Visits to industry should be planned to demonstrate use of various types of materials in the industry.

RECOMMENDED BOOKS

1. Material Science by R.K.Rajput; Laxmi Publications, Darya Ganj, New Delhi.
2. Advances in material Science by R.K.Dogra and Dr.A.K.Sharma;S.K.kataria & sons; New Delhi.
3. Material Science by GBS Narang; Khanna Publishers New Delhi
4. Material Science and Metallurgy by D.S. Nutt. SK Kataria and Sons, Delhi.
5. Material Science and Engineering by Dr. P.L Shah

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1.	08	10
2.	12	20
3.	02	05
4.	02	05
5.	12	20
6.	02	05
7.	10	10
8.	02	05
9.	08	10
10.	06	10
Total	64	100

3.3 PRINCIPLES OF THERMAL ENGINEERING

L T P
Periods/week 4 - 3

RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the I.C engines, air compressors and air conditioning of automobiles. Therefore, it is essential to teach concepts, principles, applications and practices covering laws of thermodynamics, basic air cycles, types of fuel used and their properties and components of air conditioners. Hence this subject has been included in this course.

DETAILED CONTENTS

1. Thermodynamic terminology (08 periods)
Concept of thermodynamics, heat, temperature, intensive and extensive properties, path, process, system, surroundings, enthalpy, internal energy and thermodynamic work
2. Gas Laws (08 periods)
Boyle's law, Charle's law, Joule's law, Characteristic gas equation, gas constant, universal gas constant. Simple numerical problems based on above laws.
3. Laws of Thermodynamics (10 periods)
Zeroth law of thermodynamics, Irreversible process, First law of thermodynamics, Second law of thermodynamics (concept only), Thermal efficiency, Heat pump, heat engine and heat sink, concept of entropy, Constant volume, constant pressure, isothermal, adiabatic, polytropic, throttling and free expansion processes. Numericals based on above processes
4. Air Cycles (10 periods)
Carnot cycle – concept only, Otto cycle, Diesel cycle, Dual combustion cycle, Numericals based on above cycles
5. Air Compressors (08 periods)
Reciprocating air compressor, Centrifugal compressor, Rotary air compressor - its types. Working of single stage and double stage compressor and applications, super charging
6. Heat Transfer (08 periods)
Modes of heat transfer – Conduction, convection, radiation, Fourier's Law, Numericals based on Fourier's Law
7. Refrigeration and Air Conditioning (12 periods)
 - Concept of refrigeration, Unit of refrigeration, refrigerants, heat pump, coefficient of performance, rating of refrigeration machines
 - Principles of air conditioning, Concept of human comfort, Air-conditioning system, components of air conditioning system and their function

LIST OF PRACTICALS

1. To find flash point and fire point of a given fuel.
2. Study and Sketch of four stroke and two stroke Engine
3. Identification of components in air-conditioning system
4. Study of components of a refrigerator
5. To study different air compressors
6. To study room air conditioning system

INSTRUCTIONAL STRATEGY

Teachers should provide simple exercises to students involving applications of various concepts and principles being covered in the subject. Problems on various topics should be prepared and students should be asked to solve them. In practical work, students should independently perform practicals.

RECOMMENDED BOOKS

1. Thermal Engineering by SK Kulshreshtha; Vikas Publishing House Pvt. Ltd., Delhi
2. Thermal Engineering by A.S. Sarao; Satya Prakashan, New Delhi
3. Engineering Thermodynamics by Valan A. Arasu, TMH, Delhi
4. Thermal Engineering by P.L. Ballaney; Khanna Publishers, Delhi
5. Thermal Engineering by R.K. Rajput; Laxmi Publications, New Delhi
6. Refrigeration and Air conditioning by G.S. Aulakh, Eagle Prakashan, Jalandhar
7. Thermodynamics –I by B.S. Ubhi, S.K. Kataria & Sons, Delhi
8. Hydraulics & Pneumatics by Birinder Singh, Kaption Publishing house, New Delhi
9. Hydraulic and Pneumatic control by Shammuga Sundram, S.Chand & Company Ltd., New Delhi
10. Pneumatic controls by Festo Didactic, Bangalore

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1	08	12
2	08	12
3	10	16
4	10	18
5	08	12
6	08	12
7	12	18
Total	64	100

3.4 CHASSIS, BODY AND TRANSMISSION

L T P
Periods/week 5 - 3

RATIONALE

Chassis, body and transmission forms the core of automobile engineering. The subject focuses at imparting knowledge and skills regarding chassis and body and transmission system.

DETAILED CONTENTS

1. Chassis (12 period)
Classification of vehicles, types of chassis, layout of conventional type of chassis, function and arrangement of major assemblies. Alternating arrangement used such as engine position, drive types, their merits and demerits
2. Body (26 period)
Classification of automobiles on different basis. Car body types, Chassis construction, types of commercial vehicles, Commercial vehicle body details. Selection of paint and painting process, body trim items, Chassis construction types- frame and unitary, body components and their constructional details. Ergonomics in design of seat, controls and displays, gear lever, steering wheel and foot control.
3. Clutch (14 period)
Necessity, function and requirements of clutch, types of clutch - single plate clutch, multiplate clutch, hydraulic power assisted and wet and dry plate clutch, clutch plate and lining material, construction and working of centrifugal, semi centrifugal, diaphragm clutch and fluid coupling
4. Transmission (14 period)
Necessity, function and types of transmission- Sliding, constant mesh and synchromesh. Over drive, over running clutch, description and operation of transfer gear box. Common faults and remedies, types of automatic transmission, working of epicyclic gear box, torque converter
5. Final Drive (14 period)
Propeller shaft – function, construction details. Universal joints - functions and types. Types of final drive – hotchkiss drive, torque tube drive. Differential – principle, functions and it's working. Rear axles – semi floating, three quarter floating, fully floating. Common faults and remedies

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	12	14
2	26	38
3	14	16
4	14	16
5	14	16
Total	80	100

3.5 BASIC ELECTRICAL AND ELECTRONICS TECHNOLOGY

L T P

5 - 3

RATIONALE

The objective of the course is to impart basic knowledge and skills regarding electrical and electronics engineering, which diploma holders will come across in their professional life

DETAILED CONTENTS

- 1. Overview of Electricity:** (04 Periods)
General use and applications of electricity; Use and applications of electricity to agriculture, Mechanical & Automobile sector; Advantages of electrical energy over other forms of energy.
- 2. DC Circuits:** (10 Periods)
Introduction to basic terms: charge, current, voltage, power, and energy; Ohm's law; Power dissipation in resistors; Series and parallel combination of resistors; Kirchhoff's laws; Star-delta conversions; Thevenin's theorem, Norton's theorem, and Maximum-power-transfer theorem; Ideal and practical voltage source; Current source.
- 3. AC Circuits:** (14 Periods)
Concept of alternating voltage and current; Introduction to basic terms: cycle, frequency, time period, amplitude, instantaneous value, rms value, peak value, phase difference, form factor, and peak factor; Concept of phasor; Phasor diagrams; Concepts of reactance, impedance, admittance, susceptance, and conductance; Concepts of instantaneous power, real power, reactive power, apparent power, complex power, and power factor; Analysis of simple AC circuits; Overview of three-phase AC circuits.
- 4. Batteries and Solar Cells:** (08 Periods)
Primary and secondary cells; Construction, working, and applications of Lead-Acid; Charging methods for Lead-Acid batteries; Maintenance of Lead-Acid batteries; Series and parallel connection of batteries; Maintenance free batteries; General idea of solar cells, solar panels and their applications.
- 5. Electrical Machines:** (16 Periods)
Electromagnetic induction; Introduction to magnetic circuits; Principles of electromechanical energy conversion; Construction and operation of single phase transformers; Tests of transformers; Efficiency and regulation; Operation of autotransformers & welding transformer;. Types of three-phase induction motors; principle of operation,; Methods of starting and speed-control of three-phase induction motors; Overview of single-phase induction motors.; Construction and operation of synchronous machines; Construction and operation of stepper motors. Applications of single and three phase induction motors.
- 6. Semiconductors:** (10 Periods)
Classification of materials as conductors, insulators, and semiconductors; Intrinsic and extrinsic semiconductors; p-type and n-type semiconductors; pn-junction diode; Half wave and

full wave rectification using diodes; Basic construction and operation of BJT, UJT, JFET, MOSFET, and thyristor.

7. Measuring Instruments: (10 Periods)

Construction and working principles of PMMC and MI type voltmeters and ammeters; Dynamometer wattmeter; Induction-type energy meters; Measurement of power and energy in three-phase circuits; Use of digital meters (voltmeter, ammeter, and multimeter).

8. Electrical Installation and Safety: (08 Periods)

Various accessories and parts of electrical installation; Overview of industrial and domestic wiring systems; Common electrical safety measures; Protection and precaution against electrical shock; Treatment of electrical shock; Basic protective devices like fuse, MCB, thermal overload relay, ELCB, and RCCB; Concepts and types of earthing; Protection against lightning.

LIST OF PRACTICALS

1. Verification of Ohm's Law
2. Verification of KCL and KVL
3. Test of charging and discharging of lead-acid battery using hydrometer
4. Connection of a three-phase motor and starter with fuses and reversing of direction
5. Connection of analog and digital single phase energy meter
6. Study of a distribution board for domestic and industrial installation
7. Open-circuit and short-circuit test on a single-phase transformer
8. Star-delta starting of induction motors
9. To draw V-I characteristics of pn-junction diode
10. To draw input and output characteristics of a transistor in CB and CE configurations

RECOMMENDED BOOKS

- 1 Basic Electrical Engineering by PS Dhongal; Tata McGraw Hill Publishers, New Delhi
- 2 Basic Electricity by BR Sharma; Satya Prakashan, New Delhi
- 3 Electrical Machines by SK Bhattacharya; Tata McGraw Hill, New Delhi
- 4 Experiments in Basic Electrical Engineering by SK Bhattacharya and KM Rastogi, New Age International Publishers Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	5
2	10	13
3	14	16
4	8	10
5	16	20
6	10	13
7	10	13
8	8	10
Total	80	100

3.6 AUTO ENGINEERING DRAWING

L T P
Periods/week - - 8

RATIONALE

An Automobile Engineering diploma holder, irrespective of his field of operation in an industry or transport undertaking, is expected to possess a thorough understanding of engineering drawing, which includes clear spatial visualization of the subject and the proficiency in reading and interpreting a wide variety of drawings. Besides this, he is also expected to have a certain degree of drafting skills depending upon his job functions to perform his day-to-day activities e.g. communicating and discussing the ideas with his superiors and passing on instructions to his subordinates in an unambiguous way. The teachers are recommended to lay emphasis on showing automobile components to students..

DETAILED CONTENTS

Assembly Drawings of the following automotive components:

1. Joints and Bearings (30 period)
 - Cotter Joint
 - Knuckle Joint
 - Universal joint
 - Bush bearing
 - Plummer block or pedestal bearing
 - Ball bearing
 - Roller bearing- Straight and Needle type

2. Engine Components (30 period)
 - Four Stroke Petrol Engine Piston
 - Diesel Engine Piston
 - Connecting rod
 - Crank shaft – 4 cylinder Engine
 - Spark Plug

3. Gears (24 period)
 - Nomenclature of gears
 - Profile of spur gear by ‘Approximate method’
 - Profile of spur gear by ‘Unwin’s Method’

4. Cam Profile (26 period)
 - Different types of cams and followers
 - Drawing of cam profile for following motion of follower
 - a. Uniform velocity motion
 - b. Simple harmonic motion (SHM)
 - c. Uniformly accelerated and retarded motion

5. Coupling (18 period)
Flange coupling – Protected, unprotected and flexible, muff coupling, Oldham coupling

INSTRUCTIONAL STRATEGY

Teacher should make use of models while explaining the details of drawing of various automobile parts and components. Emphasis should be laid on cleanliness and quality of drawings.

RECOMMENDED BOOKS

1. Auto Engineering Drawing by RB Gupta; Satya Parkashan, New Delhi
2. Automobile Engineering Drawing by Raj Kumar, North Publication, Jalandhar
3. Machine Drawing by PS Gill; BD Kataria and Sons, Ludhiana
4. Machine Drawing by Lakshminarayan; Jain Brothers, New Delhi
5. Automobile Engineering- Vol. I and II by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi

LIST OF PRACTICALS

1. Study and sketches of Heavy and Light vehicle chassis.
2. Study and sketches of Motor cycle and scooter chassis
3. Study and sketches of single plate clutch(coil pressure spring and diaphragm type)
4. Study and sketches of multiple clutch
5. Study and sketches of sliding mesh gear box
6. Study and sketches of constant mesh gear box
7. Study and sketches of synchromesh gear box
8. Study and sketches of universal joints, slip joint and propeller shaft
9. Study and sketches of different floating axles
10. Study and sketches of differential

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Automobile Engineering, Vol. I by Dr. Kirpal Singh, Standard Publishers
2. Automobile Engineering by GBS Narang, Khanna Publishers, Delhi
3. Automobile Engineering (in Hindi) by Dr. Kirpal Singh, Standard Publishers Distributors, Delhi

