 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI 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 2009-10						
SEMESTER : FOURTH										DURATION: 16 WEEKS						
PATTERN : FULL TIME - SEMESTER										SCHEME : E						
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 (16004)
								MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	
1	Theory of Machines & Mechanisms Ø	TMM	12089	04	--	02	03	100	40	--	--	--	--	25@	10	50
2	Automobile Engines	AEN	12097	03	--	04	03	100	40	50#	20	--	--	25@	10	
3	Automobile Systems	ASY	12098	03	--	02	03	100	40	--	--	25#	10	25@	10	
4	Heat Power Engineering	HPE	12099	04	--	02	03	100	40	--	--	25#	10	25@	10	
5	Automobile Manufacturing Processes	AMP	12100	03	--	02	03	100	40	--	--	--	--	25@	10	
6	Computer Programming Ø	CPR	12094	01	--	02	--	--	--	50@	20	--	--	--	--	
7	Professional Practices- IV	PPR	12101	--	--	03	--	--	--	--	--	--	--	50@	20	
TOTAL				18	--	17	--	500	--	100	--	50	--	175	--	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, Ø - common to ME / PT / AE / PG
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 : Mechanical Engineering Group

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

Semester : Fourth

Subject Title : Theory of Machines and Mechanisms

Subject Code : 12089

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **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:

It is a core Technology subject in Mechanical Engineering Discipline. Mechanical Engineering Diploma Holders often come across various mechanisms in practice. He should be able to analyze, identify and interpret various mechanisms and machines in day-to-day life. In maintaining various machines, a diploma technician should have sound knowledge of fundamentals of machine and mechanism. It will be helpful to technician to understand the mechanisms from operational point of view in better way. This subject imparts the facts, concepts, principles, procedure, kinematics and dynamics involved in different machine elements and mechanisms like lever, gear, cam, follower, belt, flywheel, brake, dynamometer, clutch, etc.

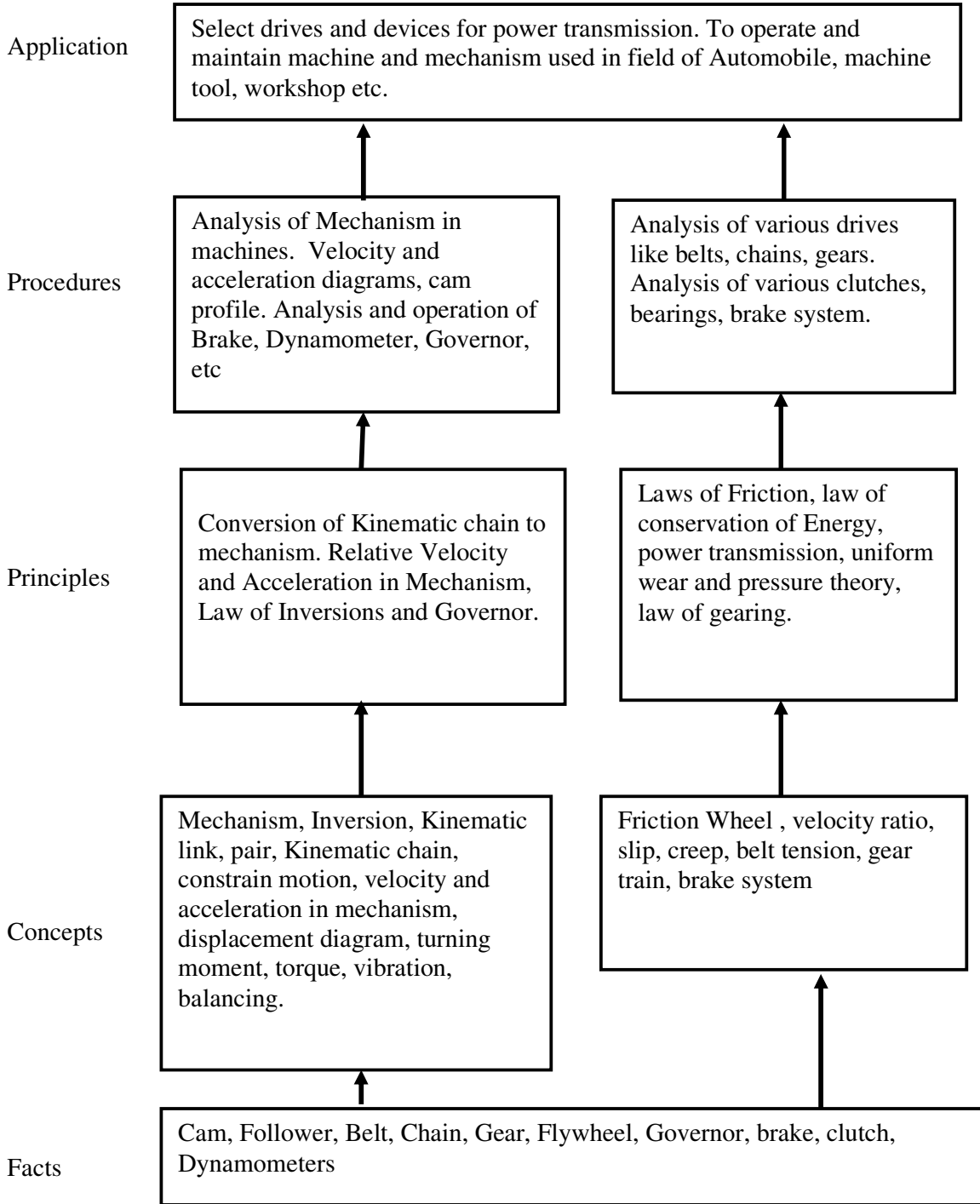
Detail knowledge of above-mentioned aspect with deep insight to the practical applications develops a professional confidence in them to become successful Engineer.

Objectives:

Student will be able to:

1. Know different machine elements and mechanisms.
2. Understand Kinematics and Dynamics of different machines and mechanisms.
3. Select Suitable Drives and Mechanisms for a particular application.
4. Appreciate concept of balancing and Vibration.
5. Develop ability to come up with innovative ideas.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	<p>Fundamentals and types of Mechanisms</p> <p>Kinematics of Machines: - Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain and its types, Mechanism, inversion, machine and structure. (Marks- 6)</p> <p>Inversions of Kinematic Chain. (Marks- 8)</p> <ul style="list-style-type: none"> • Inversion of four bar chain, coupled wheels of Locomotive & Pentograph. • Inversion of Single Slider Crank chain- Rotary I.C. Engines mechanism, Whitworth quick return mechanism, Crank and Slotted lever quick return mechanism. • Inversion of Double Slider Crank Chain Scotch Yoke Mechanism & Oldham's Coupling. <p>Common Mechanisms. (Marks- 4)</p> <ul style="list-style-type: none"> • Bicycle free wheel Sprocket mechanism. • Geneva Mechanism. • Ackerman's Steering gear mechanism. • Foot operated air pump mechanism. 	12	18
2.	<p>Velocity and Acceleration in Mechanism</p> <p>Concept of relative velocity and relative acceleration of a point on link, angular velocity and angular acceleration, inter- relation between linear and angular velocity and acceleration.</p> <p>Analytical method [no derivation] and Klein's construction to determine velocity and acceleration of different links in single slider crank mechanism. (Marks- 4)</p> <p>2.2 Drawing of velocity and acceleration diagram of a given configuration, diagrams of simple mechanisms. Determination of velocity and acceleration of a point on link by relative velocity method [Excluding coriollis components of acceleration]. (Marks- 8)</p>	09	12
3.	<p>Cams and Followers</p> <p>3.1 (Marks- 4)</p> <ul style="list-style-type: none"> • Concept, definition and application of Cams and Followers. • Classification of Cams and Followers. • Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation. 	08	12
	<p>3.2 Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method). (Marks- 8)</p>		

4.	<p>Power Transmission</p> <p style="text-align: right;">(Marks- 8)</p> <p>Belt Drives - flat belt, V– belt & its applications, material for flat and V-belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission(Simple numericals)</p> <p style="text-align: right;">(Marks-12)</p> <ul style="list-style-type: none"> • Chain Drives – Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods of lubrication. • Gear Drives – Spur gear terminology, types of gears and gear trains, their selection for different application, train value & Velocity ratio for compound, reverted and simple epicyclic gear train, methods of lubrication, Law of gearing. • Rope Drives – Types, applications, advantages & limitations of Steel ropes. 	14	20
5.	<p>Flywheel and Governors</p> <p style="text-align: right;">(Marks- 12)</p> <ul style="list-style-type: none"> • Flywheel - Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numericals). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance. • Governors - Types, concept, function and application & Terminology of Governors. • Comparison between Flywheel and Governor. 	06	12
6.	<p>Brakes, Dynamometers, Clutches & Bearings</p> <p>Brakes and Dyanometers (Marks- 12)</p> <ul style="list-style-type: none"> • Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer. • Construction and working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake. • Concept of Self Locking & Self energizing brakes. • Numerical problems to find braking force and braking torque for shoe & band brake. • Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometer. 	12	20

	Clutches and Bearing (Marks- 8) <ul style="list-style-type: none"> • Clutches- Uniform pressure and Uniform Wear theories. • Function of Clutch and its application, Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch v) Diaphragm clutch. (Simple numericals on single and Multiplate clutch). • Bearings – i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation). Simple numericals. 		
7.	Balancing & Vibrations (Marks- 6) <ul style="list-style-type: none"> • Concept of balancing. Balancing of single rotating mass. Graphical method for balancing of several masses revolving in same plane. • Concept and terminology used in vibration, causes of vibrations in machines, their harmful effects and remedies. 	03	06
Total		64	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Understand working of free wheel mechanism of a bicycle, Geneva mechanism, steering gear mechanism etc.
2. Determine velocity and acceleration of links in a given mechanism.
3. Analyse balancing of rotating masses in a single plane.
4. Interpret interrelationship between components of various braking mechanisms.
5. Understand concepts of vibrations in various machineries, their harmful effects and remedies.
6. Compare various power transmission devices.

Motor Skills:

1. Drawing of velocity and acceleration diagrams.
2. Assembly and dismantling of brakes and clutches.
3. Drawing of cam profiles from a given data for i. C. Engine.
4. Drawing of velocity and acceleration diagram.

Note - The Term work shall consist of Journal / lab manual and A-3 size sketch book.**List of Practical:**

Find the ratio of time of cutting stroke to the time of return stroke for quick return mechanism of a shaper machine.

- 1) Sketch & describe working of bicycle free wheel sprocket mechanism.
- 2) Determination of velocity and acceleration by relative velocity method (four problems).
- 3) Determination of velocity and acceleration of piston of an I.C. engine's Slider Crank mechanism by Klein's construction, for different position of crank in

between 0° and 360° . Represent graphically velocity verses crank angle and acceleration verses crank angle.

- 4) Draw the profile of radial cam for the given motion of follower. (At least four problems)
- 5) Determine the radius of rotation of flyball for different speed of governor and draw a graph between radius of rotation versus speed.
- 6) Dismantling and assembly of mechanically operated braking mechanism for two wheelers.
- 7) Determination of power transmitted by any belt drive using any one dynamometer.
- 8) Dismantling and assembly of multiplate clutch of two-wheeler.
- 9) Determine graphically balancing of several masses rotating in a single plane.

Learning Resources:

Books:

So. No	Author	Title	Publication
01	Khurmi Gupta	Theory of machines	Eurasia publishing House Pvt. Ltd. 2006 edition
02	S.S.Rattan	Theory of Machine	McGraw Hill companies, II Edition
03	P.L.Ballaney	Theory of machines	Khanna Publication
04	Timo Shenko	Theory of machines	Wiley Eastern
05	Jagdishlal	Theory of machines	Bombay Metro – Politan book ltd.
06	Ghosh - Mallik	Theory of machines	Affiliated East west press
07	Beven T.	Theory of machines	CBS Publication
08	J.E.Shigley	Theory of machines	Mc Graw Hill

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Fourth

Subject Title : Automobile Engines

Subject Code : 12097

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 MSBTE.**
- **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:

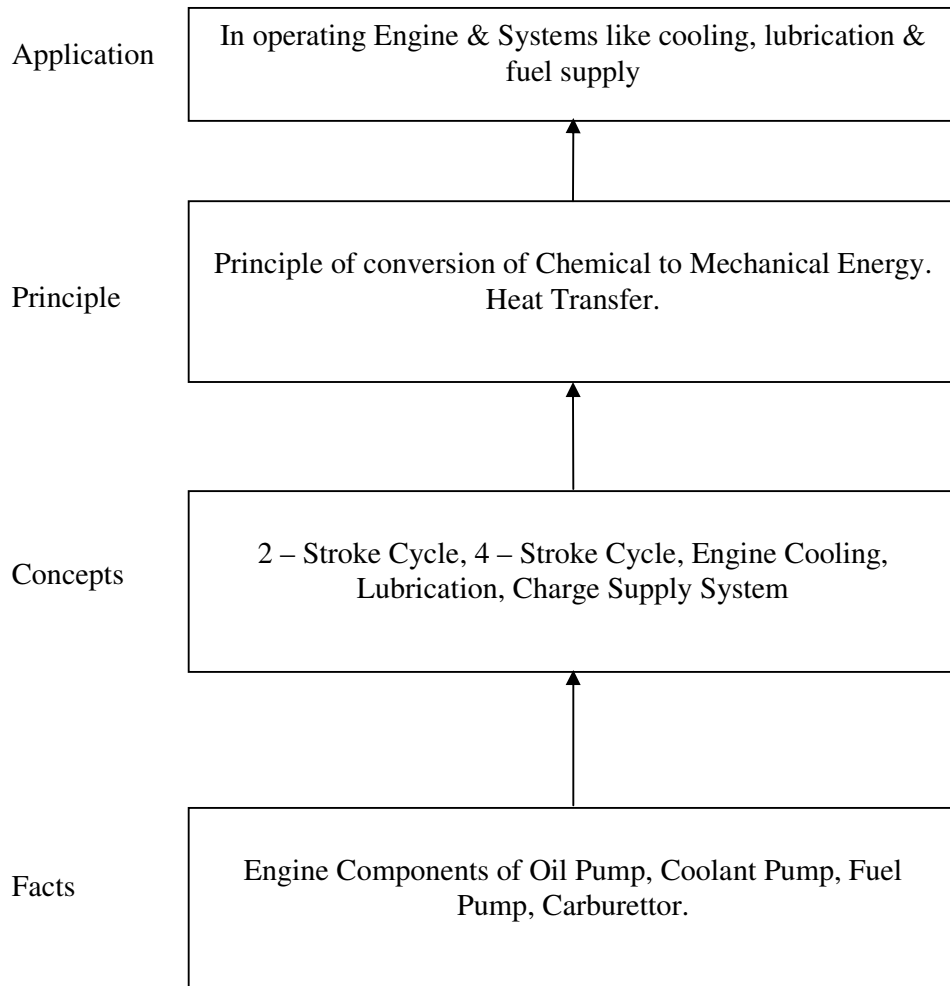
The Engine being the most important part of automobile vehicle, the automobile engineers should know various types of engines, their working and different systems employed in sound working of automobile engine. This subject intend to develop the skills of identification and location of engine parts, and its functions, procedure for disassembly & assembly of systems and components related to automobile engine.

Objectives:

Students will be able to:

1. Understand engine principle and fundamentals.
2. Understand Constructional features of automobile engine components.
3. Understand Engine cooling system.
4. Understand Engine Lubrication systems.
5. Understand Fuel Systems.
6. Understand engine power calculations.
7. Analyse engine condition by performing Morse / Motoring test.

LEARNING STRUCTURE:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Engine principles and fundamentals 1.1 Introduction <ul style="list-style-type: none"> • Basic engine nomenclature. • Classification of automobile engines. • Use of engines 1.2 Merits and Demerits of vertical and horizontal engines. 1.3 Four stroke SI and CI engine <ul style="list-style-type: none"> • Two stroke cycle engine. • Comparison of two stroke and four stroke cycle engine • Reasons for using single cylinder two stroke and four stroke cycle engine. 	06	18
02	Constructional features of automobile engine components. 2.1 Cylinder block, cylinder liner, types of liner, comparison of dry and wet liners, cylinder head, gaskets, type of gaskets, piston, piston ring pin etc. 2.2 Piston, piston rings, Piston ring joints, piston pin. Crank shaft, camshaft, connecting rod, valve, valve cooling, valve mechanisms, valve timing, port-timing diagram, manifolds, silencers, flywheel etc. Types of camshaft drives. 2.3 Rotary and reed valve	08	20
03	Engine cooling system 3.1 Introduction – Purpose of cooling <ul style="list-style-type: none"> • Systems- Air cooling system, water cooling systems. • Comparison of air & water cooling systems. 3.2 Parts of cooling system. Thermostat, water expansion tank, Temperature Indicator Pressure cap, water pump, fan and fan belt, radiator. 3.3 Cooling water additions	04	10
04	Lubrication systems 4.1 Introduction Purpose of lubrication, parts to be lubricated, functions and properties of engine lubricating oils, additives for lubricants, classification of lubricating oils. 4.2 Dry Sump lubrication system, wet sump lubrication system, petrol lubrication system, pressurized lubrication system, splash lubrication system.	06	08

05	Fuel Systems Part A 5.1 Fuel feed system in petrol engines. • Mechanical fuel pump, electrical fuel pump 5.2 Principles of carburetion. • Simple carburettor. • Starting, Idling & slow running, acceleration, Main metering system, choke system. • S.U. Carburettor, solex carburettor. 5.3 Carburettors used in two wheelers and four wheelers. 5.4 Requirement of fuel injection system. • Various components & Diesel Fuel injection system. • Types of fuel injection pumps for single and multi cylinder engines, inline and rotary types of fuel injection pumps. 5.5 Types of fuel injectors. • Air fuel mixture ratio in a petrol and diesel engine and comparison. • Mixture requirement for Transient conditions.	14	24
06	I.C. Engine Testing. 6.1 Engine Power – Indicated, Brake and Frictional Power. • Efficiency- Mechanical, Thermal, Relative and Volumetric. • Fuel Consumption- BSFC 6.2 Morse test, Motoring test. • Heat Balance Sheet.	10	20
Total		48	100

Practical:

Skills to be developed:

Intellectual skill:

- To identify engine components.
- To select tools / equipments for engine assembly / dismantling
- To interpret results from engine power calculations, observations.
- To read service manual for dismantling, assembly of engine.
- To understand working principle of SI / CI engine.

Motor skills:

- To observe engine components & to sketch them.
- To adopt proper procedure of engine assembly, dismantling, engine trial.
- To measure certain parameters accurately. (Engine speed, coolant temp & mass flow rate of water).

List of Practical:

- 1) Operate a cut section model to explain two- stroke cycle engine.
- 2) Operate a Cut section model to explain four- stroke CI and SI engine
- 3) Dismantling and reassembling of following types of engines. (Any one from each category)
 - Moped, scooter, motorcycle Single cylinder petrol or diesel engines.
 - Four stroke petrol or diesel engines.
- 4) i) Remove the radiator from the vehicle, check it for leak, clean and reverse flush the radiator and refit.
 ii) Remove the water pump, clean, inspect and refit.
 iii) Remove the thermostatic valve, check and refit
- 5) Remove the carburettor from the engine of motor cycle, identify and check the components, draw the circuits and refit.
- 6) Remove the carburettor from the car engine, identify and check the components, draw the circuits and refit.
- 7) Open the fuel injection pump and fuel injector, identify the components – draw sketch and reassemble.
- 8) Perform a trial on a Multi-cylinder engine. Prepare a heat balance sheet.
- 9) Perform a Morse test on a Multi-cylinder 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 : Diploma in Automobile Engineering

Course Code : AE

Semester : Fourth

Subject Title : Automobile Systems

Subject Code : 12098

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 MSBTE.**
- **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:

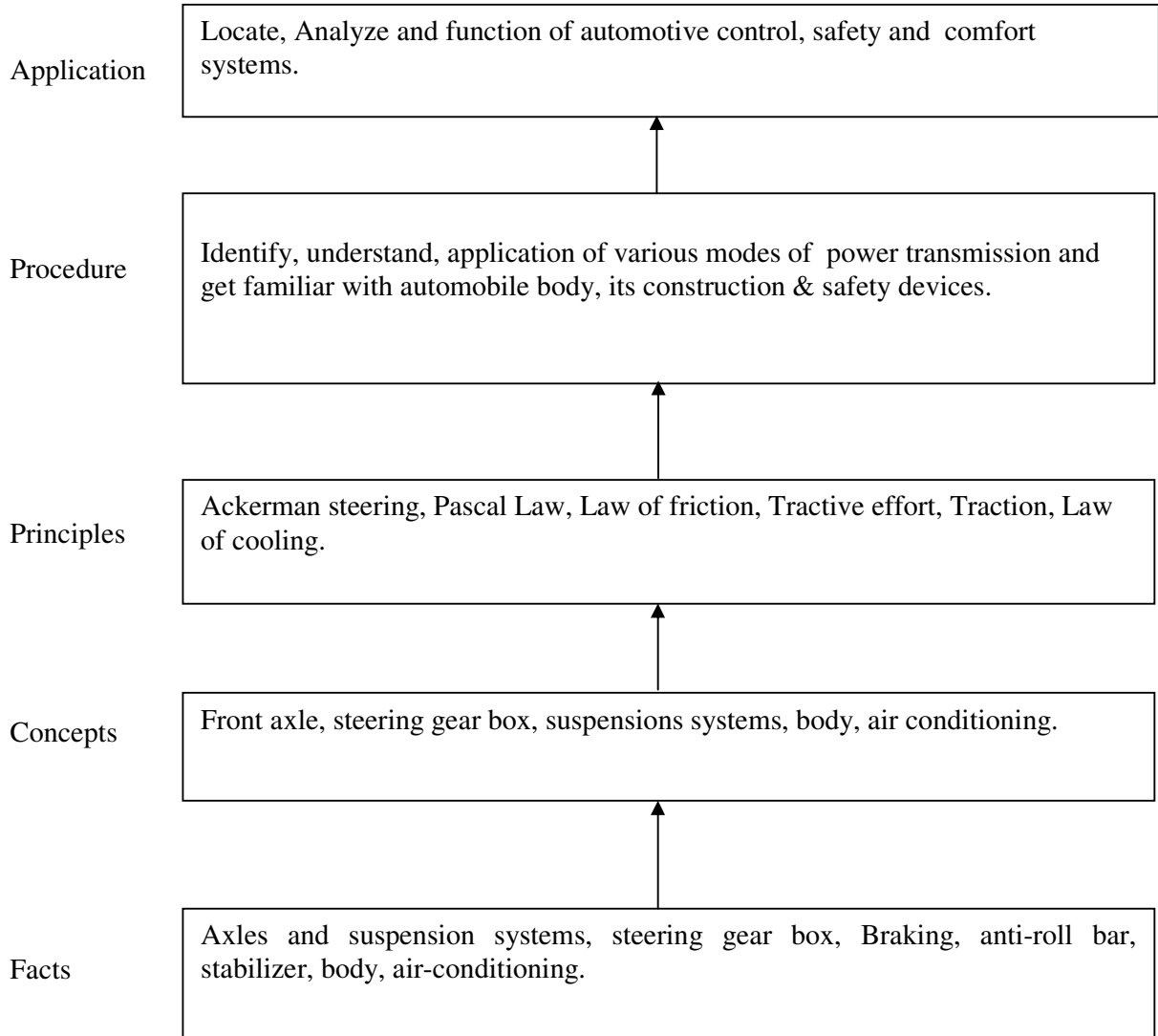
This subject is Core Technology subject for Automobile Engineering course. This subject is part of Automobile systems concerning control of vehicles. Knowledge of this subject is required in the subjects like Automobile Component Design, Vehicle maintenance, vehicle testing. Conceptual knowledge of this subject is useful for understanding and improving the performance of Automobile system.

Objectives:

Students will be able to:

1. Understand construction, working and functions of Automobile Systems.
2. Understand construction, working and functions of Automobile control systems such as steering, braking and suspension.
3. Compare the developments in body engineering, control systems and safety equipment.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	Front Axle and Steering : 1.1 Steering mechanisms 1.2 Types of front axle - Dead axle, live axle, type of stub axle arrangements- Elliot, reverse Elliot, lamoine, reverse lamoine. 1.3 Front wheel assembly. 1.4 Steering geometry – Caster, camber, king pin inclination, toe in– toe out, Correct Steering angle. Under steering and over steering, Turning radius & their effects. 1.5 Construction, working & application of Steering gear box – rack and pinion type, recirculating ball type, worm & roller type. 1.6 Ackerman Principle & linkage. 1.7 Power assisted steering & its types (Hydraulic & electrical)	12	22
02	Brakes: 2.1 Function and necessity. 2.2 Classification of brakes and braking systems. 2.3 Principle, construction and working of -disc brakes, drum brake 2.4 Construction and working of the following-- Mechanical braking system, Hydraulic Braking system, Air braking system, Hydraulic operated air assisted braking system. 2.5 Properties of brake fluids and their specifications 2.6 Concept and working of antilock braking system. 2.7 Parking brake.	10	20
03	Suspension Systems : 3.1 Types of suspension systems - Rigid & independent suspension 3.2 Types of Independent suspension system-McPherson strut, wishbone type. 3.3 Semi-elliptical Leaf spring, coil spring , torsion bar arrangement 3.4 Telescopic shock absorber, Gas filled shock absorber, hydraulic shock absorber 3.5 Air Suspension System. 3.6 Anti roll bar, stabilizer bar.	08	18

Chapter	Name of the Topic	Hours	Marks
04	Body Engineering: 4.1 Effect of stream lining on vehicle performance. 4.2 Materials used in body construction and types of bodies. 4.3 Protective and anti corrosive treatments, painting procedure. 4.4 Safety devices –air bags, exhaust brake, emergency brake, Central locking, collapsible steering.	06	16
05	Car Heating Ventilation & Air Conditioning System(HVAC): 5.1 Basic principle- vapour compression cycle, layout and operation of HVAC. 5.2 Types of refrigerant used in car air conditioning and their Properties. 5.3 Human comfort conditions. 5.4 Temperature control system, humidity control.	06	16
06	Vehicle Performance : 6.1 Resistance faced by the vehicle- Air resistance , rolling Resistance, gradient resistance. 6.2 Define traction, tractive efforts, draw bar pull, gradeability and Acceleration, pitching, Bouncing, Rolling, Sway and yaw. 6.3 Stability of vehicle on turn and slopes (No mathematical Treatment).	06	08
Total		48	100

Practical:

Skills to be developed:

Intellectual Skill:

1. Identify concepts applied.
2. Identify parts like front axle, steering, brakes, suspension system.
3. Classify the system according to their application.
4. Select proper tools & their ranges.
5. Detect fault by observation, trial.

Motor Skill:

1. Sketch the different devices.
2. Handle tools, equipment, instruments.
3. Observe the working of various systems under various parameters.

List of Practical:

1. Open the steering gearbox, observe the components and steering linkages, sketch and assemble.
2. Observe and draw layout of hydraulic braking system. Open master cylinder, wheel cylinder, and brake drum. Observe and sketch the components.
3. Observe and draw the layout of Hydraulically operated air assisted braking system.
4. Open, observe and sketch leaf spring and assemble.
5. Dismantle telescopic shock absorber, observe and sketch its components.
6. Observe and draw the layout of air suspension system.
7. Visit to body building and body manufacturing industry, prepare a report considering following points – layouts, body construction, body materials, body repair and painting procedure.
8. Observe and draw the layout of car air- conditioning. Measure temperature at various places.

Learning Resources:**Books:**

Sr. No	Author	Title	Publisher
1	Anthony Schwaller	Motor Automotive Technology	Delmar Publisher Inc.
2	Tim Gills	Automotive Service	Delmar Publisher Inc.
3	Anil Chikara	Automobile Engineering Vol. II	Satya Prakashan New Delhi
4	Crouse / Anglin.	Automobile Mechanics	TATA McGRAW – HILL
5	Kirpal Singh	Automobile Engineering Vol. I	Standard Publication
6	R.B. Gupta	Automobile Engineering	Satya Prakashan New Delhi
7	S. Srinivisan	Automotive Mechanics	TATA McGRAW – HILL
8	--	Ashrae Handbook Of Hvac	Ashrae
9	Boyce H. Dwiggin	Automobile Air Conditioning	Thomson Learning

Course Name : Diploma in Automobile Engineering**Course Code : AE****Semester : Fourth****Subject Title : Heat Power Engineering****Subject Code : 12099****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	25 #	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **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)**

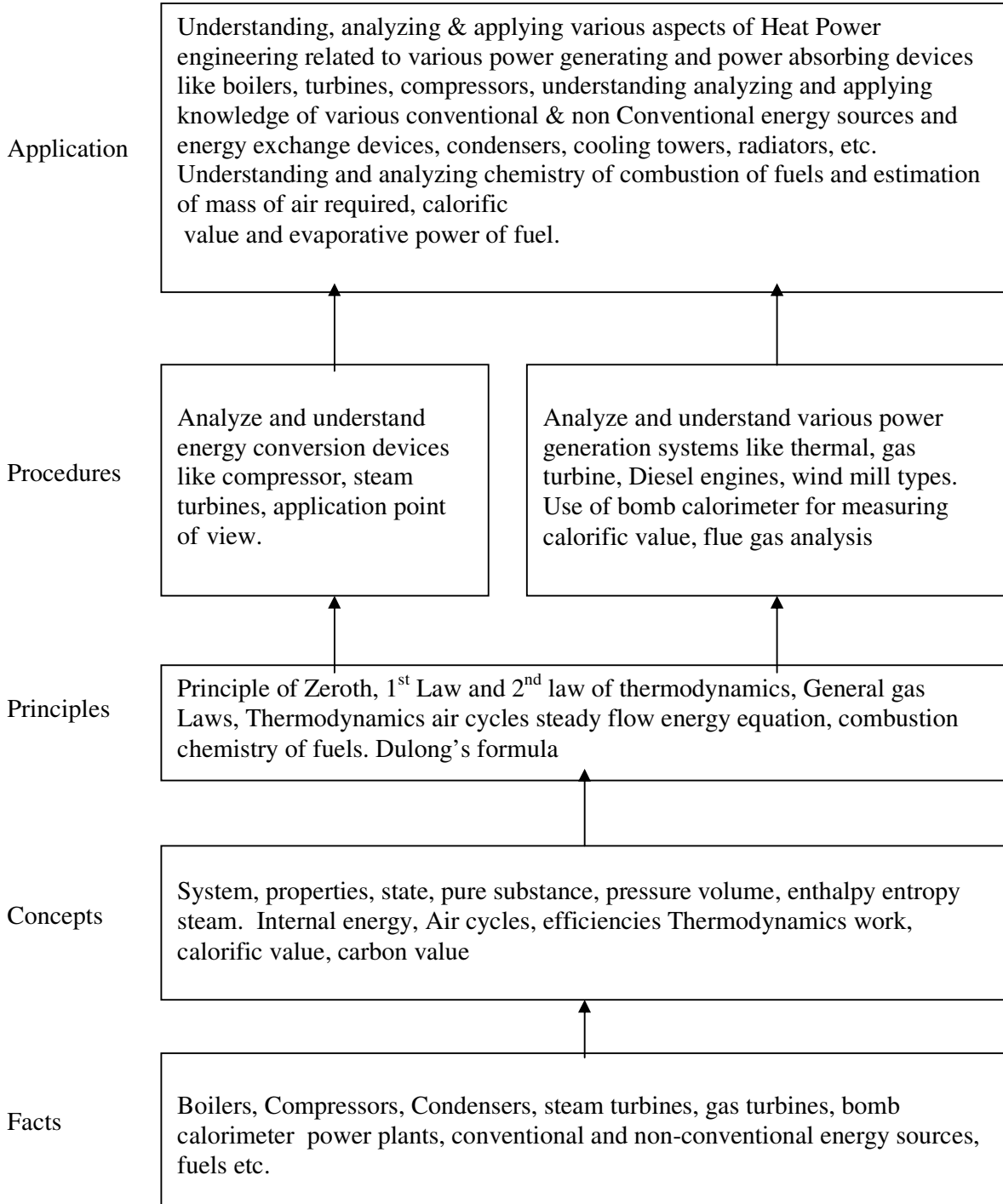
Rationale:

Heat Power Engineering is a core engineering subject. Heat energy is the basis for most of the power producing and power absorbing devices. In order to understand the principles and working of these devices it is essential to understand the basic laws, concepts of thermodynamics, gas laws, properties of steam, generation of steam with modern boilers, steam condensers and turbines. As modern diesel engine vehicles are turbocharged, students should also understand the working principles and constructions of air compressors, gas turbines and jet engines. Due to energy crunch of petroleum products worldwide hunt for alternative energy sources is being done for the last three decades. Hence students should also have comparative brief idea about various conventional energy sources, calorific values, carbon value and evaporative power of fuels, alternative energy sources. Heat transfer forms basis of different components like condensers, radiators, cooling fins, etc. Hence student should have capability to calculate the necessary parameters.

Objectives: Students will be able to:

1. Learn to correlate the theoretical knowledge with practical aspects of systems of work producing and work absorbing devices like boilers, condensers, steam turbines, air compressors, gas turbines, etc.
2. Understand the various sources of energy and ways to harness it.
3. Understand the chemistry of combustion of fuels, estimation of calorific value, mass of air required for complete combustion of fuels.
4. Understand the basic concepts of heat transfer and its application in various appliances.
5. Identify/observe/locate/ operate various parts of instruments / equipments carefully and follow test procedures.
6. observe the behavior of devices with the change in parameters and make changes if necessary.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<p>Fundamental concepts of thermodynamics and various thermodynamic processes:</p> <p>1.1 Basic concepts of - i) system ii) surrounding iii) Universe iv) open system v) closed system vi) Isolated system vii) steady flow energy equation viii) internal energy ix) enthalpy x) entropy.</p> <p>1.2 Zeroth, first and second law of thermodynamics, General gas equation, Characteristics of gas constant, Mol of gas, Universal gas constant, specific heats of ideal gases.</p> <p>1.3 Thermodynamic processes of ideal gases. Isobaric, Isochoric, Isothermal, Adiabatic and polytropic with representation on P-V and T-S diagram, work done, change in internal energy, change in enthalpy and relation between P, V & T (Derivations only for adiabatic process)</p> <p>1.4 Air cycles: - P-V and T-S diagram and equations for air standard efficiency of Otto, Diesel & Dual combustion cycle.</p>	12	18
02	<p>Properties of steam and steam power:</p> <p>2.1 Formation of steam, various phases like wet steam, dry saturated Steam, superheated steam.</p> <p>2.2 Dryness fraction, degree of superheat, sensible heat, Latent heat, calculation of enthalpy of wet, dry saturated & superheated steam using steam table.</p> <p>2.3 Study of boilers like three pass packaged type boiler, Water Tube & Fire Tube Boiler. Mountings - Bourdan Pressure Gauge, Safety valves, Water level Indicator and fusible Plug. Accessories - Economiser, superheater and air pre-heater.</p> <p>2.4 Steam condenser: Principle, Function, locations in steam power plant. Surface condenser & its Applications..</p> <p>2.5 Steam Turbines: Classification of turbines, construction and working of Impulse and Reaction turbine. Application of equation of continuity to steam turbine.</p>	12	18
03	<p>Air Compressors:</p> <p>3.1 Various uses of compressed air and classification of compressors.</p> <p>3.2 Construction and working of single stage and two stage reciprocating air Compressors with P.V diagram. Necessity of multistaging and intercooling.</p> <p>3.3 Construction & working of rotary compressors i) Centrifugal compressor ii) Axial flow compressor iii) Screw compressor</p> <p>3.4 Comparison of various compressors</p> <p>3.5 Air compressor terminology like</p>	08	16

	i) Free air delivered ii) Capacity of compressor iii) Piston displacement iv) I.P., B.P. v) Volumetric efficiency vi) Isothermal efficiency vii) Overall Isothermal or Compressor efficiency		
04	Gas Turbines: 4.1 Brayton cycle- P. V. diagram and thermal efficiency 4.2 Classification of gas turbines. 4.3 Construction and working of gas turbines i) open cycle ii) closed cycle gas turbines, P.V. & T.S diagrams. 4.4 Turbojet & turboprop engine.	06	08
05	Sources of Energy & Power plants: 5.1 Classification of various conventional and non-conventional sources of energy. 5.2 Construction and working of power plants based on conventional energy sources : i) Thermal power plant ii) Diesel power plant iii) Gas turbine power plant. 5.3 Parameters of site selection : 5.4 Study the working and construction of non-conventional energy sources. i) Solar ii) Bio-diesel iii) Bio Mass iv) Wind energy based power plant v) Only introductory concept of geo thermal & Tidal power plant.	08	16
06	Heat transfer: 6.1 Modes of heat transfer--conduction, convection and radiation. 6.2 Conduction - Fourier's law , thermal conductivity, conduction through cylinders, thermal resistance, composite walls, combined conduction and convection. 6.3 Thermal radiation, absorptivity, transmissivity, reflectivity, emissivity, black and gray bodies, Stefan-Boltzman law, Heat transfer by radiation.	08	08
07	Fuels and Combustion : 7.1 Types of fuels – definition, classification, calorific value of fuels. 7.2 Ultimate analysis and proximate analysis of solid fuels. 7.3 Liquid fuels- Comparative information about composition, specific gravity and gross calorific values of liquid fuel. 7.4 Gaseous fuels- natural gas, LPG, CNG, and other artificially prepared gaseous fuels. 7.5 Combustion of fuels – combustion chemistry of carbon, hydrogen and methane. 7.6 Mass of air required for complete combustion of fuel, excess air, and flue gas analysis. 7.7 Calorific value of fuel and its estimation, carbon value, vaporative power of fuel. Dulong's formula. Junker's gas calorimeter.	10	16
Total		64	100

Practical:

Skills to be developed:

Intellectual Skills :

- Observe & calculate thermal efficiency at constant pressure heating.
- To understand working of steam turbine.
- To refer relevant act & list its salient features.
- To calculate efficiency of solar water heating system.

Motor Skills:

- To observe & draw boiler mountings.
- To start reciprocating air compressor & to take measurements.
- To follow given procedure to conduct trial on reciprocating air compressor

List of Practical:

- Assembling and dismantling of Gas Geyser.
- Study of boiler mounting- a) safety valve and b) Bourdon's pressure gauge. Boiler accessories-a) economizer b) super-heater (construction and working should be studied with the help of models.)
(for study of safety valves, practical experiments like replacing dead weight safety valve on ordinary pressure cooker with lever safety valve can be carried out.)
- Study and provisions of Indian boiler act with reference to duties of boiler inspector, registration process, transfer of boilers etc.
- To conduct trial on reciprocating air compressor.
- Dismantling and assembling of one reciprocating or rotary compressor.
- Study of gas turbines used in turbocharger.
- Study of functioning of domestic solar water heater and calculating its efficiency.
- Determination of calorific value of solid or liquid fuel using Bomb calorimeter.

Learning Resources:**Books:**

Sr.No.	Author	Name of Book	Publication
01	R. S. Khurmi & J. K. Gupta	A Text book of Thermal Engineering	S. Chand & Co. Ltd.
02	Patel and Karamchandani	Elements of Heat Engines (Vol. I, II & III)	Acharya Book Depot.
03	A. S. Rao	Thermal Engineering	Satya Prakashan
04	B.K.Sarkar	Thermal engineering	Tata McGraw Hill
05	Jones & Dugan	Engineering Thermodynamics	Prentice Hall of India
06	Yunus Cengel & Mike Boles	Thermodynamics	Tata McGraw Hill
07	Jesse S.Doolittle & Francis J Hale	Thermodynamics for Engineers.	John Willey & Sons
08	S. Domkundwar, Dr C.P. Kothandaraman & A.V. Domkundwar	A course in Thermal Engineering	Dhanpat Rai & Co.(P) Ltd, New Delhi

Course Name : Diploma in Automobile Engineering**Course Code : AE****Semester : Fourth****Subject Title : Automobile Manufacturing Processes****Subject Code : 12100****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 MSBTE.**
- **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:

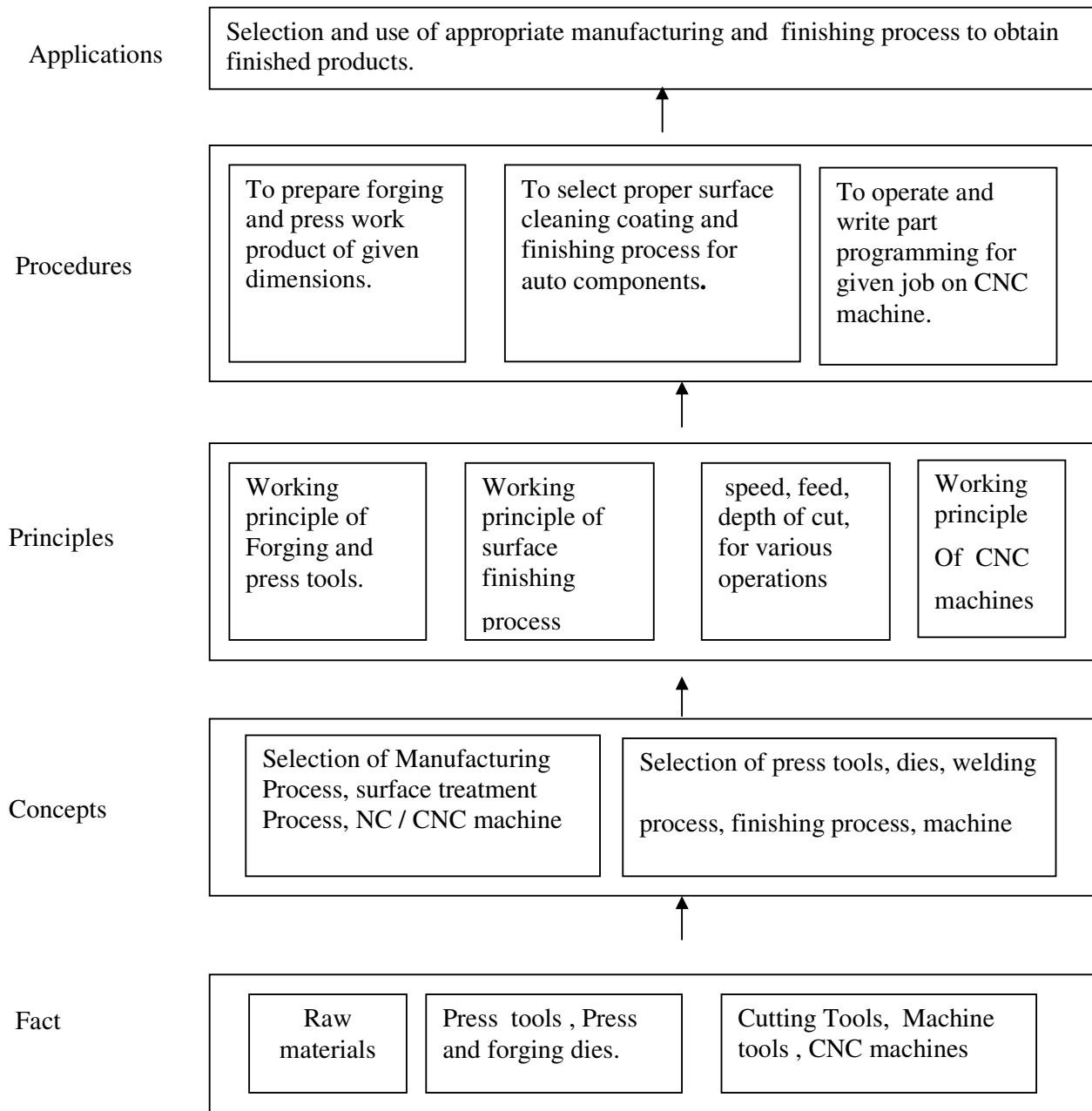
Automobile manufacturing process is a core technological subject in Automobile engineering course. With advent of technology there are many advances in manufacturing processes and equipments. The knowledge of these advances is essential for a diploma student engaged in engineering organizations. He should also be proficient in writing CNC programmes and use it in manufacturing industry. This subject is intended to develop these abilities.

Objectives:

The student will be able to

1. Know the forging process and it's use in manufacturing automobile parts.
2. Know the different press tools and their operations.
3. Understand different welding process used in industry.
4. Selection and applications of different surface cleaning and coating process
5. Know the different methods of surface finishing.
6. Know about CNC machines and to write CNC programming.

Learning Structure:



Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	Forging - 1.1 Forgeable materials and forgeability. 1.2 Advantages and limitations of forging process. 1.3 Classification of forging processes. 1.4 Hand tools 1.5 Forging sequences for connecting rods, crankshafts, camshafts, spanners and gears.	06	16
2.	Press and press work – 2.1 Materials used in press work. 2.2 Classifications of presses. 2.3 Parts of standard die set. 2.4 Die accessories- Pilots, Stops, Strippers, Pressure pads & Knock outs 2.5 Types and construction of dies—Simple, progressive, compound and combination die. 2.6 Press operations with sketches 2.7 Press components used in automobiles.	12	24
3.	Welding processes - 3.1 Classification of welding process. 3.2 Working principle of Gas welding and types of flames. 3.3 Arc welding process like metal arc, TIG & MIG. 3.4 Resistance welding (spot, projection, seam & butt) 3.5 Brazing and soldering.	08	16
4.	Surface treatment and finishing processes – 4.1 Introduction 4.2 Surface cleaning process (acid, alkaline, electrolytic cleaning, blasting and tumbling. 4.3 Metallic surface coating(Electroplating, Galvanizing and metal spraying) 4.4 Selection and use of finishing process. 4.5 Surface finishing processes (Lapping, honing, super finishing, buffing, burnishing.)	04	10
5	Introduction to CNC machines - 5.1 NC, CNC and DNC machines. 5.2 Classifications of CNC machines. 5.3 Advantages and disadvantages of CNC machines. 5.4 Co-ordinate system- Absolute and Incremental 5.5 Axes identification- X, Y and Z axes. 5.6 Procedure for developing the Part program. 5.7 ISO Codes used in programming. 5.8 Structure (Format) – Block and part program 5.9 Simple Part programming as per ISO codes on CNC &VMC for operations like turning, drilling and milling	18	34
Total		48	100

List of Practicals:

1. One composite job involving different milling machine operations such as key way cutting, gear cutting by indexing, etc. for the batch of 4 to 6 students.
2. One press work job using progressive, compound or combination die. Job should be selected from market utility.
3. One resistance welding job to show the working principle of resistance welding
4. One simple part programming job on CNC machine.
5. At least one industrial visit should be arranged to show the different Milling machines, grinding machines, CNC machines, forging operations, press operations, Surface treatment and surface finishing processes.

Recommended Books:

Sr. No.	Author	Title	Publication
1.	S. K. Hajra Choudhury. A. K. Hajra Choudhury. Nirjhar Roy	Elements of Workshop Technology. Vol. - I & II	Media Promoters & Publishers Pvt. Ltd.
2.	H. S. Bawa	Workshop Technology Vol. - I & II.	Tata McGraw-Hill Publishing Co. Ltd.
3.	R. K. Jain	Production technology	Khanna Publishers.
4.	P.N.Rao	CAD/CAM Principles and applications	Tata McGraw-Hill Publishing Co. Ltd.
5.	M.S. Sherawat, J.S. Narang	CNC Machines	Dhanpat Rai & Co.
6	Aditan, Pabla	CNC machines programming & applications	New age international publications
7.	H.M.T.	Production Technology	H.M.T.

2. Video Cassettes and CDs:

Video cassettes developed by:

- Electronics Trades and Technology Development Corporation
(A Govt. of India undertaking), Akbar Hotel Annex , Chanakyapuri ,
New Delhi – 110 02.

Learning Materials – CBT Packages developed by N.I.T.T.T. R, Bhopal.

Course Name : Mechanical Engineering Group

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

Semester : Fourth

Subject Title : Computer Programming

Subject Code : 12094

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	--	--	50@	--	--	50

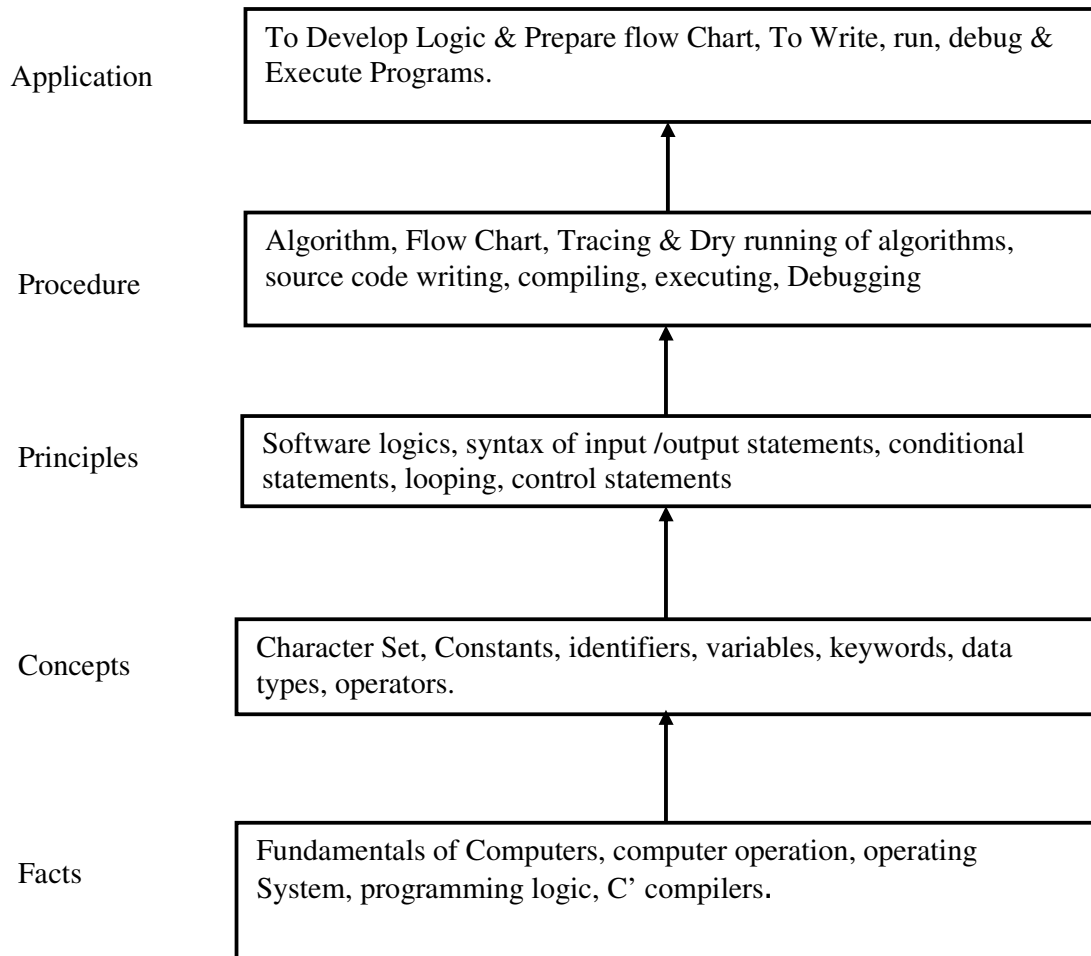
Rationale:

In advanced age of computer, it becomes essential to understand how to give instructions to computers. This course intends to expose a student to the basic principles of programming through a structured programming language like 'C'. Study of this course would enable the students to learn any advanced Object Oriented Language.

Objectives:

Students should be able to:

1. Break a given task into subtasks.
2. Enhance logical thinking.
3. Develop 'C' programs for simple applications.

Learning Structure:

Contents: Theory

Chapter	Name of the Topic	Hours
1.	Introduction - Problem, definition and analysis, algorithm, flow charts, tracing and dry running of algorithms. Introduction to 'C' programming, simple program using Turbo 'C' compiler and execution of 'C' program	02
2.	C Fundamentals: Character set, constants, data types, identifiers, key words, variable declarations Types of Operators – unary, binary, arithmetic, relational, logical, assignment. Hierarchy of operators, expressions, library functions, Use of input/ output functions viz. Printf(), Scanf(), getch(), putch()	03
3.	Use of Control Statements:- if-else, while loop, do – while loop, for loop, switch, break and continue. Writing, Compiling, Executing and debugging programs	05
4.	Introduction to Subscripted variables, arrays, defining and declaring one and two dimensional arrays, reading and writing	03
5.	Concept of String, string input / output functions Defining and accessing a user defined functions, Passing of arguments, declaration of function prototypes Storage classes: automatic, external, static variables	03
Total		16

Practical:**Skills to be developed:**

Intellectual Skills:

1. Prepare and interpret flow chart of a given problem.
2. Represent data in various forms.
3. Use various control statements and functions

Motor Skills:

1. Write program in 'C' language.
2. Run and debug 'C' program successfully.

List of Practical:

To write simple programme having engineering application involving following statements

1. Use of Sequential structure
2. Use of if-else statements
3. Use of for statement
4. Use of Do-While Statement

5. Use of While statement
6. Use of brake and Continue statement
7. Use of multiple branching Switch statement
8. Use of different format specifiers using Scanf() and Printf()
9. Use of one dimensional array e.g. String, finding standard deviation of a group data
10. Use of two dimensional array of integers/ reals
11. Defining a function and calling it in the main

Learning Resources:**Books:**

Sr. No	Author	Title	Publication
01	Byron Gotfried	Introduction to 'C' programming	Tata McGraw Hill
02	Yashwant Kanitkar	Let us 'C'	BPB publications
03	Denis Ritchie and Kernighan	Introduction to 'C' programming	Prantice Hall Publications
04	Balguruswamy	Programming in 'C'	Tata Mc- Graw Hill

Course Name : Diploma in Automobile Engineering

Course Code : AE

Semester : Fourth

Subject Title : Professional Practices-IV (AE)

Subject Code : 12101

Teaching and Examination Scheme

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

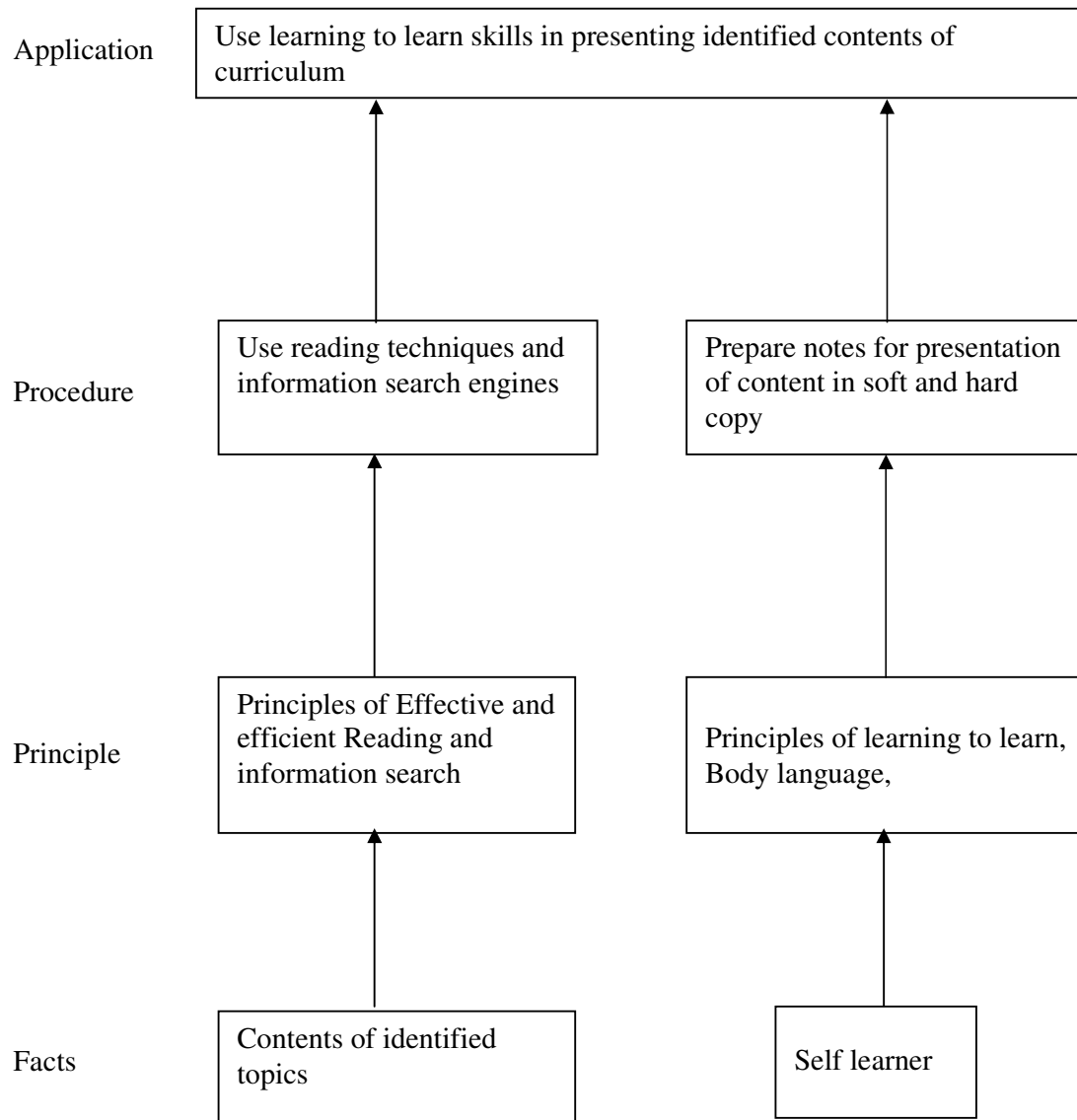
The purpose of introducing professional practices is to provide opportunities to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester so that there will be increased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



Contents:

Sr. No.	Activities	Hours
1	<p>Industrial Visits</p> <p>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.</p> <p>TWO industrial visits may be arranged in the following areas / industries</p> <ul style="list-style-type: none"> i) Garage / service station. (Engine/chassis components, subsystems, their location.) ii) Vehicle manufacturing company.(Component manufacturing processes.) iii) Engine FIP testing unit. iv) Sugar Factory / SSI / Chemical Factory v) Machine shop having CNC machines. 	14
2	<p>Lectures by Professional / Industrial Experts to be organized from any of the following areas (3 Lectures : 2 hrs duration each):</p> <ul style="list-style-type: none"> i) Interview Techniques. ii) Power steering iii) Antilock braking system iv) Air suspension system v) Automotive safety systems vi) Car heating, ventilation & air conditioning system. vii) Vehicle performance viii) Alternative sources of energy (wind, solar and biomass) ix) Use of internet 	06
3	<p>Information Search:</p> <p>Information search through manufacturers, catalogue, internet, magazines; books etc. and submit a report of max. 10 pages (Any Two topics)</p> <p>Following topics are suggested:Two wheeler engine specifications.</p> <ul style="list-style-type: none"> i) Four wheeler engine specifications ii) Engine lubricants & additives iii) Automotive gaskets and sealants iv) Engine coolants and additives v) Two wheeler carburettor. vi) Four wheeler carburettor. vii) Fuel injection pumps viii) Power steering ix) Filters x) Different drives/Transmission systems in two wheelers. xi) Types of Rolling Contact bearings – construction, mountings, applications, cost and suppliers. xii) Radiators xiii) Maintenance procedure for solar equipment. xiv) Drilling machines-types, tools and operation 	08

4	<p>Seminar :</p> <p>Seminar topic should be related to the subjects of fourth semester. Each student shall submit a report of at least 10 pages and deliver a seminar (Presentation time – 10 minutes)</p>	08
5	<p>Mini Project / Activities :</p> <p>a) Prepare one model – cardboard / acrylic / wood / metal / etc such as : i) Elliptical Trammel ii) Pantograph iii) Coupling iv) Geneva Mechanism v) Cam & follower mechanism</p> <p style="text-align: center;">OR</p> <p>b) Dismantling and assembly (e.g. Piston – connecting rod, Cylinder head – valves, Tool post, valves etc.) Take measurement and prepare sketches of different parts.</p> <p style="text-align: center;">OR</p> <p>c) Make a small decorative water fountain unit.</p> <p style="text-align: center;">OR</p> <p>d) Toy making with simple operating mechanism</p> <p style="text-align: center;">OR</p> <p>e) How it works ? (students to collect information on working of small assemblies or mechanisms) Such as - - door closer, mobile charger , microwave oven , washing machine , gas lighter , oil-can , grease gun , electromagnets , burglar alarm , central lock (automobile).</p>	12
Total		48

Note: The topics suggested under various activities (Sr.No.1 to 4) are only suggestive and may serve as guidelines to the teachers. Any other equivalent topics or activities may be considered to improve professional skills of the learner.