

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION , MUMBAI

TEACHING AND EXAMINATION SCHEME

COURSE NAME : POST DIPLOMA IN AUTOMOBILE ENGINEERING

COURSE CODE : AB SCHEME - C

DURATION OF COURSE : THREE SEMESTERS/ ONE AND HALF YEAR

SEMESTER : FIRST (WITH EFFECT FROM 2007-08) (16 WEEKS DURATION)

FULL TIME / PART TIME: FULL TIME

SR. NO.	SUBJECT TITLE	SUBJECT CODE	TEACHING SCHEME			EXAMINATION SCHEME											
			TH	TU	PR	PAPER HRS	TH		TEST	TOTAL		PR		OR		TW	
							MAX	MIN		MAX	MIN	MAX	MIN	MAX	MIN		
1	Spark Ignition Engine	9869	02	--	03	03	80	28	20	100	40	50#	20	--	--	25@	10
2	Compression Ignition Engine	9870	02	--	03	03	80	28	20	100	40	50#	20	--	--	25@	10
3	Automobile Transmission	9871	02	--	03	03	80	28	20	100	40	50@	20	--	--	--	--
4	Automotive Steering Suspension and Brake	9872	02	--	03	03	80	28	20	100	40	50@	20	--	--	--	--
5	Automotive Electrical	9873	03	--	02	03	80	28	20	100	40	--	--	--	--	25@	10
6	Project -I	--	--	--	06	--	--	--	--	--	--	--	--	50#	20	50@	20
TOTAL			11	--	20	--	400	--	100	500	--	200	--	50	--	125	--

STUDENT CONTACT HOURS PER WEEK(FORMAL TEACHING) : 31 HRS

THEORY AND PRACTICAL PERIODS OF SIXTY MINUTES EACH

@ - INTERNAL ASSESSMENT , # - EXTERNAL ASSESSMENT

TOTAL MARKS – 875

ABBREVIATIONS : TH – THEORY , TU – TUTORIAL , PR – PRACTICALS , OR –ORAL, TW – TERMWORK

All assessment of practical, oral and term work are to be done as per the prevailing norms of implementation and assessment

COURSE NAME : POST DIPLOMA IN AUTOMOBILE ENGINEERING
COURSE CODE : AB
SEMESTER : FIRST
SUBJECT TITLE : SPARK IGNITION ENGINE
SUBJECT CODE : 9869

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
02	---	03	03	80	20	50#		25@	175

Rationale:

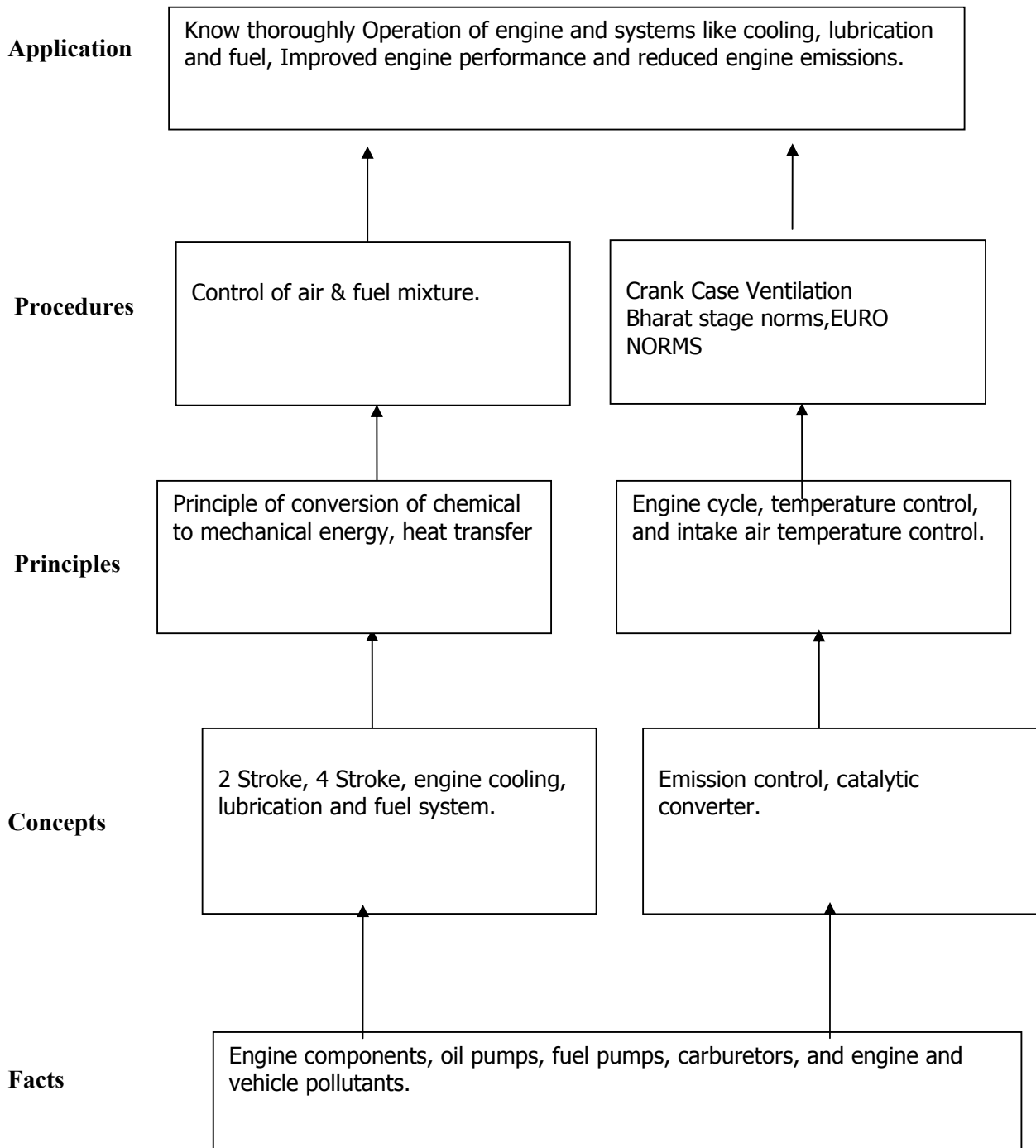
Spark Ignition Engines (SI Engines) have less noise, vibration and harshness. (NVH) So there is the first preference in passenger car. Further they being relatively small they are preferred in two wheelers. There have been tremendous advances in SI engines since last two decades and they are further developing with know knew bound. Being prominent prime mover for motor vehicle any individual associated with design, manufacturing, servicing and allied activities regarding motor vehicle in general and engine particular should have thorough knowledge of SI engine.

OBJECTIVES:

Students will be able to:

1. Understand the thermodynamic aspects of automobile engine.
2. Get sufficient knowledge on the engine combustion and fuel supply systems.
3. Understand engine principle and fundamentals.
4. Understand Constructional features of automobile engine components.
5. Understand Engine cooling system
6. Understand Engine Lubrication systems
7. Get sufficient knowledge of engine power boosting and exhaust systems

Learning Structure:



Contents: Theory

Note: No numerical to be asked in examinations

Chapter	Name of the Topic	Hours	Marks
01	S. I. Engine Fuels 1.1 Requirements of ideal SI engine fuel. 1.2 Types, Rating of SI engine fuel, Indian standards of SI engine fuels & emerging standards as per Indian auto fuel policy. 1.3 Blended gasoline additives in fuels. 1.4 Comparative study & application of various fuels	02	05
02	Power Cycles 2.1 Basic engine terminology. 2.2 Working of Two-stroke engine and four-stroke engine 2.3 Engine Cycles: Theoretical and actual Otto cycle. 2.4 Valve timing diagram of high torque slow speed engine, low torque high-speed engine, two stroke and four-stroke engine.	02	05
03	Combustion in S. I. Engine 3.1 General combustion theory, Normal combustion & flame front. 3.2 Pre-ignition, auto-ignition, ignition lag and effect of mixture strength on ignition lag. 3.3 Three phases combustion in SI engine. Change of pressure & temperature during second and third phases of combustion, factors affecting flame speed, normal combustion and abnormal combustion. Theory of detonation, factors influencing detonation. 3.4 Design, comparison and application of Combustion Chamber in SI engine- Side valve type, Wedge type, Inverted bath tub type, Flat head type, Hemispherical Type, Stratified type, Multi valve type.	04	10
04	Engine Construction and Details 4.1 Construction, application and comparison of Arrangement Of Engine: horizontal engine, inclined engine, vertical Engine, inline engine, V-Engine, Radial engine, Opposed Cylinder engine, Opposed direction engine. 4.2 Firing order, Need, Star diagram in inline and V-Engine. 4.3 Engine Balancing & Vibration, Various engine foundation. Various factors affecting engine vibrations. 4.4 Material, construction and manufacturing process of Cylinder block, Cylinder Head, Crankcase, Oil Pan, Inlet Manifold. Exhaust Manifold, surge tank, Cylinder Liners, Piston, Crankshaft, Flywheel, Engine Valves, Piston	06	15

Chapter	Name of the Topic	Hours	Marks
	Rings, Connecting Rod. Muffler and bearings.		
05	Filters and Air Cleaners 5.1 Need, construction & Working of Fuel filters, air filters and oil filters. 5.2 Failures, symptoms and remedies	02	05
06	SuperChargers 6.1 Super Charger, Naturally aspirated engine. 6.2 Introduction to super charger. 6.3 Curves showing relative power output with and without super charging. 6.4 Construction, working, locations and comparison of super charger, Centrifugal, root type with bypass valve and with magnetic clutch, vane type and sliding vane type, spiral type, rotary piston type super charger.	02	05
07	Fuel System in S. I. Engine 7.1 Types of fuel supply system– Gravity system, Pressure system, and Pump system. 7.2 Principle of Carburetion, construction, working, types & Limitations of Carburetor. 7.3 Fuel injection system. Material, construction and location of Fuel Tank. 7.3 Types, working, testing and troubleshooting of AC Mechanical pump and SU Electrical pump. 7.6 Need and working of Vapour return line. 7.7 Types of Petrol Injection and its Comparison with carburetor system.	04	10
08	Engine Lubrication Systems 8.1 Need, types, construction and working of Lubrication Systems. 8.2 Oil additives. 8.3 Effect of engine conditions on lubricating oils. 8.4 Critical lubricating conditions for auto engine. 8.5 Types, Working & construction of oil strainer. 8.6 Working, construction, application, comparison of Oil Pumps – Gear, Crescent, Rotor, plunger and Vane pump	02	05
09	Engine Cooling System 9.1 Need, types, construction and working of cooling Systems. 9.2 Construction and working of various components of cooling systems. 9.3 Faults and remedies.	02	05
10	Exhaust Systems	06	15

Chapter	Name of the Topic	Hours	Marks
	10.1 Emission Norms – Indian and Euro norms Properties of Exhaust gas components. Exhaust Emissions and effects with SI Engine Fuels, Emission Control, Engine design measures, Fuel metering, Mixture Formation, Uniform distribution. 10.2 Construction and working of Exhaust gas re-circulation (ERG) Valves. 10.3 Valve timing, Compression ratio and Design of Combustion chamber. 10.4 Working, need and types of Crankcase ventilation system. 10.5 Fuel tank and Carburetor ventilation, Changes in cooling system, Changes in fuel supply system. 10.6 Evaporative emission control system, Early fuel evaporation system with mechanically operated vent, working & construction of valve and purge control valve, working of Decel emission system. 10.7 Construction, working and types of Catalytic converter 10.8 Construction and working of Air injection system and Pulse air injection reactor system. 10.9 Emission Test in SI engine, Faults, Symptoms, and Causes & Remedies in Exhaust System. 10.10 Routine maintenance of Exhaust system.		
Total		32	80

Practical:

Skills to be developed:

1 Intellectual Skill

To understand working principle of SI engine.

- To identify engine components.
- To select tools / equipments for engine assembly / dismantling
- To read service manual for dismantling, & assembling of engine.

2 Motor skills:

- To observe engine components & to sketch them.
- To adopt proper procedure of engine assembly, dismantling, engine trial.
- Ability to locate the fault and diagnosis.

List Of Practical:

- 1) Dismantling and assembling of following types of engines. (Any one from each category)
 - Moped, scooter, motorcycle.
 - Four stroke petrol engines.
- 2) Flash point and fire point testing of petrol.
- 3) Viscosity testing of lubricating oil.

- 4) Identify and draw sketches of the following engine components (Three types each) Piston, Cylinder Block, Cylinder Head, Inlet Manifolds, Exhaust Manifolds and Valve Train Components.
- 5) Identify and draw sketches of air filter and fuel filters of petrol engine (any four.)
- 6) Remove the oil pump, clean, inspect and refit.
- 7) Remove the water pump, clean, inspect and refit.
- 8) Remove the radiator from the vehicle, check it for leaks, clean and reverse flush the radiator and refit.
- 9) Remove the mechanical fuel pump and electrical fuel pump, inspect and refit.
- 10) Remove the carburettor from the engine of motorcycle, identify and check the components, draw the circuit and refit.
- 11) Remove the carburettor from the car engine, identify and check the components, draw the circuit and refit.
- 12) Perform Exhaust gas analysis of a petrol engine using gas analyzer,
Diagnose engine condition from exhaust gas analysis
- 13) Study of special tools used for petrol engine.

Learning Resources:

Books:

Sr No.	Author	Title	Publisher
01	M.L Mathur R.P.Sharma	A course in internal combustion engine	Dhanpat Rai Publication
02	Newton, Steeds, Garrett.	The Motor vehicle	Butterworth Heinmann.
03	Dr. Kirpal Singh	Automobile Engineering Vol.-2	Standard Publishers.
04	Anil Chikara	Automobile Engineering Vol. I - Engines.	Satya Prakashan, New Delhi
05	Crouse / Anglin.	Automobile Mechanics	TATA McGRAW – HILL
06	R.B. Gupta	Automobile Engineering	Satya Prakashan
07	H. M. Sethi	Automotive Technology	Tata McGraw Hill.
08	S. Srinivasan	Automotive Engines	Tata McGraw Hill.

COURSE NAME : POST DIPLOMA IN AUTOMOBILE ENGINEERING

COURSE CODE : AB

SEMESTER : FIRST

SUBJECT TITLE : COMPRESSION IGNITION ENGINE

SUBJECT CODE : 9870

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
02	--	03	03	80	20	50#	--	25@	175

Rationale:

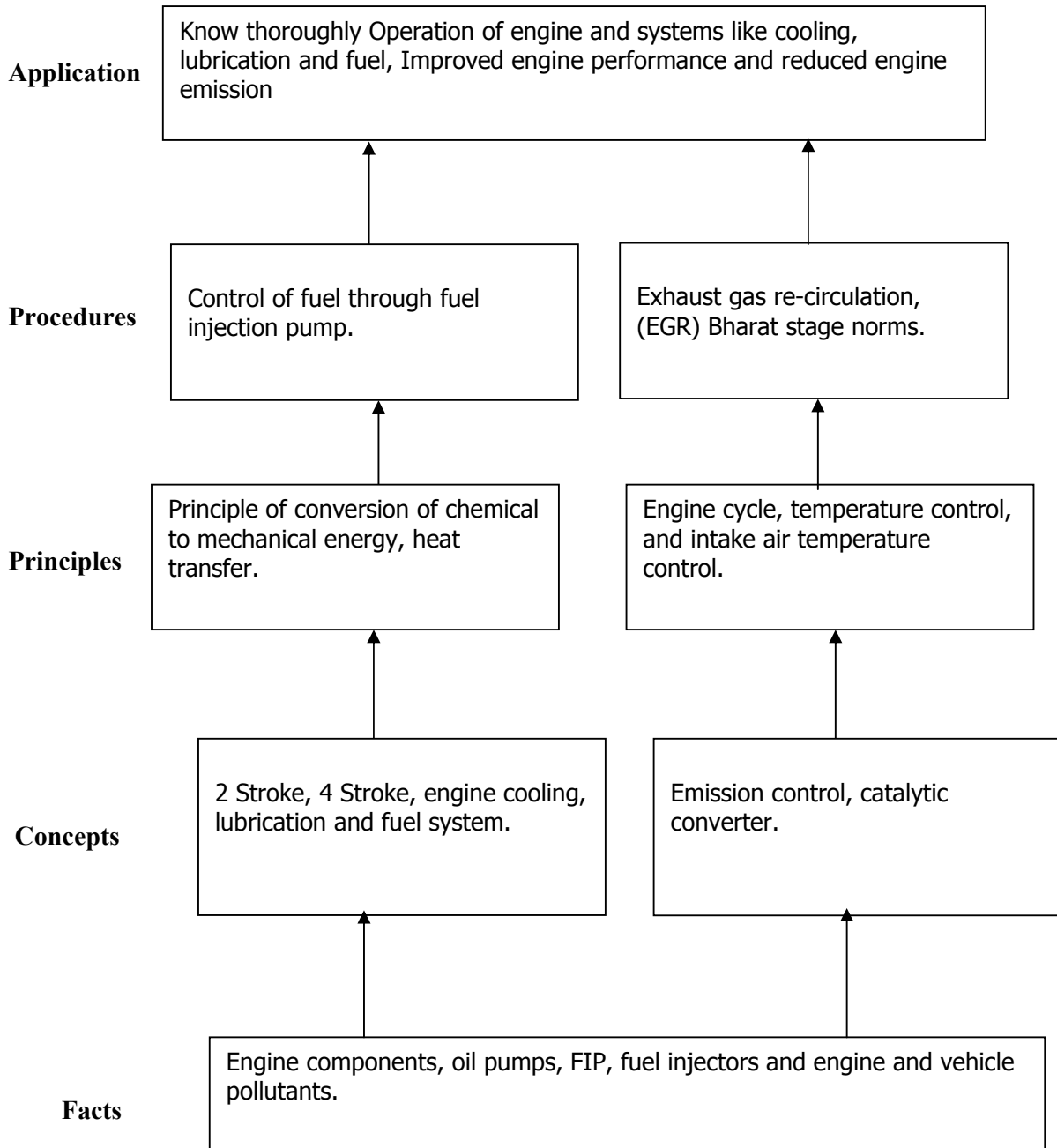
Compression Ignition Engines (CI Engines) are Highly powered engines. So they have the first preference in all commercial vehicles. There have been tremendous advances in CI engines since last two decades in the form of CRDI, TCIC etc and they are further developing. Being prominent prime mover for motor vehicle any individual associated with design, manufacturing, servicing and allied activities regarding motor vehicle in general and engine particular should have through knowledge of CI engines.

OBJECTIVES:

Students will be able to:

8. Understand the thermodynamic aspects of automobile engine.
9. Get sufficient knowledge on the engine combustion and fuel supply systems.
10. Understand engine principle and fundamentals.
11. Understand Constructional features of automobile engine components.
12. Understand Engine cooling system
13. Understand Engine Lubrication systems
14. Get sufficient knowledge of engine power boosting and exhaust systems

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Fuels & Power Cycles</p> <p>1.1 Properties and additives of diesel fuel.</p> <p>1.2 Diesel cycle: two-stroke & four stroke, theoretical and actual.</p> <p>1.3 Valve timing diagram for high torque low speed engine, low torque high-speed engine, two stroke and four-stroke engine.</p>	02	05
02	<p>Combustion in CI Engine</p> <p>2.1 Stages of combustion in CI engine - Ignition delay, Rapid Or uncontrolled combustion, controlled combustion, after burning, diesel knock, Cetane numbers Graphical analysis of detonation and diesel knock.</p> <p>2.2 Construction and working of Combustion Chamber for C.I. engines.- Direct injection type, open type, turbulent type, swirl type, pre-chamber type.</p> <p>2.3 Air movements useful for proper combustion in C.I. engine.</p> <p>2.4 Combustion chambers and nozzle locations.</p>	04	10
03	<p>Diesel Engine Fuel Supply System</p> <p>Part A</p> <p>3.1 Requirement of fuel metering and fuel injection process.</p> <p>3.2 Types & comparison of Fuel injection system.</p> <p>3.3 Construction and working of In line fuel injection pump i.e. Jerk type.</p> <p>3.4 Need & types of governing.</p> <p>3.5 Description and functions of Mechanical add-on equipments – Torque control, Manifold pressure compensator, Altitude pressure compensator, temperature dependant starting devices, Rack travel sensor, Port-timing sensor, timing devices, pump shut off.</p> <p>3.6 Construction and working of Distributor type fuel injection pump. and its comparison with in line type pump.</p> <p>Part B</p> <p>3.7 Construction and working of Unit Pumps & unit Injectors, And its comparison with inline type.</p> <p>3.8 Description and functions of Cold Starting Devices, i.e. Decompression devices, Heater plugs, Inlet manifold heaters, chemical sprays.</p> <p>3.9 Test setup & procedure for Phasing & calibration of Pump.</p>	06	15
		06	15

Chapter	Name of the Topic	Hours	Marks
	3.10 Need, construction and working of Common rail direct Injection system(CRDI). Its Faults Symptoms & Remedies 3.11 Need, construction and working of Unit injection System. It's Faults Symptoms & Remedies.		
	Atomizers and Holders		
04	4.1 Construction & working of different types of nozzles. 4.2 Construction & working of Nozzle Holders. 4.3 Procedure for Injector Testing.	02	05
	Turbochargers		
05	5.1 Need, Limitations of Naturally aspirated engines 5.2 Comparison of turbocharger with supercharger. 5.3 Construction, working and types of Turbocharger. 5.4 Working and application of Variable geometry turbo-Charger. Balancing and lubrication of turbochargers and Turbocharger lag. 5.6 Faults Symptom, cause and remedy in turbo charger. 5.7 Preventive maintenance of turbocharger.	02	05
	Engine Construction and Details		
06	6.1 Comparison between SI & CI engines in following engine parts. Cylinder block, Cylinder Head, Crankcase, Oil Pan, Inlet manifold, Exhaust Manifold, surge tank, Cylinder Liners, Piston, Crankshaft, Flywheel, EngineValves, Piston Rings, Connecting Rod. Muffler and bearings.	06	15
	Exhaust Systems		
07	7.1 Comparison between SI & CI engines with respect to Emission Norms. 7.2 Properties of Exhaust gas components. Exhaust Emissions. 7.3 Construction and working of Diesel EGR system. 7.4 Construction and working of Evaporative emission Controls system. 7.5 Exhaust gas after treatment. 7.6 Procedure for Emission Test.	04	10
Total		32	80

Practical:

Skills to be developed:

1 Intellectual Skill

- To identify engine components.
- To select tools / equipments for engine assembly / dismantling
- To read service manual for dismantling & assembling of engine.
- To understand working principle of CI engine.

2 Motor skills:

- Ability to observe engine components & to sketch them.
- Ability to adopt proper procedure of engine, dismantling & assembling
- Ability to locate the fault and diagnosis.

List Of Practical:

- 1) Dismantling and assembling of Four stroke four cylinder diesel engine.
- 2) Flash point and fire point testing of diesel.
- 3) Observe constructional features and draw sketches of the following engine components (Three types each)
Piston, Cylinder Block, Cylinder Head, Inlet Manifolds, Exhaust Manifolds and Valve Train Components.
- 5) Observe constructional features and draw sketches of air filter and fuel filters of diesel engine, (any four).
- 6) Dismantling & Assembly of Fuel Injection Pump (FIP) & feed pump (Jerk Type).
- 7) Dismantling & Assembly of Fuel Injection Pump (FIP) & feed pump (Distributor Type).
- 8) Dismantling & Assembly of Fuel Injection Pump & feed pump (Unit Pump & Injector Type).
- 9) Observe constructional features and draw sketches of different types of Atomizers.
- 10) Observe constructional features and draw sketches of Turbocharger.
- 11) Perform Exhaust gas analysis of a diesel engine using Exhaust-gas analyzer & Diagnose engine condition from exhaust gas analysis.
- 12) Study of special tools used for diesel engines.

Learning Resources:

Books:

Sr No.	Author	Title	Publisher
01	M.L Mathur R.P.Sharma	A course in internal combustion engine	Dhanpat Rai Publication
02	Newton, Steeds, Garrett.	The Motor vehicle	Butterworth Heinmann.
03	Dr. Kirpal Singh	Automobile Engineering Vol.-2	Standard Publishers.
04	Anil Chikara	Automobile Engineering Vol. I – Engines.	Satya Prakashan, New Delhi
05	Crouse / Anglin.	Automobile Mechanics	TATA McGRAW – HILL
06	R.B. Gupta	Automobile Engineering	Satya Prakashan
07	H. M. Sethi	Automotive Technology	Tata McGraw Hill.
08	S. Srinivasan	Automotive Engines	Tata McGraw Hill.
09	Harbans singh Reyat	The Automobile	

COURSE NAME : POST DIPLOMA IN AUTOMOBILE ENGINEERING

COURSE CODE : AB

SEMESTER : FIRST

SUBJECT TITLE : AUTOMOBILE TRANSMISSION

SUBJECT CODE : 9871

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
02	--	03	03	80	20	50@	--	--	150

Rationale:

In an Automobile, transmission system plays very important role so Automobile engineer is supposed to have knowledge of Automobile Transmission system.

Objectives:

Student will be able to

1. Be conversant with construction, working of major assemblies of Automobile transmission system.
2. Understand various types of possible faults, remedies and maintenance of transmission and suspension components.

Learning structure:

Application

To Locate & Analyze automotive transmission sub systems.

Procedure

Transmission sequence & types of drives. Progressive engagements, Selection of gears as per torque requirement, Transmission of fluctuating & angular torque, Torque and speed variations.

Principles

Tractive forces, Friction, Law of gearing, fluid friction & Law of motion

Concepts

Location of different systems to achieve transmission efficiency, Engaging & disengaging the power train, Variation in torque, Universal transmission, Differential transmission.

Facts

Power transmission & its control through different systems

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Transmission Layout</p> <p>1.1 Transmission layout of Front Engine Front Wheel Drive Vehicle, Rear Engine Rear Wheel Drive Vehicle, Front Engine Rear Wheel Drive Vehicle, Four Wheel Drive Vehicle. & Multi-axle Vehicle</p> <p>1.2 Transmission layout of Two Wheelers – Scooters & Motorcycles</p>	02	06
02	<p>Clutch</p> <p>2.1 Requirements of clutch.</p> <p>2.2 Classification of clutch on various parameters.</p> <p>2.3 Construction, working, comparison & typical Characteristic curves of Single Plate Coil Spring & diaphragm spring type clutch</p> <p>2.4 Construction, working & comparison of Multi plate clutch</p> <p>2.5 Construction, working, comparison & typical Characteristic curves of Semi Centrifugal clutch & Centrifugal Clutch</p> <p>2.6 Various linkages of clutch and their adjustments.</p> <p>2.7 Circuit diagram, construction and working of Hydraulically & Vacuum operated clutch</p> <p>2.8 Construction & working of Fluid Flywheel</p> <p>2.9 Operation, construction & application of Freewheel clutch & Electromagnetic clutch</p> <p>2.10 Comparison of Pull type & push type clutch.</p> <p>2.11 Construction & working of Automatic wear adjustment in clutch.</p> <p>2.12 Faults, Symptoms, causes and remedies in clutch</p>	05	14
03	<p>Manual Gearbox</p> <p>3.1 Function and Necessity with graphical representation of Gear Box</p> <p>3.2 Types of Gears , Gear trains & , Gear terminology, backlash and its need and magnitude.</p> <p>3.3 Construction, Working, Limitations and Application of Sliding Mesh gearbox , Constant Mesh Gear Box, Synchromesh Gear Box & Epicyclic Gear Box.</p> <p>3.4 Construction & Working of Gear Selector Mechanism</p> <p>3.5 Construction, Working, Limitations and Application of overdrive</p> <p>3.6 Construction & Working of Hydraulic & Electronic engaging & disengaging Mechanism of overdrive</p> <p>3.7 Construction, working and application of Transfer Case, types, Construction & Working transfer case.</p> <p>3.8 Lubrication of above assemblies.</p> <p>3.10 Faults symptom, cause, remedies of Manual Gearbox</p>	06	14

04	<p>Automatic Transmission</p> <p>4.1 Working, construction, performance curve & methods of improving efficiency Single stage, Two stage Torque Converter</p> <p>4.2 Construction, Working, Advantages & Limitations of Step less regulation & variomatic transmission in two wheeler & four wheeler</p> <p>4.3 Construction , Working & comparison of Automatic & Electronically controlled Transmissions</p> <p>4.4 Faults symptom, cause, remedy of Automatic Transmission</p>	06	14
05	<p>Drive Line & Final Drive</p> <p>5.1 Layout and comparison of Hotchkiss drive & torque tube drive</p> <p>5.2 Construction, working & need of center bearing in Propellers shaft</p> <p>5.3 Construction, working, application and comparison of Hooks joint, Slip joint, constant velocity joint i.e. Rzeppa joint, Tripoid joint, Tulip joint, plunging and non-Plunging type.</p> <p>5.4 Need, construction and working of Differential, Differential lock and limited slip differential</p> <p>5.5 Gear ratio, different gear pairs , applications Clearance adjustment for proper teeth contact, preloading and various patterns of teeth contact in Crown & pinion</p> <p>5.6 Direction of load, construction, bearing location & application of Semi floating, three quarter floating and fully floating Rear Axle.</p> <p>5.7 Construction and working of Wheel hub assembly</p> <p>5.8 Double reduction, arrangement of multiple rear axle & differential in four-wheel drive.</p> <p>5.9 Faults symptom, cause & remedy of Drive line & final Drive</p>	05	12
06	<p>Transaxle & Rear Axle Of Front wheel drive (FWD) Vehicle</p> <p>6.1 Arrangement, layout, constructional details, components & subassembly of transaxle with different bearing arrangement.</p> <p>6.2 Layout & constructional details drive axle with unequal length and equal length, front drive axle with C.V. joint, types of drive axles</p> <p>6.3 Layout and construction of Rear axle arrangement of front wheel drive vehicle with independent suspension system and semi-independent suspension system.</p> <p>6.4 Faults symptom, cause, and remedy in Transaxle.</p>	04	10

07	Wheels & Tyres	04	10
	7.1 Construction, comparison, application & Requirement of Light alloy wheel & forged wheel.		
	7.2 Arrangement of wires for load in various directions, comparison with light alloy wheel.		
	7.3 Need & procedure of Wheel balancing		
	7.4 Desirable properties and consideration in tyre design.		
	7.5 Tyre designation.		
	7.6 Construction, comparison Functions, general cross-section of Conventional tube tyre and tubeless tyre		
	7.7 Construction and comparison of Cross ply, radial ply and belted bias tyre.		
	7.8 Factors affecting tyre life; - Tyre Inflation, Overloading, bleeding, wheel alignment, driving manner, miscellaneous factor, tyre rotation, wheel balancing, retraining and vulcanization of tyre.		
7.9 Faults symptom, cause, remedies of tyres			
Total		32	80

Practical:

Intellectual skill:

1. Identify concepts applied.
2. Identify parts like clutch, gearbox, universal joints, propeller shaft, final drive, wheels & tyres.
3. Classify the system according to their application.
4. Detect fault by observation & trial.

Motor skill:

1. Sketch the different devices.
2. Tools, equipment, instrument.
3. Observe the behaviors of various systems under various parameters.
4. Take reading from various instruments like chassis dynamometer.

List of Practical:

Observe construction, identify and list components and draw sketches of following:

1. Single plate clutch, Coil & diaphragm Spring type.
- 2. Centrifugal Clutch**
3. Multi plate Clutch
4. Hydraulic coupling
5. Torque converter
6. Synchromesh gear box
7. Epicyclic gear box
8. Gear box and Shifting Mechanism
9. Two wheeler gear box & Shifting mechanism
10. Transfer case.
11. Vario drive & centrifugal Clutch
12. Propeller shaft & universal Joint

13. Differential crown & pinion
14. Transaxle & Tractor Differential
15. Automatic transmission

Learning Resources:

Books:

Sr. No	Author	Title	Publication
1	A. W. Judge	Automobile Engineering series	
2	William crouse.	Automobile Engineering Vol I to IV	Tata McGraw Hills
3	Joseph Hestner	Automobile Mechanics	
4	Dr. Kirpal Singh.	Automobile Engineering Vol I	Standard Publication
5	R. B. Gupta.	Automobile Engineering	Satya Prakashan
6	Don Knowles	Auto mechanics, Understanding New Technology	Prentice Hall
7	Bosch	Automotive Handbook	Bosch

COURSE NAME : POST DIPLOMA IN AUTOMOBILE ENGINEERING

COURSE CODE : AB

SEMESTER : FIRST

SUBJECT CODE : 9872

SUBJECT TITLE : AUTOMOTIVE STEERING, SUSPENSION & BRAKE

Teaching and examination scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
02	--	03	03	80	20	50@	-	-	150

Rationale:

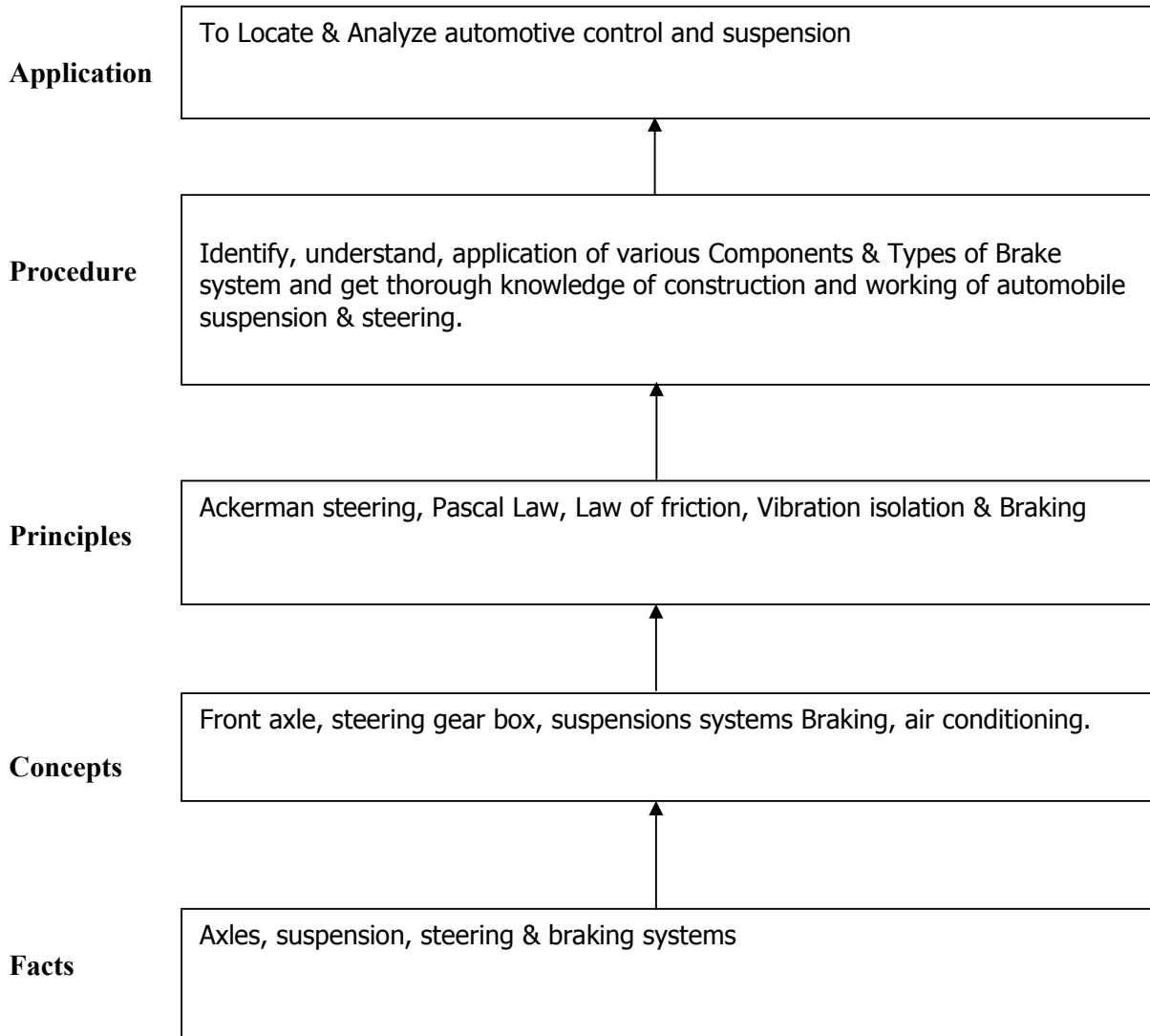
Automobile engineer is supposed to have knowledge of major assemblies of the vehicle, their developments and their maintenance.

Objectives:

At the end of this course student will be able to

1. Be conversant with construction, working of major assemblies of vehicle and their use.
2. Understand various types of possible faults, remedies Steering, Suspension & brake System Components.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Steering</p> <p>1.1 Construction and Working of Different types of front axle</p> <p>1.2 Introduction to the following: - Legal requirement of steering system, True rolling of wheels, Steering as controlling system, Turning radius requirement of perfect steering, Cornering force, self-Rightening torque, slip angle, Pneumatic trail, over steer and under steer.</p> <p>1.3 Layout and comparison of Ackerman's and Devi's Steering mechanism.</p> <p>1.4 Construction, Working & comparison of Steering linkages for rigid and independent suspension System.</p>	02	05
02	<p>Steering Geometry</p> <p>Objective, magnitude, drawing & effect of: - Toe in, Toe out, camber, caster, kingpin inclination / steering axis inclination, combined angle and scrub radius.</p> <p>2.2 Procedure of wheel alignment and wheel balancing</p>	02	05
03	<p>Steering Gearbox & Power Steering</p> <p>3.1 Construction, working, application, comparison and backlash adjustment of Worm and wheel, cam and double roller, worm and nut, recirculating ball type, rack and pinion type steering gear box.</p> <p>3.2 Need of Power Steering.</p> <p>3.3 Construction, working & types of Power steering pumps.</p> <p>3.4 Working and construction of ZF Power assisted steering for heavy commercial vehicle</p> <p>3.5 Working and construction of Rotary valve type, Linkage type & Rack & Pinion type power steering.</p> <p>3.6 Need & introduction of Variable Power Assisted steering, Electronic variable orifice power steering Electronically controlled Electrical power steering, Four Wheel Steering</p> <p>3.7 Faults symptom, cause, remedy of steering system</p>	04	10
04	<p><i>Steering Columns</i></p> <p>4.1 Construction of a steering column,</p> <p>4.2 Construction & working of special steering column i.e. collapsible, energy absorbing, tilting wheel, telescopic, tilt and telescopic, steering column with anti theft lock.</p>	02	05

Chapter	Name of the Topic	Hours	Marks
05	<p>Suspension</p> <p>5.1 Requirement & classification of suspension system.</p> <p>5.2 Types, construction & working of Rigid Axle Suspension - application and comparison of Leaf spring suspension</p> <p>5.3 Arrangement and function of trailing arm, watt linkage panhard rod</p> <p>5.4 Construction & working of rigid axle coil spring suspension.</p> <p>5.5 Construction, working, types, layout & application of Independent Suspension system for front axle & Rear axle.</p> <p>5.6 Comparison and application of Leaf spring, Coil spring, helper coil spring, paper coil spring, torsion bar, rubber spring, plastic spring, air spring in suspension system</p> <p>5.7 Function & Location of Stabilizer bar, antiroll bar, Panhard rod, trailing arms, transverse link, Watts linkage, A arms, lateral link & semitrailing arms.</p> <p>5.8 Construction, working Necessity and damping characteristics of Single tube type, telescopic type & gas type damper</p> <p>5.9 Need, construction & working of Vehicle Body Leveler</p> <p>5.10 Faults symptom, cause, and remedies for suspension system</p>	06	14
06	<p>Advanced Suspension Systems</p> <p>6.1 Construction, working, application, types & comparison of Air Suspension System</p> <p>6.2 Construction & working Hydroelastic & Hydra gas Suspension System</p> <p>6.3 Need, construction & working of Active suspension System</p>	04	09
07	<p>Braking Principle</p> <p>7.1 Legitimate Requirement of brakes - Brake efficiency deceleration and stopping distance</p> <p>7.2 Forces on vehicle moving on leveled road, incline road, uphill, downhill l& curved road (Brakes applied on front wheel only)</p> <p>7.3 Wheel skidding & Brakes classification</p> <p>7.4 Need and various types of servomechanisms used in brakes</p> <p>7.5 Construction, working & comparison of Fixed expander Type, floating expander type, floating anchor type, two Leading shoe type, two trailing shoe type, combination type drum brakes</p> <p>7.6 Construction, working & comparison of Floating type, Fixed type, sliding type, Solid type & ventilated type disc Brakes</p> <p>7.7 Factors influencing braking effect & Brake linkages</p> <p>7.8 Brake compensation of Expander unit & Adjuster unit</p>	04	10

Chapter	Name of the Topic	Hours	Marks
	7.9 Construction & working of Parking brakes, disc & drum Brakes.		
08	<p>Hydraulic brakes & Air Brakes</p> <p>8.1 Schematic diagram & application of Hydraulic brakes - Brake circuit configurations II, X, HI, LL, & HH</p> <p>8.2 Construction & working of – Master cylinder, Tandem Master cylinder, fluid check valve with restrictor hole, pressure differential valve with warning light switch, proportioning valve, metering valve & system protection valve.</p> <p>8.3 Two shoe leading brakes, Brake shoe adjusters - Wheel cylinder ratchet type, Double-toothed cam type, Automatic brake adjusters, Automatic adjustment of disc brakes</p> <p>8.4 Brake fluid requirements</p> <p>8.5 Servo Mechanism – Mechanical servomechanism, Disc-brake with servo action</p> <p>8.6 Layout, construction & working of Vacuum Servo brakes Master vacuum power assisted brakes with single diaphragm master vacuum unit & tandem, diaphragm master vacuum unit</p> <p>8.7 Layout, types, construction & working of service, parking, fail-safe of Air Brakes</p> <p>8.8 Faults & remedies in brakes</p>	06	16
09	<p>Modern Brakes</p> <p>9.1 Need, types, construction & working of Antilock brake system</p>	02	06
Total		32	80

Practical:

Skills to be developed:

Intellectual skill:

5. To identify concepts applied.
6. To identify parts like front axle, steering, brakes, suspension system.
7. To classify the system according to their application.
8. To select proper tools & their ranges.

Motor skill:

1. Ability to assemble & dismantle steering, brakes & suspension system
2. Ability to sketch the different devices.
3. Ability to handle tools, equipment, instruments.
4. Ability to observe the working of various systems under various parameters.
5. Ability to detect fault by observation and trial.

List of Practical:

1. Dismantle & Assemble Rear Axle
2. Dismantle & Assemble Front axle & steering linkages
3. Dismantle & Assemble Steering gear box, ball and Screw type
4. Dismantle & Assemble Steering gear box rack and Pinion type.
5. Dismantle & Assemble Worm and sector type steering Gearbox.
6. Dismantle & Assemble Cam & follower type steering Gear box
7. Dismantle & Assemble Power steering
8. Dismantle & Assemble Suspension front (Independent suspension)
9. Dismantle & Assemble Suspension front
10. Dismantle & Assemble Damper (any three type)
11. Dismantle & Assemble Transaxle
12. Hydraulic Brake System – Circuit & component identification
13. Hydraulic Brake system Components- constructional details, working (all above)
14. Mechanical Brake System (2 wheeler) Linkages & component details
15. Pneumatic Brake System circuit & components identification HCV
16. Pneumatic Brake System components construction details & working.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
1	A. W. Judge.	Automobile Engineering series	
2	William Crouse.	Automobile Engineering Vol I to IV	Tata Mc graw hills
3	Joseph Heitner.	Automobile Mechanics	
4	Don Knowles	Auto mechanics, Understanding New Technology	Prentice Hall
5	Kirpal Singh	Automobile Engineering Vol.I	Standard Publication
6	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
7	Bosch	Automotive Handbook	Bosch

COURSE NAME : POST DIPLOMA IN AUTOMOBILE ENGINEERING

COURSE CODE : AB

SEMESTER : FIRST

SUBJECT TITLE : AUTOMOTIVE ELECTRICAL

SUBJECT CODE : 9873

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
03	--	02	03	80	20	--	--	25@	125

Rationale:

Auto electrical systems plays vital role in functioning of various systems of motor vehicle. With the advancements in Auto field, electrical system has become integral part of controlling systems. Further, it is assisting various other systems to become utmost efficient in their functioning.

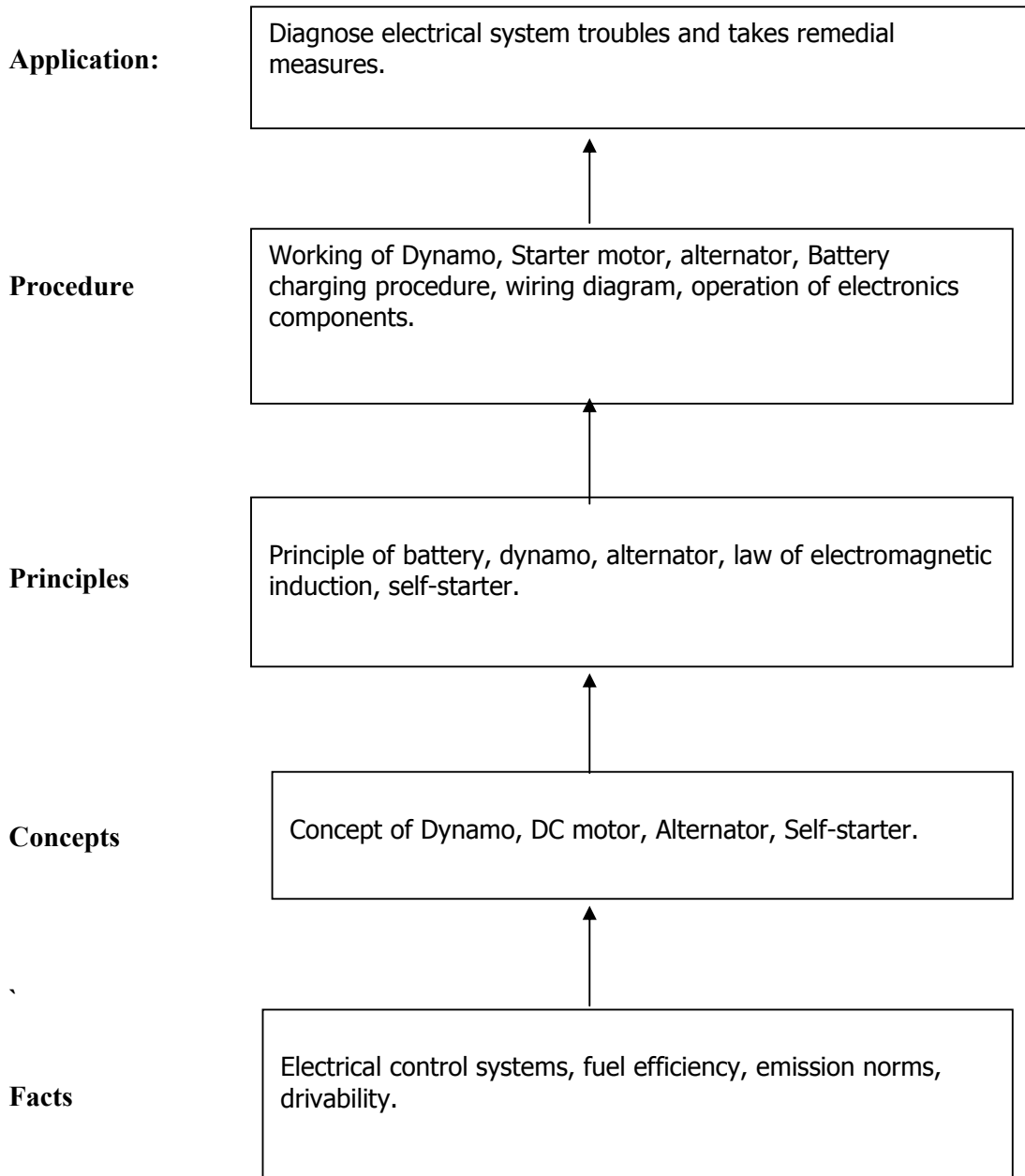
Under such circumstances Automobile engineer must thoroughly understand facts, concepts, principles & procedure about relevant Electric aspects & diagnose faults in auto electrical systems.

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 lighting system & accessories
5. Troubleshoot various complaints in electrical system.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Introduction</p> <p>1.1 Basics of Electrical. 1.2 Earth return system. Positive & Negative Earthing. 1.3 Wiring System & Harnessing. 1.4 Automobile Cables- Starting system, high tension cables, General-purpose cables, Color-codes used, Sample Circuits. 1.5 Harnessing methods. 1.6 Types & application of Cable connectors 1.7 Displays & various layouts.</p>	05	08
02	<p>Electric Component Identification, Symbols, Types, Construction & Operation.</p> <p>2.1 Resistances. 2.2 Capacitors. 2.3 Ignition coil/transformer. 2.4 Switches. 2.5 Circuit protection devices. 2.6 Terminals & Connectors. 2.7 Fuse Box. 2.8 Relays.</p>	05	08
03	<p>Battery</p> <p>3.1 Introduction. 3.2 Classification of Battery. 3.3 Construction & Comparison of Low maintenance battery. 3.4 Construction & Comparison of Maintenance free battery. 3.5 Low cost batteries & their application. 3.6 Construction & working of Lead acid battery. 3.7 Battery Specifications. 3.8 Battery ratings. 3.9 Battery voltage & current. 3.10 Battery performance, 3.11 Battery efficiency and Capacity. 3.12 Battery Testing & Maintenance. 3.13 Battery storage, mounting & maintenance. 3.14 Procedure for Initial Charging of battery. 3.15 Various symptoms, faults & remedies in battery.</p>	08	14

04	<p>Charging System</p> <p>4.1 Construction and working of Alternator. 4.2 Testing of Alternators. 4.3 Construction and working of Dynamo. 4.4 Comparison of alternator with Dynamo. 4.5 Construction, working and types of voltage regulators. 4.6 Circuits, working & advantages of Alternators with Integral regulator. 4.7 Electrical Testing of Alternator components. 4.8 Construction and working of charging system in two wheeler. 4.9 Various faults, symptoms, causes & remedies in Alternator</p>	06	10
05	<p>Cranking Motor</p> <p>5.1 Principle, construction and Working of Cranking motor. 5.2 Working, construction, application & comparison of Engaging mechanisms like Bendix drive, Overrunning clutch with & without gear reduction & Dyer drive. Testing of cranking motor. 5.3 Engagement mechanism testing. 5.4 Performance tests & Insulation tests. 5.5 Faults, Symptoms and Remedies in cranking motors & Engaging mechanisms.</p>	06	10
06	<p>Basic Electrical Accessories</p> <p>6.1 Need, Construction and Types of Horns. 6.2 Need, construction, working and types of Fuel Gauge. 6.3 Need, construction, working and types of Oil pressure gauge. 6.4 Need, construction, working and types of Water temperature gauge. 6.5 Need, construction, working and types of Speedometer. Need, construction and working of Oil pressure warning light. 6.6 Need, construction and working of Water temperature warning light. 6.7 Need, construction and working of Choke out warning. 6.8 Need, construction and working of Brake Warning light. 6.9 Need, construction and working of Ignition warning light. 6.10 Need, construction and working of Direction indicator with & without flashing.</p>	06	10
07	<p>Lighting System</p> <p>7.1 Construction and working of Sealed beam headlight. 7.2 Control of headlight beam, headlight dazzle, Antidazzle Devices. 7.3 Construction and working of Two-filament headlight. Advanced Headlights. 7.4 Adjusting headlights, Checking light output, Asymmetric headlights. 7.5 Need & types of Fog Lamps.</p>	06	10

	7.6 Types, construction & circuit of Side & Tail lights. 7.7 Necessity, construction & circuit of Autronic eye. 7.8 Necessity and wattages of parking light. 7.9 Necessity and wattages of Reversing lamps 7.10 Need & Circuit of Interior lighting.		
08	<p style="text-align: center;">Miscellaneous Electrical System</p> 8.1 Need, construction & working of Defogger. 8.2 Specification, construction and wiring diagram of Windshield wiper. 8.3 Construction & working of Windshield washer. 8.4 Construction & working of Electric fuel pump. 8.5 Construction & working of Power windows. 8.6 Types, circuit & installation of Audio system.	06	10
	Total	48	80

Practical:

Intellectual Skills:

1. To understand various test procedures for battery as specified by manufacturer.
2. To understand the precautions while handling a battery.
3. To identify the alternator components, starter motor components and understand test procedure of some of the components.
4. To understand the lighting system of vehicle.
5. To understand the various circuit diagram and wiring of vehicle.

Motor Skills:

1. Ability to take specific gravity reading using hydrometer, to correct it using temperature correction factor.
2. Ability to perform alternator tests as specified by manufacturer.
3. Ability to perform alternator component tests as specified by manufacturer.
4. Ability to measure parameters such as current, voltage drop using multi meter.
5. Ability to locate the fault in alternator and voltage regulator.

List Of Practical:

1. Measure Specific gravity of electrolyte and carry out High rate discharge test of battery.
2. Conduct Load test of battery.
3. Observe constructional features of Alternator.
4. Conduct alternator output test, Regulated Voltage Output Test and Charging circuit resistance test.
5. Electrical testing of alternator i.e. Rotor and Stator.
6. Mechanical testing of alternator.
7. Observe constructional features of Starter Motor.
8. Conduct starter current draw test and voltage drop test.
9. To trace and draw the wiring diagram of two-wheeler.
10. To trace and draw the wiring of four-wheeler.
11. Testing of Relays and Horns.

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	Dr. Kirpal Singh	Automobile Engineering , Vol II	Standard Publishers
05	Young & Griffiths	Auto Electrical & Electronic Equipment	
06	William Crouse & Angline.	Automotive Mechanics	Tata McGraw-Hill

COURSE NAME : POST DIPLOMA AUTOMOBILE ENGINEERING

COURSE CODE : AB

SEMESTER : FIRST

SUBJECT TITLE : PROJECT-I

SUBJECT CODE :

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
--	-	06	--	--	--	--	50 #	50 @	100

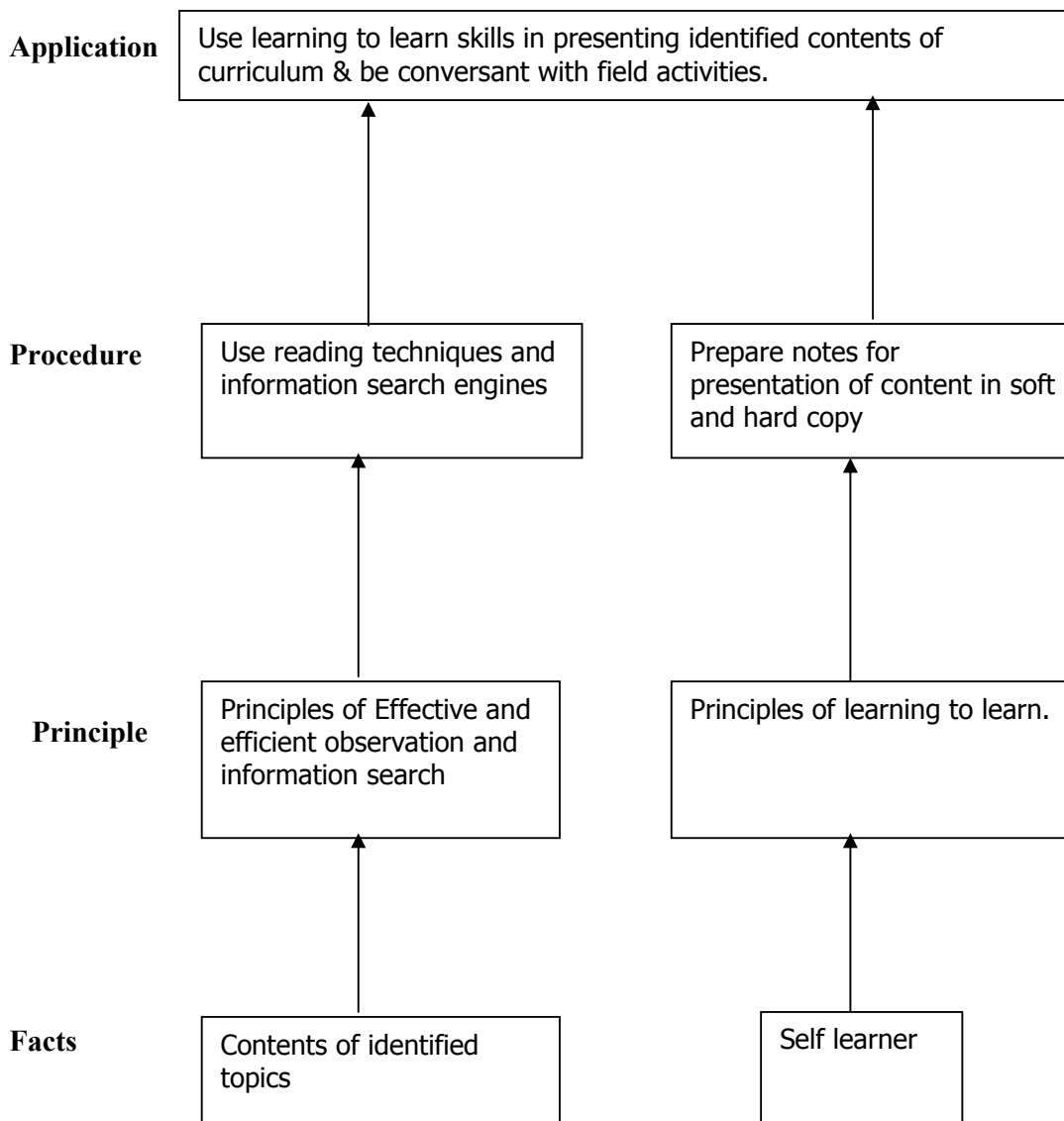
RATIONALE:

Integration classroom & laboratory experiences with field or real life situation is vital for any professional course. That is more valid in case of programme related to motor vehicle. Structured day release is the way to achieve integration at experience level and finally at curriculum level.

OBJECTIVES:

1. Students will know various activities taking place in automobile field.
2. The purpose of introducing project 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.

Learning Structure:



Contents: Theory

Nil

Practical:

Skills to be developed:

Intellectual skills:

9. Ability to observe working
10. Develop understanding of field practices

Motor skills:

1. Observe the working of various systems under various parameters.
2. Ability to work with workshop equipments

List of Practical:

PART – I

1. Students will visit various Service stations/local garages. Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. industrial visits will be arranged in the following areas / industries :

- Two-wheeler garage with dealer point.
- MUV garage with dealer point.
- Garage for Specialised work.
- HCV garage with dealer point.
- Tractor garage with dealer point.
- Fair wheeler garage with dealer point.
- four-wheeler local garage.
- two-wheeler local garage.
- Automobile manufacturing plant.

PART – II

1. Students will study following & prepare a report & give seminar on following topics

- History of Automobile.
- Various types of roads and their condition in India. Traffic density and condition in India.

World Automobile Industry (Four wheeler)

Top 15 Automobile manufacturers in the World.

- Their sales to last five years
- Their models (Where they sell their vehicles)
- Location of plants & collaboration
- Their market
- **Indian Automobile Industries [2 wheeler** (Scooter, Moped & Motorcycle), Cars (MUV, HCV, Passenger cars & Tractors)
- Manufacturers of above vehicles, their sales for last 5 years
- Their models & model wise sales statistics, Location & collaboration

- Their market, Their investment & employee strength.
- Specifications of any two vehicles from each of the following categories.
2 wheeler (Scooter, Moped & Motorcycle), Cars, MUV, HCV, Passenger vehicles & Tractors.
- New arrivals & their special features from each of the following categories.
2 wheeler (Scooter, Moped & Motorcycle), Cars, (MUV, HCV, Passenger cars & Tractors.)
- Price analysis of all vehicles available in India.
- Popular abbreviation in automobile field.
- Auto future and Auto policy in India.

Books:

Sr. No.	Author	Title	Publisher
1	-	Auto magazines	-
2	-	Journals	-
3	-	Automotive Hand book by Bosch	-