

4.1 STRENGTH OF MATERIALS

L T P
Periods/week 4 - 4

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 contraflexure.

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 Srivatava & 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, Delhi.
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

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

4.2 METROLOGY, INSTRUMENTATION AND CONTROL

	L	T	P
Periods/week	4	-	4

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 electromechanical 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, New Delhi.
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 (Period)	Marks Allotted (%)
1	12	20
2	12	20
3	10	15
4	10	15
5	10	15
6	10	15
Total	64	100

4.3 PRODUCTION TECHNOLOGY

L T P
4 0 6

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, discontinuous chip with BUE, 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. Teachers 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

Topic No.	Time allotted (Period)	Marks Allotted (%)
1	08	15
2	12	20
3	12	20
4	12	15
5	10	15
6	10	15
Total	64	100

4.4 AUTOMOTIVE ENGINE II (DIESEL ENGINES)

L T P
Periods/week 4 - 2

RATIONALE

This subject imparts basic knowledge about Diesel Engines and Accessories including Cycles, constructional details, combustion process and engine performance. This will help Students in learning construction, operation and performance assessment of Diesel Engines and its accessories.

DETAILED CONTENTS

- 1. Engine Construction and Operation** 12 period
Four stroke and two stroke Diesel engine- working principle, construction and operation. Scavenging, Comparison of four stroke and two stroke engine operation, Valve Timing diagram of Diesel engines. Comparison of two & four stroke Diesel engine, Comparison of petrol & diesel Engines.
- 2. Combustion and Combustion Chambers** 16 period
Combustion in CI engine: stages of combustion, flame propagation, rate of pressure rise, delay period, abnormal combustion, Diesel knock, Cetane number, effect of engine variables on knocking, Fuel additives. Combustion chambers for diesel engines & its different types.
- 3. CI Engine Fuel System** 18 period
Requirements, air blast and mechanical injection, functions of various components, Fuel filter – primary and secondary, Study of FIP: Plunger pump its construction & working, fuel quantity variation by pump plunger, Distributor fuel injection pump its construction and working, common rail system (CRDI), fuel Injector, its function. Construction & working of injector assembly. Types of injection nozzles. Need of Governor, Construction & working of Mechanical and pneumatic governors. Electronic control module and sensors for engine control.
- 4. Supercharging and Turbo charging** 08 period
Necessity, principle, construction & working of centrifugal, twin screw & roots type supercharger. Concept of turbo charging, Turbocharger construction & working, Advantages & disadvantages of Supercharged & Turbocharged Engines, Difference between supercharger & Turbocharger.
- 5. Engine Testing & Performance** 10 Period
Classification of tests, fault finding test, routine test, I.H.P, B.H.P, F.H.P, Mechanical Efficiency, indicated & Brake thermal efficiency, Specific fuel consumption, Volumetric efficiency, Relative Efficiency, Heat Balance Sheet, Morse Test, Simple numerical problems based on use of these formulae. Engine performance Curves, variables affecting engine performance. RAC/SAE/DIN engine ratings

LIST OF PRACTICALS

1. Study of two stroke diesel engine
2. Study of four stroke diesel engine.
3. Study of injector assembly.
4. Study of different types of nozzles.
5. To open the Fuel injection Pump, sketch and identify the components and assemble them.
6. To conduct Morse test on multi cylinder engine.
7. Study of turbocharger.

RECOMMENDED BOOKS

1. Heldt P.M., "High Speed Combustion Engines", Oxford IBH Publishing Co., Calcutta,
2. William H.Crouse, "Automotive Engines", McGraw-Hill Publishers,
3. Ellinger H.E., "Automotive Engines", Prentice Hall Publishers,
4. John B.Heywood, "Internal Combustion Engine Fundamental", McGraw-Hill,
5. Ganesan.V. "Internal Combustion Engines", Tata McGraw-Hill Publishing Co.,
6. M.L.Mathur and R.P.Sharma, "A course in Internal combustion engines", Dhanpat Rai & Sons Publications, New Delhi
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 (Period)	Marks Allotted (%)
1	12	18
2	16	20
3	18	24
4	08	16
5	14	22
Total	64	100

4.5 AUTOMOTIVE CHASSIS II

L T P
Periods/week 4 - 2

RATIONALE

In teaching fundamentals of Automobile Engineering chassis is essential topic. It is divided in two parts. In this part we have included other chassis components and system such as steering, Suspension, Brakes and Body. The student will learn about working of different types of front axles, steering system, suspension system and Braking system.

DETAILED CONTENTS

- 1. Front Axle and Steering System** 16 Periods
Types of front axles, construction details, materials, front wheel geometry: castor, camber, king pin inclination, toe-in. conditions for true rolling motion of wheels during steering, steering geometry, Ackermann and Davis steering system, constructional details of steering linkages, different types of steering gear boxes, steering linkages and layouts, turning radius, wheel wobble, collapsible steering. Power steering - necessity, types, Construction features and working of hydraulic and electronic power steering system. Cornering force, cornering power and self-righting torque. Over steering and under steering
- 2. Suspension System** 16 Periods
Purpose, various elements of suspension system, sprung and unsprung masses and their effect on human comfort. Springs – functions, construction materials and types (coil spring, leaf spring and torsion bar). Function and construction of hydraulic dampers (shock absorbers). Types: independent, rigid axle. Study and comparison of different types of front axle suspension system. Pneumatic suspension system – lay out and working. Hotchkiss drive & Torque tube drive
- 3. Braking System** 16 Periods
Purpose of brakes, Classification of brakes: service & parking brake, study of car braking system and its components, Drum brakes-Construction & Working, Disc. Brakes-Construction and Working, leading & trailing shoes, theory of braking, concept of dual brake system, brake lining material, Principle of hydraulic brakes, construction & working of hydraulic braking system, brake fluid characteristics, master cylinder, wheel cylinder, vacuum assisted servo system, pneumatic brake system, antilock braking.
- 4. Chassis and Body** 16 Periods
Various types of vehicles, Vehicle frames, various types of frames, constructional details, body materials like GRP, carbon fiber, steel sheet, timber, plastic. various types of loads acting on frames. Testing of vehicle frames, unitized frame body construction. Car body construction and functioning, body parts identification and their function. Corrosion in car bodies, anticorrosion methods, paint & painting process. Concept of monocoque body.

LIST OF PRACTICALS

1. Study and sketch of steering system of vehicle and its parts
2. Study and sketches of mechanical brake system and its parts
3. Study and sketches of hydraulic brake system and its parts
4. Study and sketch of suspension system - coil spring, leaf spring, torsion bar, shock absorber
5. Study of various elements of steering geometry of a vehicle such as castor, Camber, kingpin inclination, toe in, toe out.

INSTRUCTIONAL STRATEGY

Teacher should make use of audio visual aids to show features of steering, brakes and suspension system. Demonstration should be made in the automobile shop to explain various aspects of steering, brakes and suspension system

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. 2 by Dr. KIRPAL SINGH; Standard Publishers Distributors,
9. Automobile Engineering by R.B. GUPTA; Satya Prakashan, New Delhi.
10. Automobile Engineering by KM GUPTA, Umesh Prakashan, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	16	28
2	16	25
3	16	25
4	16	22
Total	64	100

4.6 AUTO ELECTRICAL AND ELECTRONICS

L T P
Periods/week 4 - 3

RATIONALE

Diploma holders in Automobile Engineering have to deal with different types of batteries, their charging and testing, regulators, ignition system, lighting system and various other electrical accessories used in Automobile Engineering. Hence the subject of automotive electric equipment is very essential for these technicians.

DETAILED CONTENTS

1. **Introduction** 06 periods
Need of Auto electrical system & its components, Conductor, Insulator, Semiconductor, current, voltage, resistance, ohm's law, series & parallel connections, electromagnetism. Introduction to Electrical measuring instruments Earth return system, types of earthing.
2. **Batteries** 12 periods
Principle and construction of lead acid battery, Battery Testing: Electrolyte testing by hydrometer, voltage test, high discharge and cadmium test (voltage), Battery charging methods. Battery Defects: Sulphation, cracking, sedimentation, separator defects, short circuits, overcharging
3. **Starting System** 10 periods
Requirements of starting system, Principle, construction & working of starting motor, Need of starting drive units, bendix, folothru & over running Clutch Drives.
4. **Charging System** 12 periods
Requirements of charging system, construction & working principle of D.C generator & A.C generator (alternator), Armature reaction, cut-out relay, voltage & current regulator systems. Difference between DC generator & alternator.
5. **Ignition System** 12 periods
Need of ignition system, construction & working of ignition coil, distributor, spark plug, condenser. Constructional details of spark plugs, classification as per reach, heat range, diameter. Types of ignition Systems - battery & magneto ignition system, Need of spark advance, construction & working of vacuum & centrifugal spark advance. Basic concept of Electronic ignition system.
6. **Lighting System** 06 periods
Lighting system: Head light, tail light (brake light, reverse light), side light, instrument light and indicator lights. Head light dazzling and preventive methods.
7. **Electrical Accessories** 06 periods
Speedometer, Horn, wind screen wiper system. Different types of fuel gauges, oil pressure gauges & engine temperature gauges.

LIST OF PRACTICALS

1. Study the construction and operation of lead acid battery.
2. Testing of Battery with hydrometer and high rate discharge tester.
3. Dismantling, inspection and assembling of starter motor.
4. Dismantling, inspection and assembling of alternator.
5. Study the construction and operation of centrifugal and vacuum advanced mechanism.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while imparting instructions. As far possible, subject teaching should be supplemented by demonstrations in the laboratory. During practical work, individual students should be given opportunities to perform practicals independently.

RECOMMENDED BOOKS

1. Automobile Engineering Vol 1 & 2 by Kirpal Singh, Standard Publishers, Delhi
2. Automotive Electrical Equipment by P.L. Kohli, Tata McGraw Hill, Delhi
3. Automotive Electrical Equipment by William H. Crouse, Tata McGraw Hill, Delhi
4. Automobile Engineering by R.B. Gupta, Satya Prakashan, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	08
2	12	20
3	10	18
4	12	20
5	12	20
6	06	08
7	06	06
Total	64	100

4.9 INDUSTRIAL TRAINING

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%