

STATE BOARD OF TECHNICAL EDUCATION, JHARKHAND																
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																
COURSE NAME : DIPLOMA IN AUTOMOBILE ENGINEERING																
COURSE CODE : AE																
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2011-12						
SEMESTER : SIXTH										DURATION : 16 WEEKS						
PATTERN : FULL TIME - SEMESTER																
SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									
				TH	TU	PR	PAPER HRS	TH (01)		PR (04)		OR (08)		TW (09)		SW (16006)
								Max	Min	Max	Min	Max	Min	Max	Min	
1	Management Ø	MAN	12219	03	--	--	03	100	40	--	--	--	--	--	--	
2	Automotive Electrical & Electronic Systems	AEE	12252	03	--	02	03	100	40	--	--	25#	10	25@	10	
3	Transport Management	TMT	12253	03	01	--	03	100	40	--	--	--	--	25@	10	
4	Vehicle Maintenance	VME	12254	03	--	04	03	100	40	50#	20	--	--	25@	10	
5	Industrial Project \$	IPR	12248	--	--	06	--	--	--	--	--	50#	20	50@	20	
6	Professional Practices- VI (AE)	PPS	12257	--	--	05	--	--	--	--	--	--	--	50@	20	50
7	ELECTIVE – II (Any One)															
	Alternate Energy Sources & Management \$	AES	12244	03	--	02	03	100	40	--	--	--	--	25@	10	
	CAD -CAM And Automation \$	CCA	12247	03	--	02	03	100	40	--	--	--	--	25@	10	
	Automobile Air Conditioning	AAC	12255	03	--	02	03	100	40	--	--	--	--	25@	10	
	Special Purpose Vehicles	SPV	12256	03	--	02	03	100	40	--	--	--	--	25@	10	
TOTAL				15	01	19	--	500	--	50	--	75	--	200	--	50
Student Contact Hours Per Week: 35 Hrs.																
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.																
Total Marks : 875																
@ Internal Assessment, # External Assessment, No Theory Examination, \$- Common to ME/PG/PT/MH/MI, Ø - Common to ME/PT/AE/MH/FE																
Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Termwork, SW- Sessional Work.																
➤ Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).																
➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.																
➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.																

Course Name : All Branches of Diploma in Engineering / Technology

Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/EE/EP/CH/CT/PS/CD/EDEI/CV/FE/IU/MH/MI

Semester : Sixth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/ CE/CS/ CR/CO /CM/IF/EE/EP/CH/CT/PS/CD/EDEI/CV/FE/IU and Seventh for MH/MI

Subject Title : Management

Subject Code : 12219

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by SBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

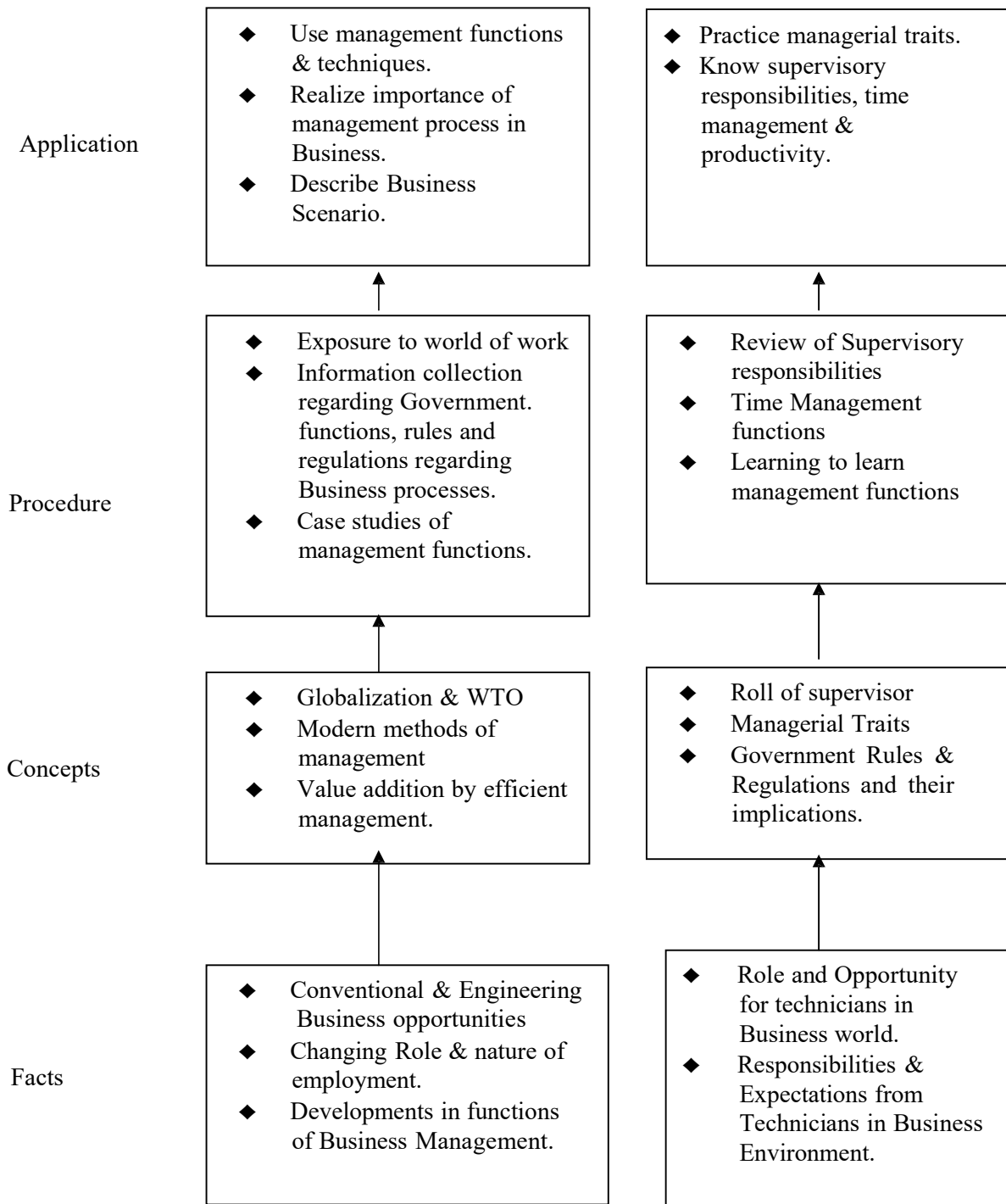
After completion of three years of technical training, Polytechnic students are expected to enter in to the World of Work. The business environment is altogether different and new to the students. A proper introduction and understanding of Business Processes is therefore essential for all Polytechnic students. Management is a subject which deals with basics of Managerial science required to understand the processes in Industrial & Commercial environment. This will enable the students of Polytechnics to become familiar and to understand various Business Organizational structures, their functioning and the Role these technicians will have to play in these setups with responsibilities.

Objective:

The students will be able to:

1. Familiarize environment in the world of work
2. Explain the importance of management process in Business.
3. Identify various components of management.
4. Describe Role & Responsibilities of a Technician in an Organizational Structure.
5. Apply various rules and regulations concerned with Business & Social responsibilities of the Technician.

Learning Structure:



Contents: Theory

Chapter	Name of the Topics	Hours	Marks
01	Overview of Business 1.1. Types of Business <ul style="list-style-type: none"> • Service • Manufacturing • Trade 1.2. Industrial sectors <ul style="list-style-type: none"> • Introduction to • Engineering Industry • Process Industry • Textile Industry • Chemical Industry • Agro Industry 1.3 Globalization <ul style="list-style-type: none"> • Introduction • Advantages & disadvantages w.r.t India 1.4 Intellectual Property Rights I(I P R) <ul style="list-style-type: none"> • Concept • Types of IPR 	02	04
02	Management Process 2.1 What is Management? <ul style="list-style-type: none"> • Evolution • Various Definitions • concept of Management • Levels of Management • Administration and Management • Scientific Management by F W Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management: <ul style="list-style-type: none"> • Planning • Organizing • Coordinating • Directing • Controlling • Decision Making 	07	14
03	Organizational Management 3.1 Organization <ul style="list-style-type: none"> • Definition • Steps in forming organization 3.2 Types of Organization <ul style="list-style-type: none"> • Line • Line & Staff • Functional • Project type 3.3 Departmentation <ul style="list-style-type: none"> • Centralized & Decentralized 	07	14

	<ul style="list-style-type: none"> • Authority & Responsibility • Span of Control (Management) <p>3.4 Forms of ownerships</p> <ul style="list-style-type: none"> • Proprietorship • Partnership • Joint stock company • Co-operative society • Govt. Sector 		
04	<p>Human Resource Management</p> <p>4.1 Personnel Management</p> <ul style="list-style-type: none"> • Introduction • Definition • Function <p>4.2 Staffing</p> <ul style="list-style-type: none"> • Introduction to HR • Introduction to HR Planning • Recruitment procedure <p>4.3 Personnel – Training & Development</p> <ul style="list-style-type: none"> • Types of training <ul style="list-style-type: none"> - Induction - Skill enhancement <p>4.4 Leadership & Motivation</p> <ul style="list-style-type: none"> • Leadership- Styles & types • Motivation –Definition , Intrinsic & Extrinsic • Moslow’s theory of Motivation and its significance <p>4.5 Safety Management</p> <ul style="list-style-type: none"> • Causes of Accidents • Safety Procedures <p>4.6 Introduction, Objectives & feature of Industrial Legislation such as</p> <ul style="list-style-type: none"> • Factory Act •ESI Act, •Workman Compensation Act, •Industrial Dispute Act. 	08	20
05	<p>Financial Management (No Numericals)</p> <p>5.1. Financial Management- Objectives & Functions</p> <p>5.2. Capital Generation & Management</p> <ul style="list-style-type: none"> • Types of capitals • Sources of finance <p>5.3. Budgets and Accounts</p> <ul style="list-style-type: none"> • Types of Budgets • Production Budget (including Variance Report) • Labour Budget • Introduction to Profit & Loss Account (Only concept) • Balance sheet etc. <p>5.4. Introduction to Various Taxes</p> <ul style="list-style-type: none"> • Excise Service Tax, • Income Tax 	08	18

	<ul style="list-style-type: none"> • VAT • Custom Duty. 		
06	Materials Management 6.1. Inventory Management (No Numericals) <ul style="list-style-type: none"> • Meaning & Objectives 6.2 ABC Analysis 6.3 Economic Order Quantity: <ul style="list-style-type: none"> • Introduction & Graphical Representation 6.4 Purchase Procedure <ul style="list-style-type: none"> • Objectives of Purchasing • Functions of Purchasing Department • Steps in Purchasing 6.5 Modern Techniques of Material Management <ul style="list-style-type: none"> • Introductory treatment to Just in Time(JIT)/ System Applications & Products (SAP) /Enterprise Resource Planning (ERP) 	08	18
07	Project Management (Simple /Elementary Numericals) 7.1 Project Management <ul style="list-style-type: none"> • Introduction & Meaning • Introduction to CPM/PERT Techniques (simple network problems) • Concept of Break Even Analysis and its significance 7.2 Quality Management <ul style="list-style-type: none"> • Definition of Quality, Concept of Quality, Quality Circle, Quality Assurance • Introduction to TQM, Kaizen, 5 'S' & Six Sigma 	08	12
Total		48	100

Learning Resources:**Books:**

Sr. No	Author	Title	Publisher
01	Dr. O.P. Khanna	Industrial Engg & Management	Dhanpal Rai & sons New Delhi
02	Dr. S.C. Saksena	Business Administration & Management	Sahitya Bhavan Agra
03	W.H. Newman E.Kirby Warren Andrew R. McGill	The process of Management	Prentice- Hall of India Pvt. Ltd. New Delhi - 110001

Video Cassetts:

Sr. No	Subject	Source
1	Business opportunity selection and guidance	Website : http://www.ediindia.org
2	Planning for completion and Growth	

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Sixth

Subject Title : Automotive Electrical and Electronic Systems

Subject Code : 12252

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25 #	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by SBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

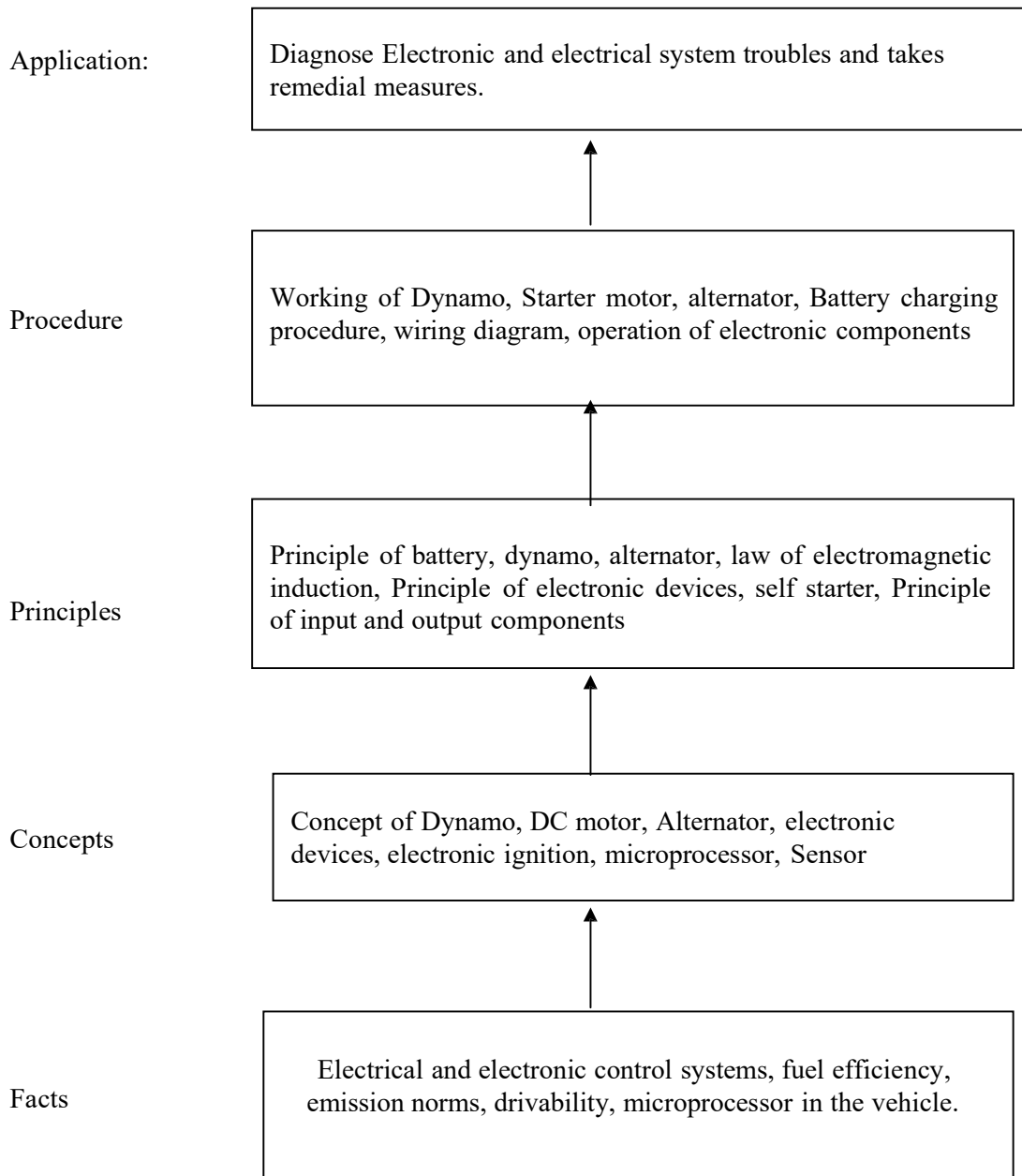
An Automobile engineer must have knowledge of electrical and electronic systems in vehicle because proper function of automobile depends on some important parts of electrical and electronic system. Nowadays use of microprocessor rapidly goes on increasing .The main aim of this subject is to impart the basic knowledge of electrical and electronic circuits as well as microprocessor in modern vehicles.

Objectives:

Students will be able to:

1. Diagnose and repair the defects in the circuits, to protect circuits & understand working of electromagnetic gauges as well as electrical accessories.
2. Understand the purpose, construction, rating, testing of battery & major reasons of battery failure.
3. Identify components, operation and testing of starting as well as charging system.
4. Understand the basic need, components, and operations of ignition system as well as trouble shooting of the ignition system.
5. Understand lighting system & accessories.
6. Troubleshoot various complaints in electrical & electronics system.

Learning Structure:



	<p>regulator and rectifier.</p> <p>3.6 Regulation- Electronic, Computer Regulation circuit layout and operation.</p> <p>3.7 Operation of charge indicator light circuit.</p>		
04	<p>Ignition Systems</p> <p>4.1 Need of ignition system.</p> <p>4.2 Triggering of Primary circuit – Inductive, Hall Effect and Optical method. Mutual Induction.</p> <p>4.3 Classification of ignition systems on basis of – a) triggering system b) source-battery & magneto c) spark timing- dual spark timing (vacuum and centrifugal advance), electronic spark timing</p> <p>4.3 Magneto ignition system- construction and working of CDI system.</p> <p>4.4 Components of ignition system:- Ignition coil types, Distributor, spark plug, cords, and condenser.</p> <p>4.5 Advance & retard timing mechanism-construction and working.</p> <p>4.6 Electronic (or solid state) ignition system with distributor- circuit diagram and working.</p> <p>4.7 Distributor less/ computer controlled coil ignition system operation.</p> <p>4.8 Sensors and Ignition Control Module for triggering and timing of spark.</p>	08	16
05	<p>Advanced lighting accessories -fundamentals</p> <p>5.1 Operation of automatic headlight dimming.</p> <p>5.2 Operation of automatic on/off headlight with time delay.</p> <p>5.3 Use and working of fiber optics & its diagnosis</p> <p>5.4 Operation of keyless entry</p> <p>5.5 Operation of common anti-theft system</p> <p>5.6 Purpose & operation of automatic door lock system</p>	05	12
06	<p>Diagnosis of electronic components & Systems</p> <p>6.1 Sensor testing:- Oxygen sensor, Engine coolant sensor, Intake air temp. sensor, Throttle position sensor, Manifold absolute pressure sensor.</p> <p>6.2 Electronic fuel Injector testing:- only sound test, Ohmmeter test.</p> <p>6.3 Onboard diagnosis (OBD):-</p> <p>6.3.1 Purpose of (onboard diagnostic second generation) OBD II, flash codes of Malfunction indicator light.</p> <p>6.3.2 OBD II terminology:- Drive cycle, Trip, Warm up cycle (Definitions only)</p> <p>6.3.3 SAE J2012 standards Diagnostic Trouble Code(DTC) :-5 digits only</p> <p>6.4 Troubles of electronic gauges like.</p> <p>6.4.1 Gauge reads low constantly.</p> <p>6.4.2 Gauge reads high constantly.</p> <p>6.4.3 Inaccurate Gauge reading.</p>	05	12
Total		48	100

Practical:

Skills to be developed:

Intellectual Skills:

- Understand various test procedures for battery as specified by manufacturer.
- Understand the precautions while handling a battery.
- Identify the alternator components, starter motor components and understand test procedure of some of the components.
- Understand principle of stroboscope operation and concept of ignition timing adjustment.
- Understand the test and service procedure for spark plug, distributor and spark plug cords.
- Identify and locate sensors and to understand diagnostic procedures (on-board and stand alone diagnosis).

Motor Skills:

- Take specific gravity reading using hydrometer, to correct it using temperature correction factor.
- Perform alternator tests as specified by manufacturer.
- Perform alternator component tests as specified by manufacturer.
- Measure parameters such as current, voltage drop using multimeter.

List of Practical:

1. Specific gravity of electrolyte, High rate discharge test of battery. Load test of battery.
2. Alternator-component identification and output test, Regulated Voltage Output Test charging circuit resistance test. Electrical testing of rotor and stator of alternator
3. Starter Motor –component identification, starter current draw test and voltage drop test.
4. Adjustment of ignition timing of a multi cylinder engine with strobe (neon light)
5. Inspection of spark plug cords, Servicing of spark plugs and distributor
6. Location and identification of sensors. Stand alone diagnosis.
7. Assignment - On Board Diagnosis.

Demonstration: Trainer kits as well as charts of electronic circuits may be prepared for Demo.

Learning resources:

Books:

Sr.No	Author	Title	Publisher
01	Barry Hollenbeck	Automotive Electricity, Electronics & Computer Controls	Delmar Publishers
02	Jack Erjavec, Robert Scharff	Automotive Technology: A System Approach	Delmar Publisher Inc
03	P. L. Kohli	Automotive Electrical Equipment	Tata McGraw-Hill
04	Trevor Mellard	Automotive electronic systems	ELBS

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Sixth

Subject Title : Transport Management

Subject Code : 12253

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	01	--	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by SBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

The industrial development in India has brought a great revolution in manufacturing of automobiles. The different requirements of transportation are achieved by automobile manufacturing. The technical knowledge of automobile engines, automobile transmission and maintenance can be used in the study of this subject. This creates opportunities of providing service to the passengers or goods transport business. The service industry provides good opportunity for automobile diploma engineers as service engineer or other employment opportunities. The reputation, quality of service, convenience of scheduling, economics depends up on the true knowledge of motor vehicle act, working of different transport organizations, standard methods of record keeping, use of computers, valuation of vehicles and driving skills. By keeping some of the objectives in mind, the subject Transport Management and Motor Industry is essential to learn.

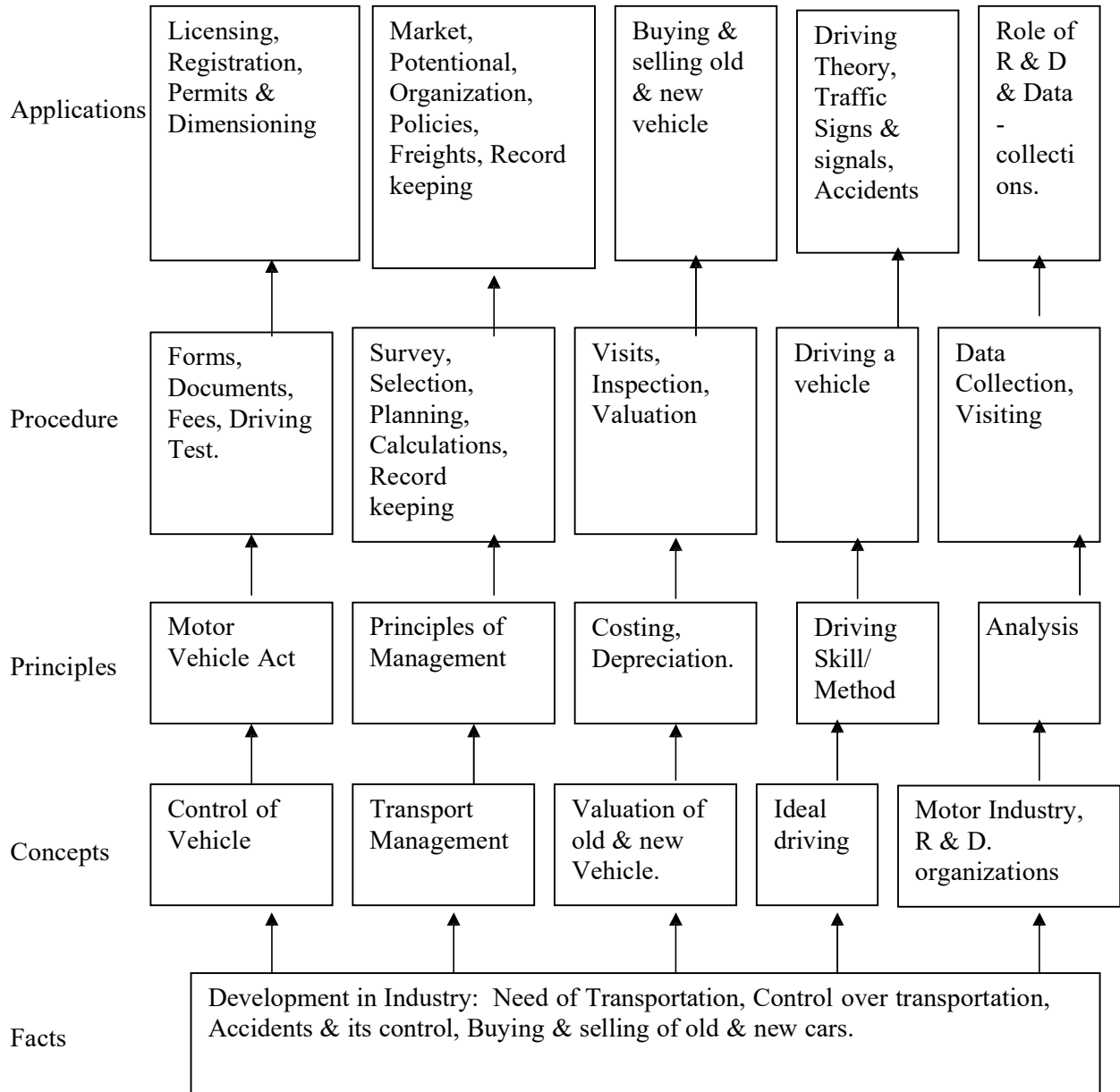
Objectives:

The students will be able to:

1. Study & fill up the forms required as per Motor Vehicle Act.
2. Prepare small project reports of bus / goods transport organization enabling him to work in different organizations like MSRTC, private organization.
3. Start SSI unit or may be able to work as service provider.
4. Understand, prepare the different documents used in transport organization. If necessary, he can modify the ideas of documentation.

5. Enter in the business of buying and selling of old & new vehicles.
6. Create awareness of ideal driving which includes safety, legal aspects.
7. Understand the purpose of research institutes in India, which are working on advancements of automobiles rather than adopting the idea of reverse engineering.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Introduction to transport management</p> <p>1.1 Motor Vehicle Act: Short titles used in MVA, Definitions, Terms regarding vehicle.</p> <p>1.2 Licensing of Drivers of Motor Vehicle: Necessity, Age limit, Responsibility of owners, Restriction on holding a driving license, General, Preliminary test and driving test.</p> <p>1.3 Conductor's license: Necessity, Eligibility, Documents required and rules for conductors.</p> <p>1.4 Registration of Vehicles: Necessity, Where to be made, How to be made, Temporary registration, Production of vehicle at the time of registration, Form and manner of display of registration mark, Size of letters and numerals of registration mark, Transfer of Ownership of Motor Vehicle.</p> <p>1.5 Control of Transport: Transport authorities, Difference between STA & RTA, Necessity of Permit, All types of Permit, Transfer of permit, Temporary permit, Tourist permit, National permit. Speed limits.</p> <p>1.6 Construction of Motor Vehicle: Overall dimensions, General provision regarding construction and maintenance of motor vehicle. Power of central government to make rules.</p> <p>1.7 Taxation: Objectives, Basis of taxation, Methods of levying tax, Tax exemption.</p> <p>1.8 Insurance: Motor Vehicle Insurance, No-fault liability, Procedure for accident claim.</p>	14	30
02	<p>Transport Management</p> <p>Part A</p> <p>2.1 Terms used in transportation: Road transport service, Transport vehicle, Public service vehicle, Goods vehicle, Public place, Depot, Route, Trip, Time table, Vehicle schedule, Fare.</p> <p>2.2 Comparison of Modes of transport.</p> <p>2.3 Requirements of goods and passenger transport on the basis of—Volume, type, weight of material; class of passenger.</p> <p>2.4 Basic elements in Transport Management:</p> <p>2.4.1 Market potential: Type of goods/ passengers, Period of use, Probable competition.</p> <p>2.4.2 Selection of vehicle: Type of load, Class of passenger, Type of service.</p> <p>2.4.2 Organization setup: Govt., Semi Govt., Private.</p> <p>2.4.4 Legal compliance:</p>	06	12

	<p>Documents required as per MVA, Registration.</p> <p>2.4.5 Policies of transport organization: Policies towards passenger, employees, like Long distance service, Express service, Night service and others.</p> <p>Part B</p> <p>2.4.6 Layout of organization: Location, elements considered in location, Passenger amenities, infrastructural facilities.</p> <p>2.4.7 Scheduling: Basic factors in bus, crew (staff) and maintenance scheduling, calculation of number of buses.</p> <p>2.4.8 Freight calculation: Time base, Distance base, Contract, per passenger, cubic feet tone method. Structure of fare, fixed cost- Maintenance cost, depreciation cost, insurance, interest on capital, variable cost, Hiring of trucks, Toll, staff wages, Miscellaneous cost.</p> <p>2.4.9 Record keeping : Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, various types of bookings, Use of Computer.</p>		
03	<p>Estimation and Valuation of Vehicle: 3.1 Role of surveyor. 3.2 Procedure of survey and valuation of vehicle. 3.3 Accident survey report. 3.4 Importance of warranty system and protection of law: How to deal with defects, benefits of warranty system. Protection of law.</p> <p>3.5 Buying a new vehicle: Factors to be considered - Ex-showroom price and on road price, use of vehicle, when and where to buy, Closing the deal, Running in. inspecting the vehicle, Points to check: test drive, Controls, Bonnet, Suspension, Switches, Seat, Noise, Ventilation, Safety, Boot, Interior Storage.</p> <p>3.6 Buying a used vehicle: When & where to buy: Dealers, used car firms, Private sellers, Garages, Auctions. Factors to be considered-- Depreciation, Model and year, Oil leak, Oil Pressure, Exhaust , Battery, Odometer, Bonnet, Crash damage, Rust, Suspension damage, Tyres, Switches & accessories, Lights, Chrome, Wiring , Steering, Hydraulic System, Structural corrosion, Floor, Test drive.</p> <p>3.7 Preparations for selling : When to sell, How to sell, Auctions, Garages, Private sale, Preparing the car, Documentation, Selling price, Safeguards.</p>	08	16

04	Driving skills: 4.1 Instructions in driving of motor vehicle : Driving theory, traffic education, light vehicle driving practice, Vehicle mechanism & repair, Public relations for drivers, Fire hazards, vehicle maintenance, first aid. 4.2 Traffic signs: Mandatory signs, Cautionary signs, Informatory signs. Traffic signals. Causes of accident and remedies. 4.3 Measures to avoid accidents 4.4 Defensive driving : 4.5 Rain and flood, fog and mist, snow and ice, 4.6 Fitness to drive : Driving and age, stress due to traffic jam, night driving.	08	16
05	Motor Industry 5.1 The Automobile Industry In India (Collection of Data of various companies) 5.2 Importance of Automobile Engineer. 5.3 Working of Various State Transport Organizations. (MSRTC, BEST)	08	16
06	6.1 Functions & Role in Automobile Industry: Various Research Organizations like- Central Institute of Road Transport. Automotive Research Association of India. Vehicle Research, Development & Establishment. Central Road Research Institute. Petroleum Conservation & Research Association	04	08
Total		48	100

Tutorials: (1 Hr/ Week)

The following tutorials / assignments may be completed by a group 5 or 6 students.

1. Study, fill up, highlight the important points & prepare report on following forms under M V rules --
 - a. Medical certificate
 - b. Learner's license.
 - c. Driving license.
 - d. Addition of license.
 - e. Renewal license
 - f. Registration of vehicle.
 - g. Transfer of vehicle.
2. Prepare a report on buying of a new vehicle.
3. Prepare a report on buying /selling an old vehicle.
4. Prepare a report showing different road signs and signals.

Note: It is recommended that the eligible student as per M.V. Act should seek license up to LMV.

Learning resources:

Books:

Sr. No.	Author	Title	Publication
01	Dr. P. Sudarsanam.	Passenger Amenities in STU	CIRT, Pune
02	Dr. P. Sudarsanam.	Fare structure in STU	CIRT, Pune
03	Dr. P. Sudarsanam.	Bus station Management	CIRT, Pune.
04	Dr. P. Sudarsanam	Bus & Crew scheduling	CIRT, Pune.
05	O.P. Khanna.	Industrial Organization & Management	Dhanpat Rai & sons
06	Dr. P.G. Patankar. Director.	Compedium of Transport Terms	CIRT, Pune
07	Bharat Kalaskar	Vahan Mitra	Sanjivini Prakashan, Pune
08	Book Of The Car	--	Drive Publications Limited Automobile Association

M. V. Acts:

Sr. No.	Title	Publication
1	Motor Vehicle Act, 1988	Home Department (M .S.)
2	Central M. V. Rules 1989	Home Department (M .S.)

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Sixth

Subject Title : Vehicle Maintenance

Subject Code : 12254

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	---	04	03	100	50#	--	25@	175

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by SBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

Vehicle maintenance is a advance technology subject. Perquisites for this subject are automobile engines, advance automobile engines, automobile transmission systems and automobile systems which are covered adequately in previous semesters.

Vehicle, engine and system components have definite life for which they give better performance. So, to get the best performance from the engine and systems, it is required to be maintained at regular intervals.

The proper maintenance of the components results in good fuel economy, least environmental pollution and reliability.

To do above task, an automobile engineer should have adequate knowledge of maintenance and maintenance methods.

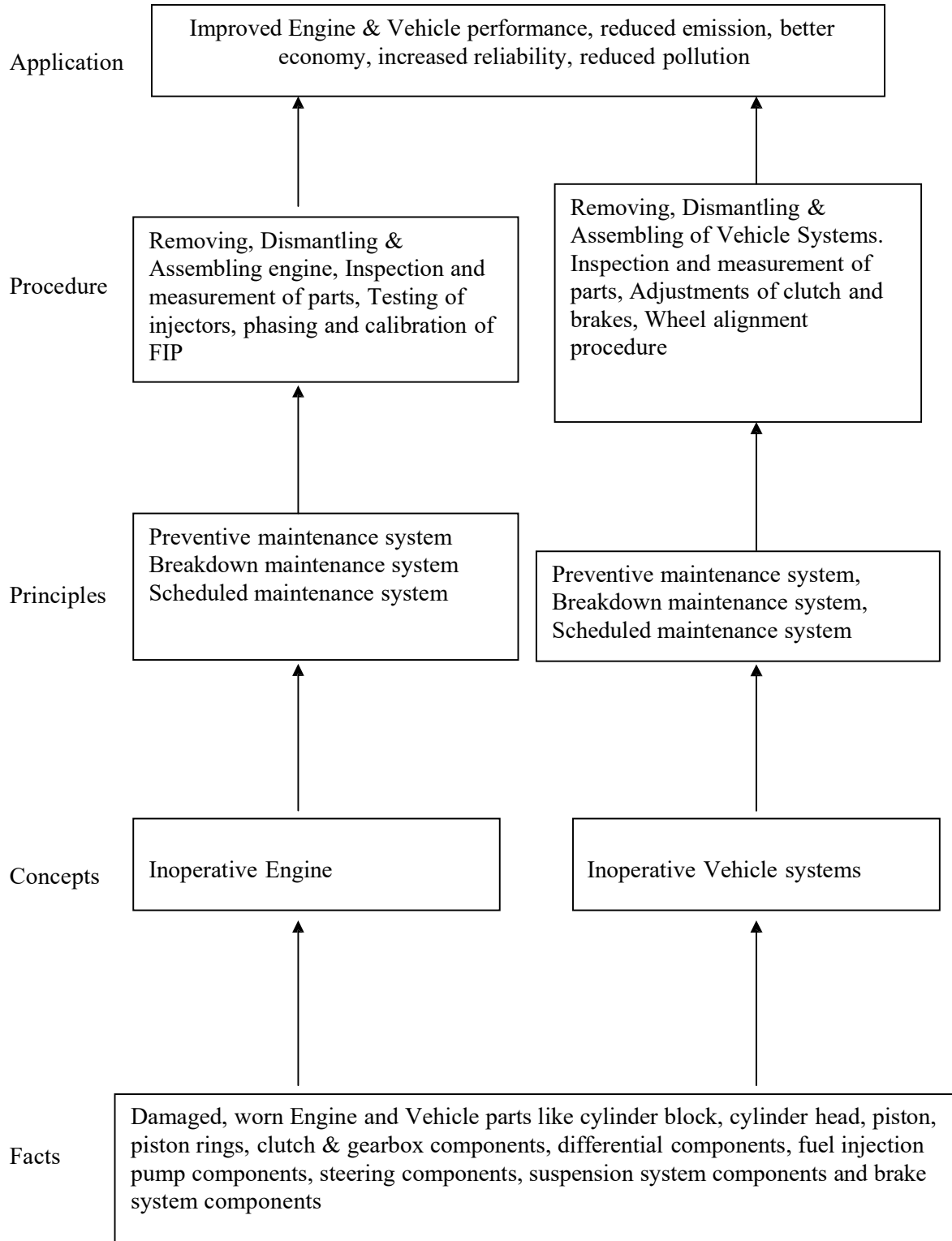
Objectives:

The student will be able to:

1. Understand use of tools and equipments.
2. Draw layout of Automobile workshop.
3. Compare and understand types of maintenance systems.
4. Critique whether to repair or replace.
5. Execute dismantling of assemblies.
6. Check the parts for proper functioning.

7. Execute various adjustments to be done for proper functioning.
8. Execute tuning of assemblies.

Learning Structure:



04	Chassis & Body Maintenance Part A: 4.1 Checking and repairing of Clutch for clutch plate thickness, run-out, rivet depth, warpage of pressure plate. 4.2 Adjustment of clutch. 4.3 Troubles, Causes and remedies of clutch. 4.4 Checking gearbox for run out of main shaft and lay shaft, for wear of synchronizer and worn bearings, checking oil seals. 4.5 Troubles, Causes and remedies of gearbox 4.6 Checking and adjusting differential for ring gear run-out, backlash in ring gear, tooth contact between ring gear and pinion, bearing preload. 4.7 Troubles, Causes and remedies of propeller shaft, differential and rear axle. 4.8 Inspection and repair of master cylinder, wheel cylinder, brake drum, brake disc, brake linings and brake pads. 4.9 Adjustment of hydraulic brakes – shoe clearance, brake pedal free travel, pedal to wall clearance, parking brake adjustment. 4.10 Bleeding of hydraulic brakes 4.11 Troubles, Causes and remedies in brake system.	10	20
	Part B: 4.12 Troubles, Causes and remedies of suspension system. Lubrication of leaf springs 4.13 Procedure of wheel alignment (after chassis height adjustment) by wheel alignment gauges and procedure of wheel balancing. Troubles, Causes and remedies of steering system. 4.14 Care of wheels and tires, retreading of tires and vulcanizing. Tire rotation. 4.15 Frame repairs (cracks, loose rivets, skewness in frames) and alignments. 4.16 Body repairs- denting, denting tools and equipments 4.17 Repainting procedure, patch work. 4.18 Painting defects. 4.19 Adjustment of doors and locks	09	20
Total		48	100

Practical:

Skills to be developed

Intellectual Skills:

- Select tool and equipment for vehicle maintenance.
- Diagnose faults and suggest remedies.
- Understand tuning, backlash and detonation.

Motor Skills:

- Put vehicle on the ramp

- Use diagnostic tester
- Use service manuals for maintenance of vehicle.

List of Practical:

1. Remove multi-cylinder engine from a vehicle, dismantle, clean, inspect and repair following components
 - cylinder head for warpage and cracks, refacing by grinding or cutting, straightening cylinder heads
 - cylinder block for measurement of ovality and taperedness , cylinder boring , honing process, changing of liners.
 - Piston and piston rings for wear, appearance, piston head for signs of deposits and detonation, oversize piston, ring groove clearance, removing and refitting rings.
2. Tuning of carburettor, tuning and maintenance of diesel fuel injection system.
3. Servicing lubrication system – change oil filter, check oil pump, diagnose causes for excessive oil consumption, external oil leakage, and low oil pressure in an automobile engine.
4. Overhauling of clutch and gear box- dismantling, inspection of clutch and gearbox parts – pressure plate, clutch plate, gear shaft bearing, synchromesh unit, shifting ring forks etc. repairing, replacement of components and reassembling of the clutch and gear box, adjustment of shifting mechanism. Adjust the clutch paddle.
5. Dismantle the propeller shaft and differential, Check wear in universal joints, straightness in propeller shaft, remove bushes and bearings and reassemble it. Check the differential gears for wear, run out, backlash, tooth contact. Adjust the final drive and obtain even tooth contact.
6. Adjustment of mechanical and hydraulic brakes and renewal of brake liners, repairing of master cylinder, wheel cylinder, brake chamber, brake bleeding, skinning scored brake drum.
7. To remove and refit the drag link and steering gearbox. Adjust joints and track rod ends. Do the Adjustment of steering gear to take up backlash.
8. Evacuation, charging and trouble shooting of Air conditioner.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	Tim Gills	Automotive Service	Delmar Publisher Inc.
02	Crouse / Anglin.	Automobile Mechanics	TATA McGraw – HILL
03	Anil Chikara	Automobile Engineering Vol. III Auto Marketing and Workshop Techniques	Satya Prakashan, New Delhi
04	Anil Chikara	Automobile Engineering Vol. IV Body repair techniques	Satya Prakashan, New Delhi
05	Anil Chikara	Automobile Engineering Vol. V Paint techniques	Satya Prakashan, New Delhi

06	Dr. Kirpal Singh	Automobile Engineering Vol. I	Standard Publishers.
07	Anthony Schwaller	Motor Automotive Technology	Delmar Publisher Inc.
08	Ken Layne	Automotive Engine Performance	Prentice Hall Career Technology
09	Ian Norman, Robert Scharff, John Corinchoke	Heavy Duty Truck System	Delmar Publisher Inc.
10	--	Santro & Accent Basic training Book	Hyundai Motors India Ltd.
11	--	Service Manuals of all Euro –II vehicles.	Maruti motors India Ltd.
12	S.Srinivasan	Automotive Mechanics	Tata McGraw Hill.

Course Name : Mechanical Engineering Group

Course Code : ME/MH/MI/AE/PG/PT

Semester : Sixth for ME/AE/PG/PT and Seventh for MH/MI

Subject Title : Industrial Project

Subject Code : 12248

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	06	--	--	--	50#	50@	100

Rationale:

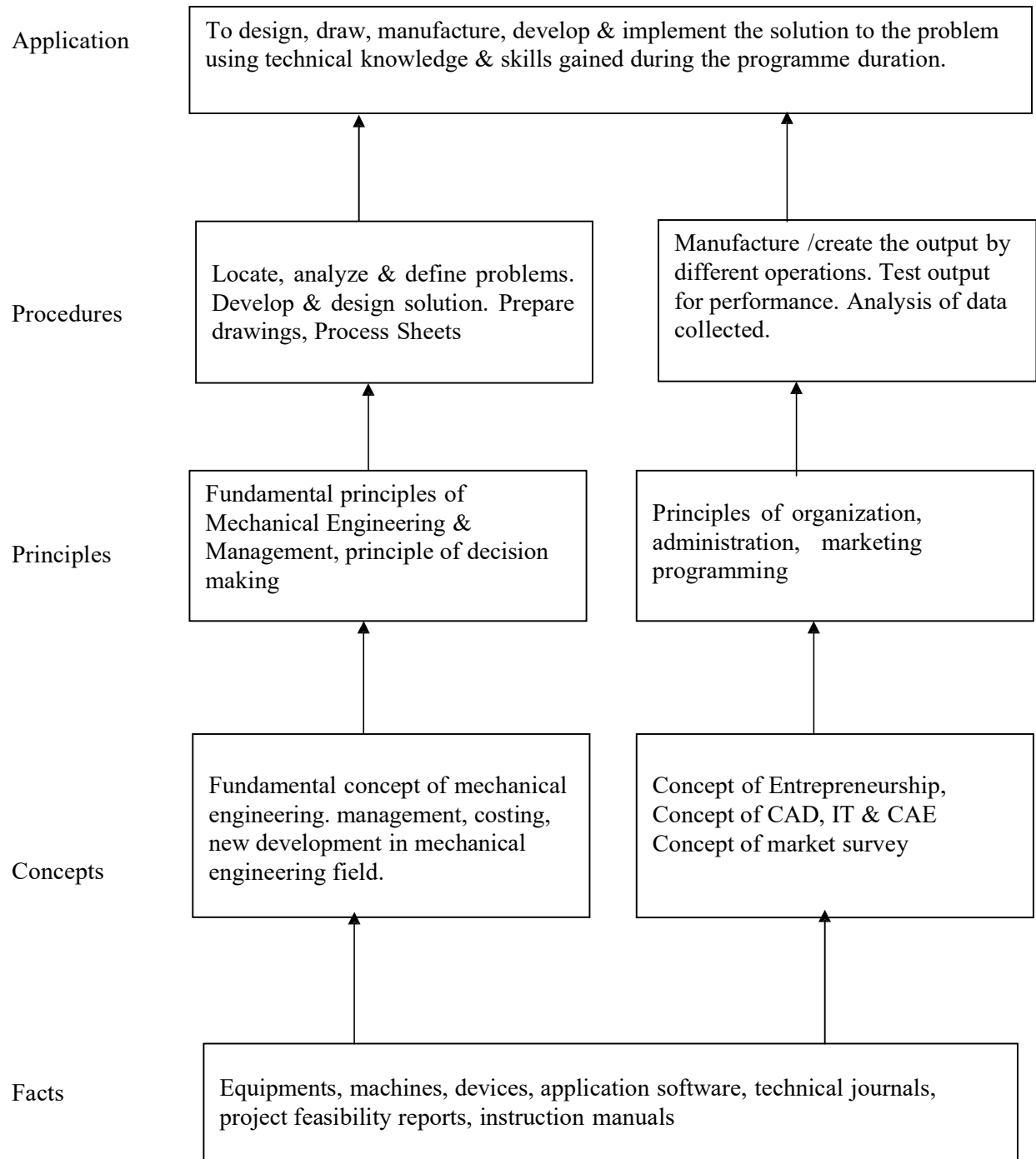
In practice the diploma technicians come across problems of varied nature. He/she will have to solve the problems involving drawings, designs, manufacturing, installation, testing and maintenance of machines. In order to cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, this particular subject is introduced. This subject will also help to enhance the generic skills & professional skills.

Objectives:

The student will be able to-

1. Identify, analyse & define the problem.
2. Generate alternative solutions to the problem identified.
3. Compare & select feasible solutions from alternatives generated.
4. Design, develop, manufacture & operate equipment/program.
5. Acquire higher-level technical knowledge by studying recent development in mechanical engineering field.
6. Compare machines/devices/apparatus for performance practices.
7. Work effectively in team.

Learning Structure:



Contents:

Skills To Be Developed:

Intellectual Skills

1. Design the related machine components & mechanism.
2. Convert innovative or creative idea into reality.
3. Understand & interpret drawings & mechanisms
4. Select the viable, feasible & optimum alternative from different alternatives.

Motors skills

1. Use of skills learnt in workshop practical.
2. Assemble parts or components to form machine or mechanisms.
3. Classify & analyze the information collected.
4. Implement the solution of problem effectively.

- Notes:** 1) Project group size: Maximum 4 students
2) Project report will be of minimum 40 pages unless otherwise specified.
3) Project diary should be maintained by each student.

Part A-Project

A batch of maximum 4 students will select a problem and then plan, organize & execute the project work of solving the problem in a specified duration. Student is expected to apply the knowledge & skills acquired. Batch may select any one problem/project work from following categories.

- a) Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/ demonstration models, etc. Report involving aspects of drawing, process sheets, costing, Installation, commissioning & testing should be prepared and submitted.
- b) Design & fabrication of mechanisms, machines, Devices, etc. Report involving aspects of designing & fabricating should be prepared & submitted .
- c) Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots etc.
- d) Industry sponsored projects- project related with solving the problems identified by industry should be selected. One person / engineer from industry is expected to work as co- guide along with guide from institution.
- e) Literature survey based projects: Project related with collection tabulation, classification, analysis & presentation of the information. Topic selected must be related with latest

technological developments in mechanical or mechatronics field, and should not be a part of diploma curriculum. Report should be of min 60 pages.

- f) Investigative projects- Project related with investigations of causes for change in performance or structure of machine or component under different constraints through experimentation and data analysis.
- g) Maintenance based projects: The institute may have some machine/ equipment/ system which are lying idle due to lack of maintenance. Students may select the specific machines/equipment/system. Overhaul it, repair it and bring it to working condition. The systematic procedure for maintenance to be followed and the report of the activity be submitted.
- h) Industrial engineering based project: Project based on work study , method study, methods improvement, leading to productivity improvement, data collection, data analysis and data interpretation be undertaken .
- i) Low cost automation projects: Project based on hydraulic/pneumatic circuits resulting into low cost automated equipment useful in the identified areas.
- j) Innovative/ Creative projects – Projects related with design, develop & implementation of new concept for some identified useful activity using PLC, robotics, non-conventional energy sources, CIM , mechatronics, etc.
- k) Environmental management systems projects: Projects related with pollution control, Solid waste management, liquid waste management, Industrial hygiene, etc, Working model or case study should be undertaken.
- l) Market research/ survey based projects: Projected related with identification of extent of demand, sales forecasting, Comparative study of marketing strategies, Compararative study of channels of distribution, Impact of variables on sales volume, etc. The project involves extensive survey & market research activities information to be collected through various mechanisms/tools & report be prepared.
- m) Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.
- n) Project can be selected other than the area specified above. Project should provide viable and feasible solution to the problem identified. Report should be of min 50 pages.

Part B- Seminar

Every student will prepare & deliver the seminar. Evaluation of seminar will be carried out by panel of at least three teaching staff from mechanical/ production /automobile department.

1. Selection of topic for the seminar should be finalized in consultation with teacher guide allotted for the batch to which student belongs.
2. Seminar report should be of min.10 & max. 20 pages & it should be certified by guide teacher and head of the department

3. for presentation of seminar, following guide lines are expected to be followed:-

- a) Time for presentation of seminar: 7 to 10 minutes /student.
- b) Time for question/answer : 2 to 3 minutes /student
- c) Evaluation of seminar should be as follows:-

Presentation: 15 marks

Use of A. V. aids: 05 marks

Question /answer: 05 marks

Total: 25 marks

d) use of audio visual aids or power point presentation is desirable.

4. Topic of the seminar should not be from diploma curriculum

5. Seminar can be on project selected by batch.

Learning Resources:

1. Books:

Sr. No	Author	Title	Publication
1	Karl Smith	Project management & Team work	Tata- Mc Graw Hill
2	Clifford gray & Erik Lasso	Project management	Tata- Mc Graw Hill

2. Magazines:

- 1. Invention intelligence magazine
- 2. Popular mechanics Journals/ Magazines

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Sixth

Subject Title : Professional Practices-VI (AE)

Subject Code : 12257

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	05	--	--	--	--	50@	50

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts.

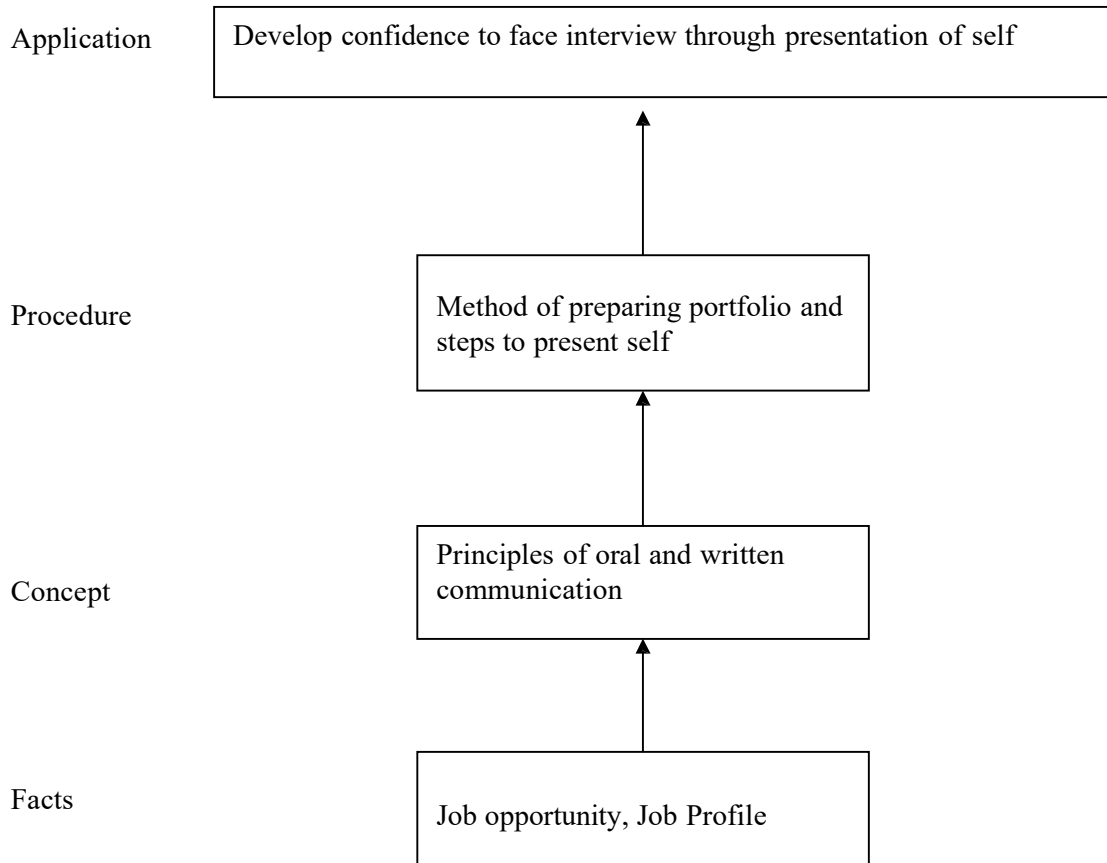
The purpose of introducing professional practices is to provide opportunities to students to undergo activities, which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

1. Acquire information from different sources.
2. Prepare notes for given topic.
3. Present given topic in a seminar.
4. Interact with peers to share thoughts.
5. Prepare a report on industrial visit, expert lecture.

Learning Structure:



Sr. No.	Activities	Hours
01	<p>Industrial Visits Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. TWO industrial visits may be arranged in the following areas / industries to observe - Material Handling System, quality control charts / production record / layout flow systems / Facilities / Hydraulic & pneumatic systems / Working of Boilers and steam engineering applications.</p> <ul style="list-style-type: none"> i) Auto / Electronic equipment manufacturing industry. ii) Modern service station or garage (understanding of latest scanning & testing equipments, auto air-conditioning) iii) Earth Moving Equipment Maintenance Shop. iv) Transport organization (records of transport , transport management) 	22
02	<p>Lectures by Professional / Industrial Expert / Student Seminars based on information search to be organized from any of the following areas (4 lectures of 2 hrs duration each):</p> <ul style="list-style-type: none"> a) Electrical accessories b) Types of Batteries c) Charging systems d) Electronic ignition system e) Advanced auto mobile lighting accessories f) Auto sensors & actuators g) Motor vehicle rules h) Transport management i) Estimation & valuation of a vehicle j) Buying a new / used vehicle k) Driving skills l) Motor industry m) Maintenance management & record keeping n) Engine / chassis / body maintenance o) Air conditioning & heating systems p) Earth moving machines q) Tractors r) Excavators s) Fork lift trucks t) Road- roller u) Automated Guided Vehicles (AGV) v) Career opportunities in RTO, Service stations, Marketing, Surveyor, Insurance, R&D, call centers ,CAD, NDT, Railways, Defense, Aeronautics, Marine, Software development, Information Technology w) Continuing education / Open universities programmes for diploma holders. 	14
03	<p>Information Search : Search information on any TWO of the following suggested topics and write a report (Group size – 3-5 students, Report – upto10 pages).</p> <p>Collection of information related to :</p> <ul style="list-style-type: none"> a) Buying of a new / old vehicle (cost, make, model etc.). b) Road signs, signals & traffic regulation. c) Motor vehicle taxes/ insurance. d) Elements of transport. e) Automotive batteries – Construction, features & specifications. f) Automotive electrical / electronic accessories. g) Starting & charging system. h) Maintenance management & record keeping. i) Chassis & body maintenance. j) A Special purpose vehicle. k) Maintenance of Automobile air-conditioning systems. 	20

04	<p>Group Discussion:</p> <p>The students should discuss in group of six to eight students and write a brief report on the same as a part of term work. The topics of (ANY TWO) group discussions may be selected by the faculty members. Some of the suggested topics are -</p> <ul style="list-style-type: none"> i) Solar Vehicles / Electric Vehicles. ii) Vehicles – Comparison. iii) Two stroke versus Four stroke automobile engines iv) Tribological aspects in automobiles v) Energy Conservation In Institutes vi) Creativity and Innovativeness. vii) Attributes of Product Design 	10
05	<p>Student Activities :</p> <p>The students in a group of 3 to 4 will perform any one of the following activities (other similar activities to be considered), and write a report as part of term work.</p> <p>Activity (Any Two):</p> <ul style="list-style-type: none"> i) Collecting internal communication forms. ii) Collecting Failure data for automobile / machines / equipments. iii) Study of Hydraulic Circuit of any one system/machine tool like – dumpers, Earth moving equipment, Auto service station. 	14
Total		80

Course Name : Mechanical Engineering Group

Course Code : ME/MH/MI/AE/PG/PT

Semester : Sixth for ME/AE/PG/PT and Seventh for MH/MI

Subject Title : Alternate Energy Sources and Management (Elective-II)

Subject Code : 12244

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- Two tests each of 25 marks to be conducted as per the schedule given by SBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)

Rationale:

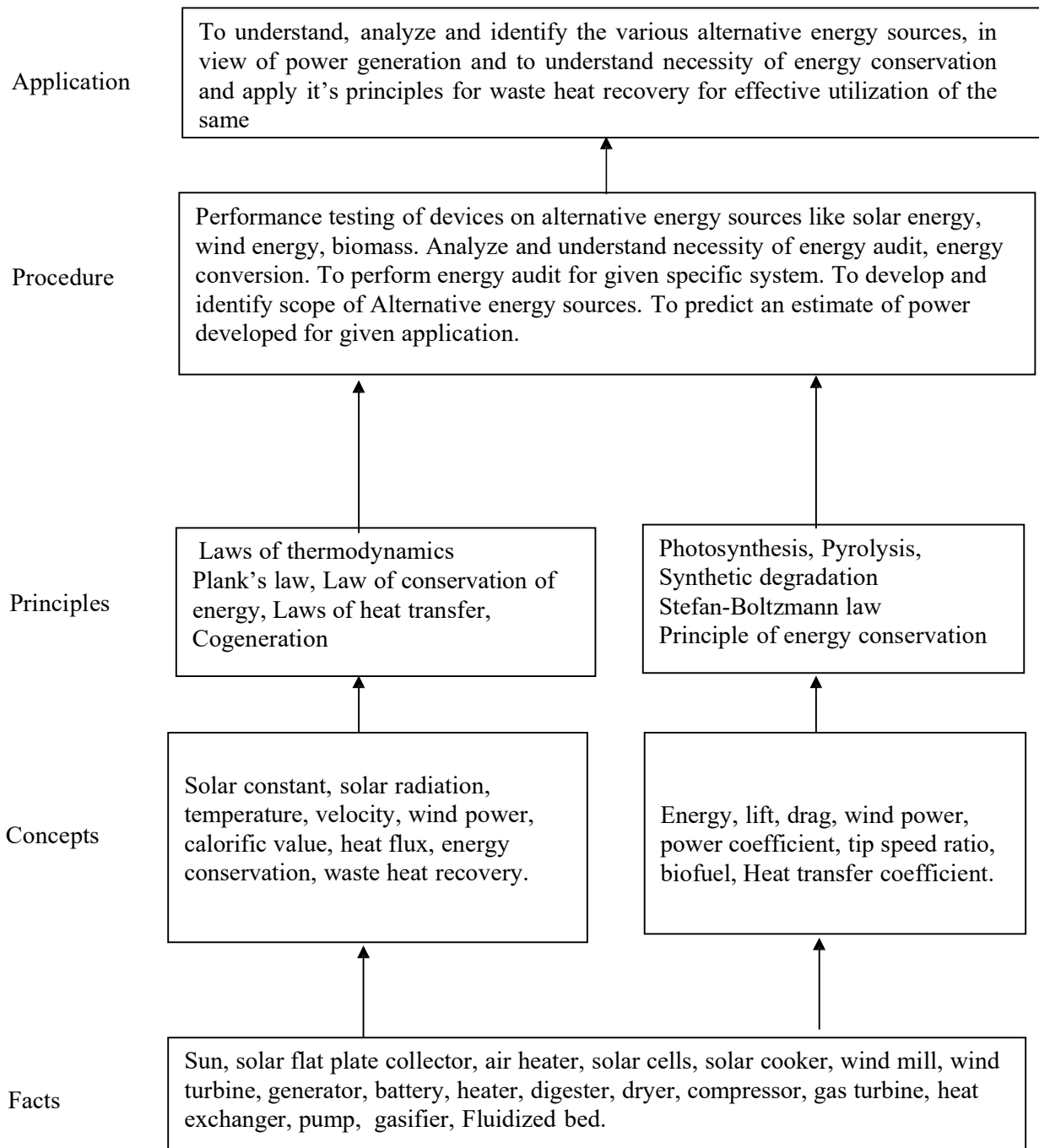
Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population and enhanced standard of living and life style of people. The conventional sources of energy are insufficient to meet these demands. These are polluting the environment disturbing ecobalance. Hence, alternative energy sources are utilized for power production. The use of alternate energy sources is increasing day by day. Diploma engineers are expected to develop, operate and maintain these systems. It is therefore essential to know basics of energy conversion, conservation, and energy audit and waste heat recovery techniques.

Objectives:

Students should be able to:

1. Develop awareness for effective utilization of alternative energy sources.
2. Identify different components of solar energy and wind energy devices.
3. Identify and analyze biomass plant.
4. Identify and apply energy conservation techniques for commonly used power absorbing and generating devices.
5. Apply principles of energy conservation and energy management techniques.
6. Develop awareness about Energy Audits.

Learning Structure:-



Contents: Theory:

Chapter	Name of the Topic	Hours	Marks
01	Introduction to Energy Sources 1.1 Introduction. 1.2 Major sources of energy: Renewable and Non-renewable. 1.3 Primary and secondary energy sources. 1.4 Energy Scenario: <ul style="list-style-type: none"> • Prospects of alternate energy sources. • Need of Alternate energy sources. 	06	12
02	Solar Energy 2.1 Principle of conversion of solar energy into heat and electricity 2.2 Solar Radiation: Solar Radiations at earth's surface <ul style="list-style-type: none"> • Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle 2.3 Applications of Solar energy: - <ul style="list-style-type: none"> • Construction and working of typical flat plate collector and solar concentrating collectors and their applications, • advantages and limitations • Space heating and cooling. • Photovoltaic electric conversion. • Solar distillation, Solar cooking and furnace. • Solar pumping and Green House. • Agriculture-Solar drying for foods • (no derivations and numerical) 	12	20
03	Wind Energy 3.1 Basic Principle of wind energy conversion. 3.2 Power in wind, Available wind power formulation, Power coefficient, Maximum power 3.3 Main considerations in selecting a site for wind mills. <ul style="list-style-type: none"> • Advantages and limitations of wind energy conversion. 3.4 Classification of wind mills <ul style="list-style-type: none"> • Construction and working of horizontal and vertical axis wind mills, their comparison • Main applications of wind energy for power generation and pumping. 	08	14
04	Energy from Biomass 4.1 Common species recommended for biomass. <ul style="list-style-type: none"> • Methods for obtaining energy from biomass 4.2 Thermal classification of biomass <ul style="list-style-type: none"> • Gasifier, • Fixed bed and fluidized • Application of gasifier 4.3 Biodiesel properties, production and application 4.4 Agriculture waste as a biomass <ul style="list-style-type: none"> • Biomass digester 	06	14

	<ul style="list-style-type: none"> • Comparison of Biomass with conventional fuels 		
05	Energy Conservation & Management 5.1 Energy scenario in various sectors and Indian economy 5.2 Need and importance of energy conservation and management 5.3 Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.	04	12
06	Energy Conservation Techniques 6.1 Distribution of energy consumption <ul style="list-style-type: none"> • Principles of energy conservation. • Energy audit • Types of audit 6.2 Methods of energy conservation <ul style="list-style-type: none"> • Cogeneration and its application • Combined cycle system 6.3 Concept of energy management 6.4 Study of different energy management techniques like <ul style="list-style-type: none"> • Analysis of input • Reuse and recycling of waste • Energy education • Conservative technique and energy audit 	06	16
07	Economic approach of Energy Conservation 7.1 Costing of utilities like steam, compressed air, electricity and water. <ul style="list-style-type: none"> • Ways of improving boiler efficiency 7.2 Thermal insulation, Critical thickness of insulation 7.3 Waste heat recovery systems, their applications, criteria for Installing unit. 7.4 An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.	06	12
Total		48	100

Assignments:

- 1) To collect information about global and Indian energy market.
- 2) To perform an experiment on solar flat plate collector used for water heating.
- 3) To study and analyze performance of Solar street lighting System.
- 4) To study construction and working of photo voltaic cell.
- 5) To study construction, working and maintenance of solar cooker.
- 6) Visit to plant of solar heating system for hotel/hostel/railway station etc.
- 7) To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
- 8) To visit a biomass/ biogas plant of municipal waste or else where.
- 9) Perform energy audit for workshop/Office/Home/SSI unit.

10) Study of various waste heat recovery devices.

Learning Resources:

1. Books:

Author	Title	Publication
Dr B.H.Khan	Non conventional energy Resources	Tata McGraw Hill
G. D. Rai	Non conventional energy sources	Khanna publication
S. P. Sukhatme	Solar energy	Tata McGraw Hill
H. P. Garg	Solar energy	Tata McGraw Hill
Arrora Domkundwar	Power plant engineering	Dhanpat Rai & co.
P.H. Henderson	India- The energy sector	Oxford University Press
D. A. Ray	Industrial energy conservation	Pergaman Press
W. C. Turner	Energy management handbook	Wiley Press
K. M. Mittal	Non-conventional energy source	--
Krupal Singh Jogi	Energy resource management	Sarup and sons

2. Cassettes/CD/websites:

1. CDs developed by National Power Training Institute, (Under the ministry of Power, Government of India) Opposite VNIT, South Ambazari road, Nagpur
2. Website of Bureau of Energy and Efficiency. (www.bee-india.nic.in)
3. Website for Akshay Urja News Bulletin. (www.mnes.nic.in)

Course Name : Mechanical Engineering Group

Course Code : ME/AE/MH/MI/PG/PT

Semester : Sixth for ME/AE/PG/PT and Seventh for MH/MI

Subject Title : CAD-CAM & Automation (Elective – II)

Subject Code : 12247

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by SBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

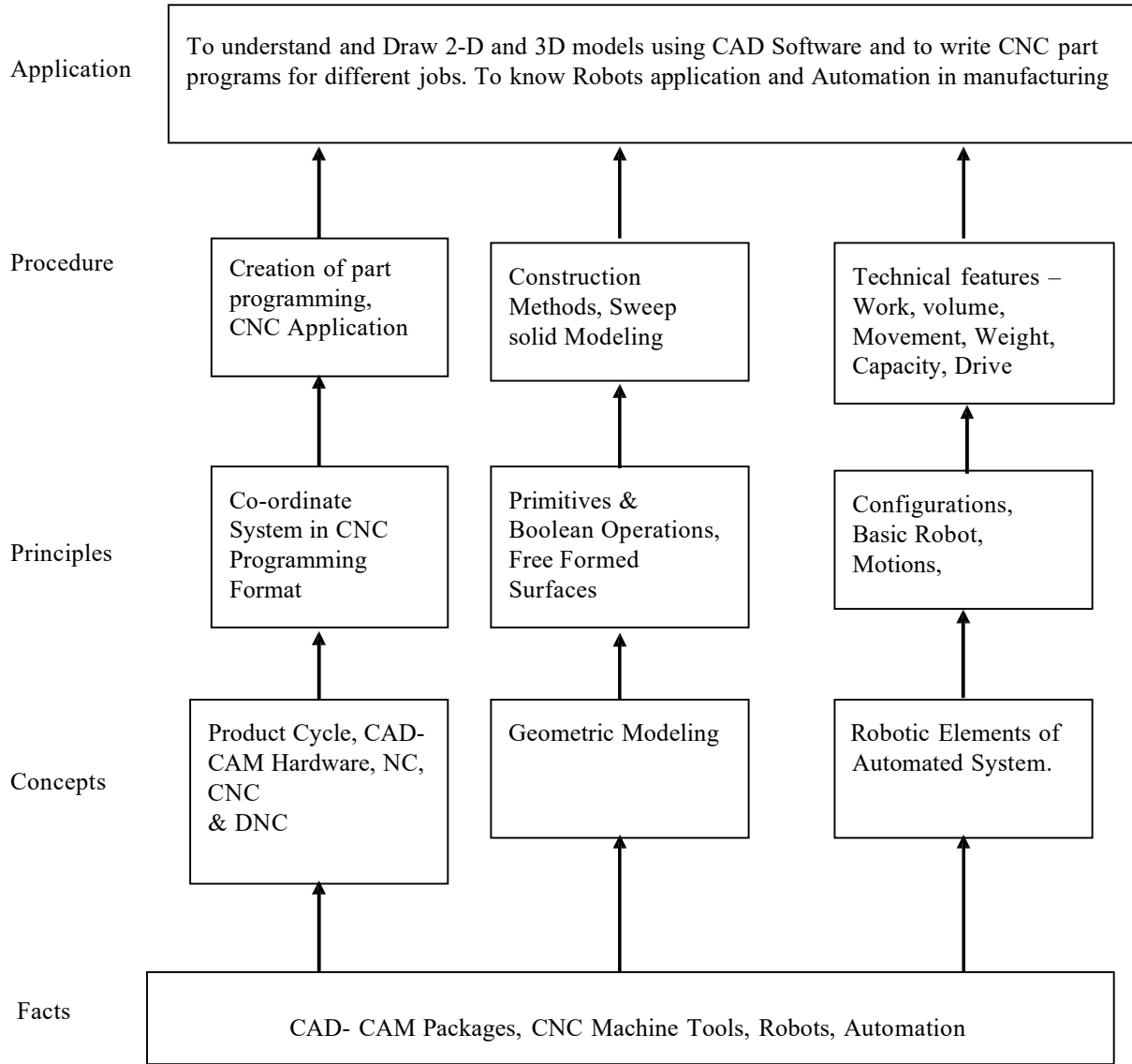
The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time .To satisfy this need the use of CAD/CAM & automation is inevitable. To satisfy industrial need, diploma engineer should be able to cope with CAD/CAM technology. With this intention this subject is introduced in the curriculum. The prerequisites of this subject have been introduced in earlier subjects such as engineering graphics, engineering drawing & mechanical engineering drawing.

Objectives:

Student should be able to:

1. Understand the fundamentals & use CAD.
2. Conceptualize drafting and modeling in CAD.
3. Prepare CNC part programming.
4. Operate CNC machines.
5. Conceptualize automation and FMS.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Introduction to CAD/CAM Role and Need of Computers in industrial manufacturing. Product Cycle, CAD/CAM. CAD/CAM hardware:- Basic structure, CPU, Memory, I/O devices, Storage devices and system configuration.	06	12
02	Geometric Modeling Requirement of geometric modeling, Types of geometric models. Geometric construction methods:-sweep, solid modeling- Primitives & Boolean operations, free formed surfaces (Classification of surface only), Rapid Prototyping (No numerical treatment)	08	16
03	Introduction to computer numerical Control Introduction - NC, CNC, DNC, Advantages of CNC, The coordinate system in CNC, Motion control system - point to point, straight line, Continuous path (Contouring). Absolute system and Incremental system, Feedback control system, Application of CNC.	06	16
04	Part programming Fundamentals, manual part programming, NC –Words, Programming format, part programming, use of subroutines and do loops, computer aided part programming (APT).	10	20
05	Industrial Robotics Introduction, Types of Robots and their working principle, physical configuration, basic robot motions, technical features such as - work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. Applications – Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.	10	20
06	Automation Basic elements of automated system, advanced automation functions, levels of automation. Flexible manufacturing system :-Introduction, Scope and benefits, Types, Major elements of FMS, FMS equipment, FMS application, Introduction to CIM Lean Manufacturing :- Introduction	08	16
Total		48	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Interpret the various features in the menu of solid modeling package.
2. Synthesize various parts or components in an assembly.
3. Prepare cnc programmes for various jobs.

4. Understand the concept of finite element method.
5. Prepare a report of visits.

Motor Skills:

1. Operate a turning center and a machining center.
2. Operate and use solid modeling packages for drawing of assemblies.
3. Draw sketches of assemblies for converting into solid models.
4. Handle various tools used in cnc.

List of Practicals:

1. Two assignments on CAD for 2D drafting.
2. Two assignments on CAD for 3D Modelling.
3. Manufacturing one turning and one Milling component on CNC.
4. At least four assignments on part programming using subroutines do loops for turning and milling component.
5. Report writing on visit to industry having CNC machine.
6. Report writing on visit to industry having robot Application.
7. Report writing on visit to Industry having Automation in manufacturing.

Learning Resources:

Books:

Sr. No.	Author	Title	Publication
01	P.N.Rao	CAD/CAM Principles and Applications	Tata McGraw-Hill
02	RadhaKrishna P. & Subramanyam	CAD/CAM/CIM	Wiley EasternLtd
03	B.S.Pabla and M.Adithan	CNC Machine	New age International(P)Ltd
04	Groover M.P. & Zimmers Jr	Computer Aided design and manufacturing	Prentice hall of India

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Sixth

Subject Title : Automobile Air Conditioning (Elective-II)

Subject Code : 12255

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25 @	125

Rationale:

All the major global players in Automobile sector have launched their products in India. Modern cars, Multi-utility vehicles, heavy passenger & goods vehicles are equipped with “heating ventilation & air conditioning (HVAC) system”. HVAC system not only provides comfort but also ultimately results in road safety. HVAC servicing, therefore offers good job opportunities for diploma engineers. The prerequisite for this subject is Heat Power engineering & Hydraulics & Pneumatics.

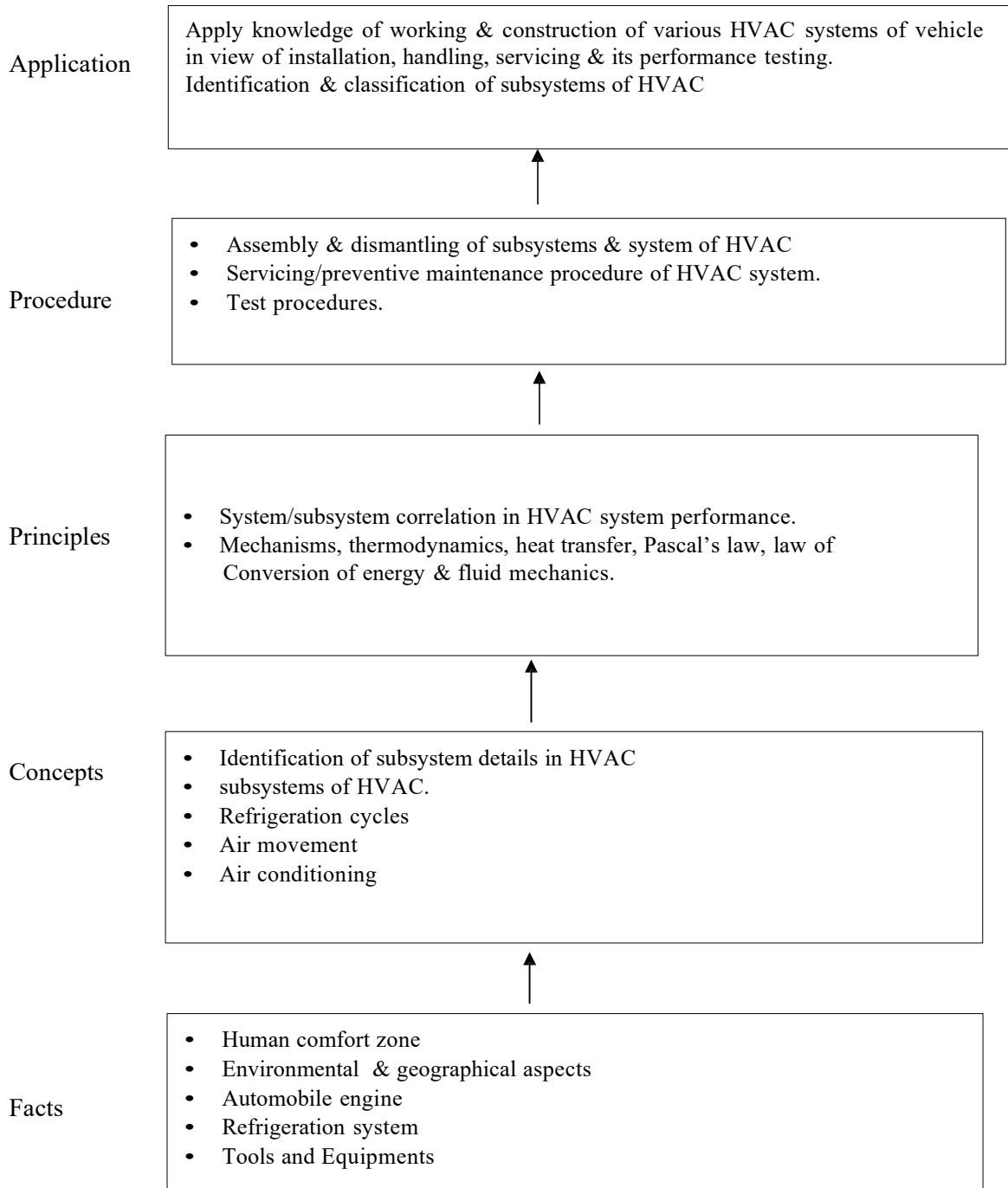
This subject will make student to understand & apply the knowledge in servicing various systems & subsystems of HVAC.

Objective:

The student will be able to:

1. Identify various HVAC systems and sub systems.
2. Explain working & construction of HVAC Systems and sub systems.
3. Carry out repair and maintenance of HVAC Systems and sub systems.
4. Carry out retrofitting and alteration of HVAC Systems.
5. Know environmental aspects related to HVAC Systems.

Learning Structure:



Contents: Theory**Note:** No numerical be asked in examination

Chapter	Name of Topic	Hours	Marks
01	Introduction <ul style="list-style-type: none"> • Environmental & safety aspects in heating, ventilation & air conditioning systems • Human comfort control - comfort zone, air movement, wind chill factor, odour problems & effects of humidity. <ul style="list-style-type: none"> • Heat transfer fundamentals- forced & natural convection, radiation, evaporation & conduction. • Requirements of heating, ventilation & air conditioning in cars, multi utility vehicles, vans, safari, heavy passenger vehicles, coaches, cargo vehicle cabin, vehicle carrying perishable commodities & cryogenic substances. • Controlled & uncontrolled ventilation - working, application & comparison. 	06	16
02	Case & Duct System <p>2.1 Construction & working of Air intake section, core section & distribution section.</p> <p>2.2 Construction & working of Downstream, upstream, split & hybrid.</p> <p>2.3 Construction & working of rear heating & cooling system.</p>	06	12
03	Air Conditioning System Part A <ul style="list-style-type: none"> • General layout of Air conditioning system. • Construction & working of following refrigeration sub systems – thermostatic expansion valve, fixed orifice tube & rotary vane air cycle system. • Construction & working of evaporator, condenser, accumulator. • Receiver driers & accumulator- Types, construction & working • Construction & working of reciprocating, scroll & rotary vane compressors. Drive systems for compressors. 	06	14
	Part B <p>3.6 Construction & working of electromagnetic clutch</p> <p>3.2 Metering devices- comparison of thermostatic expansion valve & fixed orifice tube. Types working & comparison of thermostatic expansion valves i.e. H valve, block type, internally equalized & externally equalized.</p> <p>3.3 Functions of thermostatic expansion valve i.e. Throttling action, modulating action & controlling action. Construction & working of remote bulb.</p>	06	12

04	<p>System Control Devices & Electrical Circuits</p> <p>4.1 System controls - Construction & working of typical vacuum system & electronic temperature control system.</p> <p>4.2 Construction & working of vacuum operated devices i.e. vacuum reserve tank, vacuum restrictor, vacuum motor, check valve & check relays.</p> <p>4.3 Switches - Construction & working of high- side temperature switch, low-side temperature switch, high-pressure switch, low- pressure switch, pressure regulator, ambient switch & superheat switch.</p> <p>4.4 Sensors- Construction & working of sun load sensor, outside temperature sensor & in car temperature sensors.</p> <p>4.5 Construction & working of Aspirator.</p> <p>4.6 Construction & working of blower clutch control, heater control, and time delay relay for heater control.</p> <p>4.7 Mode doors and temperature doors.</p> <p>4.8 Electrical circuits- Typical climate control system & Electronic climate control system, their electrical circuits & working.</p>	11	22
05	<p>Repairs & maintenance of Air Conditioning system</p> <p>5.1 Visual & acoustic check, side glass, leak test, temperature test, Procedure of charging & discharging. Moisture removal procedure.</p> <p>5.2 Service equipments & tools – Vacuum pump, Manifold & gauge i.e. Low side & high side, gauge calibration, recovery unit & recycling unit, Halide (freon) & Fluorescent leak detector, nitrogen leak test</p> <p>5.3 Compressor service - Symptoms, faults, cause & remedy.</p> <p>5.4 Electromagnetic clutch service - Symptoms, faults, cause & remedy.</p> <p>5.5 Performance testing procedure of thermostatic expansion valve & fixed orifice tube.</p> <p>5.6 Refrigerant lubricants- Properties & types</p> <p>5.7 Refrigerant- types, Packaging, storage, restrictions, color code & purity test</p> <p>5.8 Hoses & connectors – construction of system hoses, charging hose with shutoff valve & connectors.</p> <p>Retrofitting from CFC- R12 to HFC- 134 A – need, procedure & Precautions</p>	09	16
06	<p>Comfort Heating System</p> <p>6.1 Function, construction, working, maintenance, general faults and their remedies of Comfort Heating System.</p>	04	08
Total		48	100

Practical:

Skills to be developed:

Intellectual Skills:

- Select tools for servicing of heating, ventilation & air conditioning system. (HVAC).
- Diagnose electrical system faults, control system faults.
- Diagnose various faults in car HVAC system.
- Understand charging & evacuation procedures of refrigerant from the HVAC system.
- Understand construction of three different compressors & to identify them.

Motor Skills:

- Perform lubrication of air conditioning system & servicing of heating system as per manufacturer's service procedure.
- Carry-out diagnostic procedure to trace faults in car heating, ventilation & air conditioning.

List of Practical:

Sr. No	Name of Practical
01	Demonstration of all parts of all subsystems & assembly & disassembly of three different types of compressors.
02	Identification & use of tools, gauges & equipment for servicing.
03	Demonstration of charging & evacuation of refrigerant from system.
04	Demonstration of leakage testing using soap solution & other techniques.
05	Diagnosis of electrical systems faults.
06	Diagnosis of control systems faults.
07	Perform lubrication of A C system & servicing of heating system.
08	Retrofitting from CFC- R12 to HFC- 134 A
09	Diagnosis of various running faults in car HVA C

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	Boyce H. Dwiggin	Automobile Air Conditioning	Thomson Learning
02	--	Service Manual	Subros Company
03	--	Service Manual	Sanden Company
04	--	Service Manual	Baher Company

CD.s:

1. C. D. on various Topics of Automobile Engineering By SAE Publisher.

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Sixth

Subject Title : Special Purpose Vehicles (Elective-II)

Subject Code : 12256

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

Rationale:

In the fast developing economy of India, the infrastructure development is at its peak. Earth moving machines are integral part of infrastructure development activity.

India being largest market of Tractor in the world, it is necessary for automobile engineer to have full knowledge of tractor or agricultural machinery.

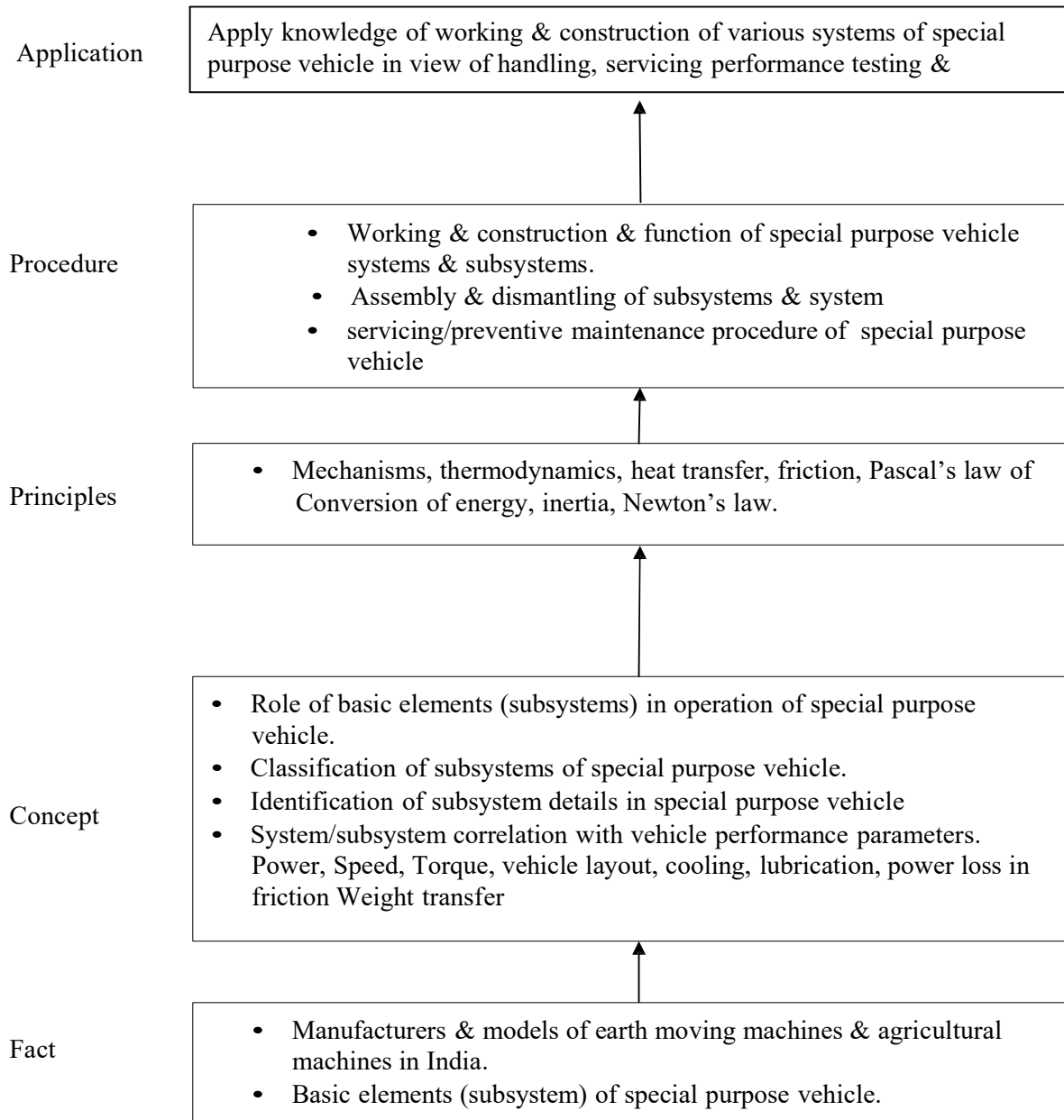
Hence these two categories of off-highway vehicles are primarily included in special purpose vehicle. This course in Automobile Engineering will make student understand & apply the knowledge about various system & subsystems for servicing of these vehicles.

Objective:

The student will be able to:

1. Know importance of earth moving machines & agricultural machines in India.
2. Identify various systems & subsystems of earth moving machines & agricultural machines
3. Explain working & construction of various systems & subsystems in earth moving machines & agricultural machines
4. Carry out preventive maintenance of earth moving machines & agricultural machines.

Learning Structure:



Contents: Theory

Note: No numerical to be asked in examination.

Chapter	Name of Topic	Hours	Marks
01	<p>Earth Moving Machines – Introduction</p> <p>1.1 General layout, Application & Classification of earth moving machines. Comparison of tyred & crawler tractor</p> <p>1.2 General Specifications of a typical earth moving machine.</p> <p>1.3 Comparison between general automobile & earth moving machine on following parameters:</p> <ul style="list-style-type: none"> • Traveling Speed • Working conditions • Power output & power variations • Controls • Torque & torque variations. • Steering • Suspension • Fuel & fuel consumption • Hydraulics • Power take offs • Clutch • Brakes • Driving license • RTO registration <p>1.4 Implications of earth moving machines on economy & infrastructure development:</p> <ul style="list-style-type: none"> ○ Next five year plan ○ Role of earth moving machine in road laying, bridge construction, building construction, tunnel, mining & in disaster management. 	10	20
02	<p>Tractor Dozer</p> <p>2.1 Tractor dozer- types, layout , power train & bucket swing Applications i.e. ripping, blasting Vs ripping)</p> <p>5.1 Rippers – types i.e. hinge & parallelogram, their application & comparison.</p> <ul style="list-style-type: none"> • Ripper tip selection. • Dozing, & Underwater application. <p>2.5 Dozer blade – types i.e. straight dozer, angle dozer, S’ blade, ‘U’ blade, ‘C’ blade, ‘A’ blade, and their applications.</p> <p>2.6 Track shoe construction & working.</p> <p>2.7 Under carriage maintenance.</p> <p>2.8 Safety precautions for Dozer operations.</p>	07	16

03	<p>Dragline (Rope Operated Excavator)</p> <p>3.1 Applications of dragline i.e. excavating channels, ditches, trenches, underwater soil, stripping overburden, shallow grading, general excavation, loading into hoppers, loading hauling units, sloping & grading.(simple sketches only)</p> <p>3.3 Clamshell - application, capacity, bucket, construction & size</p> <p>3.4 Hoe and Cranes - their working & Application.</p>	06	08
04	<p>Loaders & Excavators:</p> <p>4.1 Crawler loader – working & attachments i.e. standard bucket, bulk handling bucket, fork lift attachment, crane attachment Stability & safety of crawler loader operations.</p> <p>4.2 Wheeled loader –types i.e. back hoe & front hoe, working, capacity & output.</p> <p>4.3 Hydraulic Excavator: Application, block diagram, types of buckets & their applications e.g. 3 in 1 bucket, ejector bucket, square hole bucket, ditch digging bucket, clay bucket and hydraulic grab.</p> <p>4.4 Scraper: Block diagram, types – Towed & self-propeller,</p> <p>4.5 Motor Grader – Block diagram, constructions, application, stability & safety, capacity & outputs.</p>	09	18
05	<p>Tractor:</p> <p>5.1 Comparison of tractor with an automobile</p> <p>5.2 Indian tractor industry</p> <p>5.3 General Layout of a tractor</p> <p>5.4 Power train & transmission layout of a tractor</p> <p>5.5 Tractor Power take off its working & construction</p> <p>5.6 Tractor tyres construction & selection</p> <p>5.7 Counterweight & its importance</p> <p>5.8 Types of implements in tractors, its uses & its effect on performance of a tractor</p> <p>5.9 Power tiller- Comparison with tractors, Various attachments & its applications</p>	09	22
06	<p>Forklift Truck , tipper & road roller</p> <p>6.1 Forklift Truck- Types, layout, lifting mechanism, counterweight & steering mechanism. Safety in operation.</p> <p>6.2 Tipper – Types, construction & working tipping mechanism & maintenance. Safety in operation of tipper.</p> <p>6.3 Road roller- Types, layout , operation & maintenance.</p>	07	16
Total		48	100

Practical:

Skills to be developed:

Intellectual Skills:

Identify tractor systems, components of tractor transmission system.

- To select proper tools and equipment for servicing of tractors.

- To read Manufacturer’s service manual for servicing procedures.
- To observe components and subsystems of tractor, dozer, excavator, fork lift, road roller.
- To observe earth moving machines that are in operation.

Motor Skills:

- To adopt recommended service manual procedure for servicing of tractor.

List of Practical/ Assignments:

1. Visit to service center of Tractor or Dozer or Excavator or Fork lift or Road roller. Write report on various mechanisms used, service procedure adopted, cost of equipment and other financial aspects.
2. Visit to a mine/ construction site to observe various operations of Earth Moving Machines. Write a report on the visit.
3. Assignment on specifications and features like hydraulic circuit, control systems of any one earth moving machine,
4. Assignment on specifications and capacities of any one dozer. Draw the sketches of various dozer blades stating their applications.
5. Assignment on applications of any one Rope operated excavator/ fork lift.
6. Assignment on working of crawler loader and its attachments/ road roller types and operations.

Learning Resources:

1. Books:

Sr. No.	Author	Title
01	Jagman Singh	Art of earth moving
02	Radichev	Tractors and automobile.
03	Burge	Tractors and their power units
04	Trucker	Earth moving plant

2. C. D.s: on various Topics of Automobile Engineering By SAE Publisher.