

CURRICULUM

FOR

DIPLOMA PROGRAMME

IN

AUTOMOBILE ENGINEERING

3rd year (5th & 6th Semester)

FOR THE STATE OF HIMACHAL PRADESH



(Implemented w.e.f. Session 2014-15)

Prepared by:-

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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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3rd YEAR OF THREE YEAR DIPLOMA PROGRAMME IN AUTOMOBILE ENGINEERING

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 : 3rd 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.

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, Dharamshala 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:-
 - (i) 60% marks for sheets ii. 40% for test.

FIFTH SEMESTER AUTOMOBILE ENGINEERING

SR. NO	SUBJECTS	STUDY SCHEME Hrs/Week		MARKS IN EVALUATION SCHEME									Total Marks Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
5.1	Elements of Design	5	-	50	-	50	100	3	-	-	100	150	
5.2	Mechanics of Vehicle	4	-	50	-	50	100	3	-	-	100	150	
5.3	Auto Electrical and Electronic Equipment	4	2	30	20	50	100	3	50	3	150	200	
5.4	*Generic Skills and Entrepreneurship Development	2	1	50	50	100	50	2	-	-	50	150	
5.5	Automobile Refrigeration & Air-conditioning	4	-	50	-	50	100	3	-	-	100	150	
5.6	Auto Repair and Maintenance	-	6	-	50	50	-	-	100	3	100	150	
5.7	Driving Practice – II	-	6	-	50	50	-	-	100	3	100	150	
5.8	**Practices in communication Skills.	-	2	-	50	50	-	-	50	3	50	100	
5.9	Student Centered Activities	-	2	-	25	25	-	-	-	-	-	25	
Industrial Training		-	-	-	50	50	-	-	50	-	50	100	
Total		19	19	230	295	525	450	-	350	-	800	1325	

* Common with other diploma programmes.

** Common with other diploma programmes in 6th semester.

SIXTH SEMESTER AUTOMOBILE ENGINEERING

SR. NO.	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	*Basics of Management	3	-	50	-	50	100	3	-	-	100	150
6.2	Automobile Reconditioning	4	-	50	-	50	100	3	-	-	100	150
6.3	Production Planning and Costing	5	-	50	-	50	100	3	-	-	100	150
6.4	Motor Vehicle Act and Transport Management	4	-	50	-	50	100	3	-	-	100	150
6.5	Elective – I 6.5.1 Tractor & Farm Equipment 6.5.2 Automotive Body 6.5.3 Heavy Earth Moving Machinery 6.5.4 Marketing, Sales and Auto Spares	4	-	50	-	50	100	3	-	-	100	150
6.6	Auto Reconditioning Workshop	-	6	-	50	50	-	-	100	3	100	150
6.7	Project Work	-	12	-	100	100	-	-	100	3	100	200
6.8	Student Centred Activities	-	2	-	25	25	-	-	-	-	-	25
Total		20	20	250	175	425	500	-	200	-	700	1125

* Common with other diploma programmes.

5.1 ELEMENTS OF DESIGN

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RATIONALE

Understanding of basic principles of designing of components like cylinder liner, piston, crank shaft, connecting rod, simple mechanism. This subject clears many concepts of quality and standardizations.

DETAILED CONTENTS

1. **Introduction** (10 hrs)
 - Design considerations, design procedure
 - Basic requirements, classifications of design and principles of good economic design.
 - Standardization, interchangeability of Automobile parts with reference to IS-specifications.
 - Limits, fits and tolerances.
 - Material selection and economics.
 - Designing for strength
2. **Shaft Design** (15 hrs)
 - Stresses in shaft
 - Shaft coupling and various types
 - Design of shafts(Solid and hollow)
 - Design of axles
 - Shaft under torsion
 - Combined bending and torsion
 - Keys & flanged coupling.
3. **Design of Engine Parts** (25 hrs)
 - Cylinder liner and cylinder head
 - Piston
 - Connecting Rod
 - Crank Shaft
4. **Design of Chassis parts** (20 hrs)
 - Flywheel used in Automotive Engine.
 - Clutch: Single plate clutch and Multiplate clutch
 - Brakes-Internal expanding shoe brake used in an Automobile
 - Gear and Bearing
 - (i) Design of spur gear
 - (ii) Design of Bush bearing

INSTRUCTIONAL STATREGY

Use of learning resource, CDs and models can help in the understanding the subject.

RECOMMENDED BOOKS

1. Machine Design by P.C. Sharma & Aggarwal
2. Machine Design by Pandya & Shah
3. Machine Design by R.S. Khurmi
4. Machine Design by A.P. Verma

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	15	20
3	25	30
4	20	30
Total	70	100

5.2 MECHANICS OF VEHICLES

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RATIONALE

Various types of motions, power transmission, forces acting on moving vehicle, vehicle braking, balancing and vibration in rotating body are some of the concepts which are essential for diploma holders in Automobile Engineering. Hence the subject is introduced in the syllabus.

DETAILED CONTENTS

1. **Simple Mechanism** (8 hrs)
 - Definition of link, kinematic pair, kinematic chain, Mechanism, inversions and machines.
 - Simple examples of mechanism with:-
 - Lower pairs, Four bar chain, Slider crank chain, Double slider crank chain, Higher pairs

2. **Motion and Turning Moment** (10 hrs)
 - Displacement, velocity and acceleration of piston.
 - Angular velocity and angular acceleration of connecting rod.
 - Calculations of piston effort and crank effort at different angles.
 - Fly wheel - its types, weight and moment of inertia.
 - Fluctuation of energy for fly wheel.
 - Turning moment diagrams with reference to internal combustion engines.
 - Analysis of Hooke's Joint.

3. **Power Transmission** (08 hrs)
 - Flat belt, V-belt and chain drives.
 - Ratio of tension of two sides of the belt with and without centrifugal tension.
 - Horse power transmitted and condition for maximum horse power transmitted.
 - Velocity ratios transmitted by Belts
 - Simple, compound and epicyclic gear box.

4. **Vehicle in Motion** (8 hrs)
 - Air, gradient, and rolling resistances.
 - Tractive effort, traction, Inertia load, Draw bar pull and power required to propelled 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.

5. **Vehicle Control** (06 hrs)
 - Braking friction and limits of braking.
 - Retardation and Braking force, calculations in case of front wheel, rear wheel and all wheel braking.
 - Weight transfer during braking.
 - Stopping distance and stopping time.
 - Ackermann Steering Mechanism, Correct Steering angle.
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6. **Balancing** (8 hrs)
- Concepts of static and dynamic balancing, working of static and dynamic machine.
 - Balancing of rotating masses-single rotating mass by a single mass rotating in the same plane and by two masses rotating in different planes, balancing of several masses rotating in the same plane. Balancing of several masses rotating in different planes.
7. **Vibration** (08 hrs)
- Introduction, Types of vibrating motion, Types of free vibrations, Natural Frequency of Free longitudinal Vibrations, Natural frequency of free, Transverse vibrations.
 - Causes of vibration in rotating bodies, damping of vibrations, Free damped vibrations (Vacuum Damping)

INSTRUCTIONAL STATREGY

1. *Models should be shown.*
2. *Practical demonstrations should be organized.*

RECOMMENDED BOOKS

1. *Theory of Machines by R.S. Khurmi*
2. *Automobile Engineering Vol-I, II, Dr. Kirpal Singh, Standard Publishers and Distributor, New Delhi*
3. *Theory of Machines by D.R. Malhotra; Satya Parkashion*
4. *Theory of Machines by PL Balaney; Khanna Publishers, Delhi.*
5. *Mechanics of Vehicles by W. Steed; Kafe books Limited, London.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	15
2	10	18
3	08	12
4	08	15
5	06	12
6	08	16
7	08	12
Total	56	100

5.3 AUTO ELECTRICAL AND ELECTRONIC EQUIPMENT

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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** (03 hrs)
Various Electrical components/systems in Automobile. Their functions and demands, earth return system, types of earthing, 6V, 12V & 24V system.
2. **Lead Acid Batteries** (10 hrs)
 - 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.
 - Battery Testing: Electrolyte testing by hydrometer, voltage test, high discharge and cadmium test. (voltage)
 - Battery Charging: Constant potential and constant current, initial charging, normal charging, trickle charging, intermittent charging, boost charging.
 - Battery Defects: Sulphation, plates decay, working, erosion, cracking, sedimentation, separator defects, short circuits, overcharging.
 - Alkaline Batteries: Construction, working, merits and demerits of Ni-Fe, Ni-Cd, Ag-Zn cells
3. **Charging System** (05 hrs)
 - Circuits, function and various components, dynamo and alternator, types, construction, working, advantages and disadvantages of dynamo and alternators, drives, cut out relay.
 - Regulation: Functions of various components of two unit, three unit and heavy duty Regulators, Regulators for alternators.
4. **Starting System** (08 hrs)
 - Function of various components, torque terms, principle and constructional details of starter motor, switches, types, starter to engine drive and their types, Starter-alternators.
5. **Ignition System** (08 hrs)
 - Constructional details of coil, distributor, condenser, meaning of cam angle, ignition timing, ignition advancing mechanisms, centrifugal and vacuum type, transistorized ignition system, construction and working details of magneto ignition system.
 - Spark Plugs: Constructional details of spark plugs, classification as per reach, heat range, diameter, and effect of leaded fuels, care and maintenance of spark plug.

6. **Lighting System** (08 hrs)
 - 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.
 - Wiring: HT and LT, their specifications, cable colour codes, wiring Harness, Cable connections, Wiring diagrams, of cars and two wheeler, Fuses, faults and rectification.
7. **Electrical Accessories** (04 hrs)
 - Fuel gauges:- bimetallic and balancing coil type, Air pressure gauges, temperature gauges, warning light, speedometers, wind screen wipers, horns, horn relay, electric fuel pump, Faults and rectification.
8. **Miscellaneous Electrical Equipment** (03 hrs)
 - Impulse Speedometer, tachometer, heaters, defrosters, Air conditioner, and Electric door locks, window actuation, Seat adjusters.
9. **Electronic Devices** (02 hrs)
 - Familiarization to automobile Electronic devices, Sensing Units, Computer controlled Sensors.
10. **Electronics and Computer Applications in Automobiles** (05 hrs)

Brief introduction of circuit-symbols, Integrated circuits, stepper and synchronous motors, Logic gates, sensors. Analog and digital devices, communication chips, multiplexed wiring, working of ECU.

LIST OF PRACTICALS

1. Testing of Battery with hydrometer and high rate discharge tester, charging of Batteries.
2. Testing and measurement of ignition timing and dwell angle with timing light and cam angle tester.
3. Testing, cleaning and setting of spark plug on spark plug cleaning and testing machine.
4. Testing of alternator rotor and stator winding for short circuit, ground and broken circuit.
5. Head light beam setting.
6. Testing and setting of horn and relay.
7. Testing and fault tracing of field winding, armature and magnetic switch for short circuit, grounding of a starter.
8. Testing dipper switch, flasher unit and indicator circuits and fault tracing.
9. Testing and fault tracing of different components of transistorized ignition system.
10. Testing of magneto ignition circuit and Adjustment.
11. Identification of colour codes for continuity test in a wiring harness.
12. Study and sketching of complete wiring circuit of an Indian vehicle.

INSTRUCTIONAL STATREGY

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

RECOMMENDED BOOKS

1. *Automobile Engineering* by Kirpal Singh
2. *Automotive Electrical Equipment* by P.L. Kohli
3. *Automotive Electrical Equipment* by William H. Crouse
4. *Automobile Engineering* by R.B. Gupta

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	10	20
3	05	10
4	08	15
5	08	12
6	08	12
7	04	08
8	03	05
9	02	04
10	05	08
Total	56	100

5.4 GENERIC SKILLS & ENTREPRENEURSHIP DEVELOPMENT

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RATIONALE

In present scenario, there is an urgent need to develop right kind of attitude, knowledge and skills amongst the Diploma engineers leading them to achieve gainful wage/ self employment. There is a huge gap in perceptions of employers and employees regarding meeting the job requirements. Also the dual challenges of competing in global working environment and keeping pace with the rapid technological advancements call for re-design of curricula and thus enabling the importance of employability or generic skills. Entrepreneurship development aim at developing conceptual understanding for setting up owns' business/enterprise to cope up with the problem of unemployment and also to promote the socio- economic development of our country.

Both the subject areas, "generic skills and entrepreneurship development" are supplementary to each other. Knowledge and skills of these must be imparted to diploma engineering students for enhancing their employability and confidence in their personal and professional life.

DETAILED CONTENTS

- 1. Introduction to Generic Skills (02 Hrs)**
 - 1.1 Concept and importance
 - 1.2 Local and global scenario
 - 1.3 Concept of life-long learning (LLL)

- 2. Self- Management and Development (07 Hrs)**
 - 2.1 Concept of Personality Development, Ethics and Moral values
 - 2.2 Concept of Intelligence and Multiple intelligence Types viz, linguistic, mathematical & Logical reasoning, emotional, and social intelligence (interpersonal & intrapersonal).
 - 2.3 Concept of Physical Development; significance of health, hygiene, body gestures & kinesics.
 - 2.4 Time Management concept and its importance
 - 2.5 Intellectual Development; reading skills (systematic reading, types and SQ5R), speaking, listening skills, writing skills (Note taking, rough draft, revision, editing and final drafting), concept of critical Thinking and problem solving (approaches, steps and cases).
 - 2.6 Psychological Management; stress, emotions, anxiety and techniques to manage these.
 - 2.7 ICT & Presentation skills; use of IT tools for good and impressive presentations.

- 3. Team Management (03 Hrs)**
 - 3.1 Concept of Team Dynamics. Team related skills such as; sympathy, empathy, leading, coordination, negotiating and synergy. Managing cultural, social and ethnic diversity.
 - 3.2 Effective group communication and conversations.
 - 3.3 Team building and its various stages like forming, storming, norming, performing and adjourning (Bruce Tuckman's five stage Model)

4. **Project Management (02 Hrs)**
 - 4.1 Concept of Management and features
 - 4.2 Stages of Project Management; initiation, planning, execution, closing and review (through case studies)
 - 4.3 SWOT analysis concept.

5. **Introduction to Entrepreneurship (02 Hrs)**
 - 5.1 Entrepreneurship, Need of entrepreneurship, and its concept, Qualities of a good entrepreneur
 - 5.2 Business ownerships and its features; sole proprietorship, partnership, joint stock companies, cooperative, private limited, limited, public limited, PPP mode.
 - 5.3 Types of industries viz, micro, small, medium and large

6. **Entrepreneurial Support System (features and roles in brief) (03 Hrs)**
District Industry Centres (DIC's), State Financial Corporation's (SFC's), Small Industries Service Institutes (SISI), Commercial Banks, Micro Financing Institutions, SIDBI, NABARD, National Small Industry Corporations (NSIC), Cooperative Societies and Venture Capitalists. Various Consultancy Organizations; HIMCON, Khadi and Gramodyog Board (H.P.) etc.

7. **Market Study and Opportunity Identification (04 Hrs)**
Types of study; primary and secondary, product or service identification, assessment of demand and supply, type of surveys and important features; qualitative, empirical, schedules, questionnaire, interview.

8. **Project Report Preparation (05 Hrs)**
 - 8.1 Preliminary Report, Techno-Economic Feasibility Report, Detailed Project Report (DPR) and illustration of these through examples.
 - 8.2 Exercises on writing project reports of micro and small projects.

List of Practical Exercises

1. *Understanding Self Management and Development (Related to Chapter 02); through examples, cases, exercises, panel discussions, seminars, meditation and yoga techniques.*
2. *Team Management (Related to chapter 03); through examples, cases, role plays, group discussions and panel discussions.*
3. *Market Study and Opportunity Identification (Related to Chapter 07); through literature reviewing, making questionnaires, conducting mock interviews and analysing data for product/service identification and demand assessment.*
4. *Project Management and Project Report Preparation (Related to chapter 04 and 08); through exercises on making project reports on micro and small enterprises. Case studies and SWOT analysis of projects can be taken.*

Instructional Strategy

Since the emphasis of present training need and work requirements is on budding entrepreneurs as well as intelligent and multi skilled work force. Therefore skill development and knowledge imparting should be focussed on generic and entrepreneurial skill development. Thus instructional strategy of the subject should be more practical oriented and theories must be taught up to conceptual or informal levels. Different methodologies may be

used with inclusive approach and must be supported with different training tools such as group and panel discussions , role plays, case studies, field surveys through questionnaires, schedules and interviews, presentations, seminars and expert talks in practical lectures and through student centred activities. Students may also be provided with extracted study material and handouts too.

Recommended Books:

1. *Generic Skill Development Manual, MSBTE, Mumbai*
2. *Lifelong Learning, Policy Brief (www.oecd.org)*
3. *Towards Knowledge Society, UNESCO Publication, Paris*
4. *Human Learning, Ormrod*
5. *What Work Requires of Schools? SCANS Report: U.S. Department of Labour*
6. *Entrepreneurship Development by CB Gupta and P Srinivasan: Sultan Chand and sons: New Delhi*
7. *Entrepreneurship Development by S. L. Gupta and Arun Mittal: IBH Publication*
8. *A Handbook of Entrepreneurship, Edited by B S Rathore and Dr. J S Saini*
9. *Entrepreneurship Development and Small Business Enterprises by Poornima M: Pearson Education India*
10. *Handbook of Small Scale Industry by P M Bhandari*

Inspirational Books

1. *Stay Hungry stay Foolish by Rashmi Bansal*
2. *An Autobiography by Lee Iacocca*
3. *Steve Jobs: The Biography by Walter Isaacson*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs.)	Marks Allotted %
1	2	7
2	7	26
3	3	10
4	2	7
5	2	10
6	3	10
7	4	15
8	5	15
Total	28	100

5.5 AUTOMOTIVE REFRIGERATION AND AIRCONDITIONING

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4 - -

RATIONALE

Human comfort has gained priority in latest developments in automobile fields. Automobile air conditioning is now forming part of new technology vehicles. A diploma holder in Automobile Engineering must know basics of refrigeration and air-conditioning and their applications. Hence this subject.

DETAILED CONTENTS

1. **Principles of Refrigeration** (10 hrs)
 - 1.1 Meaning
 - 1.2 Refrigeration Methods
 - 1.3 Units of Refrigeration
 - 1.4 Reversed Carnot Cycle
 - 1.5 Heat Pump
 - 1.6 Coefficient of Performance
 - 1.7 Rating of Refrigeration Machines

2. **Refrigeration Systems** (12 hrs)
 - 2.1 Air Refrigeration cycle-applications and its limitations.
 - 2.2 Vapour Compression Cycle.
 - 2.3 Effect of sub cooling and super heating.
 - 2.4 Departure of actual vapour compression cycle from theoretical cycle.
 - 2.5 Effect of varying condensing and suction temperature on coefficient of performance.
 - 2.6 Simple mathematical calculation with pressure - enthalpy charts.
 - 2.7 Vapour absorption cycle.
 - 2.8 Actual vapour absorption cycle and application.

3. **Refrigerants** (06 hrs)
 - 3.1 Important properties of a refrigerant.
 - 3.2 Properties and application of commonly used refrigerants such as R11, R12, R22, NH₃ and Water.
 - 3.3 Newer refrigerants.

4. **Refrigeration System, Components and Controls** (04 hrs)
 - 4.1 Function, types, specification and constructional details of components such as compressor, condenser, throttling device, evaporator, oil, separator, accumulator.
 - 4.2 Various controls - solenoid valve, thermostat, low pressure/high pressure cut out, safety switch.

5. **Psychrometry** (08 hrs)
 - 5.1 Various terms- Dry and wet bulb temperatures, saturation, dew point, adiabatic saturation, temperature, relative humidity, absolute humidity, humidity ratio.
 - 5.2 Psychrometric chart and its uses.
 - 5.3 Psychrometric processes - sensible heating and sensible cooling, humidification and dehumidification, cooling and dehumidification, heating and humidification, and their representation of psychrometric chart.
 - 5.4 Simple problems.

6. **Air Conditioning** (06 hrs)
- 6.1 Introduction
 - 6.2 Metabolism in human body
 - 6.3 Human comfort
 - 6.4 Applications of air-conditioning

7. **Air conditioning System** (10 hrs)
- 7.1 Principles of automobile air conditioning.
 - 7.2 Air distribution systems, concept of filter, damper, fan, blower, air register and diffuser, case/duct system, engine cooling and heater circuit.
 - 7.3 Auto air conditioning systems - operating conditions, car air conditioning, bus air conditioning, truck air conditioning, performance, rating, typical installations.
 - 7.4 Causes of failure of auto air conditioners.
 - 7.5 Trouble shooting

INSTRUCTIONAL STATREGY

Teachers should lay emphasis on concepts and principles related to heating system and air conditioning of automobiles. It is important to make use of audio-visual aids/video films to support the recommended materials.

RECOMMENDED BOOKS

1. *Automobile air conditioning by Boyce H Dwiggin, Delman Thomson Publishers.*
2. *Automobile air conditioning by Crouse and Mghin, McGraw Hill Book Company.*
3. *Thermal Engineering by A.A. Sara, Satya Prakashan New Delhi.*
4. *Air Conditioning and Refrigeration by R.K. Rajput, Luxmi Publications, New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	12	20
3	06	10
4	04	05
5	08	15
6	06	10
7	10	20
Total	56	100

5.6 AUTO REPAIR AND MAINTENANCE

L T P
- - 6

RATIONALE

Testing and trouble shooting in an area which forms the main job of a diploma holder in automobile engineering. The competencies in knowing the working and testing of the engine, electrical system will go a long way in instilling confidence for a place in the world of work. The practice in above areas has thus been included in the curriculum. This also includes the driving practice without which testing of vehicle is not possible.

DETAILED CONTENTS

1. Servicing of Lubrication system - Flushing, crank case cleaning and replacing oil, filter element.
2. Servicing of fuel system - petrol feed system, cleaning and flushing fuel tank.
3. Servicing feed pump - mechanical pump, electrical pump and testing.
4. Servicing carburetor, cleaning and adjusting of carburettor.
5. Servicing of the air cleaners.
6. Overhauling of Petrol Engine.
7. Engine testing and finding out fuel consumption.
8. Engine out put and efficiency.
9. Emission test using exhaust gas analyzers.
10. Operation and use of engine Analyzer, Analysis of Petrol engine performance.
11. Trouble shooting of engine - Diagnosing and rectifying to the following troubles - Engine overheating, high oil consumption, engine noises and knocks, high fuel consumption, starter turns the engine on but the engine does not start, engine fires but dies out, engine misfires, lack of power, poor acceleration, engine produces black or white smoke.
12. Inside and outside inspection/checking of vehicle, checking of engine oil, horn, starter, cooling water before starting of engine.
13. Painting practice of vehicles to change from base.
14. Study of Refrigeration system in the Vehicle.
15. Study of Air Conditioning System in the Vehicle.
16. Trouble Shooting in Refrigeration & Air Conditioning System of a Vehicle.

RECOMMENDED BOOKS

1. *Automobile Repair by Abbay*
2. *Automobile Practical by N.K. Mangal*
3. *Car Maintenance & Repair W.Judge*

5.7 DRIVING PRACTICE -II

L T P
- - 6

RATIONALE

After learning the basics of driving the emphasis has to shift to driving under hard condition such as in snow, fog, heavy traffic, at night and steep gradient etc. suitable practice needs to be given to the students to make them aware of different situation in driving of the vehicle.

DETAILED CONTENTS

1. **Driving Techniques**
 - 1.1 Revision
 - 1.2 Maneuver in: Passing, Merging, Diverging, Overtaking, Crossing, Turning, Cornering, Reversing, Emergency stopping.
2. Use of bye pass, sub way, over bridge and fly over
3. Difficult driving- Night driving, Hill driving, Driving under special conditions like fog, heavy rain and snow etc.
4. Driving on highways: lane selection & lane discipline
5. Public relations and dealing with police
6. Fire Hazards
7. First Aid
8. Vehicle Repair & Maintenance: Break down recovery
9. Recovery from police: accident cases
10. Record keeping
11. Accounting
12. Practice on road up to 60 K.M. during the semester for each student.

INSTRUCTIONAL STATREGY

The students should be given independent practice on road as for possible so that competency in driving can be achieved.

5.8 PRACTICES IN COMMUNICATION SKILLS

L T P
- - 2

RATIONALE

For successful completion of diploma programme, the students should possess adequate command on language and communication skills so that they are able to express themselves with ease and felicity. The language used by the students should be appropriate to objectives and occasion. The contents of this subject shall provide them practical training through language laboratory.

LIST OF PRACTICAL EXERCISES

1. Exercises on phonetics
2. Group Discussion
3. Exercises on self-assessment using tools like SWOT analysis.
4. Internet communication
5. Correspondence
 - 5.1 Resume writing
 - 5.2 Covering letter
 - 5.3 Follow-up correspondence
 - 5.4 Business Correspondence
6. Practice on listening skills.
7. Speaking exercises with emphasis on voice modulation (reading and extempore)
8. Demonstration and practice on Body language and Dress sense.
9. Exercises on etiquettes and mannerism in difficult situations like business meetings, table manners, telephone etiquette and manners related to opposite gender.
10. Mock interviews (telephonic/personal)
11. Cross-cultural Communication
12. Role play for effective Communication.
13. Exercises on wit and humour in conversations and creating lively environment.

6.1 BASICS OF MANAGEMENT

L T P
3 - -

RATIONALE:

Diploma holders are expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Some topics like Structure and ownership of Organization, Leadership, Motivation, Customer Relationship Management (CRM), Legal Environment of Business, Environmental Management, Accident and Safety: Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject.

DETAILED CONTENTS

1. **Introduction:** (12 hrs)
Definition and concept of management, functions of management- planning, organizing, staffing, coordinating and controlling. Various areas of management-
 - (a) Human Resource Management(HRM)-Manpower recruitment and selection, induction , training and development and performance appraisal.
 - (b) Financial Management- Meaning of financial management, its importance, various sources of finance- long term and short term. Concept of Internal Rate of Return(IRR), Net Present Value (NPV) and Average Rate of Return.
 - (c) Marketing Management- Product life cycle, concept of pricing, promotion strategies- advertising, sales promotion and market research.
 - (d) Material Management – Inventory management, concept of economic order quantity and waste management.

2. **Structure and Ownership of Organization:** (04 hrs)
Concept and structure of an organization, hierarchical management structure (top, middle and lower level management), functional management structure and matrix organizational structure. Types of business ownership (salient features)- Sole Proprietorship, Partnership, Joint Stock Companies and Cooperative Ownership.

3. **Leadership:** (02 hrs)
Meaning, importance , types of leadership and qualities of a good leader.

4. **Motivation:** (04 hrs)
Concept and importance of motivation-drives and incentives, types of motivation and theories of motivation- Abharam Maslow Theory and Herzberg Two Factor Theory.

5. **Customer Relationship Management:** (04hrs)
Need, various types of customers, customer satisfaction, Customer Satisfaction Index(CSI) and its significance in playing effective role of engineers in changing scenario.

6. **Legal Environment and Business:** (08 hrs)
 - a) Various labour laws and its necessity. Salient features of Income Tax Act – computation of income tax on salary income, Sales and Excise Tax Act-VAT & Excise duty and Factory Act. 1948.
 - b) Labour Welfare Schemes including wage payment-types, system of wage payment and incentives.

- c) Intellectual Property Rights(IPR)- Concepts, infringements and remedies related to patents, copy rights, trademarks and designs.
 - d) Accident and Safety- Meaning and concept of accident and safety, causes, safety precautions and various measures after accidents.
7. **Total Quality Management:** (04 hrs)
Meaning and concept of Total Quality Management(TQM), various factors/measures to achieve TQM in an organization. Standards and Codes- National & International.
8. **Environmental Management:** (04 hrs)
Concept of ecology and environment, factors contributing to air pollution, water pollution and noise pollution. Different measures to control pollution. Disaster management-features and measures.

INSTRUCTIONAL STRATEGY:

Generally the diploma holders occupy middle level managerial positions in an organization, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different topics related to management. Some of the topics may be taught using question answer, assignment or seminar. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organisations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS:

1. *Principles of Management by Philip Kotler TEE Publication*
2. *Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.*
3. *Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co.: 7, West Patel Nagar , New Delhi.*
4. *Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.*
5. *Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.*
6. *Essentials of Management by H Koontz, C O' Daniel , Mc Graw Hill Book Company, New Delhi.*
7. *Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi*
8. *Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.*
9. *Intellectual Property Rights and the Law by Dr. GB Reddy.*
10. *Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.*
11. *Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi*
12. *Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi*
13. *Environment Engineering by GN Pandey & GC Pandey, Tata McGraw Hill Publication.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	4	10
3	2	08
4	4	12
5	4	10
6	8	18
7	4	10
8	4	12
TOTAL	42	100

6.2 AUTOMOBILE RECONDITIONING

L T P
4 - -

RATIONALE

A diploma holder is supposed to encounter vehicle breakdown and maintenance problems during his duties. He should be able to check up the performance of the vehicle and take correct measure to make up for power losses and other such defects occurring due to wear and tear in operation. It is rather highly uneconomical to outrightly reject and replace the whole unit observed to be faulty if it is possible to recondition some of the parts like cylinder, piston, crankshaft etc. at a lesser cost. It is with this consideration that reconditioning should be undertaken. This subject is designed to give foundational knowledge and skill regarding reconditioning and maintenance.

DETAILED CONTENTS

1. **Servicing and Maintenance** (09 hrs)
 - Servicing and its necessity. Types of servicing. Classifying motor vehicles for servicing.
 - Engine de knocking methods, precautions to minimize carbon deposits in the combustion chamber.
 - Road services, inspection before and after servicing road test and test report.
 - Concept of maintenance.
 - Preventive maintenance.
 - Maintenance schedules.
 - Seasonal maintenance.
 - Break down maintenance.
 - Maintenance chart.

2. **Overhauling** (09 hrs)
 - Explanation of overhauling, necessity of overhauling, period of overhauling, Delaying of overhauling period, Precautions taken during overhauling.
 - Overhauling procedure (Dismantling and assembling) of engine, clutch, gear box, differential, axles, brake assemblies, suspension system, steering system.

3. **General Components** (08 hrs)
 - Method of engine decarburizing and its need.
 - Method and necessity of engine sump flushing, cleaning of oil filter and air cleaner.
 - Necessity and method of adjustment of dynamo/alternator belt tension, valve clearance, spark plug gap.
 - Valve seat cutting and grinding, valve re-facing
 - Systematical approach to disconnect engine parts and accessories from chassis, removal of engine assembly, use of engine dismantling tools, cleaning of engine components.
 - Storage of tyre and tubes.
 - Factors determining retreading of tyre.
 - Salient features of hot and cold retreading plants.

4. **Reconditioning of Cylinders** (06 hrs)
 - Cylinder wear - ovality and taper in cylinder and their Measurement.

- Necessity of cylinder re-boring
 - Dimensions for re-boring with reference to any engine i.e. M&M Vehicle, Tata vehicle, Leyland vehicle(Indian vehicles).
 - Number of re-bores in light and heavy motor vehicle engines.
 - Reconditioning of cylinder by boring, boring machines operation And procedure.
 - Ridge removing, cylinder honing.
 - Fitting and removing cylinder liners
5. **Piston and Piston Rings** (04 hrs)
- Measurement of piston ring side clearance and worn gudgeon pin Holes.
 - Method and procedure of replacement of pistons and piston Rings.
 - Piston grooves cleaning. Over size of piston and rings of light and heavy engines.
6. **Crank shaft, Cam shaft and Engine Bearing** (08 hrs)
- Necessity and method of crank shaft and cam shaft grinding, Effect on the performance of engine.
 - Operation of crank shaft and cam shaft grinding machine size of crank shaft and cam shaft grinding amount.
 - Building up worn journals.
 - Over sizes of crank and cam shaft bearings.
 - Alignment of connecting rod, replacement of big and small end bearing and its over sizes.
 - Changing of connecting rod bush.
 - Bearing clearance, its measurement and effect on engine Performance.
7. **Welding** (08 hrs)
- Introduction to welding
 - Types of welding
 - Principles and uses of gas welding - high pressure and low pressure.
 - Description of gas welding equipment, different types of flames and their applications.
 - Fluxes and fillers
 - Welding techniques and safety precautions
 - Principles of arc welding
 - Description of AC and DC welding equipment and their applications.
 - Electrodes and their specifications
 - Resistance welding, its types and uses
 - Welding defects and testing of its joints
 - Modern techniques of welding - brief description and uses
 - Welding of different metals
 - Metal spraying
8. **Painting** (04 hrs)
- Preparation of surfaces for painting
 - Undercoating, its necessity
 - Sequence of painting

- Testing of coated surfaces
- Spray and oven painting
- Paint sprayers and sanders

INSTRUCTIONAL STATREGY

The teacher may preferably treat the subject can Lecture Cum Demonstration basis.

RECOMMENDED BOOKS

1. *Automobile Engineering, Vol I and II by Kirpal Singh.*
2. *Practical Mechanic by Srivastava.*
3. *Automobile Engineering by GBS Narang.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	09	15
2	09	15
3	08	15
4	06	10
5	04	05
6	08	15
7	08	15
8	04	10
Total	56	100

6.3 PRODUCTION PLANNING AND COSTING

L T P
5 - -

RATIONALE

A diploma holder in Automobile Engineering is supposed to look after the planning scheduling and production control activities in the industry. Also he is required to manage the materials function. He is also required to estimate the cost of new components as well as that of repairs and reconditioning components. Therefore, it is essential to teach him concepts, principles, applications and practices covering production planning and control, material and process planning and cost estimation of components manufactured by different processes. Hence this subject has been included in this course. It is expected that efforts will be made by the teacher to provide enough learning experiences to the students for developing necessary competencies related to this subject area.

DETAILED CONTENTS

- | | |
|---|-----------------|
| A. Production Planning | (06 hrs) |
| 1. Introduction | |
| - Necessity of Planning and control. | |
| - Functions of production, planning and control Department | |
| - Factors determining control procedure. | |
| - Advantages of PPC. | |
| - Types of production. | |
| 2. Planning | (07 hrs) |
| - Material planning and allocation. | |
| - Allocation for optimum utilization. | |
| - Make or buy decision. | |
| - Break even analysis. | |
| - Process planning. | |
| - Procedure for process planning. | |
| - Process planning sheet. | |
| - Calculation of man and machine hours. | |
| 3. Production Control | (06 hrs) |
| - Objectives | |
| - Routing | |
| - Loading and scheduling | |
| - Dispatching | |
| - Follow up | |
| 4. Plant Layout & Material Handling | (07 hrs) |
| - Concept of plant layout | |
| - Method of Plant Layout | |
| - Work Station Design | |
| - Introduction and function of material handling | |
| - Material handling equipments. | |
| - Safety Precaution in their use. | |
| 5. Inspection and Quality Control | (07 hrs) |
| - Inspection - Need and Planning for Inspection | |
| - Types of Inspection | |
| - Role of Operator and Inspector in Inspection | |
| - Quality Control and Quality Assurance - Meaning and Need. | |

- Statistical Quality Control
 - Acceptance Sampling
 - Control Charts for variables and Attributes
 - Concept of TQM
6. **Standards and Codes** (04 hrs)
- National and International Codes
 - ISO-9000 - Concept, its evaluation and implications
7. **Inventory Control** (07 hrs)
- Importance
 - Store room operation
 - Inventory control techniques
 - Just in Time (JIT) Concept
- B. **Costing** (05 hrs)
8. **Introduction**
 Definition, and importance of estimating and costing. Difference between estimating and costing. Importance of preparing realistic estimates® Estimating procedures.
9. **Elements of Cost** (14 hrs)
- Direct materials - components.
 - Direct Labour
 - Indirect materials such as lubricants, Cotton waste
 - Indirect Labour
 - Other direct expenses such as of hired equipments.
 - Overhead expenses - rent of building, office expenses.
 - Depreciation and other costs like service charges.
 - Profits - concepts and requirements.
 - Terms used in costing.
 - Prime cost
 - Fabrication/service cost/factory cost
 - Production cost
 - Ultimate cost
 - Selling price
 - Fixed costs
 - Variable costs.
 - Estimation of costs.
 - Perception of job/work order.
 - Different units of work (Bifurcation as per type, Section etc).
 - Analysis of time
 - Handling time
 - Preparation time
 - Work time
 - Inspection and despatch time
 - Computation of charges: Labour Charges like operator, Supervisory and Helper charges, Storage charges, Components charges, material charges, Total charges.
 - Estimation of service charges.
 - Estimation of overhauling charges.
 - Estimation of fabrication charges.

- Estimation of operational cost of a vehicle.
- Cost estimation for machines job.
- Cost estimation for cast, forged and welded jobs.

10. Sales and Purchase

(06 hrs)

- Market Trends and Survey
- Advertising and sales techniques
- After sales service
- Warrantee and its claim procedures
- Purchasing - various procedures

INSTRUCTIONAL STATREGY

Teacher is supposed to take examples from field to illustrate the concepts.

RECOMMENDED BOOKS

1. *Production Estimating and Costing* by M. Adithan and B.S. Pabla
2. *Industrial Engineering and Management* by T.R. Banga, M.K. Agarwal and S.C. Sharma

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	10
2	08	12
3	06	06
4	07	10
5	07	12
6	04	05
7	07	10
8	05	05
9	14	20
10	06	10
Total	70	100

6.4 MOTOR VEHICLE ACT AND TRANSPORT MANAGEMENT

L T P
4 - -

RATIONALE

A diploma holder is supposed to perform following types of functions:

- Significance of vehicle accident
- Accidental vehicle claim study
- Compensation from Insurance Company
- Thorough study of Motor Vehicle Act
- Driving Practices of 2/4 wheelers (private and commercial vehicles)

Therefore, it is essential to teach them Motor basic principles, essentials and appropriateness practices covering Motor Vehicle Act and driving of different vehicles. Hence this subject has been included in this course. It is expected that efforts will be made by the teacher to provide learning experiences to students for developing necessary competencies related to this subject area.

DETAILED CONTENTS

1. **Motor Vehicle Act** (07 hrs)
Definition and provisions (Salient features of M.V. Act).
Requisites and formalities for following:
 - Different forms, application for various Uses
 - Registration of old and new vehicles
 - Private and commercial vehicle
 - Transfer of vehicle - Local and State to State.
2. **Inspection and Fitness of Vehicle** (05 hrs)
 - Fitness of vehicle
 - Private and Commercial,
 - Permit consideration for transport and public service
3. **Insurance** (08 hrs)
 - Different types.
 - Procedure to get Accidental claim and compensation
 - Surveyor duties, Relations between company and surveyor
4. **Driving** (08 hrs)
 - Driving License
 - Different types of driving licenses
 - Procedure to get license.
 - Private, commercial, invalid, international license
 - Principle of Driving
 - Driving procedure
 - Driving precautions
 - Driving in abnormal conditions: Like Hilly, night, fog, typhoon, heavy traffic, rainy
5. **Road Safety** (05 hrs)
 - Road Signs
 - Imposition of Penalties for violation
 - Act and Articles
 - Duties of Driver

- Duties of conductor, Duties of Helpers
6. **Pollution Control** (08 hrs)
- Different contents of exhaust gas
 - Prescribed standards for vehicles
 - Control of pollution
 - Fuel efficiency
 - Storage, Handling and efficient use of fuels & oils.
7. **Transport Management** (15 hrs)
- Structure of fleet organization
 - State transport - optimum utilization of fleet
 - Road worthiness requirement
 - Maintenance of log book
 - History sheet, causes and prevention of: Road Accident
Analysis of Accident
 - Economy of replacement
 - Inspection Procedure-Required accessories, preliminary requirements,
Exterior and interior inspection, inspecting the engine compartment,
inspecting the Trunk Bottom, Test Drive
 - Assessment of used vehicles for sale and purchase
 - Automotive Associations in India.

INSTRUCTIONAL STATREGY

Topics need to be supplemented by examples from Practical life problems as experienced by Drivers.

RECOMMENDED BOOKS

1. *Journal of Transport Management by C.I.R.T. Pune*
2. *Motor Vehicle Act of India (with Latest Amendment)*
3. *Motor Vehicle Act with Rules by B.S. Kohli*
4. *Automobile Engineering Vol I by Dr. Kirpal Singh*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	07	15
2	05	10
3	08	10
4	08	15
5	05	10
6	08	15
7	15	25
Total	56	100

6.5 ELECTIVE

6.5.1 TRACTOR AND FARM EQUIPMENT

L T P
4 - -

RATIONALE

Diploma holder in Automobile Engineering have to deal with repair and maintenance of heavy duty vehicles such as tractors and farm equipments. The subject provides basic understanding of such vehicles and equipments. Hence this subject.

DETAILED CONTENTS

1. **Tractor** (08 Hrs)
Classification of tractors, main tractor assemblies, functions on farm tractors, types of engine used, Horse power requirement, human factor in tractor design. Prominent Indian makes tractors, specifications, selection, maintenance and operation of tractors.
2. **Tractor Theory** (06 Hrs)
Basics trends in tractor design, forces acting on a tractor on move, parallel pull and rolling resistance, tractor stability and weight distribution.
3. **Hydraulic System** (08 Hrs)
Functions of hydraulic system, hydraulic components, and methods of attaching implements classification of hydraulic controls for hitches, integral hitch system, three point hitches, and draft control system.
4. **Tractor Chassis** (06 Hrs)
Salient features of engine, clutch, power transmission, final drive, brakes and steeping of Indian tractors.
5. **Supplementary System** (06 Hrs)
Power take off shaft, draw bar working, belt pulley, tractor control unit.
6. **Tractor Wheels and Tyres** (06 Hrs)
Salient features of wheels and tyres, specifications of wheels and tyres, dual versus tandom tyres, tread design, effect of tyre inflation.
7. **Agricultural Equipment** (12 Hrs)
Types of agriculture equipment, trailer and mounted types, description and working principles of ploughs, single plough, disc plough, tiller, cultivator, reaper, winnowers, binder, thrasher , pumps, sprayers and attachments.
8. **Repair and Maintenance** (04 Hrs)
Faults and their rectification in tractor and farm equipment and their maintenance.

INSTRUCTIONAL STATREGY

The students are to be made well versant with working and constructional details of Tractors and Farm Equipment. Practical demonstrations will be more beneficial.

RECOMMENDED BOOKS

1. *Farm machines and equipment by C.P. Nakra, Dhanpat Rai and Sons.*
2. *Manual of Tractors by Joachian Konard, Asia Publishing house.*
3. *Tractors and Agriculture Equipment by Jain and Roy.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	16
2	06	12
3	08	15
4	06	10
5	06	10
6	06	12
7	12	20
8	04	05
Total	56	100

6.5.2 AUTOMOTIVE BODY

L T P
4 - -

RATIONALE

Automobile body is very important aspect of management/operation of vehicles. Basic knowledge to diploma students of automobile engineering is significant as they have to deal with the manufacture and up keep of auto body especially accident repair. Hence the subject is added in the syllabus.

DETAILED CONTENTS

1. **Auto Body** (08 hrs)
 - Introduction
 - Main features and functions of body
 - Body requirements
 - Types, shapes - Car, Jeep, Medium and Heavy truck Half body, Articulated
 - Design principles
 - Frame construction - tubular, interrelated, channel section, Car Frame, Truck frame, Ladder.

2. **Body Structures** (10 hrs)
 - Frame less construction
 - Integral construction
 - Semi Unitary or Endo - Skeleton
 - Unitary with sub-frame
 - Car body paneling
 - Special purpose bodies
 - Passenger and luggage requirements, all metal bodies, Coach built bodies.
 - Auto floors, cowl assembly, front end assembly, roof assembly, doors and door fittings.

3. **Body Materials** (10 hrs)
 - Requirements of body materials
 - Types of materials and their specifications
 - Timber - ply wood, fiber, boards
 - Steel, M.S. - Angle, Channel, Strips
 - Aluminum alloys - Sheets, Strips, Channels etc.
 - Rivets/Screws
 - Glass - Coloured glass
 - Toughened
 - Fiber reinforced
 - General parts like door handles, hinges, latches locks - Plastics, fiber glass

4. **Seating's and Upholstery** (10 hrs)
 - Importance/need of seats
 - Types of seats
 - Seat designs/cont-ours
 - Rigidity and comfort
 - Adjusting mechanisms

- Seat making
 - Seat materials- Rubber/Foam/Jute, mats/Springs Sutri
 - Seating clothes - Cotton, Rexins, Leather
 - Seats covers and colours, Correct, Upholstry, cuxtain, and curtain materials
 - Maintenance/cleanliness of seat and item of upholstery
 - Interior Fitting-covers/mats, decoration, electrical fittings.
4. **Safety Standards** (08 hrs)
- Safety standards regarding
 - Anchorage
 - Instruments/controls
 - Windshields, glass, wipers
 - Doors, Windows, Roofs
 - Head rests
 - Safety belts
6. **Body Maintenance and Accident repairs** (10 hrs)
- Periodic maintenance for nuts/bolts/latches and moveable parts.
 - General body repairs, replacement of panels and damaged portions, denting systematic, preparatory work, ironing of dents, finishing and patching welding, soldering. General and special tools and equipments for repair work.

INSTRUCTIONAL STATREGY

1. *Practical aspects of different bodies may be demonstrated.*
2. *Use of tools may be demonstrated.*

RECOMMENDED BOOKS

1. *Automotive Body by Anil Chhikara; SK Kataria Publication.*
2. *Automobile Engineering by G.B. Narang.*
3. *Automobile Engineering by K.M. Gupta.*
4. *Automobile Engineering by Dr. Kirpal Singh.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	15
2	10	20
3	10	15
4	10	20
5	08	12
6	10	18
Total	56	100

6.5.3 HEAVY EARTH MOVING MACHINERY

L T P
4 - -

RATIONALE

A diploma holder in Automobile Engineering has to deal with repair and maintenance of heavy duty vehicles. The subject provides basic understanding of such special vehicles.

DETAILED CONTENTS

- 1. Earth Moving Equipment** (25 hrs)
Function, classification and constructional features of the following: Excavators, scrapers, rippers, draglines, graders, shovels, trailers, loader. Dozers - Types, Poclain Difference in each type of engine used, features of clutch, power transmission, track chains, sprockets, springs and blades.
- 2. Hoisting Equipment** (12 hrs)
Brief introduction and description of hoist winch, part lines, hoisting chains, slings, fork lift truck, cranes. Factors affecting the selection of hoisting equipment.
- 3. Rollers** (06 hrs)
Types of rollers, type of engines used for rollers. Chassis, power transmission, steering, braking and other features.
- 4. Pneumatic Equipment** (08 hrs)
Function and salient features of pneumatic tools - rock drills, hammers, chippers. Air operated grease gun and spray gun.
- 5. Calculations of hire charges for various types of earth moving equipments.** (05 hrs)

INSTRUCTIONAL STATREGY

The students may be taken to workshops dealing in Repair of Heavy Earth Moving Machinery and given practical demonstration, expert lectures will also be beneficial.

RECOMMENDED BOOKS

1. *Construction Equipment by Mahesh Verma.*
2. *On and with the Earth by Jagman Singh.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	25	40
2	12	20
3	06	15
4	08	15
5	05	10
Total	56	100

6.5.4 MARKETING, SALES AND AUTO SPARES

L T P
4 - -

RATIONALE

A Diploma holder in Automobile Engineering is required to undertake marketing and sales. For this purpose, knowledge in the field of marketing is essential. This subject aims at providing necessary knowledge in taking marketing and sales decisions in the management of an enterprise.

DETAILED CONTENTS

1. **Introduction** (03 hrs)
 - 1.1 Role and importance of marketing in an organization / industry.
 - 1.2 Nature and scope of marketing.
 - 1.3 Marketing- scope and functions
 - 1.4 Marketing concepts and their applications in Indian context.

2. **Marketing System** (03 hrs)
 - 2.1 Factors affecting marketing environment.
 - 2.2 Influence of marketing environment of marketing strategy.

3. **Consumer Behaviour** (04 hrs)
 - 1.1 Consumer markets.
 - 3.2 Classifying products into consumers and industrial products
 - 3.3 Factors determining consumer behaviour
 - 3.4 Different models of consumer behaviour

4. **Market Research and Information Systems** (04 hrs)
 - 4.1 Functions of marketing research
 - 4.2 Steps in conducting marketing research and market survey.
 - 4.3 Designing a marketing information system for an organization.

5. **Sales Forecasting** (04 hrs)
 - 5.1 Sales forecasting and market potential.
 - 5.2 Different methods of sales forecasting.

6. **Market Segmentation** (05 hrs)
 - 6.1 Basic of market segmentation.
 - 6.2 Different types of market segmentation.
 - 6.3 Strategies for market segmentation.

7. **Market Planning** (04 hrs)
 - 7.1 Characteristics of market planning.
 - 7.2 Designing a marketing plan.
 - 7.3 Analyzing marketing planning process.

8. **Marketing Mix Strategies** (05 hrs)
 - 8.1 Elements of marketing mix.
 - 8.2 Formulating marketing mix strategies.

9. **Product Planning** (07 hrs)
 - 9.1 Product mix concept.
 - 9.2 Branding policies
 - 9.3 Packaging policies
 - 9.4 Product life cycle and underlying strategies.
 - 9.5 Introduction of a new product.

10. **Pricing Policies** (07 hrs)
- 10.1 Pricing objectives.
 - 10.2 Price setting in practice
 - 10.3 Different pricing strategies such as psychological pricing, unit pricing, prestige pricing, geographical pricing.
 - 10.4 Price change decisions.
 - 10.5 Discounts and allowances.
11. **Distribution Policies** (05 hrs)
- 11.1 Roles of agencies in distribution.
 - 11.2 Types of distribution channels.
 - 11.3 Designing a distribution channel.
 - 11.4 Evaluating a distribution channel.
 - 11.5 Criteria for selecting agencies.
 - 11.6 Physical distribution systems (Physical logistics).
12. **Sales Promotion Policies** (05 hrs)
- 12.1 Promotion mix- advertising, publicity, sale, promotion and personal selling.
 - 12.2 Advertising- objectives, media selection, designing advertising copy, evaluating advertising effectiveness.
 - 12.3 Sales promotion- tools, sales promotion at manufacturer, dealer, retailer levels.
 - 12.4 Sales management- selection, training, compensating, motivating and maintaining sales force.
 - 12.5 After Sales service. Management and Provision of after sales service in the area, various strategies.

LIST OF PRACTICAL

1. To establish a marketing strategy for a given product.
2. To design distribution channels for a given product.
3. To study consumer acceptability for a given product.
4. To write and evaluate an advertisement.
5. Identification of a new consumer product/industrial product and designing a Questionnaire for conducting market survey for given product.

INSTRUCTIONAL STATREGY

The teacher is required to demonstrate with the actual examples. The expert in the field to be invited for expert lectures. A visit to a reputed show room nearby may be arranged.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	05
2	03	05
3	04	08
4	04	08
5	04	07
6	05	10
7	04	07
8	05	10
9	07	15
10	07	15
11	05	05
12	05	05
Total	56	100

6.6 AUTO RECONDITIONING WORKSHOP

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- - 6

RATIONALE

A diploma holder in Automobile Engineering should have a reasonable practice in overhauling, reconditioning, pump calibration and maintenance of automobiles. This subject in actual practice of shop floor had been added to impart competency to handle above work areas.

DETAILED CONTENTS

1. Decarbonising of Engines - removing carbon deposits from engine combustion chamber, piston crown, and valve parts. Latest trends in decarbonising.
2. Inspection of crankshaft - bearing replacement and setting of journal bearings, crank pin bearings and crank shaft bearings, measuring bearing clearances by gauges.
3. Servicing of valve and valve mechanism - replacement of valves, valve seats, valve guide, checking and replacement of defective springs, facing of valve, tappet and rocker arm and seat reconditioning, lapping, adjusting of valve tappets.
4. Overhauling of Diesel engine.
5. Testing of fuel injector in fuel injection tester.
6. Calibrations of fuel injection pump on fuel calibration machine.
7. Operation and use of engine analyzer, analysis of diesel engine performance.
8. Surfacing of cylinder heads, cylinder blocks and manifolds with cylinder head re-facing machine.
9. Practice in cylinder ridge removing.
10. Practice in cylinder boring machine, measuring ovality and taperness of cylinder bore, using cylinder dial gauge, inside micrometer, telescopic gauge, use of direct reading micrometer.
11. Practice in honing cylinder blocks, keeping allowance of cylinder clearances.
12. Demonstration in crankshaft of metal spraying and grinding, measuring of ovality and taperness of journals and crank pins. Setting and grinding of cam shaft journals, heat treatment of crank shaft, crack detection and demagnetizing.
13. Practice of crankshaft, crankpin, journal grinding, main journal grinding on crankshaft grinding machine.
14. Aligning of the connecting rod.
15. Practice of cam shaft journals on line boring machine.

16. Practice in fitting cylinder liners - sleeving and desleeving.
17. Practice in nozzle grinding and lapping, setting of injection pressure and nature of spray.
18. Practice in bending and nipple forming of fuel pipes.
19. Practice on brake drum lathe, measuring ovality, skimming the brake drum.
20. Visit to Tyre retreading plant in the near by area.

RECOMMENDED BOOKS

1. *Automobile Engineering* by Kirpal Singh, Standard Publishers Distributors Limited, Delhi
2. *Automotive Electrical Equipment* by P.L. Kohli
3. *Automotive Electrical Equipment* by William H. Crouse
4. *Automobile Engineering* by R.B. Gupta, Satya Prakashan.

INSTRUCTIONAL STRATEGY

All the practical's need thorough practice by the students as it is required to be given more thrust. The students must understand the constructional details, functions of each of the parts and minute details of settings.

6.6 MAJOR PROJECT

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- - 8

RATIONALE

The practical training cum project work is intended to place students for project oriented practical training in actual work situations for the stipulated period with a view to :

- i) Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study.
- ii) Develop understanding of subject based knowledge given in the class room in the context of its application at work places.
- iii) Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems in the world of work.
- iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with minimal supervision. This experience is required to be planned and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnic may establish close linkage with 8-10 relevant organization for providing such an experience. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organizations. Each teacher is expected to supervise and guide 5-6 students.

Effort should be made to identify actual field problems as project work for the students. Project selected should not be too complex which is beyond the level of the students. The placement of the students for such a practical cum project work should match with the competency profile of students and the project work assigned to them. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below :

- (1) Punctuality and regularity
- (2) Initiative in learning/working at site
- (3) Level/proficiency of practical skills acquired
- (4) Ability of solve live practical problems
- (5) Sense of responsibility
- (6) Self expression/communication skills
- (7) Interpersonal skills/Human Relation
- (8) Report Writing Skills
- (9) Viva Voce

The projects given to students should be such for which someone is waiting for solution. Some of the suggested project activities are given below:

1. Projects connected with repair and maintenance of machine .
2. Claim Settlement of Accidental Vehicle

3. Body Fabrication.
4. Projects related to quality control.
5. Project work related to increasing productivity.
6. Project connected with work study.
7. Projects relating to erection, installation, calibration and testing.
8. Projects related to wastage reduction.
9. Problem related to value analysis/value engineering
10. Project related to mistake proofing.
11. Setting up of a Garage.
12. Overhauling and testing of Engine (using engine scanner).
13. Vehicle testing.