

CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

AUTOMOBILE ENGINEERING

2nd Year (i.e. 3rd & 4th Semester)

FOR THE STATE OF HIMACHAL PRADESH



(Implemented w.e.f. Session 2013-14)

Prepared by:-

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July, 2013

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PREFACE

India, in last two decades, has made significant progress in all major spheres of activity. Since 1947, the Technical Education System has grown into fairly large sized system, offering opportunities for education and training in wide variety of trades / disciplines at different levels. Needless to say that well trained technical manpower is the backbone of any growing economy in the era of fast industrialization. It has been the endeavor of the Technical Education Department to take decisive steps to enhance the capacities of technical institutions with major emphasis on quality and excellence in technical education .Our country is the only country in the world which has 50% population below the age of 25 years whereas America has 30% and China 40%.Working Age Population (WAP) is increasing in India whereas it is decreasing in other parts in the world. Challenge before us is to train this WAP for the world of work .Updated curriculum is one of the most powerful tools to improve the quality of training.

Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.

While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:

- i) Major employment opportunities of the diploma holders.*
- ii) Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.*
- iii) Vertical and horizontal mobility of diploma pass outs for their professional growth.*
- iv) Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.*

The document is an outcome of the feedback received from field organizations/ industry of different categories viz. small, medium and large scale which offer wage employment for the diploma pass outs. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought and incorporated as per the requirement of curriculum . The document contains the study and evaluation scheme and detailed subject/course contents to enable the H.P. Polytechnics to implement revised curriculum and to achieve the desired objectives.

Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.

We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment.

Er. L.R. Rana
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2nd YEAR OF THREE YEAR DIPLOMA PROGRAMME IN AUTOMOBILE ENGG.

1. SALIENT FEATURES

- 1) Name of the Programme : Three year Diploma Programme
Automobile Engineering
- 2) Duration of the Programme : Three years (06 Semesters)
- 3) Entry Qualification : As prescribed by H.P. Takniki
Shiksha Board
- 4) Intake : As approved by H.P. Takniki
Shiksha Board
- 5) Pattern of the Programme : Semester Pattern
- 6) Curriculum for : 2nd year of Three year Diploma
Programme(Technical Stream)

7) **Student Centred Activities:**

A provision of 2-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These activities will comprise of co-curricular & other activities such as expert lectures, games, seminars, declamation contests, educational field visits, NCC, NSS and cultural activities & hobby classes like photography, painting, singing etc.

8) **Industrial Training:-**

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

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

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

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.

2. GUIDELINES

2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

Distribution of 25 marks for SCA will be as follows:

- i. 5 Marks shall be given for general behaviour
- ii. 5 Marks for attendance shall be based on the following distribution:
 1. Less than 75% Nil
 2. 75-79.9% 3 Marks
 3. 80-84.9% 4 Marks
 4. Above 85% 5 Marks
- iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:
 1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
 2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
 3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

Note: *Head of Department shall ensure that these marks are conveyed to the H.P. Takniki Shiksha Board, Dharamsala at the end of semester along with sessional record.*

2.2 GUIDELINES FOR SESSIONAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
 - i. 60% of internal assessment shall be based on the performance in the tests. At least three tests shall be conducted during the semester out of which at least one should be house test. 30% weightage shall be given to house test and 30% to class test(One best out of two).
 - ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
 - iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal/External Assessment in practical subjects shall be made as per the following guidelines:
 - i. 60% marks shall be awarded for performance in practical.
 - ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
 - iii. 20% marks shall be for Viva-voce conducted during the practicals.
- The distribution of mark for internal assessment in drawing subjects shall be as per following guidelines:-
 - 60% marks for sheets ii. 40% for test.

1. STUDY AND EVALUATION SCHEME

THIRD SEMESTER AUTOMOBILE ENGINEERING

SR. NO.	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	*Applied Mechanics	4	2	30	20	50	100	3	50	3	150	200
3.2	Principles of Thermal Engineering	4	2	30	20	50	100	3	50	3	150	200
3.3	Automotive Materials	4	-	50	-	50	100	3	-	-	100	150
3.4	Automobile Chassis, Transmission and Control	5	-	50	-	50	100	3	-	-	100	150
3.5	Production Processes	3	-	50	-	50	100	3	-	-	100	150
3.6	Auto Engineering Drawing - I	-	6	-	50	50	100	4	-	-	100	150
3.7	Auto shop Practices - I	-	4	-	50	50	-	-	100	3	100	150
3.8	Mechanical Workshop Practice	-	4	-	50	50	-	-	100	3	100	150
<i># Student Centred Activities including Ecology and Environmental Awareness Camp</i>		-	2	-	25	25	-	-	-	-	-	25
Total		20	20	210	215	425	600	-	300	-	900	1325

* Common With other diploma programmes

FOURTH SEMESTER AUTOMOBILE ENGINEERING

SR. NO.	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	Elements of SOM and Hydraulics	5	2	30	20	50	100	3	50	3	150	200
4.2	**Electrical Technology	4	2	30	20	50	100	3	50	3	150	200
4.3	Garage Equipment	3	-	50	-	50	100	3	-	-	100	150
4.4	Automobile Engines	6	-	50	-	50	100	3	-	-	100	150
4.5	Computer aided drafting	-	6	-	50	50	-	-	100	3	100	150
4.6	Autoshop Practices - II	-	4	-	50	50	-	-	100	3	100	150
4.7	Driving practice -I	-	6	-	50	50	-	-	100	3	100	150
# Student Centred Activities		-	2	-	25	25	-	-	-	-	-	25
Total		18	22	160	215	375	400	-	400	-	800	1175

* Common With other diploma programmes

** Common with diploma in Mechanical Engineering

9. INDUSTRIAL TRAINING OF STUDENTS

The importance of Industrial Training of students during their 3 years of studies at Polytechnics is immense. The industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

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

An internal assessment of 50 marks and external assessment of 50 marks have been provided in the study and evaluation scheme of V Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

2. DETAILED CONTENTS OF SEMESTER WISE SUBJECTS

3.1 APPLIED MECHANICS

L T P
4 - 2

RATIONALE

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

DETAILED CONTENTS

1. **Introduction** (08 hrs)
 - 1.1 Concept of engineering mechanics (Applied Mechanics), definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields.
 - 1.2 Definition of mass and weight basic quantities and derived quantities of basic units and derived units
 - 1.3 Concept of rigid body, scalar and vector quantities

2. **Laws of forces** (12 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** (11 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, balance 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** (11 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, friction in simple screw jack
 - 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
 - a) Acting along the inclined plane Horizontally
 - b) At some angle with the inclined plane
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 Lifting Machines** (12 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 inclined plane, wheel and axle, different pulley blocks, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application
[Simple problems on the above topics]

LIST OF PRACTICALS

1. Verification of the following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage (M.A), velocity ratio (V.R) and efficiency (η) of a screw jack.

6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find M.A, V.R, and η of :
 - (i) First system of pulleys
 - (ii) Second system of pulleys
9. To find out center of gravity of regular lamina and irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. *A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.*
2. *Applied Mechanics By, Col. Harbhajan Singh, TL Singla and Parmod Kumar Singla Published By Abhishek Publication, 57-59, Sector-17, Chandigarh*
3. *A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.*
4. *Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.*
5. *Engineering Mechanics by Parsad, Standard Publications, New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	8	10
2	12	20
3	11	20
4	11	20
5	8	10
6	12	20
Total	64	100

3.2 PRINCIPLES OF THERMAL ENGINEERING

L T P
4 - 2

RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the I.C engines, air compressors and fuel used in IC engines and air conditioning of automobiles. Therefore, it is essential to teach him 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. It is expected that effort will be made by the teacher to provide enough learning experience to the students for developing necessary competencies related to this subject area.

DETAILED CONTENTS

1. **Principles of Thermal Engineering** (08 hrs)
 - Introduction
 - Property, system, surroundings
 - Heat and work
 - Enthalpy and internal energy

2. **Gas Laws** (08 hrs)

Boyle's law, charle's law, joule's law, characteristics equation, gas constant, universal gas constant.

3. **Law of Thermodynamics** (12 hrs)
 - Zeroth, first and second law of thermodynamics(concept only).
 - Concept of entropy
 - Constant volume, constant pressure, isothermal, hyperbolic, adiabatic and polytropic, throttling and free expansion processes.

4. **Air Cycles** (08 hrs)
 - Carnot cycle
 - Otto cycle
 - Diesel cycle
 - Dual combustion cycle

5. **Fuels and Combustion** (05 hrs)
 - Properties of fuel.
 - Fuel combustion
 - Air requirement for complete combustion of fuel, Analysis of exhaust gases with the help of electronic analysers.

6. **Air Compressor** (09 hrs)
 - Reciprocating air compressor.
 - Working of single stage and double stage compressor and applications.
 - Rotary air compressor.

- Working of fan, blower, booster and super charger.
 - Principle of turbo charger.
7. Testing of I.C. engine and determination of IHP, BHP and FHP. Heat balance sheets, mechanical efficiency, specific fuel consumption. (07 hrs)

LIST OF PRACTICALS

1. To find flash point and fire point of given fuel.
2. To find viscosity of given fuel.
3. To study air compressor.
4. To analyse exhaust gases by electronic gas analyzer.
5. To conduct morse test of multicylinder petrol engines.
6. To prepare heat balance sheet of an IC engine.

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

1. *Thermal Engineering by Mathur and Mehta.*
2. *Thermal Engineering by R.S Khurmi.*
3. *Thermal Engineering by R.K. Rajput, Luxmi Publications, New Delhi.*
4. *Thermal Engineering by A.S. Sarao, Satya Prakashan, New Delhi.*
5. *Thermal Engineering by P.L Ballaney, Khanna Publishers, Delhi.*
6. *Thermal Engineering by P.K. Nag.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	09	15
2	09	15
3	10	15
4	09	15
5	08	10
6	10	15
7	09	15
Total	64	100

3.3 AUTOMOTIVE MATERIALS

L T P
4 - -

RATIONALE

Materials play an important role in the construction and manufacture of automobiles and the equipments/tools used in service, maintenance and repair of automobiles/vehicles. Right selection of materials adds to the economy, working and life of machinery. An automobile engineer must be conversant with the properties, uses, availability and costs of materials used in construction/fabrication of different types of vehicles; normal running, service and maintenance (routine, preventive and breakdown) as well as repairs to enable him to perform his functions confidently. The subject of Automobile Engineering materials has been designed to cover the above aspects.

DETAILED CONTENTS

1. **Importance of materials in Automobile Engineering** (04 hrs)
 - Classification: Metals and non-metals, Ferrous and non-ferrous metals and their alloys.
 - Names of common metals and their alloys and non metals used in Automobile Industry.
 - Properties of metals and alloys.
 - Physical properties-Appearance, lustre, 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** (12 hrs)
 - Classification, composition and uses of cast iron and plain carbon steels.
 - Effect of alloying elements (in brief) such as Aluminium, chromium, Nickel, Cobalt, Manganese, Molybdenum, tungsten, Vanadium, Silicon, Sulphur and Phosphorous.
 - Composition, properties and uses of alloy steels e.g. High speed steel, Stainless steels, Silicon steels, Heat resistant steels, spring steels, ultra high strength steel.
 - Heat Treatment: Definition, objectives and practical aspects, Brief description and uses of principle heat treatment processes, Annealing, Normalizing, Tempering, Hardening, Carburising, Nitriding and Cyaniding.

3. **Non-ferrous Metals and Alloys** (12 hrs)
 - Copper: Properties and uses thereof.
 - Composition, properties and uses of copper alloys.
 - Brasses: Cartridge brass, Nickel silver.
 - Bronzes: Phosphor bronze, Al-bronze, Mn-bronze, and Gun metal.

- Properties and uses of Aluminum.
 - Composition, properties and uses of Al-alloys e.g. Duralmin, Yellow metal, Magnalium and Hindalium.
 - Properties and uses of alloys of lead, tin and magnesium.
 - Bearing Metals: Requisite qualities. Composition, properties and uses of white bearing metals. Copper based bearing metals. Aluminium based bearing metals.
4. **Identification and examination of Metals and alloys** (03 hrs)
- Identification tests - Appearance, sound, filing, weight, magnetic, spark, bend and microstructure.
5. **Other Important Materials** (12 hrs)
- Plastics: Definition, classification of plastics, fibre reinforced plastics. Major application of engineering plastics in automobiles.
 - 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 - plateglass, toughened glass, safety glass.
 - Abrasive materials: silicon carbide, aluminum oxide, diamond, corborandum.
 - Refractory materials: General characteristics and uses of dolomite, ceramics.
 - Protective coating materials: Paints, varnishes, enamels, putti, electroplating materials.
6. **Fuels, Lubricants, Oils and Additives** (15 hrs)
- Fuels: Types, properties, use and suitability of various fuels in automotive engines including compression ignition and spark ignition engines.
 - Lubricants: Classification (SAE and API), Types of lubricants, specifications, properties, uses, commercial names and availability of various types of lubricants. Both oils and greases.
 - Oils: used for cleaning, flushing and protective coatings.
 - Additives: Fuel additives, cleaning additives, antifreeze additives, sealing additives and additives used in lubricating oils.
7. **Selection, specifications and commercial availability of Materials** (06 hrs)
- Practical considerations for selection of material for different Automobile Components.
 - B.I.S: ISO Bureau of Indian standard specifications for metals, non-metals, auto components and other materials (brief discussion)

INSTRUCTIONAL STATREGY

The teacher should show various types of materials used in manufacture of Auto parts. Visits to some industry making the components may be arranged. The students should be encouraged to collect samples of different materials.

RECOMMENDED BOOKS

1. Materials and Processes by Y.F. Young
2. Materials and Metallurgy by D.S. Nut
3. Engineering Materials by Roy Chowdhry
4. Engineering Materials by R.S. Deshpande
5. Material Science by R.K. Rajput
6. Automobile Engineering Vol-I by Dr. Kirpal Singh, Standard Publishers.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	12	15
3	12	15
4	03	10
5	12	20
6	15	20
7	06	10
Total	64	100

3.4 PRODUCTION PROCESSES

L T P

3 - -

RATIONALE

Mechanical Workshop Practice contains only practicals in various workshops. There is need felt regarding general idea about various production processes. Also requires is basic knowledge about CNC Machine.

DETAILED CONTENTS

1. **Manufacturing Processes** (12 hrs)
General machine Tools, Description and functions of main parts, Cutting Parameters, Principles of Turning, Drilling, Boring, Shaping, Planing, Slotting and Grinding, Milling and Superfinishing.
2. (a) **Foundry Practice** (14 hrs)
 - Pattern Making
 - Types of Pattern
 - Pattern Materials
 - Pattern Allowances
 - Introduction to Core
 - Moulding
 - Introduction to Moulding
 - Types of Moulding Sand and their properties
 - Melting and pouring
 - Defect in castings(b) Simple Arc & Gas Welding, Metal forming processes- Die stamping, Metal Drawing, Spinning, Rolling, Extruding, Forging, Tube Drawing.
3. **Modern Machining Processes** (06 hrs)
Processes, Procedures, Advantages, Limitations and Applications of Electro discharge machining, Electro chemical Machining, USM, AJM and LBM.
4. **Numerical Control of Machine Tools** (08 hrs)
Introduction to Numerical control of machine tools, NC Machines, CNC machines, Direct numerical control, Advantages and disadvantages of CNC machines, Fundamentals of Part Programming, Manual part Programming, Computer aided part programming.
5. **Powder Metallurgy** (08 hrs)
Introduction, Production of Metal Powder-Atomization, Milling and grinding, Shooting. Main Characteristics of metal powder - particle shape, Size and Distribution, Apparent Density, Flowability, Compressibility, Purity and Sintering ability, Chemical Composition. Advantages and disadvantages of Power Metallurgy, Applications.

INSTRUCTIONAL STATREGY

The teaching of the subject should be in the form of Lecture Cum demonstration so that the students are able to see the processes practically.

RECOMMENDED BOOKS

1. *Workshop Technology Vol-I & II by Hazara & Chowdery – Asia Publishing House.*
2. *Workshop Technology by B.K. Manchanda, H. Tata Publications, Delhi.*
3. *Production Technology by R.K. Jain*
4. *Manufacturing Technology by M Adithan and Gupta, New Age International Private Limited, Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	26
2	14	28
3	06	12
4	08	18
5	08	16
Total	48	100

3.5 AUTOMOBILE CHASSIS, TRANSMISSION & CONTROL SYSTEM

L T P
5 - -

RATIONALE

Chassis, body, and transmission forms the core of automobile engineering. The subject aims at imparting knowledge and skills in chassis, frames, clutch system, transmission system, drive system, steering mechanism, suspension system, braking system, wheel and tyres and stability of vehicles.

DETAILED CONTENTS

- 1. Chassis and Body** (06 hrs)
Classification of vehicles, layout of conventional type of chassis, function and arrangements of major assemblies, alternative arrangement used such as engine position, types of drive such as front wheel drive, rear wheel drive and four wheel drive.
- 2. Automotive Safety Systems** (04 hrs)
Preventive design, designing for minimum injury in accident, seat belts, air bags, electronic vehicle stability and occupants protection system, pedestrian protection.
- 3. Chassis Frames** (03 hrs)
Types of frame and body stream lining cross members, brackets, and materials of frame and body upholstery.
- 4. Clutch** (07 hrs)
Necessity, function and requirement of clutch, types of clutches: single plate, multi-plate, Hydraulic Power Assisted and wet and dry plate. Constructional details and working of centrifugal, semi centrifugal, diaphragm clutch and fluid coupling, friction disc and lining material.
- 5. Transmission** (09 hrs)
Necessity, function, types of transmission - sliding, constant mesh, synchromesh, epicyclic gear box and automatic transmission, free wheeling mechanism, principle of overdrives and torque converter, description and operation of transfer gear box, common faults and remedies, Continuously Variable Transmission (C.V.T), Automated Manual Transmission (A.M.T).
- 6. Final Drive** (07 hrs)
Propeller shaft - function and constructional details, universal joints - functions and types. Types of final drive-hotchkiss drive, torque tube, differential - principle, function and its working, rear axles-semi- floating, 3/4 floating and fully floating, common faults and remedies.
- 7. Front Axle** (04 hrs)
Types - stub double drop, fully dropped, load distribution, effect of braking of axle shape, steering head, elliot and reverse elliot, steering knuckle.

8. **Steering** (08 hrs)
Steering mechanism, function, Devis and ackermann requirements of steering gears, working and constructional details of steering gear, steering linkages – sector arm, centre arm, drag link and tie-rod steering stops. Front end geometry – camber, caster Steering Axes inclination, toe in and toe out, Cornering force, cornering power and self righting torque, over steering and under steering, power steering, necessity, salient features of construction and its working. Four wheel steering, common troubles and remedies of steering system of a vehicle.
9. **Suspension System** (08 hrs)
Function type - independent, rigid axle. Springs, functions, and types (coil, leaf and torsion bar), sprung and un-sprung weight, Characteristics of springs, material, spring eye, bushes, variable rate spring, helper leafs, leaf sections. Camber grading and nippling spring seats, rubber pads, pressure blocks, spring covers, interleaf inserters, pneumatic suspension system. Function and construction of hydraulic dampers (shock absorbers), diagnosis of common faults and their rectifications.
10. **Braking System** (08 hrs)
- Purpose of brakes, lay out 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 operating temperature. Drum brakes - construction and working details. Disc brakes - constructional and working details.
11. **Power Brakes** (08 hrs)
Air, air hydraulic, hydraulic vacuum their construction and working details. Brake fluid and characteristics, brake liner, hand brake, engine exhaust brake system and its importance, brake tests, common faults and their rectification.
12. **Wheel and Tyres** (06 hrs)
Wheels, types, hub attachment, wheel specification, tyres classification and purpose, types and construction of pneumatic tyre, composition of covers, tread breaker, bead and casing, causes of excessive tyre wear, effects of different condition of vehicles stability. Care and maintenance of tyres, tubes, static and dynamic balance, retreading of tyres, tubeless tyres, Run flat tyres.
13. **Miscellaneous** (02 hrs)
History, leading manufacturers of automobiles, their market share, recent developments in automobile industry and automotive component industry in India. Specification of various 2-wheelers and 4-wheelers, milestones in the development of automobiles.

LIST OF PRACTICALS

1. Study and sketches of heavy and light vehicle chassis.
2. Study and sketches of motor cycle and scooter chassis.
3. Study and sketches of single plate clutch(coil pressure spring and diaphragm type).
4. Study and sketches of multi plate clutch.
5. Study and sketches of sliding mesh gear box.
6. Study and sketches of constant mesh gear box.
7. Study and sketches of synchromesh gear box.
8. Study and sketches of universal joint, slip joint and propeller shaft.
9. Study and sketches of real axle- and differential.
10. Study and sketches of mechanical and hydraulic brake system and its parts.
11. Study and sketches of suspension system-coil, leaf spring, torsion box, shock absorber.
12. Study and sketches of power brake system.
13. Study and sketches of different floating axles (hub -mountings).

INSTRUCTIONAL STATREGY

Chassis is the base of an automobile. Use of video films, and LRs be emphasized. Parts, their placement and functions on an open chassis be explained. Practical demonstrations may be given as far as possible.

RECOMMENDED BOOKS

1. *Automobile Engineering - I* by Kirpal Singh; Standard Publishers, Delhi.
2. *Automobile Engineering - I* by G.B.S. Narang, C.B.S. Publisher and Distributor, Delhi.
3. *Automotive Chassis & Body* by P.L. Kohli, Tata McGraw Hill, Delhi.
4. *Automotive Chassis and Body* by W.H. Crouse, McGraw Hill Book Company, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	08
2	04	04
3	03	04
4	07	08
5	09	12
6	07	10
7	04	04
8	08	10
9	08	10
10	08	10
11	08	10
12	06	08
13	02	02
Total	80	100

3.6 AUTOMOBILE ENGINEERING DRAWING - I

L T P

- - 6

RATIONALE

The Automobile Engineering Technician irrespective of his field of operation in an industry of 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 production drawing and maintenance drawing. Besides this, he is also expected to possess a certain degree of drafting skill depending upon his job functions to perform his day to day activities e.g. communication and discussing the ideas with his superior and passing on instructions to his subordinates in a unambiguous way. The teachers are recommended to give more emphasis to the students by showing them automobile components.

DETAILED CONTENTS

Drawing of the following components

1. **Joints and Pulleys**
 - Universal joint, slip joint
 - Stepped or cone pulley, V-Belt pulley (1 sheet)
2. **Engine Bearings**
 - Bush bearing
 - Split bearing
 - Thrust bearing
 - Ball bearing
 - Roller bearing - straight and needle (1 sheet)
3. **Engine Components**
 - Four stroke petrol engine piston
 - Two stroke petrol engine piston
 - Fuel injection pump
 - Fuel injector/ Atomizer
 - Crank shaft of 4 cylinder engines (5 sheets)
4. **Gears**
 - Drawing of gear tooth profile for spur gear, nomenclature and profiles by approximate and base circle as basis of construction.
 - Concept of gear massing (external) (1 sheet)
5. **Cam Profiles**
 - Different types of cams and followers
 - Types of motion of followers
 - Uniform velocity motion
 - Simple harmonic motion
 - Uniformly accelerated and retarded motion (Drawing of cam profiles) (2 sheets)

INSTRUCTIONAL STATREGY

Teachers should demonstrate various components models or cut sections in the class so that the students can comprehend the subject.

RECOMMENDED BOOKS

1. *Automobile Engineering Drawing by R.B. Gupta; Satya Parkashan, New Delhi.*
2. *Machine Drawing by P.S. Gill; B.D Kataria and Sons, Ludhiana.*
3. *Machine Drawing by Laxmi Naraynan and Mathur; Jain Brothers, New Delhi.*

3.7 AUTOSHOP PRACTICE-I

L T P
- - 4

RATIONALE

Automobile Technician/Foreman/Manager requires a thorough knowledge of Automobile Engineering theoretically as well as practically. Before the students of automobile engineering understand the theoretical aspects of automobile engineering chassis, body and transmission, it is essential to expose the student with the work study. This subject develops in the students, the skill and practical knowledge of automobile and also facilitates them to carry out the overhauling of different systems of automobile in the fifth and sixth semester of shop practice.

DETAILED CONTENTS

1. Identification and sketching of general tools of automobile workshop and practice to use them.
2. Identification and sketching of special tools and gauges of automobile workshop and practice to use them.
3. Observe and identify the components of single plate clutch and multiplate clutch.
4. Dismantling, inspection, removal of worn out parts, adjustment of clutch, free pedal play and release lever adjustment.
5. Overhauling- dismantling, cleaning, inspection and replacement of worn out parts and assembling of synchromesh gear box.
6. Overhauling-dismantling, cleaning, inspection and replacement of worn out parts and assembling of differential units and adjustment of backlash.
7. Overhauling- dismantling, cleaning, inspection and replacement of worn out parts and assembling of brakes - mechanical, hydraulic brakes and power brakes adjustments - bleeding of brakes.
8. Servicing of steering system - steering gear boxes dismantling, cleaning and inspection and assembling. Adjustment of free play.
9. Checking and adjustment of camber, caster, toe in and toe out, king pin inclination in steering geometry.
10. Dismantling, cleaning, inspection and assembling of suspension system - leaf springs, independent suspension - coil spring - torsion bar, telescopic shock absorber.
11. Removing dents on body of vehicle, body repair and painting.
12. Wheel balancing - static and dynamic.
13. Practice in brake shoe riveting and de riveting and adjustment of brakes.
14. Overhauling of wheel and axles- dismantling, inspection, removal of worn out parts and assembling.

INSTRUCTIONAL STATREGY

- *Students should be given practical demonstrations.*
- *The working of automobiles may be explained through audio, video films and learning resources.*
- *Repetitive practice is important.*

RECOMMENDED BOOKS

1. *Car maintenance and Repair by W.Judge*
2. *Carburetors and fuel Injection System by Arthur W.Judge,*

3.8 MECHANICAL WORKSHOP PRACTICE

L T P
- - 4

RATIONALE

Development of manual and machining skills are important aspects of technician training development. Skills in turning welding machining and fabrication are very essential for an automobile technician. Hence this mechanical workshop is introduced in the syllabus.

DETAILED CONTENTS

1. Turning Shop:

- Demonstration of functioning of lathe machine. Names of different parts of machine. Lathe operations, safety measure and practice of starting and stopping of the machine.
- Practical demonstration by instructor: Holding the round bar, facing at one end, centring and rough turning.
- Simple exercise of plain and step turning.
- Taper turning by various methods.
- Cutting simple threads and knurling.

2. Welding Shop:

- One exercise on lap and butt joint each with arc welding.
- One exercise of vertical and overhead arc welding.
- One exercise of welding and cutting.
- One exercise of spot welding.
- One exercise of TIG welding.
- One utility article.

3. Machine Shop:

- Shaping machine: simple exercise of shaping machine.
- Milling machine: simple exercise as gear cutting and rack cutting.
- Drilling: Simple exercise of drilling machine.
- Grinding: Face grinding and surface grinding.

4. Fabrication Shop:

- Practice job in riveting single lap joint.
- Practice job in rivetting double lap joint.
- Extensive practice in soldering and brazing.
- Practice job in joining of auto body parts.

RECOMMENDED BOOKS

1. *Elements of Workshop Technology* by S.K Chandwary and Hazre, Asia Publishing House, New Delhi
2. *Workshop Technology* by B.S Ragubanshi, Dhanpat Rai & Sons, New Delhi.

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table
3. Sources of pollution - natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms
5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms
6. Sources of noise pollution and its effects
7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods
8. Mining, blasting, deforestation and their effects
9. Legislation to control environment
10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements
11. Current issues in environmental pollution and its control
12. Role of non-conventional sources of energy in environmental protection

4.1 ELEMENTS OF STRENGTH OF MATERIALS AND HYDRAULICS

L T P
5 - 2

RATIONALE

A diploma holder in automobile engineering is supposed to select and analyze the reasons for failure of different components and select the required material for different applications. He is also required to select and maintain hydraulics equipments. Therefore, it is essential to teach him concepts, principles, applications and practices covering stresses and strains, beams, bending moment and shear force, springs, shaft etc. and basics of hydraulic including pressure and discharge measurement, pumps and flow through pipes. Hence this subject has been included in this course. It is expected that efforts will be made by the teacher to provide appropriate learning experience to the students for developing necessary competencies related to this subject area.

DETAILED CONTENTS

- A. **Strength of Materials:**
1. **Stresses and strains:** (14 hrs)
- Introduction to stress and strain.
 - Mechanical properties of materials.
 - Tensile and compressive stress.
 - Shear stress and strain.
 - Hook's law and Young's Modulus of elasticity.
 - Modulus of Rigidity.
 - Poisson's ratio.
 - Bulk Modulus.
 - Deformation and stress in uniform bar.
 - Deformation and stress in non uniform bar.
 - Temperature stresses.
 - Longitudinal and hoop stress in thin and thick cylinders.
2. **Beam and Bending:** (08 hrs)
- Concept of Beam and their types (simply supported, overhanging, cantilever)
 - Different types of supports.
 - Concept of bending moments and shear force.
 - B.M and S.F. diagram for Beams; for uniformly distributed and concentrated loads.
 - Determination of position of maximum B.M and S.F. in beam. Point of contraflexure.
3. **Bending and Shear Stresses:** (12 hrs)
- Concept of simple bending, assumptions made in it and derivation of bending equation
 - Flexural formulae.
 - Concept of Second Moment of Area and Section Modulus for simple sections:
 - Rectangle cross section.

- Circular cross section.
- Triangular cross section.
- Hollow circular cross section.
- Calculation of bending stresses for the above section with given loading and span.
- Average shear stress in Rectangular and I section.

4. **Springs:** (08hrs)

- Leaf Springs.
- Maximum deflection in leaf springs.
- Maximum stress in leaf springs.
- Close coiled and open coiled springs subjected to axial load and axial twist.
- Stiffness of a spring.
- Strain energy and proof resistance

5. **Shafts:** (08hrs)

- Concept of torque and angle of twist.
- Derivation of Torsion equation.
- Calculation of Torque transmitted by hollow and solid shafts of round sections.

6. **Columns and Struts** (06 hrs)

- Long and short columns
- Buckling of columns
- Euler, Rankine and Gordon formulae

B. Hydraulics

7. **Basics:** (02 hrs)

- Properties of fluids.

8. **Static Pressure:** (04 hrs)

- Pascal's law
- Concept of static pressure
- pressure head

9. **Measurement of Pressure:** (04 hrs)

- Introduction to absolute pressure, gauge pressure vacuum
- Working of simple manometer differential manometer, bourdon gauge.

10. **Flow of Liquid:** (06 hrs)

- Laminar and turbulent flow.
- Law of continuity.
- Velocity head, datum head, pressure Head, Total head.
- Bernoulli's Theorem.
- Discharge measurement

11. **Flow Through Pipes:** (04 hrs)
- Friction losses in pipes.
 - Darcy's equation.
 - Head loss due to sudden enlargement, contraction, obstruction and bend.
12. **Hydraulic Machinery** (04 hrs)
- Description and application of :
- Reciprocating pump
 - Centrifugal pump
 - Jack
 - Coupling

PRACTICAL EXERCISES FOR SOM

1. To study tensile behavior of three different metals.
2. To calculate shear strength of two different metal under single and double shear.
3. Test on a spring to study comparative effect of gradual, sudden and falling loads.
4. Calculation of impact strength of metals by
 - Charpy test
 - Izod test
5. To calculate bending strength by performing bending test of
 - A steel box and wooden beams
 - A steel flat
6. To calculate torsion strength of 3 different metals by torsion test.
7. To calculate hardness of metals by
 - Rockwell hardness test
 - Vickers hardness test
 - Visco hardness test

PRACTICAL EXERCISES OF HYDRAULICS

1. Measurement of pressure head with the help of following instruments:
 - Manometer- U tube and inclined tube
 - Piezometer, Bourdon type pressure gauge
2. Study of a reciprocating pump.
3. Study of centrifugal pump.
4. Measurement of flow with
 - Venturi meter
 - Orifice meter
5. Performance characteristics of centrifugal pump
6. Verification of Bernoulli's theorem

Note: Study means constructional details, inter-relation of parts working and their identification.

INSTRUCTIONAL STATREGY

1. Students should be taken to SOM Lab and shown the working.
2. Students may be shown the cut models.

RECOMMENDED BOOKS

1. *Mechanics of Materials by Kirpal Singh*
2. *Strength of Material by R.S Khurmi, S Chand & Co., Delhi*
3. *Elements of Strength of Materials by D.R Malhotra and H.C Gupta, Satya Parkashan, New Delhi.*
4. *Fluid Mechanics and Machine by Jagdish Lal.*
5. *Fluid Mechanics and Machines by R.S Khurmi*
6. *Mechanics of Solids by Virender Singh*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	20
2	8	12
3	12	16
4	08	12
5	08	10
6	06	08
B		
7	02	02
8	04	04
9	04	04
10	06	04
11	04	04
12	04	04
Total	80	100

4.2 ELECTRICAL TECHNOLOGY

L T P
4 - 2

RATIONALE

Basic knowledge of Electrical and Electronics Engineering is essential for diploma holders in Mechanical Engineering for the purpose of understanding applications of these subject areas on the shop floor and in handling machines and equipment. This subject imparts basic concepts, principles and applications to enable students to apply these principles in real live situations, may it be production, quality control or repair and maintenance.

DETAILED CONTENTS

1. **General Introduction:-** (05 hrs)
 - 1.1 Types of elect. Engg. materials; conducting semi-conducting & insulating materials and their application.
 - 1.2 Applications for electricity and Advantages of Elect. Energy over other types of energy.
 - 1.3 Concept of voltage current power and energy and their units

2. **DC Circuits:-** (05 hrs)
 - 2.1 Resistance factors affecting the resistance of conducting metals resistivity and their units.
 - 2.2 Resistances in series & parallel.
 - 2.3 Ohm's Law,
 - 2.4 Faraday's Laws,
 - 2.5 Len's Law.

3. **Principles of AC Circuits:-** (12 hrs)
 - 3.1 Concept of voltage generation advantages of three phase generation over single phase generation. Three phase star & delta connections voltage & current relationship (no derivation)
 - 3.2 Def of cycle, frequency time period instantaneous value rms & max value of sinusoidal wave (relation between rms & max value), form factor & peak factor.
 - 3.3 Concept of phase & phase difference.
 - 3.4 Concept of resistance, inductance, capacitance and impedance in ac circuits.
 - 3.5 Power factor(concept of lead, lag & unity p.f.),its importance and improvement.
 - 3.6 Measurement of three phase power using two voltmeter method.
 - 3.7 Determination of true power, current & p. f. in simple ac series circuits (simple problems)

4. **DC Machines:-** (08 hrs)
 - 4.1 Construction & principle of working of dc motor & generator.
 - 4.2 Fleming's Rules
 - 4.3 Starting of dc motors (three-point starter) & speed control.
 - 4.4 Reversing the direction of rotation of dc motors.

5. **AC Machines:-** (10 hrs)
- 5.1 Types of AC motors and their applications
 - 5.2 Construction of three phase induction motors, comparison of sq. cage and slip-ring induction motors
 - 5.3 Working principle of single phase & three-phase induction motors.
 - 5.4 Reversing the direction of rotation of single phase & three phase induction motors.
 - 5.5 Starting of three phase induction motors using star/delta & DOI, starters, starting single phase split phase motors.
6. **Transformer:-** (06 hrs)
- 6.1 Construction & working principle.
 - 6.2 Transformation ratio, emf equation, losses & efficiency.
 - 6.3 Auto transformer,
 - 6.4 Cooling of transformers.
7. **Basic Electronics:-** (10 hrs)
- 7.1 Basic idea of semiconductor products, diode, Zener diode, Transistor, SCR and their applications.

LIST OF PRACTICALS

1. Verification of Ohm's Law.
2. Series & parallel connection of resistances
3. Measurement of voltage, current & power and p.f. at various loads.
4. Measurement of transformation ratio of a single phase transformer.
5. Measurement of a cu & iron losses of transformer and to determine its efficiency by direct loading method .
6. Starting of three-phase sq. cage induction motor using star/delta starter and DOL starter.
7. Reversing the direction of three phase induction motor & single phase induction motors.
8. Measurement of terminal voltage of dc shunt generator as a function of load current and to plot the load-characteristic curve.
9. Use of multimeter for measurement of voltage & current (ac & dc both).

INSTRUCTIONAL STATREGY

- *Students may be given an assignment to prepare a chart of various electrical gadgets, their specification, rates and applications including the motors.*
- *Arrange visit to some Electrical distribution/control room.*

RECOMMENDED BOOKS

1. *Electrical Technology by B.L Theraja, S Chand and Co. New Delhi.*
2. *Basic Electrical and Electrical Engineering by S.K Sahadev, Dhanpat Rai and Sons.*
3. *Principles of Electrical Engineering by B.R Gupta, S Chand and Co.*
4. *Basic Electrical Engineering by JB Gupta, SK Kataria and Sons.*
5. *Basic Electricity by B.R. Sharma, Satya Prakashan, New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1.	06	10
2.	06	10
3.	15	20
4.	08	15
5.	12	18
6.	07	12
7.	10	15
Total	64	100

4.3 GARAGE EQUIPMENTS

L T P
3 - -

RATIONALE

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

DETAILED CONTENTS

1. **Service Station Equipment** (06 hrs)
Specification and application of:
 - Air Compressor
 - Hydraulic Hoist
 - Car washer
 - Oil sprayers
 - Grease dispensers - manual and bucket type
 - Tyre inflation Gauge
 - Tyre Changer
 - Leaf Spring recambering machine

2. **Tune up Equipment** (08 hrs)
 - Use of vacuum Performance Gauge
 - Compression Gauge
 - Distribution Tester- cam(dwelling) angle tester(r.p.m.)tester.
 - Battery Tester
 - Spark plug cleaner and tester
 - Ignition timing light
 - Fuel injector tester
 - Fuel consumption tester

3. **Engine Repair Tools/Measuring and Tester:** (07 hrs)
 - Specification and use of
 - Torque wrench, pneumatic wrench
 - Piston ring compressor and expander
 - Valve lifter and valve spring tester
 - Piston ring file, groove cleaner
 - Scrappers
 - Use of
 - Inside micrometer
 - Outside micrometer
 - Special micrometer for cylinder bore and crank pin
 - Cylinder Dial gauge
 - Wheel aligning instruments

4. **Electrical Repair Equipment:** (06 hrs)
 Specifications and use of
- Electrical Test Bench
 - Battery Charger
 - Head Lights Beam Aligner
 - Growler
5. **Chassis Body and Other Reconditioning Testing Equipment**(06 hrs)
- Brake Efficiency Tester
 - Clutch Fixture and Brake Line Riveters
 - Crane and Chain Pulley Block
 - Jacks
 - Surface Protection Methods
 - Paint Spray Gun
 - Paint Drying Equipment
 - Wheel Balancer- Static and Dynamic
6. **Engine Reconditioning, Testing and Fabrication Equipment**(15 hrs)
 Specification and use of
- Lathe Machine
 - Drilling Machine
 - Bench Grinder
 - Cylinder Boring Machine and Honing Machine
 - Crankshaft Grinding Machine and Camshaft Grinding Machine
 - Connecting Rod Aligner
 - Line Boring Machine and Arbor Press
 - Nozzle Grinding and Lapping Machine
 - Fuel Injection Pump Calibration Machine
 - Valve Refacer, Valve Seat Cutter and Grinder
 - Radiator Tester
 - Shaping Machine
 - Milling Machine

INSTRUCIONAL STATREGY

1. *Practical demonstration of use of various equipments will be useful.*
2. *Visit to workshop may he organized.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	12
2	08	16
3	07	16
4	06	10
5	06	14
6	15	32
7	48	100

4.4 AUTOMOBILE ENGINES

L T P
6 - -

RATIONALE

Automotive Engines forms the base of Automobile Engineering. The subject deals with basic concept of 2 stroke and 4 stroke petrol and diesel engine, classification of engines, constructional details, combustion phenomenon fuel system, cooling system, lubrication system, ignition system and effects of environment on engine and emission control have been included in this subject.

DETAILED CONTENTS

1. **Introduction** (09 hrs)
 - Basic of tractive power sources viz Mechanical (reciprocating and rotary engine, gas turbines), Electrical, hybrid, fuel cell, solar energy
 - Concept of two stroke and 4 stroke petrol and diesel engines, their application to automobiles, various terms and specifications of auto-engines.

2. **Classification of Engines** (08 hrs)

Classification of engines as per stroke, cycle, fuel, ignition, cooling, speed, location, placement, number, arrangement and position of cylinders, governing, cam placement, function, type of valve placement, reciprocating and rotary, Internal and external combustion, parts and scavenging.

3. **Engines Components** (10 hrs)

Construction details, specification, function and working of components, cylinder block, head, cylinder liner, piston, piston rings, wrist pin, connecting rod, crankshaft bearing, camshafts, valves and valves mechanisms. flywheel and dampers.

4. **Fuel Combustion and Combustion Chambers** (10 hrs)

Combustion phenomenon: Phases of normal combustion, delay period, flame propagation, detonation, pre-ignition, diesel knock, turbulence and combustion chamber types.

5. **Fuel System in spark Ignition Engine** (16 hrs)

Fuel System: types of fuel feed system, gravity and pump feed. STE Fuel tank, fuel lines, fuel filters, theory and types of carburetion.

 - Circuits of carburettor: Float circuit, starting and choke circuit, idling, low speed, high speed part load and full load circuits. Construction and working of solex, and amal carburettors. Dual carburettor and multi-barrel carburettor system and gaseous fuels, adoption of gaseous fuels, dry and wet air cleaners. Intake and exhaust manifold, exhaust pipes and mufflers, turbocharges and Air filters.

- Petrol Injection: Introduction to petrol injection, comparison with carburetor method, Types of petrol injection, Multi-point fuel injection system(MPFI) and its types and control. Conservation of fuel and oils.
6. **Fuel System in Compression ignition engine** (12 hrs)
components, fuel tank, fuel lines, fuel filters, priming pump, fuel injection pump plunger and distributor types, injectors, single orifice, multiple orifice, pintle nozzle, governing and governors (pneumatic, mechanical). Calibration and phasing of fuel injection pump.
 7. **Cooling Systems** (08 hrs)
Cooling system, necessity, types(air, water) thermo syphon and pump cooling. Viscous fan, Cooling fans, blowers, jackets, water pump, and its devices, hoses, thermostats pressure cap, PVRV cap, anti-freeze solution, scales and corrosion, anti-corrosion treatment, radiator shutters, trouble shooting and remedies.
 8. **Lubrication Systems:-** (06 hrs)
Necessity and types of lubrication systems (splash and pressure) wet and dry sump. Components used, oil pumps, oil lines, filters, coolers, crank case ventilation. Characteristics, classification, service rating of lubricating oil.
 9. **Ignition system:-** (08 hrs)
Concept of ignition system, types of ignition systems, coil and magneto. Function and working of coil, distributors, condenser, advance mechanisms, C.B. Point and gap, spark plugs and gaps pertaining to Indian vehicles.
 10. **Effect of Environment on engine:-** (04 hrs)
Effects on performance of engine due to temperature, pressure, and working conditions like dirt, desert running and their remedial measures.
 11. **Emission Control:-** (06 hrs)
Effects of pollutants from petrol and diesel engines on human beings and other materials, exhaust pollutants, sources of automotive emission, methods of emission control (by improvement in engine design and by exhaust gas treatment, positive crankcase ventilation, exhaust gas recirculation, catalytic converter for petrol and diesel engines, particulate filter).

LIST OF TASKS/DEMONSTRATION

Study, sketching and working of:

1. Basic components of an Automobile engine such as cylinder block, cylinder head, piston, connecting rod, crankshaft, fuel pump, Carburettor, fuel injection pump, fuel injectors.
2. Petrol engine fuel system tank, fuel pump.

3. Fuel system of diesel engine.
4. Water cooling system, Radiator, fan, pump
5. Exhaust system of multi-cylinder engine.
6. Fuel pump, identification of its parts with working.
7. Electrical fuel pump.
8. Identification of each part and working of solex carburetor circuits, idling, high speed, acceleration.
9. Maruti carburetor and circuits.
10. Scooter Carburetor.
11. Fuel injection pump 4 and 6 cylinder engine.
12. Fuel injectors

INSTRUCTIONAL STRATEGY

The students should be exposed to working of automobile engine through visits to industry.

RECOMMENDED BOOKS

1. *Automobile Engineering - II* by Karpal Singh
2. *Automobile Engineering* by R.B. Gupta
3. *Diesel Engine Mechanics* by N.K. Mangal
4. *Automobile Engineering* by Arthur W. Judge
5. *I.C. Engines* by M.L. Mathur and R.P. Singh
6. *Automobile Engineering* by G.B.S. Narang
7. *Automobile Engineering* by K.M. Gupta Vol. I & II.
9. *Automobile Engineering* by Anil Chhitkara.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	09
2	08	08
3	10	08
4	10	08
5	16	15
6	12	15
7	08	08
8	06	08
9	08	10
10	04	05
11	06	06
Total	96	100

4.5 COMPUTER AIDED DRAFTING

L T P
- - 6

RATIONALE

The diploma holders are required to integrate the drawings through a soft copy to the machines during production. Thus competency in computer aided drafting is essential. Hence this subject is required.

DETAILED CONTENTS

1. Introduction to Cad

- Introduction to Cad: - Advantages and applications, setting the drawing environment: Limits, Grid, Snap, Axis, Units, Ortho, Co-Ordinates ON, OFF Units and Color.
- 2D Drawing entities - Point - Line - Arc - circle, Ellipse, Polygon, and Trace. Object Selection using Object Snap (OSNAP).
- Editing commands: Selection of entities by different methods - copy, Move, Scale, Rotate, Fillet, Chamfer, Mirror, Array-Polar, Rectangular. Measure, Divide, and Erase.
- Drawing Display Methods: Zoom, Pan, and View.
- Adding Texts and Dimensions: Text, Dimension-linear, continued, angular

2. More Learning For Productivity of Drawing

- Pedit commands. Working on multiple layers Layer concepts in CAD -Various options with layer command - Hatch command - Creating line types library and user made library.
- Preparing the schematic drawing of a workshop building in one layer, the blocks of machines in another Layer and Electrical connection on another layer.

3. Advanced Cad Features

- Drawing 2D figure of complex shape
- Extruding it into a 3D drawing
- Understanding 3D Co-ordinate values, Creating and viewing a drawing in 3D.
- Rotating the drawings- Meshing 3D drawing.
- Turning a 3D into 2D Ortho Graphic projection.

4. Advanced 3DFeatures

- Understanding model space and paper space.
- Drawing and working in UCS.
- UCS icon, 3D editing-Union, Subtraction, 3 D Orbit.
- Basic 3D entities command, Box, Cylinder, Cone, Chamfer, Revolve.

5. Drawings of following Automobile Components

- Bush bearing
- Piston four stroke engine
- Connecting rod
- Brake assembly
- Clutch assembly

4.6 AUTOSHOP PRACTICE - II

L T P
- - 4

RATIONALE

Automobile workshop practice inducts practical attitude amongst the automobile engineering technician. A supervision /manager in transport undertaking/private sector have to deal with fabrication, repair and maintenance of vehicle such as patching, painting etc. Therefore, for an automobile technician it is necessary to develop the skill of handling and use of tools and maintenance of the vehicles. As a proprietor of a service station the knowledge of car washer, hydraulic hoist is most essential as lot of repair work of light commercial vehicles has to be carried out on hydraulic hoist.

DETAILED CONTENTS

1. Identification and function of each component and working of air compressor, car washer and hydraulic hoist.
2. Identification, dismantling, inspection and assembling of fuel pump.
3. Identification and sketching of major components in the layout of chassis of a scooter/motor cycle/3 wheeler.
4. Identification and sketching of major components in the layout of chassis of a Car/Jeep, Truck/Bus.
5. Removal, inspection and fitting of wheels and tyre's of car/jeep, rotation of tyres, checking of tyre pressure.
6. Removal, inspection and fitting of wheels and tyres of a two wheelers and repairing of punctures.
7. Soldering of defective radiator and brazing of a fuel tank.
8. Cleaning, greasing, checking as per maintenance schedule, washing, wiping and polishing of vehicle.
9. First, Second, Third servicing of vehicle as per maintenance schedule recommended by vehicle manufacturer.
10. Flushing out water jackets, cleaning of radiator and refitting in vehicle, adjustment of fan belt tension by self adjusting and automatic adjustment.
11. Dismantling, cleaning, inspection and assembly of a carburetors.
12. Dismantling, cleaning, inspection and assembly of water pump.
13. Dismantling, cleaning, inspection and assembly of injectors.
14. Dismantling, cleaning, inspection and assembly of oil pumps.
15. Dismantling, cleaning, inspection and assembly of distributor.
16. Dismantling, cleaning, inspection and assembly of fuel injection pump.
17. Engine tune up.
18. Dismantling, cleaning, inspection and assembly of fuel injection pump.
19. Study of MPFI System used in modern vehicles.
20. Study of CRDI System used in modern vehicles.

INSTRUCTIONAL STRATEGY

Emphasis may be given on practical applications and practice on fitting of wheels and rotation of tyres.

RECOMMENDED BOOKS

1. *Car Maintenance and Repair* by W. Judge
2. *Carburetors and fuel Injection system* by Arthur W. Judge

4.7 DRIVING PRACTICE-I

L T P

- - 6

RATIONALE

Driving is an essential part of learning of an Automobile Engineering Diploma holder. Testing of vehicles is not possible unless driving is known. Driving is learnt only by practice on the vehicle. The driving involves knowledge of motor vehicle act provisions and traffic rules. Practical skills in application of the act. Provision is learnt only by actual practice.

DETAILED CONTENTS

1. Know your vehicles- Different elements and their functions.
2. Vehicles controls- Hand controls, Foot controls, other controls, Major/Minor Controls.
3. Predriving checks- before sitting on the driver seats, after sitting on the driver's seat.
4. **Beginning to Drive**
 - Road users characteristics
 - Road sense
 - Traffic sense
 - Anticipation, Judgment
 - Gear changing (high to low and low to high)
 - Holding steering for controlling
 - Road signs & signals
 - Road marking
 - Traffic Signals (hand signal, traffic signs, Automatic lights).
 - Starting the engine
 - Precautions before moving the vehicles.
 - Precautions after moving the vehicles.
 - Positioning on road
 - Parking
 - Stopping distance
 - Following Distance
 - Passing
 - Turning
 - Stopping
 - Reversing
 - Driver's responsibility on road
 - Driving techniques

5. **Driving Practice**
Simple (in the ground or within the institution about 30 K.M. per students per semester).
6. **Important Provisions of Motor Vehicles Act**
Learning License, Display of learning sign on the vehicle, Regular Driving license, General Insurance, Vehicle Registration, Pollution test standards/certificates., log book and other documents.
7. **Accidents & Safety:**
Causes of accidents and precaution to avoid accidents
8. Routine Maintenance, Engine lubrication and cooling system, Battery top up and charge, Tyres air and wear, Washing, cleaning, greasing and polishing etc.

INSTRUCTIONAL STRATEGY

After the demonstration, the students be asked to practice.