

GOVERNMENT OF JAMMU AND KASHMIR
J&K SERVICES SELECTION BOARD
Hema Complex, Sector -3, Channi Himmat, Jammu
www.jkssb.nic.in

NOTICE

J&K Services Selection Board has advertised posts of Forman, (Transport Department), Union Territory Cadre, Advertised vide Advertisement Notice No 04 of 2020, under Item no 080. Accordingly, the syllabus for the said post have been received from the Transport Department vide letter no TR-O/SMG/2015 dated 30-05-2021 which is shown below as per the Annexure "A" to this notification. The candidates are also intimated that there shall be negative marking for wrong answers (-0.25 for each wrong answer) attempted in the said examination.

This notice is for the purpose of intimation to the concerned candidates only.

(Sachin Jamwal) JKAS,
Secretary
J&K Services Selection Board
Jammu

No. SSB/Secy/Syl/2021/5984-88

Dated: 07.09.2021

Copy to the: -

1. Principal Secretary to Government, Transport Department, Civil Secretariat, J&K, Jammu for information.
2. Director Information, J&K Government, Jammu with the request to get the said notification published in at least three leading local newspaper of Jammu/Srinagar for three consecutive dates.
3. Private Secretary to the Chairman, JKSSB for information of the Chairman.
4. I/c Web site.
5. Syllabus file.

Government of Jammu and Kashmir
Transport Department, Civil Secretariat, J&K,
Jammu

Subject: - Filling up of post of "Foreman" in Motor Garages Department and notification of syllabus thereof.

Ref: Letter No. SSB/COE/2021/865-870 dated 29.01.2021 of J&K Services Selection Board, Letter No. RCD-704/2736/DSMG dated 19.02.2021 from Director, Motor Garages Department, J&K, Jammu and Letter No. DSD/Poly/101/G-/347 dated 06.04.2021 from Director, Skill Development, J&K.

Government Order No: - 40 -JK (TR) of 2021
D a t e d: - 28 -04-2021

Sanction is hereby accorded to notification of the syllabus for the post of "Foreman" in Motor Garages Department forming annexure "A" to this Government Order.

By order of the Government of Jammu and Kashmir.

Sd/-

(Hirdesh Kumar) IAS


Commissioner/Secretary to the Government,
Transport Department.

Dated: - 28 -04-2021

No: - TR-9/SMG/2015

Copy to the: -

1. Joint Secretary (J&K), Ministry of Home Affairs, Government of India.
2. Secretary, J&K Services Selection Board, Jammu.
3. Director, Skill Development, J&K, Jammu.
4. Director, J&K, Motor Garages Department, Jammu.
5. Private Secretary to Hon'ble Advisor (Incharge Transport Department).
6. Pvt. Secretary to Commissioner/Secretary to Government, Transport Department.
7. I/c Website.
8. Government Order/Stock file (w.2.s.c).


(Raj Mohammad Malik) KAS
Deputy Secretary to Government,
Transport Department

SYLLABUS FOR THE POST OF FOREMAN IN STATE MOTOR GARAGES

PART - I

20 MARKS

1.1 ENGLISH AND COMMUNICATION SKILLS - I

L T P
3 - -

RATIONALE

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this subject is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the subject, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a communication skill laboratory for conducting practicals mentioned in the curriculum.

DETAILED CONTENTS

1. Facets of Literature (14 hrs)
 - 1.1 Short Stories
 - 1.1.1 Homecoming – R.N. Tagore
 - 1.1.2 The Selfish Giant - Oscar Wilde
 - 1.1.3 The Diamond Necklace- Guy- De Maupassant
 - 1.2 Prose
 - 1.2.1 I Have A Dream – Martin Luther King
 - 1.2.2 On Habits – A. G. Gardiner
 - 1.2.3 My struggle for An Education- Booker T Washington
 - 1.3 Poems
 - 1.3.1 Ozymandias – P.B. Shelley
 - 1.3.2 Daffodils – William Wordsworth
 - 1.3.3 Stopping by Woods on a Snowy Evening – Robert Frost
2. Grammar and Usage (10 hrs)
 - 2.1 Parts of speech
 - 2.1.1 Nouns
 - 2.1.2 Pronouns
 - 2.1.3 Adjectives
 - 2.1.4 Articles

- 2.1.5 Verbs
- 2.1.6 Adverbs
- 2.1.7 Prepositions
- 2.1.8 Conjunction
- 2.1.9 Interjection
- 2.1.10 Identifying parts of speech
- 2.1.11 Using a word as different parts of speech
- 2.2 Pair of words (Words commonly confused and misused)
- 2.3 Tenses
- 2.4 Correction of incorrect sentences
- 2.5 One word substitution
- 2.6. Forms of verbs (100 words)
- 3. Translation (04 hrs)
 - 3.1 Glossary of Administrative Terms (English/ Hindi/Urdu)
 - 3.2 Translation from Urdu into English
- 4. Paragraph of 100-150 words from outlines (08 hrs)
- 5. Comprehension (04 hrs)
Unseen passages of literature, scientific data/graph based for comprehension exercises
- 6. Communication (08 hrs)
 - 6.1 Definition, Introduction and Process of Communication
 - 6.2 Objectives of Communication
 - 6.3 Essentials of Communication

1.2 APPLIED MATHEMATICS - I

L T P
5 - -

RATIONALE

Applied Mathematics forms the backbone of engineering students. Basic elements of algebra, trigonometry, coordinate geometry have been included in the curriculum as foundation course. This course will develop analytical abilities to make exact calculations and will provide continuing educational base to the students.

DETAILED CONTENTS

1. Algebra (35 hrs)
 - 1.1 Complex numbers: Complex numbers, representation, modulus and amplitude, Demovier's theorem and its applications in solving algebraic equation.
 - 1.2 Geometrical progression, its nth term and sum of n terms and to infinity with application to engineering problems.
 - 1.3. Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors)
 - 1.4 Concept of permutations and Combinations: Value of $n_p r$ $n_c r$.
 - 1.5. Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof)
2. Trigonometry (20 hrs)

Review of ratios of some standard angles (0,30,45,60,90 degrees), T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T-Ratios of multiple angles, sub-multiple angles (2A, 3A, A/2).
3. Co-Ordinate Geometry (25 hrs)
 - 3.1 Equation of straight line in various standard forms (without proof), inter section of two straight lines, angle between two lines, perpendicular distance formula (without proof)
 - 3.2 General equation of a circle and its characteristics. To find the equation of a circle, given:
 - * Centre and radius
 - * Three points lying on it
 - * Coordinates of end points of a diameter

- 3.3. Equations of conics (ellipse, parabola and hyperbola), simple problems related to engineering (standards forms only)

1.3 APPLIED PHYSICS – I

L T P
4 - 2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

DETAILED CONTENTS

1. Units and Dimensions (8 hrs)

- 1.1 Physical quantities
- 1.2 Units - fundamental and derived units, systems of units (FPS, CGS, MKS and SI units)
- 1.3 Dimensions and dimensional formulae of physical quantities
- 1.4 Dimensional equations and principle of homogeneity, applications to conversion from one system of units to another, checking the correctness of physical relations and derivation of simple physical relations, limitations of dimensional analysis
- 1.5 Error in measurement, random and systematic errors, types of errors, propagation of errors, significant figures

2. Force and Motion

(12 hrs)

- 2.1 Concept of Scalar and Vector quantities – examples, types of vectors.
- 2.2 Resolution and Composition of vectors, Vector multiplication (scalar product and vector product of vectors), addition of vectors (Parallelogram law)
- 2.3 Force: Newton's laws of motion, linear momentum and conservation of linear momentum, impulse and its application, simple numerical problem in brake system of vehicles and trains etc.
- 2.4 Friction: Types of friction and its application.
- 2.5 Circular motion: Angular displacement, angular velocity and angular acceleration
- 2.6 Relation between linear and angular variables (velocity and acceleration)
- 2.7 Centripetal force (derivation) and centrifugal force with application such as banking of roads and bending of cyclists
- 2.8 Application of various forces in lifts

3 Rotational Motion

(6 hrs)

- 3.1 Concept of translatory and rotating motion with examples
- 3.2 Definitions of torque, angular momentum and their relationship
- 3.3 Conservation of angular momentum (qualitative) and its examples
- 3.4 Moment of inertia and its physical significance, radius of gyration, Theorems of parallel and perpendicular axes (statements), Moment of inertia of rod, disc, ring and sphere (Formulae only).
- 3.5 Application of rotational motions in transport vehicles, trains and aero plane turbine/engine.
- 4 Work, Power and Energy (8 hrs)
 - 4.1 Work: definition and its SI units
 - 4.2 Work done in moving an object on horizontal and inclined plane (incorporating frictional forces) with its application
 - 4.3 Power: definition and its SI units, calculation of power with numerical problems
 - 4.4 Energy: Definition and its SI units: Kinetic energy and Potential energy with examples and their derivation
 - 4.5 Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another with its application
- 5 Properties of Matter (10 hrs)
 - 5.1 Elasticity: definition of stress and strain, different types of modulus of elasticity, stress – strain diagram, Hooke's law with its applications
 - 5.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
 - 5.3 Surface tension: concept, its units, angle of contact, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension
 - 5.4 Viscosity and coefficient of viscosity: Stoke's Law and derivation of terminal velocity, effect of temperature on viscosity.
- 6 Thermometry (10 hrs)
 - 6.1 Difference between heat and temperature
 - 6.2 Principles of measurement of temperature and different scales of temperature and their relationship
 - 6.3 Types of thermometers (Concept only)
 - 6.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
 - 6.5 Modes of transfer of heat (Conduction, convection and radiation with examples)
 - 6.6 Co-efficient of thermal conductivity
 - 6.7 Engineering Application of conduction, convection and radiations

7. Waves and Vibrations

(10

7.1 Simple Harmonic Motion(SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M. Equation of simple harmonic progressive wave

7.2 Wave motion: transverse and longitudinal wave motion with examples, sound and light waves, velocity, frequency and wave length of a wave (relationship $v = n\lambda$) and their applications

7.3 Free, forced and resonant vibrations with examples

7.4 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications

7.5 Ultrasonics – production (magnetostriction and piezoelectric methods) and their engineering and medical applications

LIST OF PRACTICAL'S (to perform minimum ten experiments)

1.4 APPLIED CHEMISTRY-I

L T P
3 - 2

RATIONALE

Every branch of engineering is expanding greatly. The contributions of chemicals and chemical products are playing important role in the field of engineering, biotechnology, agriculture and pharmacology etc. The numbers of such chemical products are exponentially increasing each successive year. This results in enhancing the responsibility of engineers while choosing engineering materials for converting them into finished products. Now a days, choosing engineering material is not only based on conventional qualitative and quantitative testing of their chemical composition and behavior under service conditions, but also based on environmental and eco-friendly factors. To achieve such objectives it is essential to know applied aspects of chemistry. Applied chemistry for diploma students in various engineering and technology courses is designed to develop scientific temper and appreciation of physical and chemical properties of engineering materials, which are used in their professional career. Best efforts should be made to teach and train the engineers by imparting essential knowledge required from this subject through demonstrations, and minor projects.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

DETAILED CONTENTS

1. Basic Concepts of Chemistry (06 hrs)
 - 1.1 S.I. Units of pressure, volume, density, specific gravity, surface tension, viscosity and conductivity.
 - 1.2 Matter, element, compound and mixtures, atoms, molecules, ions, symbols and formulae, Atomic mass (A), atomic number (Z) isotopes, isobars, isotone (recapitulation only)
 - 1.3 Chemical equations, thermo-chemical equations, balancing of chemical equations

2. Atomic Structure, Periodic Table and Chemical Bonding (10 hrs)
 - 2.1 Fundamental particles- electrons, protons and neutrons
 - 2.2 Orbit & orbital, electronic configuration of elements (upto Z=30)
 - 2.3 Modern periodic law and periodic table, groups and periods.
 - 2.4 Chemical bond and cause of bonding- Ionic bond, covalent bond, and its types

3. Water (10 hrs)
- 3.1 Sources of water
 - 3.2 Types of water based on dissolved salts.
 - 3.2.1 Hard water, soft water
 - 3.2.2 Units to measure water hardness in ppm (mg/l) & simple numericals, degree Clark & degree French
 - 3.3 Disadvantages of use of hard water in domestic and industrial applications (mainly boiler feed water)
 - 3.4 Methods to remove water hardness by
 - 3.4.1 Ion exchange process
 - 3.4.2 Lime-soda process
 - 3.4.3 Reverse Osmosis method
 - 3.5 Quality criteria of drinking water as per BIS. (with special emphasis on hardness, total dissolved solids (TDS), Chloride, alkalinity present in water)
4. Solutions (08 hrs)
- with
- 4.1 Concept of homogenous solution, brief introduction of the terms (i) Ionization (ii) Acidity (iii) Basicity (iv) equivalent weight and gram equivalent weight suitable examples
 - 4.2 Strength of a solution (i) Normality (ii) Molarity (iii) Molality as applied in relation to a solution.
 - 4.3 Definition of pH, simple numericals and different industrial applications of pH.
 - 4.4 Buffer solution and applications of buffer.
5. Electrolysis (08 hrs)
- 5.1 Definition of the terms: Electrolytes, Non-electrolytes with suitable examples
 - 5.2 Faraday's Laws of Electrolysis and simple numericals
 - 5.3 Different industrial applications of 'Electrolysis'
 - 5.4 Applications of redox-reactions in battery technology such as (i) Dry cell (ii) lead acid battery and (iii) Ni-Cd battery
6. Environmental Chemistry (06 hrs)
- 6.1 Brief introduction to Environmental Chemistry & Pollution
 - 6.2 Causes and effects of air, water & soil pollutions
 - 6.3 Role of chemistry in controlling air, water & soil pollutions

1.5 ENGINEERING DRAWING – I

L T P
- - 8

RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis while imparting instructions should be to develop conceptual skills in the students.

- Note: 1. First angle projection is to be followed
2. Instruction relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students

DETAILED CONTENTS

1. Drawing Office Practice, Lines & Lettering (2 Sheets)
 - 1.1 Drawing instruments
 - 1.2 Sizes and layout of standard drawing sheets and drawing boards
 - 1.3 Different types of lines in engineering drawing as per BIS specifications
 - 1.4 Free hand lettering (alphabet and numerals) lower case and upper case, single stroke vertical and inclined at 75 degree in different standard series of 2.5, 3, 5, 7, 10, and 15 mm heights in the ratio of 7:4
2. Dimensioning (2 Sheets)
 - 2.1 Necessity of dimensioning, Types of dimensioning (chain, parallel and progressive dimensioning, size and location dimensioning) Methods of placing dimensioning (Aligned and unidirectional system), use of leader lines. General principles of dimensioning.
 - 2.2 Dimensioning of overall sizes, circles, thread holes, chamfered surfaces, angles, tapered surface holes equally spaced on PCD, counter sunk hole counter bored holes, cylindrical parts, narrow space and gaps, radii, curves and arches.
3. Simple Geometrical Constructions used in Engineering Practice (2 Sheets)
 - 3.1 Construction of regular polygons (triangle, square, pentagon, hexagon) and circles
 - 3.2 Ellipses (concentric circle method and Intersecting Arcs method)
 - 3.3 Parabola (rectangle and tangent method), cycloid

4. Scale (2 sheets)
- 4.1 Scale – their need and importance, Definition of representative fraction (R.F.), find RF of given scale
- 4.2 Construction of plain and diagonal scales
5. Principle of Projections (7 sheets)
- 5.1 Principle of orthographic projection and introduction to first angle projection and third angle projection
- 5.2 Projection of points situated in different quadrants (1 Sheet)
- 5.3 Projection of lines, Lines inclined to one plane and parallel to the other and vice versa (1st & 3rd quadrants) (1 Sheet)
- 5.4 Projection of Planes: Planes perpendicular and parallel to either of the planes; planes perpendicular to one plane and parallel to the other or vice versa (1st & 3rd quadrants) (1 Sheet)
- 5.5 Drawing 3 orthographic views of given objects (3 sheets, at least one sheet in 3rd Angle Projection)
- 5.6 Identification of surfaces on drawn orthographic views from isometric object drawn (1 Sheet)
6. Sectional Views (1 sheet)
- 6.1 Need for sectional views – Drawing of different conventions for materials in sections, conventional breaks for shafts, pipes, rectangular, square, angle, channel and rolled sections
7. Isometric Views (2 sheets)
- 7.1 Fundamentals of isometric projections (theoretical instructions) and isometric scales
- 7.2 Isometric views of combination of regular solids like cylinder, cone, cube, prism and pyramid
8. Development of Surfaces (2 sheets)
- 8.1 Parallel line method (Prism and cylinder)
- 8.2 Radial line method (Pyramid and Cone)

1.6 GENERAL WORKSHOP PRACTICE - I

L T P
- - 8

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hand on experience about use of different tools and basic manufacturing practices.

This course aims at developing general manual and machining skills in the students. Besides above, the development of dignity of labour, precision, safety at work place, team working and development of right attitude are the other objectives.

DETAILED CONTENTS (PRACTICALS)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Carpentry and Painting Shop-I
2. Fitting Shop
3. Welding Shop-I
4. Electric Shop -I
5. Smithy Shop or Electronic Shop-I
6. Sheet Metal Shop-I

Note:

1. The branches e.g. Civil Engineering, Electrical Engineering, Mechanical Engineering, Automobile Engineering, Wood Technology, Leather Technology, Food Technology, Quantity Surveying and Public Health Engineering will do **Smithy Shop** instead of Electronic Shop-I
2. The branches e.g. Electronics and Communication Engineering, Instrumentation and Control, Computer Engineering, Information Technology, and Medical Electronics will do **Electronic Shop-I** instead of Smithy Shop.

1. Carpentry and Painting Shop

- 1.1 Introduction to various types of wood such as Deodar, Kail, Partal, Teak, Mango, Sheesham, etc. (Demonstration and their identification).
- 1.2 Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to be observed.

- Job I Marking, sawing, planning and chiseling & their practice
- 1.3 Introduction to various types of wooden joints, their relative advantages and uses.
 - Job II Preparation of half lap joint
 - Job III Preparation of Mortise and Tenon Joint
- 1.4 Demonstration of various methods of painting wooden items.
 - Job IV Preparation of surface before painting including primar coat
 - Job V Painting Practice by brush/roller/spray

2. Fitting Shop

- 2.1 Introduction to fitting shop tools, common materials used in fitting shop, Identification of materials. (e.g. Steel, Brass, Copper, Aluminium etc.). Identification of various sections of steel such as Flat, Angle, Tee, Channel, Bar Girder, Square, Z-Section, etc.
- 2.2 Description and demonstration of various types of work benches. holding devices and files. Precautions while filling.
- 2.3 Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting the blade.
 - Job I Marking of job, use of marking tools and measuring instruments.
 - Job II Filing a dimensioned rectangular or Square piece of an accuracy of $\pm 0.5\text{mm}$
 - Job III Filing practice (Production of flat surfaces) Checking by straight edge.
 - Job IV Making a cutout from a square piece of MS Flat using Hand hacksaw.
- 2.4 Care and maintenance of measuring tools like calipers, steel rule, try square, vernier calipers, micrometer, height gauge, combination set. Handling of measuring instruments, checking of zero error, finding of least count.

3. Welding Shop – I

- 3.1 Introduction to welding and its importance in engineering practice; types of welding; common materials that can be welded, introduction to welding equipment e.g. a.c. welding set, d.c. rectifier, Electrode holder, electrodes and their specifications, welding screens and other welding related equipment and accessories.
- 3.2 Electric arc welding, (ac. and dc.) precautions while using electric arc welding, Practice in setting current and voltage for striking proper arc.
 - Job I Practice of striking arc while using electric arc welding set.
 - Job II Welding practice on electric arc welding for making uniform and Straight weld beads
- 3.3 Various types of joints and end preparation.

- Job III Preparation of butt joint by electric arc welding.
- Job IV Preparation of lap joint by electric arc welding.
- Job V Preparation of corner joint by using electric arc welding.
- Job VI Preparation of Tee joint by electric arc welding.

4. Electric Shop – I

- 4.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, ceiling roses, PVC Conduits, PVC Channels and allied items, tools and accessories.
- 4.2 Study of electrical safety measures and demonstration about use of protective devices. Such as fuses, MCBs and relays
 - Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin, plugs.
 - Job II Preparation of a house wiring circuit on wooden board using fuse, Switches, socket, holder, ceiling rose etc. by PVC Conduit and PVC casing and capping.
- 4.3 Study of common electrical appliances such as electric iron, electric kettle, ceiling fan, table fan, electric mixer, electric Geyser, gas geyser, desert cooler, refrigerator, water purifier
- 4.4 Introduction to the construction of a Lead-acid battery and its working.
 - Job III Installation of inverter with battery and to connect two or more batteries in series and in parallel
 - Job IV Charging of a battery and testing it with the help of hydrometer and Cell Tester

5. Smithy Shop

- 5.1 Demonstration and detailed explanation of tools and equipment used. Forging operations in Smithy shop. Safety measures to be observed in the smithy shop.
- 5.2 Demonstration and description of bending operation, upsetting operation, description and specification of anvils, swage blocks, hammers etc.
- 5.3 Demonstration and description of tongs, fullers, swages etc.
 - Job I To forge a L-Hook.
 - Job II To prepare a job involving upsetting process
 - Job III To forge a chisel
 - Job IV To prepare a cube from a M.S. round by forging method.

OR

5. Electronic Shop – I

- 5.1 Identification and familiarization with the following tools used in electronic shop:
Tweezers, Screw drivers (different sizes), Insulated Pliers, Cutter, Sniper, Philips Screw Driver (Star Screw Driver), L- Keys, Soldering Iron, soldering wire, flux and their demonstration and uses.
- 5.2 Identification and familiarization with Multimeter analog and digital (Three and half digit)
Job I Practice in the use of above-mentioned equipment. For this small experimental as set up may be done
- 5.3 Various types of protective devices such as : Wire fuse, cartridge fuse etc. ,
- 5.4 Identification and familiarization with ear phone speaker connector, telephone jacks and similar male and female connectors (Audio, Video)
- 5.5 Safety precautions to be observed in the electronic shop
- 5.6 Identification and familiarization with soldering and desoldering practice.

NOTE: Demonstration boards for the electronics components such as resistor, Capacitor, diodes, transistors, FETs, IFT Coils, ICs should be made.

Job II Cut, strip, join an insulated wire with the help of soldering iron (repeat with different types of wires)

Job III Cut, strip, connect/solder/crimp different kinds of wires/ cables (including co-axial and shielded cable) to different types of power/general purpose/Audio Video/Telephone plugs, sockets, jacks, terminals, binding posts, terminal strips, connectors. The tasks should include making complete recording/ playback/ antenna/ speaker leads for common electronic products such as Radio, TV, CD Players, VCD/DVD Players, Cassette Recorder and Players, Hi-Fi equipment, Hand- set, microphone

6. Sheet Metal Shop –I

Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

- 6.1 Introduction and demonstration of hand tools used in sheet metal shop.
- 6.2 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, power press, sheet bending machine.
- 6.3 Introduction and demonstration of various raw materials used in sheet metal shop e.g. M.S. sheet, galvanized-iron plain sheet, galvanized corrugated sheet, aluminum sheets etc.

6.4 Study of various types of Rivets, Steel Screw etc.

Job I Shearing practice on a sheet using hand shears.

- a) Practice on making Single riveted lap joint/Double riveted lap Joint.
- b) Practice on making Single cover plate chain type, riveted Butt Joint

2.1 ENGLISH AND COMMUNICATION SKILLS – II

L T P
3 - 2

RATIONALE

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this course is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the course, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a communication skill laboratory for conducting practicals mentioned in the curriculum.

DETAILED CONTENTS

- | | | |
|-------|---|----------|
| 1. | Facets of Literature | (14 hrs) |
| 1.1 | Short stories | |
| 1.1.1 | The Portrait of a Lady - Khushwant Singh | |
| 1.1.2 | The Doll's House – Katherine Mansfield | |
| 1.1.3 | The Refugees – Pearl S. Buck | |
| 1.2 | Prose | |
| 1.2.1 | Walking Tours – R.L. Stevenson | |
| 1.2.2 | A Dialogue on Civilization – C.E.M. Joad | |
| 1.2.3 | The Sign of Red Cross – Horace Shipp | |
| 1.3 | Poems | |
| 1.3.1 | All The World's A Stage – W. Shakespeare | |
| 1.3.2 | Say Not, The Struggle Nought Availeth – A.H. Clough | |
| 1.3.3 | Pipa's Song – Robert Browning | |
| 2. | The Art of Précis Writing | (04 hrs) |
| 3. | Grammar and Usage | (08 hrs) |
| 3.1 | Narration | |
| 3.2 | Voice | |
| 3.3 | Idioms and Phrases | |
| 4. | Correspondence | (04 hrs) |
| 4.1 | Business Letters | |
| 4.2 | Personal letters | |
| 5. | Drafting | (06 hrs) |
| 5.1 | Report Writing | |
| 5.2 | Inspection Notes | |
| 5.3 | Memos, Circulars and Notes | |
| 5.4 | Notices | |
| 5.5 | Press Release | |
| 5.6 | Agenda and Minutes of Meetings | |

5.7 Applying for a Job: Forwarding letter, Resume/C.V., follow up.

6. Glossary of Technical & Scientific Terms (04 hrs)

7. Communication (08 hrs)

7.1 Media and Modes of Communication

7.2 Channels of Communication

7.3 Barriers to Communication

7.4 Listening Skills

7.5 Body language

7.6 Humour in Communication

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus and integral calculus and statistics have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

DETAILED CONTENTS

1. Differential Calculus (30 hrs)
 - 1.1 Definition of function; Concept of limits.
 Four standard limits $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$,
 $\lim_{x \rightarrow 0} \frac{\sin x}{x}$, $\lim_{x \rightarrow 0} \frac{a^x - 1}{x}$, $\lim_{x \rightarrow 0} (1+x)^{1/x}$
 - 1.2 Differentiation by definition of x^n , $\sin x$, $\cos x$, $\tan x$, e^x , $\log_a x$ only
 - 1.3 Differentiation of sum, product and quotient of functions. Differentiation of function of a function.
 - 1.4 Differentiation of trigonometric inverse functions . Logarithmic differentiation. Exponential differentiation Successive differentiation (excluding nth order).
 - 1.5 Applications:
 - (a) Maxima and minima
 - (b) Equation of tangent and normal to a curve (for explicit functions only) – Simple problems only
2. Integral Calculus (30 hrs)
 - 2.1 Integration as inverse operation of differentiation
 - 2.2 Simple integration by substitution, by parts and by partial fractions (for linear factors only)
 - 2.3 Evaluation of definite integrals (simple problems)-
 Evaluation of $\int_0^{\pi/2} \sin^n x \, dx$, $\int_0^{\pi/2} \cos^n x \, dx$, $\int_0^{\pi/2} \sin^m x \cos^n x \, dx$
 using formulae without proof (m and n being positive integers only)
3. Ordinary Differential Equations (10 hrs)
 - 3.1. Definition and formation of Differential Equations
 - 3.2. Solution of first order Differential Equations of the type:
 - (i) Variable separable form
 - (ii) Homogeneous Differential Equations
 - (iii) Linear Differential Equations
4. Statistics (10 hrs)
 - 4.1 Measures of Central Tendency: Mean, Median, Mode
 - 4.2 Measures of Dispersion: Mean deviation, Standard deviation

2.3 APPLIED PHYSICS – II

L T P

4 - 2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology

DETAILED CONTENTS

1. Optics (10 hrs)
 - 1.1 Review of basic optics laws: reflection and refraction
 - 1.2 Refraction and refractive index, image formation in lenses, image magnification, lens formulae (thin lens only), power of lens, total internal reflection and their applications
 - 1.3 Simple and compound microscope, astronomical telescope, magnifying power and its calculation (in each case), Terrestrial and Galileo's telescope (Concept only) and their applications
2. Electrostatics (12 hrs)
 - 2.1 Coulombs law, unit of charge, electric potential and electric potential difference
 - 2.2 Electric field, electric field intensity, electric lines of force, electric flux Gauss's Law
 - 2.3 Applications of Gauss law in finding electric field of point charge, straight charged conductor, plane charged sheet and between two plane parallel charged sheets
 - 2.4 Capacitance, types of capacitors, capacitance of parallel plate capacitor, series and parallel combination of capacitors, Dielectric and its effect on capacitance, and dielectric break down
 - 2.5 Application of electrostatics in electrostatic precipitator
3. DC Circuits (12 hrs)
 - 3.1 Concept of electricity, current and its units, direct and alternating current, voltage, resistance, potential difference and e.m.f,
 - 3.2 Ohm's law and its applications, concept of resistance, conductance, specific resistance, effect of temperature on resistance, co-efficient of resistance, series and parallel combination of resistors, introduction to super conductivity.
 - 3.3 Kirchoff's laws, Wheatstone bridge principle and its applications (Slide Wire Bridge)
 - 3.4 Heating effect of current and concept of electric power, energy and their units, related numerical problems
 - 3.5 Application of electricity in various equipments, advantages of electrical energy over other forms of energy
4. Electromagnetism (13 hrs)
 - 4.1 Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and their units, Right hand thumb rule, magnetic lines of force due to straight conductor, circular coil and solenoid
 - 4.2 Force on a charge, moving in a uniform magnetic field (Lorentz force). Force on a current carrying straight conductor. Torque on a current carrying rectangular coil.
 - 4.3 Moving coil galvanometer conductor, its principle, construction and working, conversion of a galvanometer into ammeter and voltmeter.
 - 4.4 Electromagnetic induction, Faradays Laws, Lenz's Law.
 - 4.5 Applications of Electromagnetism
5. Semiconductor physics (07 hrs)
 - 5.1 Energy bands, intrinsic and extrinsic semiconductors, p-n junction diode and its characteristics
 - 5.2 Diode as rectifier – half wave and full wave rectifier, semiconductor transistor pnp and npn (concept only)
6. Modern Physics (10 hrs)

- 6.1 Electro magnetic spectrum, photo electric effect and work function, X rays - properties, production and their applications in medicine and industries.
- 6.2 Lasers: concept of energy levels, ionizations and excitation potentials; spontaneous and stimulated emission; lasers and its characteristics, population inversion, types of lasers, Helium- Neon and ruby lasers, their engineering and medical applications
- 6.3 Fibre optics: introduction to optical fiber materials, types, light propagation and applications in communication.

2.4 APPLIED CHEMISTRY-II

L T P
3 - 2

RATIONALE

The role of chemistry in every branch of engineering and technology is expanding greatly. Now a days, various chemical products are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behaviour when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstrations/ minor projects and with the active involvement of students.

Note:- Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to appreciate learning of these concepts and principles.

DETAILED CONTENTS

1. Metallurgy (08 hrs)
 - 1.1 A brief introduction of the terms: Metallurgy (types), mineral, ore, gangue or matrix, flux, slag, concentration (methods of concentrating the ores), ore, roasting, calcinations, smelting and refining of metal.
 - 1.2 Metallurgy of (i) Aluminium (ii) Iron
 - 1.3 Definition of an alloy, purposes of alloying, composition, properties and uses of alloys-brass, bronze, monel metal, magnalium, duralumin, alnico, stainless steel and invar.
2. Fuels (10 hrs)
 - 2.1 Definition of a 'Fuel', characteristics of a good fuel and classification of fuels with suitable examples
 - 2.2 Definition of Calorific value of a fuel and determination of calorific value of a solid fuel with the help of Bomb calorimeter. Simple numerical problems based upon Bomb-calorimeter method of finding the Calorific values

- 2.3 Brief description of 'Proximate' and 'Ultimate' analysis of a coal. Importance of conducting the proximate and ultimate analysis of a fuel
- 2.4 Merits of gaseous fuels over those of other varieties of fuels
- 2.5 Manufacture, composition, properties and uses of (i) Water gas (ii) Oil gas (iii) Biogas
- 2.6 Composition, calorific values and applications of (i) LPG (ii) CNG (iii) Power alcohol
- 2.7 Fuel rating
 - 2.7.1 Octane number for petrol
 - 2.7.2 Cetane number for diesel

3 Corrosion (06 hrs)

- 3.1 Definition of corrosion
 - 3.2 Theories of corrosion i.e. (i) direct chemical action theory and (ii) electro chemical theory
 - 3.3 Passivity
 - 3.4 Prevention of corrosion by
 - 1. (a) Alloying
 - (b) Providing metallic coatings
 - 2. Cathodic protections:
 - (a) Sacrificial
 - (b) Impressed voltage method
 - 3. Heat treatment (quenching, annealing, tempering & normalizing)
- 4 Lubricants (06 hrs)

- 4.1 Definition of (i) lubricant (ii) lubrication
- 4.2 Classification of lubricants
- 4.3 Principles of lubrication
 - (i) fluid film lubrication
 - (ii) boundary lubrication
 - (iii) extreme pressure lubrication

4.4 Properties of lubricants

4.4.1 Physical properties: viscosity, viscosity index, flash-point, fire-point, cloud-pour point, oiliness, volatility, emulsification

4.4.2 Chemical properties-Total acidity number (TAN) saponification and iodine value, coke number and aniline point.

5 Glass (04 hrs)

5.1 Glass: Chemical composition, types of glasses and their applications

5.2 Manufacture of ordinary glass and lead glass

6. Classification and Nomenclature of Organic Compounds (06 hrs)

Classification of Organic Compounds, functional group, Homologous Series, IUPAC-Nomenclature of various homologous series i.e. alcohols, aldehydes, ketones, carboxylic acids, and phenols.

7. Polymers & Plastics (08 hrs)

7.1 Definition of polymer, monomer & degree of polymerization

7.2 Brief introduction of addition & condensation polymers with suitable examples (PVC, Polyester, Teflon, Nylon 66, Bakelite)

7.3 Definition of plastic & type of plastics (thermo & thermo setting plastics) with suitable examples

7.4 Applications of polymers & plastics in daily life.

2.6 ENGINEERING DRAWING – II

L T P
- - 6

RATIONALE

Drawing is said to be the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The course is aimed at developing basic graphic skills so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation SP 46 – 1988 should be followed

- Note:
1. First angle projection is to be followed
 2. Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students

DETAILED CONTENTS

1. Detail and Assembly Drawing (2 sheets)
 - 1.1 Principle and utility of detail and assembly drawings
 - 1.2 Wooden joints i.e. corner mortice and tenon joint, Tee halving joint, Mitre faced corner joint, Tee bridle joint, Crossed wooden joint, Cogged joint, Dovetail joint, Through Mortice and Tenon joint
2. Screw threads and threaded fasteners (8 sheets)
 - 2.1 Thread Terms and Nomenclature
 - 2.1.1 Types of threads-External and Internal threads, Right and Left hand threads (Actual and Conventional representation), single and multiple start threads.
 - 2.1.2 Different Forms of screw threads-V threads (B.S.W threads, B.A thread, American National and Metric thread), Square threads (square, Acme, Buttress and Knuckle thread)
 - 2.2 Nuts and Bolts
 - 2.2.1 Different views of hexagonal and square nuts and hexagonal headed bolt
 - 2.2.2 Assembly of Hexagonal headed bolt and Hexagonal nut with washer.
 - 2.2.3 Assembly of square headed bolt with hexagonal and with washer.

- 2.3 Locking Devices
 - 2.3.1 Different types of locking devices-Lock nut, castle nut, split pin nut, locking plate, slotted nut and spring washer.
 - 2.3.2 Foundations bolts-Rag bolt, Lewis bolt, curved bolt and eye bolt.
- 2.4 Drawing of various types of machine screw, set screw, studs and washers
- 3. Keys and Cotters (3 sheets)
 - 3.1 Various types of keys and cotters and their practical application and preparation of drawing of various keys and cotters showing keys and cotters in position
 - 3.2 Various types of joints (3 sheets)
 - Spigot and socket joint
 - Gib and cotter joint
 - Knuckle joint
- 4. Rivets and Riveted Joints (4 sheets)
 - 4.1 Types of general purpose-rivets heads (4 Sheets)
 - 4.2 Caulking and fullering of riveted joints
 - 4.3 Types of riveted joints
 - (i) Lap joint-Single riveted, double riveted (chain and zig-zag type)
 - (ii) Butt Joint-
 - (a) Single cover plate
 - (i) Single riveted joint
 - (ii) Double riveted joint (Chain and zig-zag type)
 - (b) Double cover plate
 - (i) Single riveted joint
 - (ii) Double riveted joint (Chain and zig-zag type)
- 5. Couplings (2 sheets)
 - 5.1 Flange coupling (Protected and non-protected)
- 6. Symbols and Conventions (2 sheets)
 - 6.1 Civil engineering sanitary fitting symbols
 - 6.2 Electrical fitting symbols for domestic interior installations
 - 6.3 Building plan drawing with electrical and civil engineering symbols
- 7. AUTO CAD (for practical and viva-voce only)
 - 7.1 Concept of AutoCAD, Tool bars in AutoCAD, coordinate system, snap, grid, and ortho mode
 - 7.2 Drawing commands – point, line, arc, circle, ellipse
 - 7.3 Editing commands – scale, erase, copy, stretch, lengthen and explode

2.7 GENERAL WORKSHOP PRACTICE - II

L T P
- - 6

RATIONALE

As we know that, the psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skills jobs. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met.

DETAILED CONTENTS (PRACTICALS)

Note: The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus.

1. Carpentry and Painting shop-II
2. Plumbing Shop
3. Welding shop -II
4. Electric shop -II
5. Machine shop or Electronic shop-II
6. Sheet Metal Shop -II

Note:

1. The branches e.g. Civil Engineering, Electrical Engineering, Mechanical Engineering, Automobile Engineering, Wood Technology, Food Technology, Quantity Surveying and Public Health Engineering will do Machine Shop instead of Electronic shop- II
2. The branches e.g. Electronics and Communication Engineering, Instrumentation and Control, Computer Engineering, Information Technology, and Medical Electronics will do Electronic shop-II instead of Machine shop.
3. The instructor is to first explain the introductory part given at the beginning under each shop followed by demonstration and practice by students.

1. Carpentry and Painting Shop-II

1.1 Introduction to joints, their relative advantages and uses.

Job I Preparation of Dovetail joint and glued joint.

Job II Preparation of Mitre Joint

Job III Preparation of a lengthening Joint

Job IV Preparation of at least one utility job with and without lamination.

1.2 Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

1.3 Demonstration of job on Band Saw and Circular Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.

1.4 Importance and need of polishing wooden items, Introduction to polishing materials.

Job V Polishing on wooden items.

2. Plumbing Shop

- 2.1 Introduction to various types of threads (internal, external)-single start, multi-start, left hand and right hand threads.
- 2.2 Description and demonstration of various types of drills, taps and dies Selection of dyes for threading, selection of drills, taps and reamers for tapping operations.
Job I Making internal and external threads on a job by tapping and dieing operations (manually)
- 2.3 Precautions while drilling soft metals, e.g. Copper, Brass, Aluminium etc.
Job II Drilling practice on soft metals (Aluminum, Brass and Copper)
Job III Preparation of a job by filing on non-ferrous metal up to an accuracy of $\pm 0.2\text{mm}$
Job IV Preparation of job involving thread on GI pipe/ PVC pipe and fixing of different types of elbow, tee, union, socket, stopcock, taps, etc

3. Welding Shop – II

- 3.1 Introduction to gas welding, spot welding and seam welding and welding techniques. Adjustments of different types of flames in gas welding, demonstration and precautions about handling welding equipment.
Job I Practice in handling gas welding equipment (Low pressure and High pressure) and welding practice on simple jobs.
- 3.2 Common welding joints generally made by gas welding.
Job II Preparation Butt joint by gas welding.
Job III Preparation of small cot frame from conduit pipe by electric arc welding/gas welding.
Job IV Preparation of square pyramid from MS rods by welding (type of welding to be decided by students themselves).
Job V Exercise of preparing a job on spot/seam welding machine.
- 3.3 Demonstration and use of TIG and MIG Welding equipment

4. Electric Shop – II

- 4.1 Importance of three-phase wiring and its effectiveness.
Job I Laying out 3 phase wiring for an electric motor or any other 3 phase machine.
- 4.2 Estimating and costing of power connection.
Job II Connecting single-phase energy meter and testing it. Reading and working out the power consumption and the cost of energy.
Job III Checking continuity of connection (with tester and series lamp) location of faults with a multimeter) and their rectification in simple machines and/or other electric circuits fitted with earthing.
- 4.3 Demonstration of dismantling, servicing and reassembling a table fan/ceiling fan/air cooler/mixer/electric iron, Electric heater, geyser, electric oven, air conditioner etc.
Job IV Testing Single phase/three phase electrical motor by using voltmeters, ammeter, clip on meter, tachometer etc.
Job V Reversing the rotation of a motor.

5. Machine Shop

Introduction to various machines used in machine shop. Demonstration of Lathe, Milling Machine Shaper, Slotter, Radial drilling machine, Surface grinder and CNC machine

Job-1 Exercise on simple turning and facing

Job-II Exercise on taper turning

Job-III Marking and drilling practice on mild steel piece

OR

5. Electronic Shop- II

5.1 Demonstrate the jointing methods on general purpose PCB boards mounting and dismantling as well as uses of the items mentioned below:

- a) Various types of single, multi-cored insulated screened power, audio video, co-axial, general purpose wires/cables
- b) Various types of plugs, sockets connectors suitable for general purpose audio and video use, 2 and 3 pin mains plug and sockets, RF Plugs and Sockets.
Banana-plugs, and sockets, BNG, RCA, DIN, UHF, Ear phone speaker connector, telephone jacks and similar male and female connectors and terminal strips.
- c) Various types of switches such as: normal/ miniature toggle, slide, push button, piano key, rotary, micro switches, SPST, SPDT, DPST, DPDT, band selector, multi way Master Mains Switch.
- d) Various types of protective devices such as : Wire fuse, cartridge fuse, slow acting/fast acting fuse, HRC fuse, thermal fuse, single/multiple circuit breakers, over and under current relays.
- e) Materials: Conducting, insulating and magnetic materials.
- f) Single beam simple CRO, Single Generator and function-Generator, function of energy knob on the front panel.
- g) Regulated power supply-fixed and variable voltage, single output as well as dual output.

5.2 Identification and familiarization with active and passive components; colour code and types of resistor, capacitors and potentiometers (including VDR, LDR, and thermistor). Identification of components including LED, LCD, UJT, FET, Coils, relays, read relays, transformers, Linear and Digital ICs, Thyristors, etc.

3.1 PRINCIPLES OF THERMAL ENGINEERINGL T P
3 - 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 (06 hrs)
Concept of thermodynamics, heat, temperature, intensive and extensive properties, path, process, system, surroundings, enthalpy, internal energy and thermodynamic work.
2. Gas Laws (06hrs)
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 (08 hrs)
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 (08 hrs)
Carnot cycle – concept only, Otto cycle, Diesel cycle, Dual combustion cycle , Numericals based on above cycles.
5. Air Compressors (06 hrs)
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 (06 hrs)

Modes of heat transfer – Conduction, convection, radiation; Fourier's Law, Numericals based on Fourier's Law.

7. Refrigeration and Air Conditioning (08 hrs)

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

3.2 APPLIED MECHANICS

L T P
3 - 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 (04hrs)
 - 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 for density, force, pressure, work, power, velocity, acceleration
 - 1.4 Concept of rigid body, scalar and vector quantities
2. Laws of forces (09 hrs)
 - 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 (09 hrs)

- 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
- 3.8 Position of resultant force by moment
[Simple problems on the above topics]

4. Friction (06 hrs)

- 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.

5. Centre of Gravity (08 hrs)

- 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. Simple Machines (06 hrs)
- 6.1 Definition of effort, velocity ratio, mechanical advantage and efficiency of - a machine and their relationship, law of machines
 - 6.2 Simple and compound machine (Examples)
 - 6.3 Definition of ideal machine, reversible and self locking machine
 - 6.4 Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
 - 6.5 System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
 - 6.6 Working principle and application of wheel and axle, Weston's Differential Pulley Block , 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]
7. Torsion (06 hrs)
- 7.1 Torsion in shafts/bars
 - 7.2 Modulus of rigidity
 - 7.3 Torsional Equation (simple numerical problems)
 - 7.4 Power Transmission in shafts (simple numerical problems)

3.3 ELEMENTS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L T P
4 - 2

RATIONALE

The objective of this subject is to impart fundamental knowledge and skills regarding basic electrical and electronics engineering, which diploma holders will come across in their professional life. This course will provide the students to understand the basic concepts and principles of d.c. and a.c. fundamentals, electromagnetic induction, batteries, transformers, motors distribution system, domestic installation, electrical safety etc. The students will also learn basic electronics including diodes and transistors and their applications.

DETAILED CONTENTS

1. Application and Advantage of Electricity (06 hrs)
Difference between ac and dc, various applications of electricity, advantages of electrical energy over other types of energy
2. Basic Electrical Quantities (06 hrs)
Definition of voltage, current, power and energy with their units, name of instruments used for measuring above quantities, connection of these instruments in an electric circuit
3. Electromagnetic Induction (06 hrs)
Production of e.m.f., idea of a transformer and its working principle
4. Transmission and Distribution System (10 hrs)
Key diagram of 3 phase transmission and distribution system, Brief functions of accessories of transmission line. Difference between high and low voltage distribution system, identification of three-phase wires, neutral wire and earth wire in a low voltage distribution system. Identification of voltages between phases and between one phase and neutral. Difference between three-phase and single-phase supply. Arrangement of supply system from pole to the distribution board, function of service line, energy meter, main switch, distribution board

5. Domestic Installation (10 hrs)

Distinction between light-fan circuit and single phase power circuit, sub-circuits, various accessories and parts of domestic electrical installation. Identification of wiring systems.

6. Electric Motors and Pumps (12 hrs)

Definition and various applications of single-phase and three-phase motors. Connection and starting of three-phase induction motors by star-delta starter. Changing direction of rotation of a given 3 phase induction motor. Conversion of horse power in watts or kilowatts, Type of pumps and their applications, Use of direct online starter and star delta starter

7. Electrical Safety (06hrs)

Electrical shock and precautions against shock, treatment of electric shock, concept of fuses and their classification, selection and application, concept of earthing and various types of earthing, applications of MCBs and ELCBs

8. Basic Electronics (08hrs)

Basic idea of semiconductors – P and N type; diodes, zener diodes and their applications, transistor – PNP and NPN, symbols, identification of terminals of transistor, of current flowing in a transistor their characteristics and uses. Characteristics and applications of a thyristor, characteristics and applications of servo motors.

3.4 BASIC WORKSHOP

L T P
4 - 6

RATIONALE

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted. Hence the subject of basic workshop is being included in the curriculum.

DETAILED CONTENTS

1. LATHE (10 hrs)
 - 1.1 Concept of cutting tools and Cutting materials
 - 1.2 Principles of Turning
 - 1.3 Description and function of various parts of lathe
 - 1.4 Classification of various types of lathe
 - 1.5 Drives and transmission
 - 1.6 Work holding devices
 - 1.7 Lathe operations
 - 1.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time
 - 1.9 Lathe accessories: centre dogs , different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment etc.
 - 1.10 Brief description of capstan and Turret lathe, their comparison, work holding and tool grinding devices in capstan and Turret lathe

2. DRILLING (07 hrs)
 - 2.1 Principles of drilling
 - 2.2 Classification of drilling machines and their description
 - 2.3 Various operation performed on drilling machines
 - 2.4 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
 - 2.5 Types of drills and their features; nomenclature of a drill
 - 2.6 Drill holding devices
 - 2.7 Types of reamers

3. BORING (05 hrs)
- 3.1 Principles of Boring
 - 3.2 Classification of Boring machines
 - 3.3 Specifications of boring machine
 - 3.4 Boring tools, boring bars and boring heads
 - 3.5 Description of Jig boring machine
- 4 SHAPING, PLANING AND SLOTTING (10 hrs)
- 4.1. Working Principles of shaper, planer and slotter
 - 4.2. Types of shapers
 - 4.3. Types of planers
 - 4.4 Quick Return mechanism
 - 4.5 Work holding devices used in shaper, planer and slotter
 - 4.6 Specifications of Shaper, Planer and slotter
 - 4.7 Speeds and feeds in above processes
- 5 JIGS AND FIXTURES (07 hrs)
- 5.1. Importance and use of jigs and fixtures
 - 5.2. Principle of location
 - 5.3. Locating devices
 - 5.4. Clamping devices
 - 5.5 Types of jigs
 - 5.6 Fixtures for milling, turning, welding and grinding
 - 5.7 Advantages of jigs and fixtures
- 6 BROACHING (05 hrs)
- 6.1. Introduction
 - 6.2. Types of Broaching machines
 - 6.3. Elements of broach tool, broach tool details, nomenclature, types and tool material.
7. CUTTING FLUIDS AND LUBRICANTS (05 hrs)
- 7.1. Function of Cutting fluids
 - 7.2. Types of cutting fluids
 - 7.3. Difference between cutting fluids and lubricants

7.4. Selection of cutting fluids for different materials and operations

7.5. Common methods of lubrication of machine tools.

8 WELDING PROCESSES

(15 hrs)

8.1. Principles of Weldings, Classification of Welding processes; advantages and limitations of welding; Industrial applications of welding; Welding positions and techniques, symbols.

8.2. Gas Welding – Principle of operation, types of gas welding flames and their applications; gas welding equipment – Gas welding torch; oxy-acetylene cutting torch, blow pipe, pressure regulators, filler rods and fluxes

8.3. Arc Welding – Principle of operation, Arc welding, machine and equipment; A.C & D.C. arc welding. Effect of polarity, current regulation and voltage regulation, Electrodes- classification; B.I.S specification and selection; flux for Arc welding

8.4. Other Welding Processes:- Resistance welding – principles , advantages and its limitations. Working and application of spot welding; seam welding, projection welding and percussion welding.

Atomic hydrogen welding; shielded metal arc welding; submerged arc welding, welding defects. Methods of controlling welding defects and inspection of welded joints.

8.5. Modern Welding Methods:- Method, Principle of operation, advantages, disadvantages and application of tungsten inert gas (TIG) welding, metal inert gas (MIG) welding, thermit, welding, electroslag welding, electron beam welding, ultrasonic welding, laser beam welding, robotic welding

RATIONALE

Engine forms the heart of an automobile. As the scope of auto engines is very wide, it has been divided into two subjects, Auto Engine –I and Auto Engine-II. This subject deals with engine terminology basic concept of 2 stroke and 4 stroke engine, classification of engines, constructional details of petrol engine, fuel system, cooling system, lubrication system and ignition system,.

DETAILED CONTENTS

1. Introduction (09 hrs)
 - Engine as a power source
 - Concept of internal combustion engine.
 - Engine dimensions : Bore, stroke, dead centres, compression ratio, swept volume, clearance volume, engine capacity, engine torque engine power at the crank shaft.
 - Classification of engines as per stroke, cycle, fuel, ignition, number and arrangement of cylinders, reciprocating and rotary engines.
 - Concept of 2 stroke and 4 stroke engines and their comparison.
 - Working principles of petrol and diesel engines.

2. Constructional details (09 hrs)
 - Constructional details of cylinder block, cylinder head, cylinder liner piston, piston rings, gudgeon pin, connecting rod, crankshaft, camshaft, valve mechanisms, flywheel and damper.

3. Fuel System (08 hrs.)
 - 3.1. Fuel system in spark ignition engine: Fuel feed system, fuel pumps-its types, fuel tank, fuel lines, fuel filters, concept of carburetion. Working and construction of a simple carburetor. Advantages of using fuel injection system in spark ignition engines. Concept of MPFI system, Constructional details of an MPFI system. Dry and wet air cleaners.
 - 3.2. Fuel systems in compression ignition engines: Fuel feed system , fuel filters- its types, priming and fuel feed pump. Fuel injection pump-plunger and barrel type, distributor type. Fuel injectors. Concept of governing, Working principle of a governor. Concept of supercharging, Types of superchargers, Turbochargers

4. Ignition System in S.I. Engine and Combustion in C.I. Engine (10 hrs)

4.1. Ignition system in S.I. engines.

Concept of ignition system, battery and magneto types of ignition systems .
Function of ignition coil, condenser, contact breaker point, distributors, spark
plugs. Distribution less ignition system.

4.2. Combustion in C.I. Engines:

Combustion phenomenon, phases of combustion, squish and swirl, types of
combustion chambers for C.I. engines

5 Cooling System (09 hrs)

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.

6 Lubrication System (09 hrs)

Necessity of lubrication system, 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.

7 Special Types of Engines (10 hrs)

Wankel engines, Electrical/Hybrid system, Fuel Cell, Homogenous charge
compression, Ignition engine, Wheel motors.

3.6 CHASSIS, BODY AND TRANSMISSION - I

L T P
3 - 2

RATIONALE

Chassis, body and transmission form the core of automobile engineering. The subject focuses at imparting knowledge and skills regarding chassis and body viz. clutch system, transmission system, final drive, steering mechanism.

DETAILED CONTENTS

1. Chassis and Body (08 hrs)

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., types of frame and body streamlining, cross members, brackets, materials of frame and body upholstery..

2. Clutch (10 hrs)

Necessity, function and requirements of clutch, types of clutch - single plate clutch, multi plate clutch, hydraulic power assisted and wet and dry plate clutch, clutch plate and lining material

Constructional details and working of centrifugal, semi centrifugal clutch, diaphragm clutch and fluid coupling.

3. Transmission (10 hrs)

Necessity, function and types of manual 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 and their main components

Epicyclic gear box – construction, working and determination of speed ratio.

Torque converter – construction, principle of working. Continuously variable transmission, Automated Manual Transmission

4. Final Drive (08 hrs)

Propeller shaft – function, construction details. Universal joints - functions and types. Types of final drive – hotchkiss drive, torque tube drive. Differential – principle, functions and its working. Rear axles – semi floating, , three quarter floating. fully floating . Common faults and remedies

5. Front Axle (04 hrs)

Types – Stub double drop, fully dropped, load distribution, effect of braking on axle shape, steering head, Elliot and reverse elliot, steering knuckle.

6. Steering

(08 hrs)

Steering mechanism, function, Davis and Ackerman's Principle of steering. Working and constructional details of steering gear, steering linkages, sector arm, center arm, drag link and tie rod steering stops. Front wheel geometry-caster, camber, steering axis inclination, toe in and toe out. Cornering force, cornering power and self-righting torque. Over steering and under steering. Power steering – necessity, types, Construction features and working of hydraulic and electronic power steering systems, Common steering systems troubles and remedies

4.1 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT**L T P**
3 - -**RATIONALE**

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aim at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager.

Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma passouts for enhancing their employability and self confidence.

DETAILED CONTENTS

1. Introduction to Generic Skills (4 hrs)
 - 1.1 Importance of Generic Skill Development (GSD)
 - 1.2 Global and Local Scenario of GSD
 - 1.3 Life Long Learning (LLL) and associated importance of GSD.

2. Managing Self (8 hrs)
 - 2.1 Knowing Self for Self Development
 - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
 - 2.2 Managing Self - Physical
 - Personal grooming, Health, Hygiene, Time Management
 - 2.3 Managing Self – Intellectual development
 - Information Search: Sources of information
 - Listening: Effective Listening
 - Speaking: Effective Oral Communication
 - Reading: Purpose of reading, different styles of reading, techniques of systematic reading; Note Taking: Importance and techniques of note taking
 - Writing: Correspondence - personal and business

Note: Practical sessions should be coupled with teaching of effective listening, speaking, reading and writing.

2.4 Managing Self – Psychological

- Stress, Emotions, Anxiety-concepts and significance (Exercises related to stress management)
- Techniques to manage the above

3. Managing in Team (6 hrs)

- 3.1 Team - definition, hierarchy, team dynamics
- 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
- 3.3 Communication in group - conversation and listening skills

4. Task Management (3 hrs)

- 4.1 Task Initiation, Task Planning, Task execution, Task close out
- 4.2 Exercises/case studies on task planning towards development of skills for task management

5. Problem Solving (5 hrs)

- 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
- 5.2 Different approaches for problem solving.
- 5.3 Steps followed in problem solving.
- 5.4 Exercises/case studies on problem solving.

6. Entrepreneurship

- 6.1 Introduction (22 hrs)
 - Concept/Meaning and its need
 - Competencies/qualities of an entrepreneur
 - Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

6.2 Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale industry
- Procedures for registration of small-scale industry
- List of items reserved for exclusive manufacture in small-scale industry
- Assessment of demand and supply in potential areas of growth.
- Understanding business opportunity
- Considerations in product selection
- Data collection for setting up small ventures.

6.3 Project Report Preparation

- Preliminary Project Report
- Techno-Economic Feasibility Report
- Exercises on Preparation of Project Report in a group of 3-4 students

4.2 AUTO ENGINE - II

L T P
4 - 2

RATIONALE

This subject is in continuation to Auto Engine –I. It covers various fuels for automobiles and testing of engines. It also includes performance of engine. Brief description of emission control has also been included in this subject.

DETAILED CONTENTS

1. Prospective Gaseous Fuels (10 hrs)
 - Compressed natural gas,
 - Liquefied petroleum gas
 - Bio-gas/Bio-diesel,
 - Hydrogen
 - Recommendations to protect the environment in future.

2. Engine Exhaust and sources (10 hrs)
 - Exhaust gas constituents from S.I and C.I. engines
 - Emission norms and regulation in India
 - Factors responsible for exhaust - composition
 - Combustion temperature, spark timing or injection timing
 - CO emission and airfuel ratio
 - HC formation in SI and CI engines
 - Formation of oxides of Nitrogen and causes
 - Other problems

3. Emission Control (10 hrs)
 - Emission Control by Exhaust gas after treatment, Catalytic converters
 - Types of catalytic converters
 - Positive crankcase ventilation
 - Evaporative loss control
 - Particulate traps for diesel engine/soot formation
 - Exhaust gas recirculation
 - Ignition timing
 - Emission control by modifying design

4. Auto engines testing (14 hrs)
- Determination of indicated power, brake power ,mechanical efficiency volumetric efficiency, thermal efficiency, relative efficiency, Mean effective pressure, Specific fuel consumption,
 - Heat balance sheets
 - Morse test
 - Numericals based on engine testing.
5. Performance of engines (10 hrs)
- Effect on engine performance due to atmospheric temperature and pressure, compression ratio, engine speed, dirt, desert, altitude and their remedial measures.
 - Performance curves.
6. Combustion of Fuels (10 hrs.)
- Types of fuels
 - Characteristics of fuels
 - Combustion reactions
 - Amount of oxygen required for complete combustion
 - Stoichimetric ratio
 - Air fuel ratio
 - Analysis of products of combustion
 - Conversion of volumetric analysis into gravimetric analysis

RECOMMENDED BOOKS

- 1 Automobile Engineering Vol. II by Dr. Kirpal Singh., Standard Publishers, Delhi
- 2 Automobile Engineering by RB Gupta, Satya Parkashan, New Delhi
- 3 IC Engines by ML Mathur and Sharma, Dhanpat Rai and Sons, Delhi
- 4 Automobile Engineer by Dr. Kirpal Singh.(in Hindi), Standard Publishers, Delhi
- 5 Automotive Engine by Srinivasan, TMH, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	10	16
2	10	16
3	10	16
4	14	20
5	10	16
6	10	16
Total	64	100

- 2.3 Concept of bending moment and shearing force
- 2.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.

- 3. Bending stresses (06 hrs)
 - 3.1 Concept of Bending stresses
 - 3.2 Theory of simple bending
 - 3.3 Use of the equation $f/y = M/I = E/R$
 - 3.4 Concept of moment of resistance
 - 3.5 Bending stress diagram
 - 3.6 Calculation of maximum bending stress in beams of rectangular, circular, and T section.
 - 3.7 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

- 4 Columns (08 hrs)
 - 4.1 Concept of column, modes of failure
 - 4.2 Types of columns
 - 4.3 Buckling load, crushing load
 - 4.4 Slenderness ratio
 - 4.5 Factors effecting strength of a column
 - 4.6 End restraints
 - 4.7 Effective length
 - 4.8 Strength of column by Euler Formula without derivation
 - 4.9 Rankine Gourdan formula (without derivation)

- 5. Miscellaneous (06 hrs)
 - 5.1 Stress concentration, Definition, Factors affecting stress concentration
 - 5.2 Fatigue: -Definition, SN Curve, Factors affecting fatigue
 - 5.3 Creep: - Definition, creep curves; effect of stress and temp. stress relation

- 6 Torsion (06 hrs)
- 6.1. Concept of torsion-difference between torque and torsion
 - 6.2. Use of torque equation for circular shaft
 - 6.3. Comparison between solid and hollow shaft with regard to their strength and Weight
 - 6.4. Power transmitted by shaft
 - 6.5. Concept of mean and maximum torque
7. Springs (08 hrs)
- 7.1. Closed coil helical springs subjected to axial load and impact load
 - 7.2 Stress deformation
 - 7.3 Stiffness and angle of twist and strain energy
 - 7.4. Proof resilience
 - 7.5. Laminated spring (semi elliptical type only)
 - 7.6 Determination of number of plates
8. Hydraulics (04 hrs)
- 8.1. Fluid properties, Definition of Fluids, Properties of fluids with their units
 - 8.2. Static Pressure: Definition and concept, Pascal's law, pressure head
- 9 Hydraulic Pumps (04 hrs)
- 9.1. Introduction to centrifugal, reciprocating and gear pumps
10. Hydraulic Devices (04 hrs)
- 10.1. Description and application of Hydraulic jack and hydraulic coupling

4.4 CHASSIS, BODY AND TRANSMISSION-II

L T P
3 - 2

RATIONALE

Chassis, body and transmission form the core of automobile engineering. The subject aims at imparting knowledge and skills regarding chassis and body viz, clutch system, transmission system, drive system, steering mechanism, suspension system, braking system and safety of vehicles

DETAILED CONTENTS

- Suspension System (10 hrs)
1. Function, types- independent, rigid axle. Springs – functions, construction materials and types (coil spring, leaf spring and torsion bar) sprung and unsprung weight, characteristics of springs, spring eye, bushes, variable rate spring, helper leafs, leaf sections, camber grading and nippling spring seats, rubber pads, pressure blocks, spring cover, interleaf inserters. Function and construction of hydraulic dampers (shock absorbers). Pneumatic suspension system – lay out and working. Function and Construction of hydraulic damper (shock absorber). Diagnosis of common faults and their rectifications
 2. Wheel and Tyres (08 hrs)
Wheels – types, constructional detail, material used for wheels. Types-classification of tyres. Construction of pneumatic tyres, composition of covers, tread breaker, bead and casing, comparison of cross-ply and radial-ply tyres. Causes of excessive tyre wear. Tyre care and maintenance. Static and dynamic balance. Tubeless tyres, Run flat tyres, retreading of tyers.
 3. Braking System (08 hrs)
Purpose of brakes, layout of braking system, components, Types of brakes- mechanical, hydraulic, power. Principle of hydraulic brakes, braking action, master cylinder, wheel cylinder, leading and trailing shoes, self adjusting brakes, self applying and self releasing action, anti-skid devices, pedal travel, brake enclosures, heat generation and opening temperature, Drum brakes-Construction & Working, Disc. Brakes-Construction and Working. Common faults and their rectification.

4. Power Steering (06 hrs)

Power steering - necessity, types, Construction features and working of hydraulic and electronic power steering system, Four wheel steering, Common steering system troubles and remedies.

5 Power Brakes (6 hrs)

Air, air-hydraulic, hydro-vac brakes-their construction components and working details. Brake fluid and its characteristics, brake liner, hand brake, Antilock brake systems. Brake test, common faults and their rectification.

6 Automotive Safety Systems (4 hrs)

Preventive design, designing for minimum injury in accident, seat belts, air bags, electronic vehicle stability and occupant protection systems, pedestrian protection.

7. Miscellaneous (6 hrs)

History, leading manufacturers of automobiles, their market share, recent developments in automobile industry and automotive components industry in India. Specifications of various 2-wheelers and 4-wheelers, milestones in the development of automobiles

4.5 AUTOMOTIVE MATERIALS

L T P
3 - 2

RATIONALE

Materials play an important role in the manufacturing of automobiles and the equipment/tools used in repair of automobiles. Proper selection of materials adds to the life of machinery. A diploma holder must be conversant with the properties, uses, and availability of materials used in manufacturing of different types of vehicles to enable him to perform his functions confidently. The subject of Automotive Materials has been designed to cover the above aspects.

DETAILED CONTENTS

1. Properties of Materials (08 hrs)
 - Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys
 - Names of common metals, their alloys and non-metals used in Automobile Industry
 - Properties of metals and alloys
 - Physical properties - Appearance, luster, colour, density and melting point
 - Mechanical Properties: Strength, stiffness, elasticity, plasticity, toughness, ductility, malleability, brittleness, hardness, fatigue and creep.
 - Thermal and electrical conductivity and corrosion resistance.
2. Ferrous Metals and Alloys (16 hrs)
 - Classification, composition and uses of cast iron and plain carbon steels. IS, BS and SAE Grades
 - Effect of alloying elements such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorus.
 - Composition, properties, grades and uses of alloy steels such as High speed steel, Stainless steel, Silicon steel, Heat resistant steel, Spring steel
 - Heat Treatment: Iron-carbon diagram, objectives and practical aspects of heat treatment. Description and uses of principal heat treatment processes Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding

and Cyaniding and applications. Examples in heat treating automobile engineering components

3. Non-ferrous Metals and Alloys (10 hrs)
- Copper: Properties and uses
 - Composition, properties and uses of copper alloys.
 - Brass: Cartridge brass, Nickel silver.
 - Bronze: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.
 - Properties and uses of Aluminium and their grades
 - Composition, properties and uses of Al-alloys e.g., Duralumin, Yellow metal, Magnalium and Hindalium
 - Properties and uses of alloys of lead, tin and magnesium.
 - Bearing Metal: 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 tri-metallic bushes
4. Identification and Examination of Metals and Alloys (2 hrs)
- Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.
5. Other Important Materials (08 hrs)
- Plastics: Definition, classification of plastics, fibre glass, reinforced plastics. Major applications of various plastics with specific mention of their uses and grades
 - Heat insulating materials: Properties and uses of asbestos, glass wool, thermocole, cork, mica.
 - Sound insulating materials: Cork, fibre boards.
 - Fabrication materials: Wood, plywood, Rubber - natural and synthetic, Glasses – plate glass, toughened glass, safety glass.
 - Insulating materials: Asbestos, mica
 - Electrical insulating materials, properties and uses of china clay, leather bakelite, ebonite, glasswool, rubber felt

- Refractory materials: General characteristics and uses of dolomite, ceramics.
- Protective coating materials: Auto paints, primers, varnishes, enamels, putti, electroplating materials, rubasil, teflon coating

6. Selection and Specifications of Materials (04 hrs)

- Practical considerations for selection of material for different Automobile Components.

4.6 AUTOMOBILE ENGINEERING DRAWING

L T P
- - 9

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

1. Limits and Fits (01 sheet)
Limit, tolerance, deviation, allowance, its: clearance, interference, transition fit,
Hole and shaft basis system.

Assembly Drawings of the following automotive components:

2. Joints and Bearings (04 sheets)
 - Universal joint,
 - Slip joint
 - Bush bearing
 - Plummer block or pedestal bearing
 - Ball bearing
 - Roller bearing- Straight and Needle type
3. Engine Components (06 sheets)
 - Four Stroke Petrol Engine Piston
 - Diesel Engine Piston
 - Connecting rod
 - Fuel injector
 - Fuel Pump –AC mechanical type
 - Overhead and side valve mechanism (free hand)
 - Crank shaft – 4 cylinder Engine
 - Spark Plug

4. Chassis components (06 sheets)
- Leaf Spring suspension
 - Shock absorber
 - Wheel cylinder
 - Master Cylinder
 - Brake drum (assembly)
 - Singe plate clutch
5. Gears (02 sheets)
- Nomenclature of gears
 - Profile of spur gear by 'Approximate method'
 - Profile of spur gear by "Unwin's Method"
6. Cam Profile (03 sheets)
- 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.
7. Auto Electric Circuits(free hand sketches) (06 sheets)
- Battery ignition system
 - Magneto ignition system
 - Lighting system
 - Wiring diagram of a car
 - Startng system
 - Charging system
- 8 Sketching of the following Auto Parts: (02 shets)
- (i) Gear Box - Sliding, constant, synchromesh
 - (ii) Line diagram of petrol/Diesel Fuel system

5.1 COMPUTER AIDED DRAFTING IN AUTOMOBILE ENGINEERING**L T P**
- - 6**RATIONALE**

Competency in computer-aided drafting is essential for diploma holders in Automobile Engineering. Hence this subject is required.

DETAILED CONTENTS

1. Introduction to AutoCAD
 - 1.1. Introduction to AutoCAD. Setting the drawing environment: Limits, Grid, Snap, Axis, Units, Ortho, Co- Ordinates ON, OFF Units and Color.
 - 1.2. 2D Drawing entities - Point - Line - Arc - circle, Ellipse, Polygon, and Trace. Object Selection using Object Snap (OSNAP).
 - 1.3. Editing commands: Selection of entities by different methods - copy, Move, Scale, Rotate, Fillet, Chamfer, and Mirror, Array-Polar, Rectangular. Measure, Divide, and Erase.
 - 1.4. Drawing Display Methods: Zoom, Pan, and View.
 - 1.5. Adding Texts and Dimensions: Text, Dimension-linear, continued, angular
 - 1.6. Pedit commands. Working on multiple layers, Layer concepts in Auto CAD -Various options with layer command - Hatch command - Creating line types, library and user made library.
 - 1.7. Preparing the schematic drawing of a workshop building in one layer, the blocks of machines in another Layer and Electrical connection on another layer.
2. Drawing of 2D views of following automotive components using AutoCAD (Any Six sheets)
 - V – belt pulley
 - Stepped cone pulley
 - Ball bearing
 - Sectional front view of screw jack
 - Spur gear
 - Poppet valve
 - Wheel cylinder (sketch)
 - Valve tappet
 - Piston
 - Semi-elliptic leaf spring
 - Internal expanding shoes brake (sketch)

3. Introduction to 3D features of AutoCAD

5.2 MECHANICS OF VEHICLES

L T P
4 - -

RATIONALE

Understanding of the basic mechanism and motions, power transmission, vehicle braking, vibrations and balancing are essential for a diploma holder in automobile Engineering . Hence this subject.

DETAILED CONTENTS

1. Vehicle in motion (10 hrs)

Air resistance, gradient resistances and rolling resistance.

Tractive effort, traction, inertia load, draw bar pull, power required to propel a vehicle, calculations of acceleration and tractive effort required in case of front wheel drive, rear wheel drive and four wheel drive. Centrifugal force and its effect on vehicle stability on banked and unbanked road.

2. Gyroscopic couple and stability of vehicles (10 hrs)

Introduction to gyroscopic couple. Precessional angular motion. Simple problems based on above. Stability of a four wheel drive moving in a curved path. Stability of a two wheel drive taking a turn

Simple problems based on above.

3. Turning moment diagrams and flywheels (10 hrs)

Introduction to turning moment diagrams

Turning moment diagram for a four stroke cycle internal combustion engine

Fluctuation of energy

Determination of maximum fluctuation of energy

Flywheel, coefficient of fluctuating of speed. Energy stored in a flywheel

Numericals based on above

4. Governors (10 hrs)

Introduction to governors
Types of Governors
Centrifugal governors
Terms used in governors
Watt governor
Porter governor
Sensitiveness of Governors
Stability of governors
Isochronous governors
Hunting

5. Brakes (12 hrs)

Introduction to braking,
Characteristics of materials used for braking,
Internal expanding brakes,
Braking of a vehicle when brakes are applied to rear wheels,
when brakes are applied to front wheels, when brakes are applied to four
wheels.
Numericals based on above

6. Vibrations (12 hrs)

Terms used in vibratory motion
Types of vibratory motion
Types of free vibrations
Natural frequency of free longitudinal vibrations
Natural frequency of free transverse vibrations
Effect of inertia of the constraint in longitudinal and transverse vibrations
Natural frequency of free transverse vibrations due to a point load acting
over a simply supported beam
Frequency of free damped vibrations.
Damping factor or damping ratio, Logarithmic decrement

Numericals based on above.

5.3 AUTO ELECTRICAL EQUIPMENT

L T P
4 - 2

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 (04 hrs)
Various Electrical components/systems in Automobile. Their functions and demands, earth return system, types of earthing, 6V, 12V system.
2. Batteries (16 hrs)
 - 2.1. Lead Acid Batteries: Construction, working, elements, types, materials used, electrolyte and its strength, effect of added plate area and temperature, rating, capacity, efficiency, temperature characteristics, terminal voltages, charging and discharging.
 - 2.2. Battery Testing: Electrolyte testing by hydrometer, voltage test, high discharge and cadmium test. (voltage)
 - 2.3. Battery Charging: Constant potential and constant current, initial charging, normal charging, trickle charging, intermittent charging, boost charging.
 - 2.4. Battery Defects: Stipulation, plates decay, working, erosion, cracking, sedimentation, separator defects, short circuits, overcharging
 - 2.5. Alkaline Batteries: Construction, working, merits and demerits of Ni-Fe, Ni-Cd, Ag-Zn cells
 - 2.6. Lithium ion battery: Construction and working
3. Charging System (12 hrs)
 - 3.1. Circuits, function and various components, dynamo and alternator, types, construction, working, advantages and disadvantages of dynamo and alternators, drives, cut out relay.
 - 3.2. Regulation: Functions of various components of two unit, three unit and heavy duty Regulators, Regulator adjustments, Regulators for alternators.

4. Starting System (10 hrs)
- Function of various components, torque terms, principle and constructional details of starter motor, switches, types, starter to engine drive and their types.
5. Lighting System (09 hrs)
- 5.1. Various lighting circuits, head lamp, type and constructional details, sealed beam, double filaments, asymmetric and dual units, vertical and side control of lamps, fog light, side light, brake light, instrument light, indicator lights, reversing light, lamp mounting.
 - 5.2. Wiring: HT and LT, their specifications, cable colour codes, wiring Harness, Cable connections, Wiring diagrams of cars and two wheeler, Fuses, faults and rectification.
6. Electrical Accessories (09 hrs)
- Fuel gauges - bimetallic and balancing coil type, Air pressure gauges, temperature gauges, Ammeter, warning light, speedometer, wind screen wipers, horns, horn relay, electric fuel pump, Faults and rectification.
7. Miscellaneous Electrical Equipment (04 hrs)
- Impulse Speedometer, tachometer, heaters, defrosters, Air conditioner, and Electric door locks, window actuation, Seat adjusters.

5.4 GARAGE EQUIPMENT

L T P
4 - -

RATIONALE

Management of garage forms an important function of automobile technicians. To perform such functions, knowledge of service station equipment, tuning equipment, engine repair tools, electrical repair equipment and reconditioning and fabrication of equipment is very essential. Hence the subject.

DETAILED CONTENTS

1. General Tools (6 hrs)
Specifications and applications of
 - Screw drivers
 - Spanners and wrenches
 - Pliers
 - Hammers
 - Chisels
 - Files
 - Hacksaw
 - Tools for tubes flaring
 - Taps and dies
 - Reamers
 - Soldering tools
 - Measuring tools- vernier calipers, inside and outside micrometers
 - Feeler gauge
 - Tommy bar
 - Nut runner
 - Cleaning tools
 - Nipple forming tools

2. General Equipment (12 hrs)
Specifications and applications of
 - Drilling machine (portable) along with set of drills
 - Bench grinder
 - Air compressor and pneumatic gun
 - Hydraulic and electric hoists
 - High pressure washing equipment (Car washer)
 - Oil sprayers
 - Grease Guns-manual and bucket type, pneumatic
 - Tyre inflation gauge (Manual and Digital type automatic)
 - Tyre Changer (Manual and Automatic)
 - Creepers

- Electric and gas welding equipment
 - Fire extinguisher
 - First aid box
3. Tuning and Testing Equipment (6 hrs)
Specifications and applications of
- Vacuum Gauge
 - Compression Gauge (Pressure Gauge)
 - Distributor Tester, cam (dwell) angle tester, r.p.m. tester.
 - Battery Tester
 - Spark plug cleaner and tester
 - Ignition timing light
 - Fuel injector tester
 - Fuel consumption tester
4. Engine Repair Tools/Measuring and Testing Equipment (12 hrs)
Specifications and applications of
- Torque wrench, pneumatic wrench
 - Piston ring compressor
 - Valve lifter and valve spring tester
 - Piston ring files, groove cleaner
 - Scrappers
 - Piston ring remover
 - Cylinder Dial gauge
 - Smokemeter
 - Exhaust gas analyzer
 - Engine Analyser/Scanner
5. Electrical Repair Equipment (6 hrs)
Specifications and uses of
- Electrical Test Bench
 - Battery Charger
 - Head Lights Beam Aligner and Tester (Electronic and Digital type)
 - Growler
6. Reconditioning/Testing Equipment for Chassis and Body (6 hrs)
Use of
- Brake Efficiency Tester (Chassis Dynamometer) or brake testing equipment
 - Crane and Chain Pulley Block
 - Jacks – mechanical, hydraulic, trolley type
 - Paint chamber
 - Paint Spray Gun
 - Paint Drying Equipment
 - Tools for tyres, automatic tyre remover

- Trolleys
- Axle/chassis stands
- Steering work stands
- Jib crane
- Spring tester
- Computerized wheel balancer –static and dynamic
- Computerized wheel alignment equipment

7. Engine Reconditioning and Testing Equipment
Specifications and use of

(16 hrs)

- Cylinder Boring Machine and Honing Machine
- Crankshaft Machine and Camshaft Grinding Machine
- Connecting Rod Aligner
- Line Boring Machine and Arbor Press
- Nozzle Grinding and Lapping Machine
- Fuel Injection Pump Calibrating Machine
- Valve Refacer, Valve Seat Cutting and Grinding
- Radiator Tester
- Cylinder head leakage testing fixture
- Fuel injector tester
- Nozzle cleaning equipment

5.5 AUTO REPAIR, MAINTENANCE AND DRIVING PRACTICE – I

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RATIONALE

Testing and trouble shooting of various systems and components of automotive vehicle is an area where a diploma holder must have proficiency. He should be fully aware of the procedures of overhauling of engine, gearbox, and differential. He should be trained in using various controls while driving. That is why, this subject has been introduced.

LIST OF PRACTICALS

1. Testing of battery with hydrometer, high rate discharge tester, charging of batteries.
2. Testing and setting of ignition timing with timing light, cam angle tester, and dwell angle tester.
3. Testing and cleaning of spark plug.
4. Diagnosing electronic ignition system, magneto ignition system.
5. Colour codes and sketching of complete wiring circuits of an Indian automobile.
6. Inside and outside inspection/checking of vehicle, checking of engine oil, horn, starter, coolant before starting of engine.
7. Adjusting Clutch free play and cleaning clutch plate and assembly
8. Setting brake pedal free play and carry out bleeding.
9. Gear changing from low to high and high to low speed on the road.
10. Practice on general road safety, road and traffic signals and driving regulations.
11. Driving practice on road for steering control.
12. Starting of engine and warming up.
13. Overhauling of petrol engine.
14. Overhauling of gearbox.
15. Overhauling of differential.
16. Servicing of suspension system, leaf springs, independent suspension, coil spring, torsion bar, telescopic shock absorber.
17. Removal and fitting of wheels and tyres of a two wheeler and repairing of punctures
18. Cleaning, greasing, checking as per maintenance schedule of two wheelers
19. Cleaning, greasing, checking as per maintenance schedule for washing, wiping and polishing of jeep/car
20. Use of Orsat Apparatus or smoke meter to measure emission

- 21 Inspection of Turbo charger
- 22 Checking of rail pressure using pressure guage
- 23 Checking return and resistance in injectors
- 24 Inspection of boost pressure (in the turbo charger)

5.6 ELEMENTS OF AUTOMOBILE DESIGN

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RATIONALE

Understanding of basic principles of components like cylinder liner, piston, crank shaft, connecting rod, simple mechanisms are essential for diploma holders in Automobile Engineering, hence this subject.

DETAILED CONTENTS

1. Introduction (12 hrs)
 - Design consideration, design procedure
 - Basic requirements, classification of design and principles of good economic design
 - Standardization, interchangeability of automobile parts among industry and at global level.
 - Limits, fits and tolerances
 - Material Properties: elasticity, plasticity, ductility, malleability, toughness, hardness, fatigue, creep.
 - Materials selection and ergonomics
 - Designing for strength

2. Design of : (20 hrs)
 - Friction Clutch.
 - Flywheel
 - Gears
 - Brakes

3. Design of : (12 hrs)
 - (i) Design of shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of strength criteria, rigidity criterion
 - (ii) Types of keys, Functions of key, Failure of key, Design of key (determination of key dimensions)

4 Design of following Auto parts

(20 hrs)

(i) Piston (ii) Cylinder (iii) Connecting rod (iv) Crankshaft

6.1 BASICS OF MANAGEMENTL T P
3 1 1**RATIONALE**

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Topics like Structure of Organization, Leadership, Motivation, Ethics and Values, Customer Relationship Management (CRM), Legal Aspects of Business, Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject to provide elementary knowledge about these management areas.

DETAILED CONTENTS

1. Principles of Management (06 hrs)
 - 1.1. Introduction, definition and importance of management.
 - 1.2. Functions of Management
Planning, Organizing, Staffing, Coordinating, Directing, Motivating and Controlling.
 - 1.3. Concept and Structure of an organization

Types of industrial organization
 - a) Line organization
 - b) Functional organization
 - c) Line and Functional organization
 - 1.4. Hierarchical Management Structure
Top, middle and lower level management
 - 1.5. Departmentalization
Introduction and its advantages.
2. Work Culture (06 hrs)
 - 2.1. Introduction and importance of Healthy Work Culture in organization
 - 2.2. Components of Culture
 - 2.3. Importance of attitude, values and behaviour
Behavioural Science – Individual and group behaviour
 - 2.4. Professional ethics – Concept and need of Professional Ethics

3. Leadership and Motivation (06 hrs)
- 3.1. Leadership
 - a) Definition and Need of Leadership
 - b) Qualities of a good leader
 - c) Manager vs. leader
 - 3.2. Motivation
 - a) Definition and characteristics of motivation
 - b) Factors affecting motivation
 - c) Maslow's Need Hierarchy Theory of Motivation
 - 3.3. Job Satisfaction
4. Legal Aspects of Business: Introduction and need (06 hrs)
- 4.1. Labour Welfare Schemes
 - a) Wage payment : Definition and types
 - b) Incentives: Definition, need and types
 - 4.2. Factory Act 1948
 - 4.3. Minimum Wages Act 1948
5. Management Scope in different Areas (12 hrs)
- 5.1. Human Resource Development
 - a) Introduction and objective
 - b) Manpower Planning, recruitment and selection
 - c) Performance appraisal methods
 - 5.2. Material and Store Management
 - a) Introduction, functions and objectives of material management
 - b) Purchasing: definition and procedure
 - c) Just in time (JIT)

- 5.3. Marketing and Sales
- a) Introduction, importance and its functions
 - b) Difference between marketing and selling
 - c) Advertisement- print media and electronic media
 - d) Market-Survey and Sales promotion.
- 5.4. Financial Management – Introduction
- a) Concept of NPV, IRR, Cost-benefit analysis
 - b) Elementary knowledge of Income Tax, Sale Tax, Excise duty, Custom duty, Provident Fund
- 5.5 Maintenance Management
- a) Concept
 - b) Preventive Maintenance
6. Miscellaneous topics (12 hrs)
- 6.1. Customer Relationship Management (CRM)
- a) Definition and Need
 - b) Types of CRM
 - c) Customer satisfaction
- 6.2. Total Quality Management (TQM)
- a) Inspection and Quality Control
 - b) Concept of Quality Assurance
 - c) TQM
- 6.3. Intellectual Property Rights (IPR)
- a) Introduction, definition and its importance
 - b) Infringements related to patents, copyright, trade mark

6.2 AUTO REPAIR, MAINTENANCE AND DRIVING PRACTICE - II

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RATIONALE

A diploma holder in Automobile Engineering, should have reasonable practice on fault diagnosis with the help of latest machines like engine analyzer etc. Stress has also to be laid on the use of exhaust gas analyzer and other machines for the maintenance of automobiles. Student should also be proficient in driving and maintenance of vehicle. Hence this subject.

LIST OF PRACTICALS

- 1-6 Trouble shooting of engine: Diagnosing and rectifying the following troubles- Engine overheating, high oil consumption, engine noises and knock, high fuel consumption, starter turns the engine but engine doesn't start, engine fires but dies out, engine misfires, lack of power, poor acceleration, engine produces black and white smoke; use of computerized engine analyzer, exhaust gas analyzer. Bringing exhaust gas contents within emission norms.
7. Engine testing and finding out all parameters using computerized engine analyzer
8. Emission test using exhaust gas analyzer
9. Decarbonising of engine - removing carbon deposits from engine combustion chamber, piston crown, valve parts.
10. Valve servicing:
Refacing, seat reconditioning, lapping, testing, replacing worn out parts and tappet adjustment.
11. Reconditioning of engine - Measuring of bore for wear and ovality, servicing the cylinder bore, replacing of piston and piston rings.
12. Inspection of crank shaft – bearing replacement and setting of journal bearing. Crank pin bearings and crank shaft bearings, measuring bearing clearances by gauges. Inspection of bearing with plastic gauge.
13. Servicing of valves and valve mechanism – Replacement of valves, valve seats, valve guides, checking and replacement of defective springs, refacing of valves, tappet and rocker arm and adjusting valve tappets. Placement of shims in overhead valves.
14. Surfacing of cylinder head, cylinder block and manifolds with cylinder head refacing machine.
15. Practice in piston ring removal.
16. Practice in honing cylinder block, keeping allowance of clearances.
- 17 Engine diagnosis using engine control module (ECM)

- 18 Testing of sensors using Laptop/Replacement if needed
- 19 Servicing of Hydraulic systems in tractors
- 20 Servicing of components of tractors and heavy earth machines
- 21 Onboard diagnosis of car
22. Practice in fitting cylinder liners – sleeving and desleeving.
- 23 Practice in nozzle grinding and lapping, setting of injection pressure and nature of spray.
- 24 Practice in bending and nipple forming of fuel pipes.
- 25 Overhauling of wheel and axles.
26. Overhauling of power brakes. Bleeding of brakes.
27. Practice in brake drum turning, measuring ovality, skimming the brake drum.
28. Tyre retreading. (The students may be taken to a service industry).
29. Practice in wheel balancing
30. Practice in wheel alignment
31. Practice in automatic tyre changers
32. Service of injectors (petrol)
33. Crank shaft regrinding
- 34 Practice in preparing preventive maintenance schedule
- 35-40 Driving Practice on the road to gain proficiency in driving. 50% of the time of the subject should be given to driving.

6.3 MOTOR VEHICLE ACT AND TRANSPORT MANAGEMENT

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RATIONALE

A diploma holder in Automobile Engineering is supposed to have knowledge about significance of vehicle accident, accidental vehicle claim procedure from insurance company and about Motor Vehicle Act. Therefore, it is essential to teach Motor Vehicle Act features and appropriate practices covering Motor Vehicle Act. Further, knowledge of transport management systems and techniques would also be an asset to him.

DETAILED CONTENTS

1. Motor Vehicle Act (12 hrs)
 - 1.1 Motor Vehicle Act - Main Provisions
 - 1.2 Salient features of Motor Vehicle Act. Requisites and formalities for following:
 - Licensing of drivers and conductors of motor vehicles.
 - Registration of old and new vehicles
 - Control of transport vehicles
 - Transfer of vehicle - Local and State to State
 - Different forms, application for various uses
 - Traffic offences, penalties and procedures
2. Inspection and Fitness of Vehicle (06 hrs)
 - 2.1. Fitness of vehicle -meaning and purpose, provisions in the act,
 - 2.2. Detailed procedure and requirements for vehicle inspection
3. Insurance of Vehicles (06 hrs)
 - 3.1. Meaning of Insurance and its necessity
 - 3.2. Different types - comprehensive and third party insurance
 - 3.3. Procedure to get Accidental claim and compensation
 - 3.4. Surveyor duties
 - 3.5. Relation between company and surveyor
 - 3.6. Duties of driver in case of accident and injury to a person
4. Vehicle Finance (04 hrs)
 - 4.1. Sources and types of finance
 - 4.2. Rate of interest, incentives

- 4.3. Net borrowing rate, documents required.
5. Driving (08 hrs)
- 5.1. Principle of driving
 - 5.2. Driving procedure
 - 5.3. Driving precautions
 - 5.4. Driving in abnormal conditions, like hilly area, night, fog, heavy traffic and rain
 - 5.5. Emergency Driving situations
 - 5.6. Driving License - purpose, importance and requirements
 - 5.7. Different types of driving license
 - 5.8. Procedure to get driving license
6. Road Safety (06 hrs)
- 6.1. Road Signs/signals
 - 6.2. Traffic rules
 - 6.3. Imposition of Penalties for violation of rules
 - 6.4. Duties of Driver, Conductor and Helper towards safety of vehicles/ passengers/ goods and self
7. Pollution Control (06 hrs)
- 7.1. Different contents of exhaust from vehicles
 - 7.2. Prescribed standards for pollution
 - 7.3. Status and Schedule for Enforcement of emission norms
 - 7.4. Measurement of emission levels remote sensing of emission
8. Transport Management (16 hrs)
- 8.1. History of transport with special reference to road transport in India
 - 8.2. Modes of Road transport
 - 8.3. Organization- Service station and its functions, General layout of modern service station, Spare parts section and dealership service section, Accounts and books, Different types of cards and their use in maintaining service station records
 - 8.4. Structure of fleet organization
 - 8.5. State transport - optimum utilization of fleet.
 - 8.6. Roadworthiness requirement,
 - 8.7. Maintenance of logbook, History sheet, Causes, and prevention of Road Accident, Analysis of Accident, Economy of replacement, Assessment of used vehicles for sale and purchase, Training of Drivers and Mechanics.
 - 8.8. Central Motor Vehicle Rules – Main features
 - 8.9. Vehicle safety standards and regulations

6.4. AUTO SENSORS AND MECHATRONICS

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RATIONALE

A diploma holder in Automobile Engineering must have knowledge of microprocessors, microcontrollers and other electronic systems which are used in automobiles. Hence this subject.

DETAILED CONTENTS

1. Basic electronics (06 hrs)
Introduction, electronic devices and circuits, circuits, amplifiers, converters and digital electronics..
2. Microprocessors (10 hrs)
Block diagram of microcomputer, Architecture of intel 8085, importance of data, Address and control buses. Instruction formats, Addressing modes and types of instructions in Intel 8085. Instruction set of 8085. Memory devices.
3. Micro Controllers (08 hrs)
Comparison of microprocessor and microcontrollers. Survey of 4,8,16 and 32 bit microcontrollers, Architecture of 8051
DC motor and stepper motor controls.
4. Electronic fuel control system (08 hrs)
Introduction, components, open loop and closed loop control system. Intake manifold pressures, mass air flow rate, sensor, throttle body injection and multiport or point fuel injection. Fuel injection system control.
5. Digital engine control system (08 hrs)
Concept, parameters, variables, engine mapping, control strategy, enrichment, Deceleration, leaning and idle speed control. EGR control, variable valve timing control, electronic ignition control, electronic spark timing control.
6. Transmission Control System (08 hrs)
Electronic transmission management, layout, electronic control of automatic transmission, valve actuating control system, two wheel drive control, four wheel drive control.

7 Chassis Control System

(08 hrs)

Electronic management of chassis system. Cruise control systems, electronic suspension system, antilock braking control system, traction control system and vehicle stability control system. Electronic steering control.

8 Body Control and security

(08 Hrs)

Body control system, remote control locking, keyless entry, automatic air conditioning system, security systems – immobilizer and warning system, GPS system, Electronic control diagnosis , usage of multimeter. Immobilizer and oscilloscope and their uses.
Coding.

6.5.1 AUTO BODY (ELECTIVE)

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RATIONALE

A diploma holder in Automobile Engineering must have complete knowledge of automobile body construction, material used, safety aspects and other features. Hence this subject.

DETAILED CONTENTS

1. Introduction (10 hrs)
Classification of automobiles on different basis. Types of vehicles, Car body details, Types, Saleris, convertibles, limousine, eastern van, racing and sports cars. Car body construction types-frame and unitary (manocoque). Various body panels and their constructional details. Methods of improving space in cars.
2. Commercial Vehicle Details (06 hrs)
Types of commercial vehicles, Commercial vehicle body details –flat flatform, drop side, fixed side, tipper body, tanker body, tractor trailer.
3. Body Materials (08 hrs)
Steel sheet, timber, FRP, Plastic, GRP, Corrosion and anti corrosion methods, scalation of paint and painting process, body trim items and body mechanisms
4. Safety (10 hrs)
Safety aspects in vehicle bodies, Safety equipments in cars- anti roll bars, roll over bar, collapsible steering, multistage bumper, seat belts, collision crumble zones..
5. Special Purpose Vehicles (08 hrs)
Various types, Needs & constructional details – Fire station vehicle, tankers, ladder vehicle, concrete mixer, transport vehicles-Ambulance..
6. Vehicle Aerodynamics (14 hrs)
Objectives, vehicle drag and types of force and moments – Effect of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for reducing drag. Tunnel testing, Flow visualization techniques. Scale model testing.

7 Ergonomics

(08 hrs)

Man machine system. Anthropometry data and considerations in design of seat, controls and displays, gear lever, steering wheel, foot controls etc. Dimensions of driver's seat in relation to control, visibility. Methods of improving visibility. Effect of noise, vibration and heat on human body and their control. Driver cab design.

6.5.2 TRACTORS AND HEAVY EARTH MOVING MACHINERY (ELECTIVE)

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RATIONALE

Diploma holders in Automobile Engineering may have to deal with repair and maintenance of tractors and earth moving machinery. This subject provides knowledge about such vehicles and equipment

DETAILED CONTENTS

1. Tractor (12 hrs)
Classification of tractors, main tractor assemblies, functions of farm tractors, types of engine used, power requirement, human factor in tractor design, applications of tractors, Basics trends in tractor design, forces acting on a tractor on move, parallel pull and rolling resistance, tractor stability and weight distribution
- 2 Hydraulic System (08 hrs)
Functions of hydraulic system, hydraulic components, method of attaching implements, classification of hydraulic controls for hitches, integral hitch system, draft control system. Position control and Mixed control
- 3 Tractor Chassis (08 hrs)
Salient features of engine, clutch, power transmission, final drive, brakes and steering of Indian tractors.
4. Supplementary System (06 hrs)
Power take off shaft, draw bar working, belt pull traction control unit, three point linkages
5. Tractor Wheels and Tyres (10 hrs)
Salient features of wheels, tyres and wheel base/wheel tracks. Specifications of wheels and tyres, dual versus tendum tyres, tread design, effect of tyre inflation. Prominent make of Indian – Tractors. Selection criteria, maintenance and operation of tractors, differential lock.
- 6 Earth Moving Machinery (12 hrs)
Description and working principle of:
 - Bull Dozer
 - Leveller
 - Front end loader
 - Cranes
 - Scrapper

6. Repair and Maintenance

(8 hrs)

Faults and their rectification in tractor and maintenance of tractor.