

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 ENGINEERING MATERIALS

L T P

Periods/week 5 - 2

RATIONALE

Lot of developments have taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

DETAILED CONTENTS

1. Introduction (12 period)

Material, History of material origin, Scope of Material Science, Overview of different engineering materials and application, Classification of materials, Thermal, chemical, electrical, mechanical properties of various materials, present and future needs of materials Usage –Economic, Environmental and Social

2. Crystallography (12 period)

- Fundamentals - Crystal, Unit Cell, Space, Arrangement of atoms in Simple Cubic Crystal, BCC, FCC and HCP Crystals, Number of atoms per unit Cell, Atomic packing Factor
- Deformation - Overview of deformation and its mechanisms, behavior of materials under load and stress – strain
- Failure Mechanism - Overview of failure modes, fracture, fatigue and creep

3. Metal and Alloys (20 period)

- Introduction - History and development of iron and steel, Different iron ores, Raw Materials in Production of Iron and Steel, Basic Process of Iron making and steel making, Classification of iron and steel
- Cast Iron - Different types of Cast Iron, manufacture, properties and their usage
- Steels - Steels and alloy steel, Classification of plain carbon steels, availability, Properties and usage of different types of Plain Carbon Steels, effect of various alloys on properties of steel, Uses of alloy steels (high speed steel, stainless steel, spring steel, silicon steel, ultra light steel)

- Non Ferrous Materials - Properties and uses of Light Metals and their properties, properties and uses of White Metals and their alloys, Aluminum , Magnesium, Titanium & Copper-Properties and their use in automobile industry
4. Theory of Heat Treatment (14 period)
- Purpose of heat treatment, Solid solution and its types, Iron Carbon diagram, Formation and decomposition of Austenite, Martensite Transformation – Simplified Transformation Cooling Curves various heat treatment processes – hardening, tempering, annealing, normalizing, Case hardening and surface hardening. Types of heat treatment furnaces required for above operations (only basic idea)
5. Engineering Plastics (08 period)
- Important sources of plastics, Classification – Thermoplastic and Thermo Set and their uses, various trade names of engineering plastics, Plastic Coatings
6. Other Important Materials (14 period)
- Composites - Classification, properties, application
 - Ceramics and Silicon - Classification, properties, application
 - Heat Insulating Materials
 - Bio Materials
 - SMART 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

INSTRUCTIONAL STRATEGY

While imparting instruction, 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 or Heat Treatment Processes in the industry.

RECOMMENDED BOOKS

1. Text book of Material Science by RK Rajput; SK Kataria and Sons Pubs, Ludhiana
2. Text book of Material Science Material Science by Varinder Kumar, Eagle Publisher, Jalandhar
3. Text book of Material Science by V. K. Manchanda, India Publishing House, Jalandhar
4. Engineering Metallurgy by R. A. Higgins, Standard Publishers, New Delhi
5. Introduction to Materials Science by A.R. Gupta, Satya Prakashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	12	15
2	12	15
3	20	24
4	14	18
5	08	10
6	14	18
Total	80	100

3.3 BASICS OF AUTO ENGINE

L T P
Periods/week 5 - 3

RATIONALE

Engine forms the heart of an automobile. This subject deals with engine terminology, basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of engine, cooling system and lubrication system.

DETAILED CONTENTS

1. Introduction (16 period)

Layout and working of internal combustion engine

- Engine terms - Bore, stroke, dead centres, compression ratio, swept volume, clearance volume, capacity, torque, power at the crank shaft
- Classification and brief description of engines as per stroke, cycle, fuel, ignition, cooling, number and arrangement of cylinders, valve arrangement
- Rotary engine
- HCCI engine
- Atkinson cycle engine, Miller cycle engine
- Alternate Fuel Engine
 - LPG/CNG vehicles
 - Electric vehicles
 - Hybrid vehicles
 - Plug in hybrid vehicles
 - Wheel motor vehicles
 - Fuel cell vehicles

2. Constructional Details (16 period)

- Constructional details of cylinder block, cylinder head, cylinder liner, piston, piston coatings, piston rings, gudgeon pin, connecting rod, crankshaft, camshaft, valve timing, variable valve timing and lift, valve mechanisms, camless engines, flywheel and damper

3. Performance of Engine (12 period)

Performance curves, Effect on engine performance due to atmospheric temperature, pressure, compression ratio, engine speed, working conditions, dirt, desert, hills, injection timing/spark timing. Air fuel ratio, RAC/SAE/DIN engine ratings

4. Cooling System (12 period)

Necessity of cooling system. Air cooling, Water cooling system. Components of water cooling system- Radiators, thermostat, water pump, fan, pressure cap, water jackets, antifreeze solution. Trouble shooting

5. Lubrication System (12 period)

Necessity of lubrication, types of lubricants, lubricant rating, oil additives, effect of engine conditions on consumption of lubricant oil, crank case ventilation, pressure lubrication system, splash lubrication. Components of lubrication system-oil pump, oil lines, oil filters, oil coolers, classification and service ratings of lubricating oil, additives for lubricants.

6. Fuels (12 period)

Desirable properties of engine fuels, types of auto engine fuels. Properties of conventional fuels (petrol, diesel), properties of alternative fuels (Alcohols, LNG, CNG, LPG, Bio-Diesel, Hydrogen)

LIST OF PRACTICALS

1. Servicing of lubricating system
2. Servicing of fuel systems in petrol engines
3. Servicing of fuel injector
4. Servicing of F.I.P (Fuel Injection Pump)
5. Engine tune up
6. Study of turbocharger
7. Servicing of cooling system
8. Study of engine block
9. Servicing of fuel system in diesel engine
10. Study of M.P.F.I engine

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. Automobile Engineering – Vol. II by Dr. Kirpal Singh; Standard Publishers Distributors, 12th edition
2. Automobile Engineering by R.B. Gupta; Satya Prakashan, New Delhi

3. Automotive Engines by Srinivasan, TMH, Delhi
4. Automobile Engineering by Chikara, Dhanpat Rai and Sons, New Delhi
5. Automobile Engineering by KM Gupta, Umesh Publishers, Delhi
6. Auto Engine –I by G.S. Aulakh, Eagle Prakashan, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allotted (%)
1	16	22
2	16	22
3	12	14
4	12	14
5	12	14
6	12	14
Total	80	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

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

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 MEASUREMENT, INSTRUMENTATION AND CONTROL

L T P
Periods/week 5 - 2

RATIONALE

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

DETAILED CONTENTS

1. Measurements and Measurement Systems (06 period)
Definition, significance of measurement, generalized measurement systems, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, linearity, loading effect, sources of errors in measurement, classification of errors
2. Sensors, Transducers and Strain Gauges (12 period)
Introduction, classification, primary sensing elements, photo sensors, hall effect sensors, transducer conditioning, transducer selection and specification, resistance transducers, variable inductance type transducers, capacitive transducers, piezoelectric transducers, introduction to strain gauges, gauge materials,
3. Measurement of Force, Torque, Shaft Power, Speed and Acceleration (10 period)
Introduction, force and weight measurement systems, measurement of torque, shaft power, speed and velocity, acceleration, pressure measurements
4. Temperature and Strain Measurement (10 period)
Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer, strain measurements, strain gauge, preparation and mounting of strain gauges, gauge factor
5. Comparators and Angular Measurement (12 period)
Introduction to comparators, characteristics, classification of comparators, mechanical comparator, electric and electronic comparators- principles. LVDT, pneumatic comparators, angular measurements, bevel protractor
6. Determination of Count and Measurement of Time, Time Interval and Frequency (10 period)
Introduction, counters, time and frequency standards, clock and watches, frequency interval and frequency

7. Signal Transmission and Processing (10 period)
Introduction, interfacing circuits, amplifiers, modulation and demodulation, filters, transmission of signal and data, devices and systems, signal display & recording devices
8. Measurement of Process Variables -Pressure, Temperature, Flow and Level (04 period)
Introduction, pressure, temperature, flow rate, level measurement, thermometers, bimetallic thermocouples, thermistors and pyrometers.
9. Automation and Control (06 period)
Definition, types, need of automation, advantages and disadvantages of automation, introduction of control system terminology introduction to numerical control, basic concepts of NC, CNC and DNC. PLC and its applications in automotive industry

INSTRUCTIONAL STRATEGY

1. Use computer based learning aids for teaching learning
2. Demonstrations should be made to explain the concepts

RECOMMENDED BOOKS

1. Mechanical Measurements by Beckwith Marangoni and Lienhard; Pearson Education, 6th Ed., 2006
2. Engineering Metrology by R.K. Jain; Khanna Publishers, 1994
3. Industrial Instrumentation by Alstutko and Jerry. D. Faulk; Thompson Asia Pvt. Ltd.2002
4. Mechanical Measurements by Beckwith Thomas G; Narosa Publishing House, N. Delhi
6. Measurement Systems, Application Design by Doeblein E.O; McGraw Hill, 1990
6. Mechanical Measurements and Control by Kumar D.S ; Metropolitan, N. Delhi
7. Mechanical Measurement by Sirohi; New Age Publishers
8. Instrumentation and Control by D, Patranabis; ISBN No. 81-88114-30-8, Umesh Publications

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	06	08
2	12	16
3	10	12
4	10	12
5	12	14
6	10	12
7	10	12
8	04	06
9	06	08
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