

West Bengal State Council of Technical &  
Vocational Education and Skill  
Development  
(Technical Education Division)



Syllabus  
of

Diploma in Automobile Engineering [AE]

Part-III (5<sup>th</sup> Semester)

Revised 2022

**Semester-wise Detailed Curriculum**  
**Semester V (Third year)**  
**Branch/Course: Automobile Engineering**

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours/ week	Credits
				Lecture	Tutorial	Practical		
1	Program Core Course	AEPC 501	Fluid Power	3	0	0	3	3
2	Program Core Course	AEPC 502	Automotive Electrical & Electronics	3	0	0	3	3
3	Program Core Course	AEPC 503	M V Act & Transport Management	3	0	0	3	3
4	Program Elective Course	AEPE 511/ 512	Any one Programme Elective	3	0	0	3	3
5	Program Elective Course	AEPE 513/ 514	Any one Programme Elective	3	0	0	3	3
6	Program Core Course	AEPC 504	Automotive Electrical & Electronics Lab	0	0	2	2	1
7	Internship-II after IV <sup>th</sup> Sem	SI501		0	0	0	0	1
8	Major Project	PR502		0	0	2	2	1
<b>Total</b>				<b>15</b>	<b>0</b>	<b>4</b>	<b>19</b>	<b>18</b>

**List of Program Electives for Fifth Semester**

1. AEPE511: Modern Manufacturing Methods
2. AEPE512: Automobile Air Conditioning
3. AEPE513: Earth Moving Equipments & Farm Machinery
4. AEPE514: Two & Three Wheelers

### Syllabus of Fluid Power

<b>Course Code</b>	AEPC501
<b>Course Title</b>	Fluid Power
<b>Number of Credits and L-T-P</b>	3 [L - 3, T - 0, P - 0]
<b>Course Category</b>	PC
<b>Prerequisites</b>	Applied Physics-I

#### **Course Objectives:**

1. To understand working principle of Fluid Power Systems and its basic components
2. To understand working principle of gear, vane & piston pumps & their advantages & disadvantages
3. To understand working principle of various control components of Fluid Power systems namely direction, flow and pressure control valves.
4. To understand working principle of both linear & rotary actuators.
5. To understand basic components of Pneumatic systems.
6. To understand working principle of common hydraulic & pneumatic circuits
7. To identify application areas of Fluid Power Systems in automobiles.

#### **Course Contents:**

<b>Module No.</b>	<b>Description of Topic</b>	<b>Contact Hrs.</b>
1.	<p><b>Introduction to Fluid Power:</b></p> <p>1.1.Fluid Power – Definition, Principle – Pascal’s Law, Types – Hydraulics &amp; Pneumatics, Application in general, Application in Automotive industry.</p> <p>1.2.Hydraulics – Definition, Basic components of a hydraulic system, Areas of application, advantages &amp; disadvantages</p> <p>1.3.Pneumatics – Definition, Basic components of a pneumatic system, Areas of application, advantages &amp; disadvantages</p> <p>1.4.Comparison between Hydraulics &amp; Pneumatics</p>	<b>04</b>
2.	<p><b>Hydraulics – Pumps:</b></p> <p>2.1.Positive displacement pump types – Gear, Vane &amp; Piston pumps</p> <p>2.2.External Gear Pump – Construction, working principle, Working pressure range, Application, Advantages &amp; disadvantages. Symbol. Expression for theoretical discharge, Simple problems.</p> <p>2.3.Vane Pump – Construction of both balanced &amp; unbalanced, working principle, Working pressure range, Application, Advantages &amp; disadvantages. Symbol.</p> <p>2.4.Piston Pump – Types – Axial (both swash plate &amp; bent axis design) &amp; Radial, Construction, working principle, Working pressure range, Application, Advantages &amp; disadvantages. Symbol.</p>	<b>06</b>

3.	<p><b>Hydraulics - Control Components:</b></p> <p>3.1.Direction Control Valve: Function, Check valve – ball type, poppet type, pilot operated. 3/2, 4/2, 4/3 DCV application; Different types of neutral positions – closed, tandem, float, open; various types of actuations – Manual, Solenoid etc. Symbols.</p> <p>3.2.Flow Control Valve: Types – non pressure compensated and pressure compensated, Application of both types. Symbols.</p> <p>3.3.Pressure Control Valve: Types – Relief, reducing, unloading &amp; Sequence valve. Application, Symbols.</p> <p>3.4.Servo &amp; Proportional Control Valves – Electro-hydraulic servo valve and 4-way proportional control valve, use, symbols and application areas.</p>	09
4.	<p><b>Hydraulics Actuators:</b></p> <p>4.1.Actuators – Linear &amp; rotary, Applications</p> <p>4.2.Linear Actuator – Cylinder, Single &amp; Double acting. Construction of double acting hydraulic cylinder. Creep of cylinder. Cylinder cushioning.</p> <p>4.3.Rotary Actuator – Hydraulic motors, Limited rotation and full rotation, gear, vane and piston motors. Symbols and application areas.</p>	04
5.	<p><b>Hydraulics – Accessories:</b></p> <p>5.1.Reservoirs, Pipes, hoses, fittings, oil filters, seals &amp; gaskets, Hydraulic Oil. Intensifier &amp; accumulators – Application areas &amp; Symbols.</p>	05
6.	<p><b>Hydraulic Circuits:</b></p> <p>6.1.Speed Controlling Circuits - Meter in, Meter out circuits &amp; bleed off</p> <p>6.2.Regenerative circuit, Pump Unloading Circuit, synchronization circuit and Sequencing circuit.</p>	04
7.	<p><b>Pneumatics:</b></p> <p>7.1 Compressors – Reciprocating, Screw and Vane types, Air receiver</p> <p>7.2 Fluid Conditioners – Filter, Regulator, Lubricator, FRL unit, Pneumatic silencer, Air dryer</p> <p>7.3 Air Control Valves – Check valve, shuttle valve, 3-way and 4-way directional control valve. Flow control valve, Symbols</p> <p>7.4 Pneumatic Cylinders, Pneumatic Rotary Actuators. Symbols</p> <p>7.5 Pneumatic Circuits – Double acting cylinder control, Control of an air motor.</p>	06
8.	<p><b>Application of Fluid Power in Automobiles:</b></p> <p>8.1.Application of Hydraulics – Power brake, power steering, hydraulic shock absorber</p>	04

	8.2.Application of Pneumatics – Air brake	
	<b>Total Hours</b>	<b>42</b>

**Weightage distribution in both objective, short and broad answer type questions:**

<b>Group</b>	<b>Module Number</b>	<b>Weightage (%)</b>
A	1,2 & 3	50
B	4 & 5	20
C	6, 7 & 8	30

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>C01</b>	Classify different types of positive displacement type pumps and demonstrate their working principle.
<b>C02</b>	Classify different types of control valves used in hydraulic & pneumatic circuits & explain their application.
<b>C03</b>	Identify different hydraulic actuators and illustrate their working principle
<b>C04</b>	Identify hydraulic & pneumatic symbols & be able to demonstrate working principle of hydraulic & pneumatic circuits.
<b>C05</b>	Identify different hydraulic accessories and explain application of accumulator & intensifier.

**Text Books:**

1. Fluid Power with Applications: Anthony Esposito, Pearson
2. Hydraulic and Pneumatic Controls – K. Shanmuga Sundaram, S. Chand
3. Fluid Power: Generation, Transmission and Control – Jagadeesha T., Thammaiah Gowda, Wiley
4. Oil Hydraulic Systems: Principles and Maintenance – S R Majumdar, McGraw Hill Education (India) Private Limited
5. Pneumatic Systems: Principles and Maintenance – S R Majumdar, McGraw Hill Education (India) Private Limited
6. Hydraulics and Pneumatics for B.E. Pune University – Avinash G. Patil, Vinayak Gaikawad, Vikash Shinde, Technical Publications

**References**

1. Fluid Power Engineering – M. Galal Rabie, McGraw Hill

## Syllabus of Automotive Electrical & Electronics

<b>Course Code</b>	AEPC502
<b>Course Title</b>	Automotive Electrical & Electronics
<b>Number of Credits and L-T-P</b>	3 [L - 3, T - 0, P - 0]
<b>Course Category</b>	PC
<b>Prerequisites</b>	Fundamental knowledge of Electrical & Electronics theories and applications.

### Course Objectives:

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

### Course Contents:

<b>Module No.</b>	<b>Description of Topic</b>	<b>Contact Hrs.</b>
1.	<p><b>Electrical &amp; Electronic Components</b></p> <p>1.1. Purpose and operation of electrical components like Switches, relays, solenoids, buzzers, and resistors.</p> <p>1.2. Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers (Manual and automatic resetting types.) and fusible links</p> <p>1.3. Testing of circuit defects like open circuit, shorts, shorts to grounds, voltage drop.</p> <p>1.4. Working of Electromagnetic gauges like temperature Gauges, fuel gauge, engine oil pressure gauge, Speedo-meter gauge.</p> <p>1.5. Features of scan tester.</p> <p>1.6. Working of electrical accessories like wind shield wiper, washer pumps, blower motor, electro chromic mirror, power window, power seat, power door lock.</p>	<b>06</b>
2.	<p><b>Battery</b></p> <p>2.1 Lead acid battery - construction &amp; operation.</p> <p>2.2 Concept of Low maintenance, maintenance free &amp; Hybrid Battery.</p> <p>2.3 Battery - voltage, battery ratings and battery specifications.</p>	<b>08</b>

	<p>2.4 Battery testing – Battery terminal test, Leakage test, Specific Gravity Test, Open circuit voltage test, High discharge test &amp; Capacity test.</p> <p>2.5 Battery charging – Initial charging procedure. Slow and fast rate charging and tricklecharging.</p> <p>2.6 Battery maintenance and safety precautions.</p> <p>2.7 Concept of Jump starting, it's procedure &amp; precaution.</p> <p>2.8 Li-ion Batteries- basic construction, working principle of</p> <p>2.8.1 Lithium Polymer Battery (LP), <b>Li-Po</b></p> <p>2.8.2 Lithium Iron Phosphate Battery (LFP), <b>LiFePO4</b></p> <p>2.8.3 Lithium Manganese Oxide Battery (LMO), <b>LiMn2O4</b></p> <p>2.9 Comparison between Lead-Acid battery&amp; Li-ion Battery.</p> <p>2.10 Factors affecting battery life.</p> <p>2.11 Battery failures–cycle failure, internal short circuit, overcharging, local action and sulphation.</p>	
3.	<p><b>Starting System</b></p> <p>3.1. Purpose, construction and working of starting system.</p> <p>3.2. Starting motor torque and power requirement.</p> <p>3.3. Types of starting motor drive (Bendix and overrunning clutch types only) - construction and working.</p> <p>3.4. Testing of starting system – Cranking voltage test, Voltage drop test, Current draw test, starting motor bench test, &amp; no-load test.</p> <p>3.5. Starting Motor troubleshooting.</p>	<b>05</b>
4.	<p><b>Charging System</b></p> <p>4.1 Purpose of charging system.</p> <p>4.2 Operation of charge indicator light circuit.</p> <p>4.3 General construction &amp; operation of automotive alternator.</p> <p>4.4 Initial excitation and self-excitation.</p> <p>4.5 Alternator testing – Current output test, Field current draw test. Regulator output test</p> <p>4.6 Cut out Relay.</p> <p>4.7 Regulation- Voltage and current regulation. Regulator for Alternators.</p> <p>4.8 Advantage and disadvantages of dynamo and Alternator drives</p> <p>4.9 Charging system troubleshooting.</p>	<b>06</b>
5.	<p><b>Ignition System</b></p> <p>5.1 Purpose of ignition system.</p> <p>5.2 Classification of ignition systems - Contact point Ignition System &amp; Electronic ignition system.</p> <p>5.3 Contact point Ignition system (Battery Ignition and Magnetoignition).</p> <p>5.4 Magneto ignition system- construction and working of CDI system.</p> <p>5.5 Elements and construction of battery oil ignition system: -Ignition coil types, Distributor, spark plug, cords, and Condenser, Cam angle &amp; Ignition timing.</p> <p>5.6 Ignition advance &amp; retard timing mechanism-construction and</p>	<b>08</b>

	<p>working.</p> <p>5.7 Comparison between Battery and Magneto Ignition System.</p> <p>5.8 Electronic (or solid state) ignition system with distributor circuit diagram and working.</p> <p>5.9 Electronic Spark Control, Electronic Spark advance. Comparison with conventional system.</p> <p>5.10 Distributor less/ computer-controlled coil ignition system operation.</p> <p>5.11 Sensors and Ignition Control Module for triggering and timing of spark.</p> <p>5.12 Ignition System Troubleshooting.</p>	
6.	<p><b>Lighting system &amp; Advanced Electrical Accessories Fundamentals</b></p> <p>6.1 Various lighting circuits.</p> <p>6.2 Vertical and Slide control of lights.</p> <p>6.3 Fog light, Slide light, Brake light, indicator lights, and instrument light, reverse light, parking light, Trailer lighting, Interior lighting.</p> <p>6.4 Concept and application of LED in automotive lighting system.</p> <p>6.5 Construction and working of LED headlight, Projector headlight (basic concept)</p> <p>6.6 Operation of automatic headlight dimming.</p> <p>6.7 Operation of automatic on/ off headlight with time delay.</p> <p>6.8 Wiring diagram of vehicle.</p> <p>6.9 Faults and rectification of wiring system.</p> <p>6.10 Operation of keyless entry.</p> <p>6.11 Operation of common anti-theft system.</p> <p>6.12 Purpose &amp; operation of automatic door lock system</p>	<b>05</b>
7.	<p><b>Diagnosis of electronic components &amp; Systems</b></p> <p>7.1 Sensor testing: - Oxygen sensor, Engine coolant sensor, Intake air temp. Sensor, Throttle position sensor, Manifold absolute pressure sensor.</p> <p>7.2 Function of Electronic Control Module.</p> <p>7.3 Electronic fuel Injector testing: - only sound test, Ohmmeter test.</p> <p>7.4 On-board diagnosis (OBD): -</p> <p>7.4.1 Purpose of (on-board diagnostic second generation) OBD II, flash codes of Malfunction indicator light.</p> <p>7.4.2 OBD II terminology: - Drive cycle, Trip, Warm up cycle (Definitions only).</p> <p>7.5 SAE J2012 standards Diagnostic Trouble Code (DTC): -5 (five) digits only.</p> <p>7.6 Troubles of electronic gauges like.</p> <p>7.6.1. Gauge reads low constantly.</p> <p>7.6.2. Gauge reads high constantly.</p> <p>7.6.3. Inaccurate Gauge reading.</p>	<b>04</b>
	<b>Total Hours</b>	<b>42</b>



**Weightage distribution in both objective, short and broad answer type questions:**

<b>Group</b>	<b>Module Number</b>	<b>Weightage (%)</b>
A	1 & 2	30
B	3, 4 & 5	50
C	6, &7	20

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>C01</b>	Classify different types of automotive battery &electronics components and their working principle.
<b>C02</b>	Identify Starter Motor & be able to demonstrate working principle of starting system &relatedcircuits.
<b>C03</b>	Identify Alternator & be able to demonstrate working principle of charging system &relatedcircuits.
<b>C04</b>	Classify different components of Ignition system & be able to demonstrate working principle of Ignition system & related circuits.
<b>C05</b>	Identify ECM, OBD-II connector &different types of sensors &illustrate their working principle
<b>C06</b>	Identify different types of DTC fault code & troubleshooting methods

**Text Books:**

1. Automotive Electrical and Electronics: - AK BABU
2. Basic Automobile Electricity – C.P. NAKRA
3. Automotive Electrical Equipment: - PL KOHLI

**e-References**

1. [https://en.wikipedia.org/wiki/Lithium-ion\\_battery](https://en.wikipedia.org/wiki/Lithium-ion_battery)
2. <https://inverted.in/blog/types-of-lithium-ion-batteries-available-in-the-market>

## Syllabus of M. V. Act & Transport Management

<b>Course Code</b>	AEPC503
	M. V. Act & Transport Management
<b>Number of Credits and L-T-P</b>	3 [L - 3, T - 0, P - 0]
<b>Course Category</b>	PC
<b>Prerequisites</b>	NIL

### Course Objectives:

1. To impart knowledge of motor vehicle act in order to provide quality of service, convenience of scheduling and economics.
2. To impart knowledge of working of different transport organizations, standard methods of record keeping, use of computers etc.
3. To impart knowledge on valuation of vehicles and driving skills.
4. To impart knowledge on various automotive research organizations and their functions.

### Course Contents:

Module No.	Description of Topic	Contact Hrs.
01	<p><b>Motor Vehicle Act</b></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. Grant, revocation and power of licensing authority.</p> <p>1.3 Conductor's license: Necessity, Eligibility, Documents required and rules for conductors. Grant and revocation.</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, Certificate of Fitness, Form and manner of display of Registration mark, Size of letters and numerals of registration mark, renewal &amp; Transfer of Ownership of Motor Vehicle, cancellation/suspension of Ownership.</p> <p>1.5 Control of Transport: Transport authorities, Difference between STA &amp; RTA, Necessity of Permit, All types of Permits, Transfer of permit, Temporary permit, Tourist permit, National permit. Speed limits. Offences, penalties and procedures. Control of traffic.</p> <p>1.6 Construction of Motor Vehicle: Overall dimensions, General provision regarding construction and maintenance of motor vehicle.</p> <p>1.7 Road Safety: Road signs, Imposition of Penalties for violation of Act and articles, Duties of drivers, Duties of conductors, Duties of helper.</p> <p>1.8 Taxation: Objectives, Basis of taxation structure for two-wheeler, three-wheeler, goods and passenger vehicles. Methods of levying tax, Tax exemption.</p> <p>1.9 Insurance: Motor Vehicle Insurance, comprehensive, third party, No-fault liability, Procedure for accident claim. Furnishing of particulars</p>	10

	<p>of vehicles involve in accident. Duty of driver in case of accident and injury.</p> <p>1.10 Importance of Motor Vehicles (Amendment) Act, 2019: Compensation for road accident victims, Compulsory insurance, Good Samaritans, Recall of vehicles, National Transportation Policy, Road Safety Board, Offences and penalties, Taxi aggregators.</p>	
02	<p><b>Transport Management</b></p> <p>2.1 Comparison of Modes of transport - Road, water, air transport and rail transport. Selection of Transportation Mode, Advantages and limitations of Road Transport.</p> <p>2.2 Elements in Transport Management:</p> <p>2.2.1 Demand: Law of Demand, Elasticity of Demand, Passenger Demand for Travel.</p> <p>2.2.2 Revenue Function, Bus Fare, Trend in Traffic and Revenue Level</p> <p>2.2.3 Route Rationalization: Need for Route Rationalization, Approach to Route Rationalization, Rationalizing a Single Route, Analytical Steps.</p> <p>2.2.4 Scheduling of Bus Service &amp; its Economic Implications, Mofussil Service &amp; Scheduling of Services, City Bus Service &amp; Scheduling, Basic Factors in Bus Scheduling, Calculation of Number of Buses, Crew Scheduling.</p> <p>2.2.5 Traffic Demand, Peak Hour Demand, Limited Stop Services, Relief Services.</p> <p>2.2.6 Fare, Fare for Hilly Areas, Fares for Different Routes, Tariff for express and Luxury Services, Fares related to Distances, Fare for Peak Hours</p> <p>2.2.7 Ticketing System, Qualities of a Good Ticketing System, Stage and Fare Structure.</p> <p>2.2.8 Organization Setup: Government, Semi Government, Private. Setup of STU: Corporate Structure at all levels, Planning of Fleet, Maintenance management of State Transport Undertaking (STU), Bus Rapid Transport system (BRTS).</p> <p>2.2.9 Policies of transport organization: Policies towards passenger (like Luxury service, concession pass for students and senior citizen, Express service on special route, Night service on special route, Vehicles for Special private Tours/ Yatras/ functions/ Educational tours), Policies towards employees (Bonus, Overtime Allowances, Health Insurance, free Travel Packages Employee Trainings).</p> <p>2.2.10 Scheduling: Basic factors in bus, crew (staff) and maintenance scheduling, calculation of number of buses.</p> <p>2.2.11 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>2.2.12 Record keeping: Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, daily fuel consumption, various types of bookings, Use of Computer.</p> <p>2.2.13 Goods Transport Operation: Scheduling of goods transport, Management Information System (MIS) in passenger/ goods</p>	20

	transport operation, Storage & transportation of petroleum products, Intelligent Transport System (ITS), Traffic navigation, Global positioning system.	
03	<p><b>Estimation and Valuation of Vehicle</b></p> <p>3.1 Role of surveyor, Procedure of survey and valuation of vehicle, Accident survey report.</p> <p>3.2 Importance of warranty system and protection of law: How to deal with defects, benefits of warranty system. Protection of law.</p> <p>3.3 Buying a new vehicle: Factors to be considered - Ex-showroom price and on road price, use of vehicle, when and where to buy, comparison of different specifications.</p> <p>3.4 Buying a used vehicle: When &amp; where to buy: Dealers, used car firms, Private sellers, Garages, Auctions. Factors to be considered while buying a used vehicle as customer point of view - Depreciation, Model and year, Checking of mechanical and electrical accessories, Test drive.</p> <p>3.5 Preparations for selling a vehicle from seller point of view: When to sell, How to sell, Auctions, Garages, Private sale, Preparing the car, Documentation, Selling price, Safeguards.</p>	08
04	<p><b>Automobile Industry, it's Functions &amp; Role</b></p> <p>4.1 Development of motor industry in India, Structure of automobile industry, Importance of Automobile Engineer.</p> <p>4.2 Working of various types of transport organizations: CRRI, PCRA, CIRT, ARAI, VRDE</p> <p>4.3 Working of Various State Transport Organizations: CSTC, SBSTC, WBSTC, NBSTC, CTC, WBTC</p>	04
<b>Total Hours</b>		<b>42 Hrs</b>

**Weightage distribution in both objective, short and broad answer type questions:**

Group	Module Number	Weightage (%)
A	1	30
B	2	40
C	3 & 4	30

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>C01</b>	Interpret the Motor Vehicle Act and Traffic Rules.
<b>C02</b>	Apply the concept of Taxation and Insurance in vehicle registration.
<b>C03</b>	Illustrate the different aspects related to transportation system.
<b>C04</b>	Identify the roles of assessor and surveyor in automobile industry.
<b>C05</b>	Understand the role of various research organization in motor industry.

**Text Books:**

1. Vehicle Transport Management, S. L. Bhandarkar, Dhanpat Rai & Co.
2. Transport Management, R. B. Gupta, Satya Prakashan.

- Motor Vehicle Act and Transport management, V. S. Khilery, Satpal Sharma, Shaman Gupta, Ishan Publications.

**Reference Books:**

- Motor Vehicle Act, 1988 - Government of India Publications
- Central Motor Vehicles Rules, 1989 - Government of India Publications
- Motor Vehicles (Amendment) Act, 2019 - Government of India Publications
- Management of State Road Transports in India, D. K. Kulshrestha, Mittal Publications
- Rural Transport in India, K. N. Ramanujam, Mittal Publications
- Indian Transport System, P. Jegadish Gandhi and G. John Gunaseelan, Mittal Publications
- Transport Management in India, D. K. Kulshrestha, Mittal Publications

**Model Numerical (Suggestive only for 2.2.10)**

- Calculate number of buses required for transport operation between terminals KALNA to ASANSOL and prepare a bus schedule for data given below-
  - Distance between KALNA to ASANSOL is 169 km
  - Buses are operated through the day between 4 a.m. to 11 p.m. with frequency of 2 Hr. Running time is 5 Hrs. and standing time is 3 Hrs.

**Soln.:**

Calculation of Number of Buses between KALNA to ASANSOL

Bus scheduling data are given below:

Distance between Kalna to Asansol is 169 km.

Buses are operated through the day between 4 a.m. to 11 p.m. with frequency of 2 Hr.

Running time is 5 Hrs. and standing time is 3 Hrs.

By using below given formula we have to calculate the number of buses required for the schedule.

$$N = \frac{(ST + RT)}{F} \times 2$$

where, N = Number of buses

ST = Stand/ Terminus time

RT = Running/ Journey time

F = Frequency

Number of buses required = 8 (following the equation)

1ST BUS			2ND BUS		
	STATION	TIME		STATION	TIME
DEPARTURE	KALNA	4 am	DEPARTURE	ASANSOL	4 am
ARRIVAL	ASANSOL	9 am	ARRIVAL	KALNA	9 am
DEPARTURE	ASANSOL	12 pm (noon)	DEPARTURE	KALNA	12 pm (noon)

ARRIVAL	KALNA	5 pm	ARRIVAL	ASANSOL	5 pm
<b>3RD BUS</b>			<b>4TH BUS</b>		
	<b>STATION</b>	<b>TIME</b>		<b>STATION</b>	<b>TIME</b>
DEPARTURE	KALNA	6 am	DEPARTURE	ASANSOL	6 am
ARRIVAL	ASANSOL	11 am	ARRIVAL	KALNA	11 am
DEPARTURE	ASANSOL	2 pm	DEPARTURE	KALNA	2 pm
ARRIVAL	KALNA	7 pm	ARRIVAL	ASANSOL	7 pm
<b>5TH BUS</b>			<b>6TH BUS</b>		
	<b>STATION</b>	<b>TIME</b>		<b>STATION</b>	<b>TIME</b>
DEPARTURE	KALNA	8 am	DEPARTURE	ASANSOL	8 am
ARRIVAL	ASANSOL	1 Pm	ARRIVAL	KALNA	1 Pm
DEPARTURE	ASANSOL	4 pm	DEPARTURE	KALNA	4 pm
ARRIVAL	KALNA	9 pm	ARRIVAL	ASANSOL	9 pm
<b>7TH BUS</b>			<b>8TH BUS</b>		
	<b>STATION</b>	<b>TIME</b>		<b>STATION</b>	<b>TIME</b>
DEPARTURE	KALNA	10 am	DEPARTURE	ASANSOL	10 am
ARRIVAL	ASANSOL	3 pm	ARRIVAL	KALNA	3 pm
DEPARTURE	ASANSOL	6 pm	DEPARTURE	KALNA	6 pm
ARRIVAL	KALNA	11 pm	ARRIVAL	ASANSOL	11 pm

## Syllabus of Automotive Electrical & Electronics Lab

<b>Course Code</b>	AEPC504
<b>Course Title</b>	Automotive Electrical & Electronics Lab
<b>Number of Credits and L-T-P</b>	1 [L - 0, T - 0, P - 2]
<b>Course Category</b>	PC
<b>Prerequisites</b>	Nil

### Course Objectives:

1. To understand various test procedures for battery as specified by manufacturer and the precautions while handling a battery.
2. To identify the alternator components, starter motor components and understand test procedure of same.
3. To know the test and service procedure for spark plug, distributor and spark plug cords.
4. To Identify and locate sensors and to understand diagnostic procedures (on-board and standalone diagnosis).
5. To identify the vehicle wiring system.

### Course Contents:

<b>Exp. No.</b>	<b>Description of Experiments</b>	<b>Contact hours</b>
1.	1.1 Study, testing (Specific gravity of electrolyte, High rate discharge test of battery & Load test of battery), sketching of constructional details, and working principle of battery. OR	4
	1.2 Study, testing (Nominal Cell Voltage, Discharge end voltage or cut off voltage, Rated Capacity, Weight of the cell, Charging Voltage, Internal Resistance, Energy Density (wh/kg)) and sketching of constructional details and working principle of battery.	4
2.	2.1 Study, testing and sketching of various components and the functions of coil ignition systems and Inspection of spark plug cords, Servicing of spark plugs and distributor. OR	4
	2.2 Study, testing & sketching of various components and their function of Electronic Ignition system.	4
3.	3.1 Study, testing and sketching of starting system and the constructional details of self starter. OR	4
	3.2 Starter Motor –component identification, starter current draw test and voltage drop test.	4
4.	4.1 Study, testing and sketching of charging system and the constructional details of Automotive Alternator. OR	4
	4.2 Alternator-component identification and output test, Regulated	4

	Voltage Output Test, charging circuit resistance test. Electrical testing of rotor and stator of alternator.	
5.	5.1 Study, testing and sketching of Headlight Circuit with upper and dipper function. OR	4
	5.2 Study, sketching and working principle of Automatic Headlight Dimming Circuit	4
6.	6.1 Study, testing and sketching the wiring diagram of Electronic Control Module (ECM or ECU) with different sensors and actuators. OR	4
	6.2 Study, testing and fault code terminology and rectification process of OBD-II	4
7.	7.1 Study, testing and sketching of Vehicle Wiring System OR	4
	7.2 Study, location and identification of different sensors.	4
	<b>Total Hours</b>	<b>28</b>

#### Course Outcomes:

At the end of the course, students will be able to:

<b>C01</b>	Identify basic tools of Automotive Electrical and Electronics Laboratory
<b>C02</b>	Identify and diagnose different types of components and faults in automotive ignition system
<b>C03</b>	Identify and diagnose different types of components and faults in automotive Starting system
<b>C04</b>	Identify and diagnose different types of components and faults in automotive Charging system
<b>C05</b>	Identify ECU/ECM and OBD-II also their wiring and working procedure

#### Reference Books:

1. A K. BABU. Automotive Electrical and Electronics, Khanna Publishing
2. Dr. Kirpal Singh, Automobile Engineering (Vol. - 1 & 2), Standard Publishers Distributors, New Delhi.
3. P.L. Kohli, Automotive Electrical, Tata McGraw Hill Education, New Delhi.
4. C.P. NAKRA, Basic Automobile Electricity, Dhanpat Rai Publishing Company,



### Syllabus of Modern Manufacturing Methods

<b>Course Code</b>	AEPE511
<b>Course Title</b>	Modern Manufacturing Methods
<b>Number of Credits and L-T-P</b>	3 (L-3, T-0, P-0)
<b>Course Category</b>	PE
<b>Prerequisites</b>	Nil

#### Course Objectives:

1. To acquire basic knowledge about Modern Manufacturing Methods.
2. To gain knowledge about different types of nontraditional machining processes along with their characteristics and proper use in automotive industries
3. To gain knowledge about concepts of constructional features of CNC machine tools along with programming method, advantages, limitations and applications required for automotive industries
4. To acquire basic concept of additive manufacturing used in automobile sector.
5. To gather basic knowledge about some manufacturing processes very much needful in automotive sectors like die casting, spot welding, seam welding

#### CourseContents:

<b>Module No.</b>	<b>Description of Topic</b>	<b>Contact Hrs.</b>
<b>1</b>	1. Introduction to Modern Manufacturing Process 1.1. Concept of job production, batch production, mass production & continuous production and their application in automobile industries 1.2. Development of machine tools (only elementary idea) – general purpose machine tools, semi automatic machine tools, automatic machine tools; applications in automobile industries 1.3. Needs of Modern Manufacturing Processes 1.4. Pneumatic & hydraulic clamping devices used in modern shop 1.5. Concept of jig & fixture; differences between them, use of fixture in different types of manufacturing processes	<b>(6)</b>
<b>3</b>	2. Joining Processes 2.1. Definition, purpose and types of joining processes 2.2. Welding: Concept, types with examples 2.3. Arc welding: concept, types with application 2.4. Resistance welding: working principle, types with applications 2.5. Brazing & soldering: Concept & applications	<b>(10)</b>
<b>4</b>	3. Non Traditional Machining 3.1. Definition and purpose of non traditional processes 3.2. Classification of non-traditional processes with suitable	<b>(10)</b>

	<p>example and application</p> <p>3.3. Working principle, advantages, limitations and application of:</p> <p>i) Ultrasoninc machining</p> <p>ii) LASER beam machining</p> <p>iii) EDM &amp; EDM wire cut</p> <p>iv) Electro Chemical Machining</p>	
<b>4</b>	4. Additive Manufacturing: Concept, Advantages, Disadvantages, Applications	<b>(2)</b>
<b>5</b>	<p>5. Computer Numerical Control Machining</p> <p>5.1. Difference between NC &amp; CNC with respect to advantages, limitations and application</p> <p>5.2. Different components of CNC machine tools (only function and application): Stepper motor, Servo motor, Encoders (rotary &amp; linear encoder), Recirculating ball screw, Automatic tool changer, Tool magazine.</p> <p>5.3. Work holding device for turning and machining centres (only name and relative advantages, limitations)</p> <p>5.4. Manual part programming: reference point (Machine Zero, Program Zero, Part Origin), Axis identification of Turning Centre &amp; Machining Centre, CNC Codes for manual part programming G – codes, M- Codes, Spindle speed control, feed rate control, Tool selection) part programming for turning centre using different codes &amp; fixed cycles for obtaining step, taper, plain &amp; circular turning, facing, external threading &amp; parting off operation.</p>	<b>(14)</b>
<b>Total Number of Contact Hours</b>		<b>42</b>

**Weightage distribution in both objective, short and long answer type questions:**

<b>Group Name</b>	<b>Unit Number</b>	<b>Weightage (%)</b>
A	1, 2, 3	60
B	4, 5,	40

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>CO1</b>	Illustrate fundamental concepts on modern manufacturing methods along with concepts on Jig & fixture and their application in automotive industries
<b>CO2</b>	State fundamental concept on different joining process, their types, applications along with brief concept of Arc and Resistance welding.
<b>CO3</b>	Explain working principles, advantages, limitations and applications of some non-traditional manufacturing processes such as USM, LBM, EDM & ECM along with broad classification of non-traditional processes.

<b>C04</b>	State fundamental concept on Additive Manufacturing Process, their advantages, disadvantages and applications
<b>C05</b>	Explain function of different parts of a CNC machine tools along with demonstration of manual part programming of CNC to obtain basic machining operations required in automotive industries

**Reference Books:**

1. Manufacturing Technology Metal Cutting & Machine tools - P. N. Rao, Tata McGraw-Hill
2. CNC machines - Pabla B. S. M. Adithan, New age international limited
3. Non conventional Machining - P. K. Mishra, Narvasa Publishing House
4. Elements of workshop Technology – Volume I & II - S. K. Hajra Chaudary, Bose, Roy, Media Promoters and Publishers limited
5. Workshop Technology Volume-I& II - H.S.Bawa, Tata McGraw-Hill
6. Manufacturing Engineering and Technology (SI Edition) - Serope Kalpakjian and Steven R. Schmid, Pearson Publication
7. Tool Engineering - Brent Donaldson, Tata McGraw-Hill

## Syllabus of Automobile Air Conditioning

<b>Course Code</b>	AEPE512
<b>Course Title</b>	Automobile Air Conditioning
<b>Number of Credits and L-T-P</b>	3 [L - 3, T - 0, P - 0]
<b>Course Category</b>	PE
<b>Prerequisites</b>	Heat Power Engineering,

### Course Objectives:

1. To understand the necessity of Air Conditioning in car.
2. To understand working process of car Air Conditioning system.
3. To understand component of car Air Conditioning system and there uses.
4. To recognise the process of Air Conditioning unit repair and maintenance.
5. To recognise environmental aspects related to Air Conditioning Systems.

### Course Contents:

<b>Module No.</b>	<b>Description of Topic</b>	<b>Contact Hrs.</b>
1.	<p><b>Introduction of Air Conditioning system</b></p> <p>1.1.What is Air Conditioning system – Usages of AC system - Type of Air Conditioning system (only Working and Construction)</p> <p>1.2.Refrigerant- Property of Refrigerant – Eco-friendly Refrigerant</p> <p>1.3.Car Refrigerant – R12 – R134a – R1234yf- Property- Advantages – Disadvantages</p> <p>1.4.Human Comfort Control – Comfort Zone – air movement – wind chill factor – odour problem – humidity – safety.</p> <p>1.5.Requirements of Air condition system – Heat – Ventilation – humidity</p>	<b>05</b>
2	<p><b>Car Air Conditioning system and its Components</b></p> <p>2.1.Layout of Car Air Conditioning system – Different Category of Car air conditioning system.</p> <p>2.2.Construction &amp; working of following refrigeration sub systems – thermostatic expansion valve, fixed orifice tube &amp; rotary vane air cycle system.</p> <p>2.3.Construction &amp; working of evaporator - condenser - accumulator - aspirator</p> <p>2.4.Receiver driers &amp; accumulator- Types, construction &amp; Working</p> <p>2.5.Reciprocating Compressor, scroll &amp; rotary vane compressors (Construction &amp; working) - Drive systems for compressors - Compressor Clutches- Compressor Clutch electrical circuit - Compressor lubrication.</p> <p>2.6.Construction &amp; working of vacuum operated devices i.e., vacuum reserve tank, vacuum restrictor, vacuum motor, check valve &amp; check</p>	<b>12</b>

	<p>relays.</p> <p>2.7. Construction &amp; working of electromagnetic clutch.</p> <p>2.8. Metering devices- comparison of thermostatic expansion valve &amp; fixed orifice tube.</p> <p>2.9. Types working &amp; comparison of thermostatic expansion Valves i.e., H valve, block type, internally equalized &amp; externally equalized.</p> <p>2.10. Functions of thermostatic expansion valve - Throttling action, modulating action &amp; controlling action.</p> <p>2.11. Difference between conventional Air Conditioning system and Car Air Conditioning system</p>	
3.	<p><b>Air-conditioning unit inlet and delivery system</b></p> <p>3.1. Construction &amp; working of Air intake section, core section &amp; distribution section</p> <p>3.2. Construction &amp; working of Downstream – upstream - split - hybrid Case and duct system.</p> <p>3.3. Construction &amp; working of rear heating &amp; cooling system</p> <p>3.4. Hoses &amp; connectors – construction of system hoses, charging hose with shutoff valve &amp; connectors.</p>	<b>04</b>
4	<p><b>Air Conditioning system sensors and control</b></p> <p>4.1. System controls – Construction &amp; working of typical vacuum system &amp; electronic temperature control system.</p> <p>4.2. Switches – Construction &amp; working of high side temperature switch, low-side temperature switch, high pressure switch, low- pressure switch, pressure regulator, ambient switch &amp; superheat switch.</p> <p>4.3. Sensors- Construction &amp; working of sun load sensor, outside temperature sensor &amp; in car temperature sensors.</p> <p>4.4. Different types of sensors and actuators used in automatic temperature control - Fixed and variable displacement temperature control- Semi Automatic - Controller design for Fixed and variable displacement type air conditioning system</p> <p>4.5. Construction &amp; working of blower clutch control, heater control, and time delay relay for heater control.</p> <p>4.6. Mode doors and temperature doors –definition –application – working – difference.</p> <p>4.7. Electrical circuits- Typical climate control system &amp; Electronic climate control system, their electrical circuits &amp; working</p>	<b>09</b>
5	<p><b>Maintenance of Car Air Conditioning System</b></p> <p>5.1. Visual &amp; acoustic check - side glass - leak test - temperature test - Procedure of charging &amp; discharging - Moisture removal procedure.</p> <p>5.2. Service equipment &amp; tools – Vacuum pump - Manifold &amp; gauge i.e., Low side &amp; high side - gauge calibration - recovery unit - recycling unit - Halide (2reon) - Fluorescent leak detector - nitrogen leak test.</p> <p>5.3. Compressor service – Symptoms, faults, cause &amp; remedy.</p>	<b>12</b>

	5.4. Electromagnetic clutch service – Symptoms, faults, cause & remedy. 5.5. Performance testing procedure of thermostatic expansion valve & fixed orifice tube. 5.6. Refrigerant- Packaging, storage, restrictions, colour code & purity test. 5.7. Common troubleshoot - No Cold Air from A/C - No Air Coming from the Vents - Air is Cool but Does Not Get Cold - AC Smells Like Mildew - Car AC Makes Noise When Turned On - Water on the Floorboards - Air Conditioning Goes from Cold to Hot	
	<b>Total Hours</b>	<b>42</b>

**Weightage distribution in both objective, short and broad answer type questions:**

Group	Module Number	Weightage (%)
A	1 & 2	45
B	3 & 4	25
C	5	30

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>C01</b>	Identify the different component of car Air Conditioning system
<b>C02</b>	Identify different Sensor system and their uses in Car Air Conditioning system
<b>C03</b>	Differentiate the conventional Air Conditioning system with car Air Conditioning system.
<b>C04</b>	Repairer and Maintenance car Air Conditioning unit.
<b>C05</b>	Identify common problem of Car Air Conditioning system and their solution.

**Text Book:**

1. Automotive Air conditioning: William H Crouse and Donald L Anglin, McGraw Hill Inc., 1990.
2. Automotive Heating, Ventilation, and Air Conditioning systems: Warren Farnell and James D. Halderman, Shop Manual, Pearson Prentice Hall, 2004
3. Automobile Engineering (Volume – VI): Anil Chhikara, Satya Prakashan.
4. Automotive Air-conditioning: Clifford L. Samuels, Prentice Hall Int.
5. Automotive Air conditioning & climate control system: Steven Daly, Cengage Publication

**Reference Books:**

1. Automotive Air Conditioning: Goings, L.F., American Technical services, 1974.
2. Mitchell Automatic Heating and Air Conditioning Systems Mitchell Information Services, Inc., Prentice Hall Inc., 1989.
3. Paul Weisler, "Automotive Air Conditioning", Reston Publishing Co. Inc., 1990.
4. U-tube video related to A/C maintenance.

## Syllabus of Earth Moving Equipments & Farm Machinery

<b>Course Code</b>	AEPE513
	Earth Moving Equipments & Farm Machinery
<b>Number of Credits and L-T-P</b>	3 [L - 3, T - 0, P - 0]
<b>Course Category</b>	PC
<b>Prerequisites</b>	Engineering Mechanics, Automotive Chassis, Automotive Engine, Automotive Powertrain, Fluid Power

### Course Objectives:

1. To impart knowledge on the importance of earth moving machines & agricultural machines in India.
2. To identify various systems & subsystems of earth moving machines & agricultural machines
3. To explain working & construction of various systems & subsystems in earth moving machines & agricultural machines
4. To carry out preventive maintenance of earth moving machines & agricultural machines.

### Course Contents:

Module No.	Description of Topic	Contact Hrs.
01	<p><b>Earth Moving Equipments - Introduction</b></p> <p>1.1. Types of earth moving equipments and outlined their uses.                      1.2. General specifications of a typical Earth Moving Machine.                      1.3. Comparison between General Automobile and Earth Moving Machine on following parameters:</p> <ul style="list-style-type: none"> <li>a) Traveling Speed</li> <li>b) Working conditions</li> <li>c) Power output &amp; power variations</li> <li>d) Engine and Powertrain (basic concept)</li> <li>e) Pneumatic Controls</li> <li>f) Torque &amp; torque variations.</li> <li>g) Steering</li> <li>h) Suspension</li> <li>i) Fuel &amp; fuel consumption</li> <li>j) Power take offs</li> <li>k) Clutch</li> <li>l) Brakes</li> <li>m) Driving license</li> <li>n) RTO registration</li> </ul>	<b>10</b>
02	<p><b>Tractors:</b></p> <p>2.1. Comparison of tractor with an automobile.                      2.2. General Layout of a tractor.                      2.3. Comparison between tyred and Crawler Tractor.                      2.4. Power train &amp; transmission layout of a tractor.</p>	<b>08</b>

	2.5. Tractor power take off its working & construction. 2.6. Counterweight & its importance. 2.7. Factors of selection of tractors & uses. 2.8. Trouble shooting, care & maintenance. 2.9. Power tiller- Comparison with tractors.	
03	<b>Different other earth moving equipments &amp; farm machineries</b> <i>[functions, working principle, detail constructional features (with power flow layout &amp; special features), uses and troubleshooting]:</i> a) Dozer b) Dump Trucks c) Loader d) Roller e) Shovel f) Cranes g) Fork Lift h) Scrapers i) Rippers j) Excavator k) Tanker/ Trailer/ Carrier	<b>20</b>
04	<b>Plant Protection Equipments &amp; Harvesting equipments:</b> 4.1 Sprayer and Duster (types) – Construction, Function, working principle & applications. 4.2 Mowers, Reapers, Binders, Forge Harvester, Vegetable and Food Harvester – Construction, Function, working principle & applications.	<b>04</b>
<b>Total Hours</b>		<b>42 Hrs</b>

**Weightage distribution in both objective, short and broad answer type questions:**

Group	Module Number	Weightage (%)
A	1	30
B	2	40
C	3 & 4	30

**Course Outcomes:**

At the end of the course, the student will be able to:

<b>C01</b>	Understand the types, special features, working principle, application of various Earth Moving Equipments
<b>C02</b>	Explain the purpose, constructional features and operation of agriculture tractors
<b>C03</b>	Identify various systems & subsystems of earth moving machines & agricultural machines
<b>C04</b>	Carry out preventive maintenance of earth moving machines & agricultural machines



**Text Books:**

1. Latest Development of Heavy Earth Moving Machinery, Amitosh De, Galgotia Publications Pvt Ltd, New Delhi
2. Heavy Earth Moving Machinery, Amitosh De, Lovely Prakashan, Dhanbad
3. Farm Machines and Equipment, C. P. Nakra, Dhanpat Rai Publishing Company (P) Ltd.

**Reference Books:**

1. Agricultural Tractor and Machinery, D.N. Sharma, S. Mukesh and Vivek Balyan, Jain Brothers, New Delhi
2. Farm Tractor: Maintenance and Repair, S. C. Jain, Standard Publishes-Distributors
3. Farm Machinery - An Approach, S. C. Jain, Standard Publishes-Distributors
4. Farm Power & Machinery, Er Sanjay Kumar, Kalyani Publications

## Syllabus of Two & Three Wheelers

<b>Course Code</b>	AEPE514
	Two & Three Wheelers
<b>Number of Credits and L-T-P</b>	3 [L - 3, T - 0, P - 0]
<b>Course Category</b>	PE
<b>Prerequisites</b>	Automotive Engines and Automotive Chassis

### Course Objectives:

1. To impart knowledge of different types of two and three wheelers.
2. To impart adequate knowledge on frame and body of two and three wheelers.
3. To impart knowledge on power unit, various sub systems of two and three wheelers.
4. To impart knowledge of proper maintenance of two and three wheelers.

### Course Contents:

Module No.	Description of Topic	Contact Hrs.
01	<p><b>Introduction</b></p> <p>1.1. Classification of Two Wheelers: Types - Mopeds, Scooters, Motorcycles.</p> <p>1.2. Basic Systems - Frame, Wheels and Brakes, Suspensions, Engine, Drive Train, Fuel System, Ignition, Electrical System (brief ideas only)</p> <p>1.3. Classification of Three Wheelers: With respect to use, make, fuel used, wheel configuration and steering configuration.</p> <p>1.4. Types of Loading Auto Rickshaws (layout) - Passenger, Delivery, Pickup, Tipper vehicle.</p>	<b>04</b>
02	<p><b>Frame and Chassis</b></p> <p>2.1. Layout of Moped, Scooter, Motorcycle.</p> <p>2.2. Load on the Frame, Design Considerations, Components of Frame, Mounting Provisions on Frame</p> <p>2.3. Types of Frames:</p> <p style="padding-left: 20px;">2.4.1 Tubular Frame - Backbone, Double Beam, Single Cradle, Double Cradle, Trellis, Step-Through Frame.</p> <p style="padding-left: 20px;">2.4.2 Engine Based Frame</p> <p style="padding-left: 20px;">2.4.3 Twin-Spar Frame</p> <p style="padding-left: 20px;">2.4.4 Monocoque Frame</p> <p>2.4. Vibration Dampers - Handlebar Mountings, Handlebar, Steering Dampers</p> <p>2.5. Frame Materials</p> <p>2.6. Body Works</p> <p>2.7. Ergonomic Considerations</p> <p>2.8. Sidecars</p>	<b>06</b>

03	<p><b>Power Unit For Two &amp; Three Wheelers</b></p> <p>3.1. Engines for Two Wheelers</p> <p>3.1.1. Arrangements of Cylinders - single cylinder, Inline (2, 3 ,4 cylinder), V Twin, V Four, Horizontally Opposed Twin.</p> <p>3.1.2. Valve Operating Mechanism - Pushrod Overhead Valve, Single Overhead Camshaft, Double Overhead Camshaft.</p> <p>3.1.3. Cranking System: Basic Cranking Mechanism - Roller type ratchet, Lock pawl type ratchet, Regular ratchet wheel. Push Starting, Moped Cranking Mechanism - Indirect, Direct. Kick Start Mechanism, Auto Start Mechanism.</p> <p>3.1.4. Exhaust System of Two Wheelers, Exhaust Pipe and Header - Two into two, Two into one, Three into one, Four into four, Four into two, Four into one. Muffler</p> <p>3.2. Engines for Three Wheelers</p> <p>3.2.1. Four Stroke CNG, Four Stroke Diesel Engine</p>	12
04	<p><b>Sub-Systems for Two &amp; Three Wheelers</b></p> <p>4.1. Transmission System of Two &amp; Three Wheeler</p> <p>4.1.1. Layout of Transmission System in Two Wheelers, Primary Reduction - Belt Drive, Chain Drive, Gear Drive. Comparison of Drives.</p> <p>4.1.2. Gear Shifting Mechanism of Two &amp; Three Wheeler - Hand Operated, Foot Operated Shifting Mechanism.</p> <p>4.1.3. Final Drive - Belt Drive, Chain Drive, Shaft Drive.</p> <p>4.1.4. Drive Train Layout of Auto Rickshaw.</p> <p>4.2. Steering System of Two &amp; Three Wheeler</p> <p>4.2.1. Steering Geometry and Effects, Steering Column Construction</p> <p>4.2.2. Handle Bar - Types and Construction, Ape Hanger, Beach, Drag, Clip-ons Handlebar.</p> <p>4.2.3. Handlebar Controls - Right Handlebar, Left Handlebar. Controls on foot.</p> <p>4.3. Suspension System of Two &amp; Three Wheeler</p> <p>4.3.1. Suspension Requirements - Kinematic, Dynamic.</p> <p>4.3.2. Design Considerations</p> <p>4.3.3. Springer Fork, Girder Fork, Trailing &amp; Leading Link type Suspension, Single &amp; Double Link Type Front Suspension, Hardtail &amp; Swing Arm Type Rear Suspension, Upside Down Fork.</p> <p>4.3.4. Rear Suspension System of Passenger &amp; Loading Auto Rickshaw.</p> <p>4.4. Braking System of Two &amp; Three Wheeler</p> <p>4.4.1. Hand Operated and Foot Operated Mechanical Brake, Hand Operated and Foot Operated Hydraulic Brake, Antilock Braking System - Components and Operation.</p> <p>4.4.2. Braking System of Auto Rickshaw.</p>	16

05	<b>Service and Maintenance</b>	04
	5.1. Servicing and maintenance of carburetor, spark plug cleaning, ignition timing adjustment, gear box, steering head, shaft and chain drive, suspension, brake servicing and adjustment. 5.2. Periodic maintenance schedules. 5.3. Fact and Features of Two wheelers: Power to Weight Ratio, Basic Calculation, Different Stands for Two wheelers, Different size of tyres of a two wheeler.	
<b>Total Hours</b>		<b>42 Hrs</b>

**Weightage distribution in both objective, short and broad answer type questions:**

Group	Module Number	Weightage (%)
A	1 & 2	25
B	3	35
C	4 & 5	40

**Course Outcomes:**

At the end of the course, the student will be able to:

C01	Identify different types of two wheelers and three wheelers.
C02	Explain the working, components and accessories of two and three wheeler power units.
C03	Describe the transmission and control system of two and three wheelers.
C04	Classify brakes and suspension system of two and three wheelers.
C05	Explain the procedure for servicing and maintenance of different components used in two and three wheelers.

**Text Books:**

1. Two and Three Wheeler Technology, Dhruv U. Panchal, Jayesh P. Maniar and Jigar A. Doshi, PHI Learning.
2. Two Wheelers and Three Wheelers, K. K. Ramalingam, Scitech Publications (India) Pvt. Ltd.

**Reference Books:**

1. S. Srinivasan, Automotive Mechanics, Tata McGraw Hill Education, New Delhi.
2. S.K. Gupta, Automobile Engineering, S.Chand, New Delhi.
3. R.B. Gupta, Automobile Engineering, Satya Prakashan, New Delhi.

## Syllabus of Internship - II

<b>Course Code</b>	SI501
<b>Course Title</b>	Internship - II
<b>Number of Credits and L-T-P</b>	1 [L - 0, T - 0, P - 0]
<b>Course Category</b>	Internship
<b>Prerequisites</b>	Up to 4 <sup>th</sup> semester all subject knowledge

### Course Objectives:

1. Explore career alternatives prior to Diploma.
2. Integrate theory and practice.
3. Assess interests and abilities in their field of study.
4. Learn to appreciate work and its function in the economy.
5. Develop work habits and attitudes necessary for job success.
6. Develop communication, interpersonal and other critical skills in the job interview process.
7. Build a record of work experience.

After 4<sup>th</sup> Semester, for Internship-II, students are to be involved to undergo internship with industry/ NGO's/ Government Organizations/ Centre of Excellence/ Micro/ Small/ Medium Enterprises to make themselves ready for the industry. In this case also Training and Placement Cell and concerned teachers have to take initiative for coordination. Online internship options may be explored.

For more guidance regarding internship, refer AICTE Internship Policy and AICTE Internship Portal ([www.internship.aicte-india.org](http://www.internship.aicte-india.org)).

After completion of Internship, the student should prepare a comprehensive report to indicate what he/ she has observed and learnt in training period. The student may contact Industrial Supervisor / Faculty Mentor / TPO for assigning topics and problems and should prepare the final report on the assigned topics. The training report should be signed by the Industrial Supervisor/ Internship Faculty Mentor, TPO and HOD.

The Internship Report will be evaluated on the basis of following criteria (as applicable)

**60 Marks**

Sl. No.	Criteria for evaluation of Internship Report
1	Originality
2	Adequacy and purposeful write up
3	Writing Skill (Organizations, format, drawing, sketches, style, language)
4	Attendance record, daily diary, quality of Internship Report.

Seminars must be arranged for the student based on his/her training report, before an Internal Committee constituted by the concerned department of the Institute. The evaluation will be based on the following criteria:

**40 Marks**

<b>Sl. No.</b>	<b>Criteria for evaluation of Internship Report</b>
1	Quality of content presented
2	Proper Planning for presentation
3	Effectiveness of presentation
4	Depth of knowledge and skills
5	Viva voce

**Course Outcome:**

At the end of the course, the student will be able to:

<b>C01</b>	Learn the application of knowledge in real world problems
<b>C02</b>	Get exposure to team-work and leadership quality.
<b>C03</b>	Deal with industry-professionals and ethical issues in the work environment

### Syllabus of Major Project

<b>Course Code</b>	PR502
<b>Course Title</b>	Major Project - I
<b>Number of Credits and L-T-P</b>	1 [L - 0, T - 0, P - 2]
<b>Course Category</b>	Major Project
<b>Prerequisites</b>	All subject Related to Automobile Engineering

#### **Course Objectives:**

1. To understand the solution process of real-life problem
2. To achieve the potentiality of doing team work
3. To understand the gap between academic knowledge and actual real-life problem-solving knowledge.
4. To prepare the project report in a professional manner.

#### **Project Group:**

1. Formation of project group: Maximum 8 to 12 students per batch.
2. Each project group should select work by consulting the guide.

#### **Course Content:**

It is the 1<sup>st</sup> part of the major project. During this major project- I, partial work (*Review of related literature, Market Survey etc.*) of the final project have to be completed.

The project topic has been selected on an advanced topic of Automobile Engineering.

#### **Note:**

Faculty Members and students can select any project topic through mutual discussion for each student groups but related to automobile engineering.

After completion of the major project-I, each students group should prepare one comprehensive report to indicate what are observed, learnt during the project work, estimation (time and cost), work plan, layout of the project during this work. The student may contact guide for assigning topic and problem and should prepare the progress report on the assigned topics. The project report should be signed by the guide and HOD.

The format of the progress report will be as following

<b>Sl. No.</b>	<b>Particulates</b>
1	Title page
2	Certificate from guide
3	Abstract
4	Objective
5	Literature review/ background survey/history

6	Proposed work Layout
7	Proposed Methodology
8	Estimation (Duration & Cost)
9	References

**Internal Assessment:**

1. Project Report: The project Report will be evaluated on the basis of following criteria (as applicable) **40 Marks**

Sl. No.	Criteria for evaluation of Report
1	Originality
2	Adequacy and purposeful write up
3	Writing skill (Organizations, format, drawing, sketches, style, language)
4	Practical applications and relationships with basic theory
5	Concept taught in the outcome

2. Attendance and work process **20 Marks**

**External Assessment:**

Seminars must be arranged for the student based on the progress of project work so far, in presence of project guide, Internal Committee constituted by the concerned department of the Institute and External examiner/s. The evaluation will be based on the following criteria.

**40 Marks**

Sl. No.	Criteria for evaluation of project
1	Quality of content presented
2	Proper Planning for presentation
3	Effectiveness of presentation
4	Depth of knowledge and skills
5	Viva voce

**Course Outcome:**

At the end of the course, the student will be able to:

<b>C01</b>	Learn new skills and supplement knowledge
<b>C02</b>	Learn & practice communication and teamwork skills.
<b>C03</b>	Learn strategies like time management, multi-tasking, real time technical knowledge etc.
<b>C04</b>	Can apply their knowledge for developing thinking skill.
<b>C05</b>	Gain practical experience in a real working environment.