

**STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA  
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES**

<b>DISCIPLINE: AUTOMOBILE ENGINEERING</b>										<b>SEMESTER: 6<sup>TH</sup></b>		
<b>SL NO</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>PERIODS</b>			<b>EVALUATION SCHEME</b>						
			<b>L</b>	<b>T</b>	<b>P</b>	<b>INTERNAL EXAM</b>			<b>END SEM EXAM</b>	<b>TERM WORK</b>	<b>PRACTICAL EXAM</b>	<b>TOTAL MARKS</b>
						<b>TA</b>	<b>CT</b>	<b>Total</b>				
<b>THEORY</b>												
1.	HMT 601 OR BST 501	ENTREPRENEURSHIP & MANAGEMENT OR ENVIRONMENTAL STUDIES	5	0		10	20	30	70			100
2.	AET 601	TRANSPORT MANAGEMENT	4	1		10	20	30	70			100
3.	AET 602	VEHICLE DYNAMICS	4	1		10	20	30	70			100
4.	AET 603	AUTOMOTIVE SYSTEM	4	1		10	20	30	70			100
5.	AET 604	ELECTIVE (ANY ONE) CAD/CAM & AUTOMATION AUTOMOBILE AIR CONDITIONING DESIGNING & FABRICATION OF VEHICLE BODY VEHICLE MAINTENANCE	4	1		10	20	30	70			100
<b>PRACTICAL/TERM WORK</b>												
5.	AEP 601	PROJECT WORK & SEMINAR			8					50	100	150
6.	AEP 602	DRIVING PRACTICE			6					50	50	100
<b>GRAND TOTAL</b>			<b>21</b>	<b>4</b>	<b>14</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>350</b>	<b>100</b>	<b>150</b>	<b>750</b>

Total Contact hours per week: 39

Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test

Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%

# TRANSPORT MANAGEMENT

AET-601

Period/Week: 4+1

Total Periods: 60

Exam : 3 Hours

End Exam – Th: 70 marks

CT – 20 Marks

TA – 10 Marks

## Topic Wise Distribution of Periods :

Sl. No.	Topic	Period
1.	Instruction to transport management	16
2.	Transport management	12
3.	Estimation & valuation of vehicle	10
4.	Driving skills	10
5.	Motor Industry	08
6.	Functions & Role in Automobile Industry	4
<b>Total-</b>		<b>60</b>

## AIM :

The develop fundamental concepts and strategies and the structures and process of transport management and related activities are explored.

## OBJECTIVE :

On completion of subject students will be able to :

1. Study & fill up the forms required as per Motor Vehicle Act.
2. Prepare small project reports of bus / goods transport organization enabling him to work in different organization like MSRTC, private organization.
3. Start SSI unit or may be able to work as service provider.
4. Understand, prepare the different documents used in transport organization.
5. Enter in the business of buying and selling of old & new vehicles.
6. Create awareness of ideal driving which includes safety, legal aspects.
7. Understand the purpose of research institutes in India.

## COURSE CONTENTS :

### 1. Introduction to transport management

#### 1.1 Motor Vehicle Act :

Short titles used in MVA, Definitions, Term regarding vehicle.

#### 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.

#### 1.3. Conductor's license :

Necessity, Eligibility, Documents required and rules for conductors.

#### 1.4 Registration of Vehicles :

Necessity, Where to be made, How to be made, Temporary registration, Production of vehicle at the time of registration, Form and manner of display of registration mark, Size of letters and numerals of registration mark, Transport of ownership of motor vehicle

- 1.5 Control of Transport:  
Transport authorities, Difference between STA & RTA, Necessity of Permit, All types of permit, Transfer of permit, Temporary permit, Tourist permit, National permit, Speed limits.
- 1.6 Construction of Motor Vehicle:  
Overall dimensions, General provision regarding construction and maintenance of motor vehicle. Power of central government to make rules.
- 1.7 Taxation :  
Objectives, Basis of taxation, Methods of levying tax, Tax exemption.
- 1.8 Insurance:  
Motor Vehicle Insurance, No-fault liability, Procedure for accident claim.

## **2. Transport Management**

### **Part A**

- 2.1 Terms used in transportation :  
Road transport service, Transport vehicle, Public service vehicle, Good vehicle, Public place, Depot, Route, Trip, Time table, Vehicle schedule, Fare.
- 2.2 Comparison of Modes of transport.
- 2.3 Requirements of goods and passenger transport on the basis of Volume, type, weight of material; class of passenger.
- 2.4 Basic elements in Transport Management :
  - 2.4.1 Market potential :  
Type of goods / passengers, Period of use, Probable competition.
  - 2.4.2 Selection of vehicle:  
Type of load, Class of passenger, Type of service.
  - 2.4.3 Organization setup:  
Govt., Semi Govt., Private.
  - 2.4.4 Legal compliance :  
Documents required as per MVA, Registration.
  - 2.4.5 Policies of transport organization;  
Policies towards passenger, employees, like long distance service, Express service, Night service and others.

### **Part B**

- 2.4.6 Layout of organization:  
Location, elements considered in location, Passenger amenities, infrastructural facilities.
- 2.4.7 Scheduling:  
Basic factors in bus, crew and maintenance scheduling, calculation of number of buses.
- 2.4.8 Freight calculation:  
Time base, Distance base, Contract, per passenger, cubic feet tone method.  
Structure of fare, fixed cost, Maintenance cost, depreciation cost, insurance.  
Interest on capital, variable cost, Hiring of trucks, Toll, staff wages,  
Miscellaneous cost.
- 2.4.9 Record keeping:  
Log book, Trip operational sheet, Vehicle ledger, Truck history card, Monthly operational sheet, Goods consignment note, various types of bookings, Use of Computer.

### **3. Estimation and Valuation of Vehicle :**

- 3.1 Role of surveyor.
- 3.2 Procedure of survey and valuation of vehicle.
- 3.3 Accident survey report.
- 3.4 Importance of warranty system and protection of law : How to deal with defects, benefits of warranty system. Protection of law.
- 3.5 Buying a new vehicle: Factors to be considered –  
Ex-showroom price and on road price, use of vehicle, when and where to buy, Closing the deal Running in. inspecting the vehicle, Points to check; test drive Controls, Bonnet, Suspension, Switches, Seat, Noise, Ventilation, Safety, Boot, Interior Storage.
- 3.6 Buying a used vehicle :  
When & where to buy: Dealers, used car firms, Private sellers, Garages, Auctions. Factors to be considered – Depreciation, Model and year, Oil leak, Oil Pressure, Exhaust, Battery, Odometer, Bonnet, Crash damage, Rust, Suspension damage, Tyres, Switches & accessories, Lights, Chrome, Wiring, Steering, Hydraulic system, Structural corrosion, Floor, Test drive.
- 3.7 Preparations for selling:  
When to sell, How to sell, Auctions, Garages, Private sale, Preparing the car, Documentation, Selling price, Safeguards.

### **4 Driving skills :**

- 4.1 Instructions in driving of motor vehicle:  
Driving theory, traffic education, light vehicle driving practice, Vehicle mechanism & repair, Public relations for drivers, Fire hazards, vehicle maintenance, first aid.
- 4.2 Traffic signs:  
Mandatory signs, Cautionary signs, Informatory signs. Traffic signals. Causes of accident and remedies.
- 4.3 Measures to avoid accidents.
- 4.4 Defensive driving:
- 4.5 Rain and flood, fog and mist, snow and ice.
- 4.6 Fitness to drive:  
Driving and age, stress due to traffic jam, night driving.

### **5. Motor Industry**

- 5.1 The automobile industry in India (Collection of Data of various industries)
- 5.2 importance of Automobile Engineer.
- 5.3 Working of Various State Transport Organizations.
- 6 Functions & Role in Automobile Industry :  
Various Research Organization like- Central Institute of Road Transport. Automotive Research Association of India. Central Road Research Institute, Petroleum Conservation & Research Association.

### **TEXT BOOKS :**

- 1. Passenger Amenities in STU, Dr. P. Sudarsanam., Publisher CIRT, Pune.
- 2. Fare structure in STU, Dr. P. Sudarsanam., Publisher CIRT, Pune.
- 3. Bus station Management, Dr. P. Sudarsanam, Publisher CIRT, Pune.
- 4. Bus & Crew Scheduling, Dr. P. Sudarsanam, Publisher CIRT, Pune.
- 5. Industrial Organization & Management, by O.P. Khanna, Dhanpat Rai & sons.
- 6. Motor Vehicle Act & Rules.

# VEHICLE DYNAMICS

AET-602  
Period/Week : 4+1  
Total Period : 60

Examination : 3 Hrs  
End Exams : 70 Marks  
CT : 20 marks  
TA : 10 marks

## TOPIC WISE DISTRIBUTION OF PERIODS :

Sl. No.	Topic	Periods
1.	Fundamentals to vibration	12
2.	Suspension	08
3.	Tyres	08
4.	Vehicle Handling	08
5.	Stability of Vehicles	12
6.	Numerical Methods	12
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		60

## RATIONALE :

Vibration is a factor which makes hugely impact to all the parts of the vehicle and cloud effect to the efficiency on it. The subject describes how the vibration occurs and how can be damped. The subject shows optimization the vibration with respect to the handling, stabilization and numerical method. The engineers and the automotive industries adopting the techniques for diagnosis the errors.

## OBJECTIVES :

On completion of the subject a student will be able to understand and explain

1. Classifications
2. Single and multi degree freedom vibration
3. Forces acting on tyres
4. Suspension principles & effects.
5. Handling W.R.T. speed, load & effect applied
6. Methods for fundamental frequency

## COURSE CONTENTS :

### 1. Fundamentals to vibration (12 periods) :

Fundamentals of vibration, Mechanical vibrating system. Modeling & simulation. Model of an automobile-Single, two, multi degrees of freedom systems-Free, forced and damped vibration. Magnification factor-Transmissibility, Vibration absorber.

Multi Degree of Freedom System : Closed coupled system, Eigen value problems, Far coupled system-Orthogonality of mode shapes-Modal analysis.

**2. Suspension (08 periods)**

Requirements, Spring mass frequency. Wheel hop, wheel wobble, wheel shimmy. Choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft directions.

**3. Tyres (08 Periods)**

Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Ride property of tires. Magic formulae tire model, Estimation of tire road friction. Test on various road surfaces. Tire vibration. Ride characteristics of tyres, behaviors while cornering, power consumed by tyres.

**4. Vehicle handling (08 Periods)**

Oversteer, understeer, Steady state concerning. Effect of braking, driving torques on steering. Effect of chamber, transient effects in concerning. Directional stability of vehicles, condition for true rolling.

**5. Stability of vehicles (12 Periods)**

Load distribution. Calculation of tractive effort and reactions for different drives stability of a vehicle on a slope, on a curve and a banked road, power of propulsion, road performance curve and its applications (acceleration, gradability, drawbar pull)

**6. Numerical Methods : ( 12 Periods)**

Approximate methods for fundamental frequency, Dunker-Ley's lower bound, Rayleigh's upper bound-Holzer method for close-coupled systems and branched systems.

**References:**

1. Giri. N.K. Automobile Mechanics, Khanna Publishers, New Delhi, 1986.
2. Gillespie. T.D., Fundamentals of vehicles dynamics society of Automotive Engineers, Ic USA 1992
3. Heldt. P.M. Automotive Chassis, Chilton co., New York, 1992
4. Ellis. J.R. Vehicle Dynamics, Business Books Ltd., London, 1991
5. Giles. J.G. Steering, Suspension and Tyres, Iliffe Books Ltd., London, 1988.
6. Rao. J.S. & Gupta K., Theory and Practice of Mechanical Vibrations, Wiley Eastern Ltd., New Delhi, 1999.

# **AUTOMOTIVE SYSTEM**

AET-603

Period/Week : 4+1

Total Period : 60

Examination : 3 Hrs

End Exams : 70 Marks

CT : 20 marks

TA : 10 marks

## **TOPIC WISE DISTRIBUTION OF PERIODS :**

Sl. No.	Topic	Periods
1.	Front axle	05
2.	Steering & steering geometry	08
3.	Suspension system	11
4.	Brake system	20
5.	Wheel & Tyres	06
6.	Chassis & Frames	10
	Total-	60

## **RATIONALE :**

The modern automobile is made up of many components and parts. The parts under the body are referred to as chassis. Engine and several the systems are mounted on the chassis. The system through which wheels are connected to the frame is called suspension. Steering arrangement and brake system are for controlling a vehicle system.

These are an important part of automobile and hence should be learned by an automobile engineer.

## **OBJECTIVES :**

On completion of the subject a student will be able to understand and explain.

1. Function & assembly
2. Steering mechanism & steering geometry
3. Objectives principles & types of suspension system
4. Principle types & Functioning of brake
5. Types of & Properties of wheels & Tyres
6. Tyres & Layout of chassis.

## **COURSE CONTENTS :**

### **1. Front axle ( 5 Periods)**

- 1.1 Introduction & study of front axle assemblies
- 1.2 Front axle & stub axle
- 1.3 Front wheel assemble

### **2. Steering & steering geometry ( 08 periods)**

- 2.1 Introduction types of steering, steering column.
- 2.2 Steering mechanism & power steering.
- 2.3 Steering geometry i.e. camber, caster, king-pin,

- Inclination, understeer, oversteer, combined angle
- 2.4 Toe-in toe-out steering angle wheel alignment & factors affecting wheel alignment

**3. Suspension system (11 period)**

- 3.1 Introduction principle & objectives suspension system.
- 3.2 Types of suspension spring like leaf spring coil spring rubber bushes torsion bar.
- 3.3 Types of suspension system such as independent suspension system. Rigid axle suspension system. Stabilizer & shock absorber.

**4. Brake System (20 periods)**

- 4.1 Principle of operation and requirements of brakes.
- 4.2 Fading of brake types of brakes such as drum brakes and its leading & trailing shoes disc brakes.
- 4.3 Hydraulic brakes and its components like master cylinder tandem master cylinder wheel cylinder, brake fluid.
- 4.4 Servo-brakes air brake & hand brake.
- 4.5 Adjustment and bleeding of brake.
- 4.6 Common brake problems.
- 4.7 Anti-lock breaking system.

**5. Wheel & tyres (6 periods)**

- 5.1 Introduction types of wheel & wheel dimensions.
- 5.2 Types and properties of tyres. Tubeless tyres. Tube.
- 5.3 Tyre manufacturing tyre specification. Precaution regarding tyres.

**6. Chassis & frames (10 periods)**

- 6.1 Introduction and lay out of chassis showing its main components.
- 6.2 Types of chassis frame and important chassis layouts.
- 6.3 Classification, construction and description of dump truck, grader, road roller, dozer, loader, cranes, scraper, tankers / trailers.

**RECOMMENDED BOOKS**

1. Automobile Engineering VOL-1 & 2 Kirpal Singh, std publishers.
2. Automobile Engineering by G.B.S. Narang, Khanna publishers.
3. Automobile Engineering by W.H. course, Mc Graw Hill.
4. Automotive chassis & body by W.H. Crouse, Mc Graw Hill.



# ELECTIVES

## VEHICLE MAINTENANCE

AET-604

Period/Week : 4+1

Total Period : 60

Examination : 3 Hrs

End Exams : 70 Marks

CT : 20 marks

TA : 10 marks

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Auto Workshop layout & Equipments	6
2.	Maintenance management & record keeping	6
3.	Engine maintenance	18
4.	Chassis & Body maintenance	20
5.	Service Station	4
6.	Servicing of motor vehicle	6
	Total-	60

### AIM :

Promote efficient planning of transport activities, effective maintenance of vehicles, co-ordination of trips, and the use of correct vehicles for specific tasks, to limit transport costs to the minimum.

### OBJECTIVE :

On completion of subject, students will be able to

1. Understand use of tools and equipments.
2. Draw layout of Automobile workshop.
3. Compare and understand types of maintenance systems.
4. Execute dismantling of assemblies.
5. Check the parts for proper functioning.
6. Draw layout of service station.
7. Knowledge about services of motor vehicle

### COURSE CONTENTS :

- 1 Auto Workshop Layout & Equipments.
  - 1.1 General safety precautions and procedures.
  - 1.2 Functions of General shop equipments and tools. Wheel balancer, wheel aligner, Crankshaft aligner and straighter, engine analyzer, arbor press, drill press, battery charger, tyre changer, car washer, lift, FIP calibration machine, head light aligner, valve grinder, honing machine, cylinder boring machine.
  - 1.3 Layout with equipments required for dealers of two-wheeler, four wheelers- cars and commercial vehicles. For road – side garages.
  - 1.4 Layout of modern workshop for specialized job work, crankshaft grinding, engine re-boring, F.I.P repairs, crankshaft journal boring, brake drum boring.

## **2. Maintenance management and record keeping**

- 2.1 Necessity of maintenance
- 2.2 Types of maintenance and their applications.
  - 2.2.1 Preventive maintenance and their applications.
  - 2.2.2 Scheduled maintenance system.
  - 2.2.3 Break down maintenance system.
- 2.3 General maintenance schedule – Daily, Weekly, Monthly & periodic maintenance for various vehicles – Two- Wheelers, LMV, HMV
- 2.4 General servicing procedure. Decision to repair or replace.
- 2.5 Workshop records – history sheet, work order, activity file.

## **3 Engine Maintenance**

### **Part A :**

- 3.1 Troubles, Causes & remedies in engine, fuel system, cooling system, lubrication system & MPFI Engine.
- 3.2 Checking and servicing of following engine components :  
Cylinder head, cylinder block, cylinder liners, piston, piston ring, crank-shaft, connecting rod, valves.
- 3.3 Tuning of engine

### **Part B:**

- 3.4 Fuel feed system service carburetor dismantling, cleaning and tuning, injector cleaning and testing, FIP phasing and calibration, MPFI – injector testing and cleaning. Sensor testing.
- 3.5 Lubrication system service – change oil filter, check oil pump and diagnose causes for excessive oil consumption, external oil leakage and low oil pressure in an automobile engine.

## **4 Chassis & Body Maintenance :**

### **Part A**

- 4.1 Checking and repairing of Clutch for clutch plate thickness, run out, rivet depth, warpage of pressure plate.
- 4.2 Adjustment of clutch.
- 4.3 Troubles, Causes and remedies of clutch.
- 4.4 Checking gearbox for run out of main shaft and lay shaft, for wear of synchronizer and worn bearings, checking oil seals.
- 4.5 Troubles, Causes and remedies of gearbox.
- 4.6 Checking and adjusting differential for ring gear run out, back lash in ring gear, tooth contact between ring gear and pinion, bearing preload.
- 4.7 Troubles, Causes and remedies of propeller shaft, differential and rear axle.
- 4.8 Inspection and repair of master cylinder, wheel cylinder, brake drum, brake disc, brake linings and brake pads.
- 4.9 Adjustment of hydraulic brakes – shoe clearance, brake pedal free travel, pedal to wall clearance, parking brake adjustment.
- 4.10 Bleeding of hydraulic brakes.
- 4.11 Troubles, Causes and remedies in brake system.

**Part B:**

- 4.12 Troubles, Causes and remedies of suspension system, Lubrication of leaf springs.
- 4.13 Procedure of wheel alignment (after chassis height adjustment) by wheel alignment gauges and procedure of wheel balancing. Troubles, Causes and remedies of steering system.
- 4.14 Care of wheels and tires, retreading of tires and vulcanizing. Tire rotation.
- 4.15 Frame repairs (cracks, loose rivets, skewness in frames) and alignments.
- 4.16 Body repairs-denting, denting tools and equipments.
- 4.17 Repainting procedure, patch work.
- 4.18 Panting defects.
- 4.19 Adjustment of doors and locks.

**5. Service Station**

- 5.1 Location & layout of service station.
- 5.2 Equipment for service station.
- 5.3 Equipment required to install a service station.
- 5.4 Tools in service station.
- 5.5 Services carried out in service station & its procedure.

**6. Services of motor vehicle**

- 6.1 Services & its necessity.
- 6.2 Types of Services.
- 6.3 Stream Cleaning.
- 6.4 Cleaning out side of the engine.
- 6.5 Precautions of minimize carbon.
- 6.6 Methods of decarbonising.

**TEXT BOOKS**

- 1. Automotive Service by Tim Gills, Delmar Publisher Inc.
- 2. Automobile Mechanics by Crouse / Anglin, TATA Mc Graw – Hill
- 3. Automobile Engineering Vol. III, IV by Anil Chikara, Satya Prakashan, New Delhi.
- 4. Automobile Engineering by Dr. Kirpal Singh, Standard Publishers.

# CAD / CAM & AUTOMATION

AET-604

Period/Week : 4+1

Total Period : 60

Examination : 3 Hrs

End Exams : 70 Marks

CT : 20 marks

TA : 10 marks

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Introduction to CAD/ CAM	6
2.	Geometric Modeling	12
3.	Instruction to computer numerical control	6
4.	Part programming	14
5.	Industrial Robotics	12
6.	Automation	10
Total -		60

### AIM :

To study quality & precision oriented shorter manufacturing cycle time with the use of CAD/CAM technology. The prerequisites of this subject have been introduced in earlier subjects such as engineering graphics, engineering drawing & mechanical engineering drawing.

### OBJECTIVE :

On completion of subject students will be able to :

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

### COURSE CONTENTS :

#### 1. Introduction to CAD / CAM

Computers in industrial manufacturing. Product Cycle, CAD /CAM Hardware: Basic structure, CPU, Memory, I/O devices, Storage devices and system configuration.

#### 2. Geometric Modelling :

Requirement of geometric modeling, Types of Geometric models. Geometric construction method-sweep, solid modelling – Primitives & Boolean operations, free formed surfaces (Classification of surface only) (No numerical treatment).

#### 3. Introduction to computer numerical Control

Introduction – NC, CNC, DNC, Advantages of CNC, The coordinate system in CNC, Motion control system – point to point, straight line, Continuous path (Contouring). Application of CNC.

**4. Part programming :**

Fundamentals, Manual part programming, NC- Words, Programming format, Part programming, use of subroutines and do loops, computer aided part programming (APT).

**5. Industrial Robotics :**

Introduction, physical configuration, basic robot motions, technical features such as- work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. Application- Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.

**6. Automation :**

Basic elements of automated system, advanced automation functions, levels of automation. Flexible manufacturing : Introduction FMS equipments, FMS application. Introduction to CIM.

**TEXT BOOKS :**

1. CAD/CAM principles and applications by P.N. Rao, Tata Mc Graw-Hill.
2. CAD/CAM/CIM by Radha Krishna P. & Subramanyam, Wiley Eastern Ltd.
3. CNC/Machine by B.S. Pabla & M. Adithan, New age International.
4. Computer Aided design and manufacturing by Groover M.P. & Zimmers Jr, Prentice hall of India.

# AUTOMOBILE AIR CONDITIONING

AET-604

Period/Week : 4+1

Total Period : 60

Examination : 3 Hrs

End Exams : 70 Marks

CT : 20 marks

TA : 10 marks

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Introduction	8
2.	Case & Duct System	8
3.	Air Conditioning System	8
4.	System Control devices & Electrical circuits.	12
5.	Repairs & Maintenance of Air Conditioning System	12
6.	Comfort Heating System	12
Total-		60

### AIM :

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

### OBJECTIVE :

On completion of subject students will be able to :

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

### COURSE CONTENTS :

#### 1. Introduction :

- 1.1 environmental & safety aspects in heating, ventilation & air conditioning systems.
- 1.2 Human comfort control – comfort zone, air movement, wind chill factor, odour problems & effects of humidity.
- 1.3 Heat transfer fundamentals – Forced & natural convection, radiation, evaporation & conduction.
- 1.4 Requirements of heating, ventilation & air conditioning in cars, multi utility vehicles, vans, safari, heavy passenger vehicles, coaches, cargo vehicle cabin, vehicle carrying perishable commodities & cryogenic substances.
- 1.5 Controlled & uncontrolled ventilation – working, application & comparison.

#### 2. Case & Duct System :

- 2.1 Construction & working of Air intake section, core section & distribution section.
- 2.2 Construction & working of Downstream, upstream, split & hybrid.
- 2.3 Construction & working of rear heating & cooling system.

#### 3. Air Conditioning System

- 3.1 General layout of Air conditioning system.
- 3.2 Construction & working of following refrigeration sub systems – thermostatic expansion valve, fixed orifice tube & rotary vane air cycle system.
- 3.3 Construction & working of evaporator, condenser, accumulator.

- 3.4 Receiver driers & accumulator – Types, construction & working.
- 3.5 Construction & working of reciprocating, scroll & rotary vane compressors. Drive systems for compressors.

### **Part B**

- 3.1 Construction & working of electromagnetic clutch.
- 3.2 Metering devices- comparison of thermostatic expansion valve & i.e. H valve, block type, internally equalized & externally equalized.
- 3.3 Functions of thermostatic expansion valve i.e. Throttling action, modulating action & controlling action. Construction & working of remote bulb.

### **4. System Control Devices & Electrical Circuits.**

- 4.1 System controls – Construction & working of typical vacuum system & electronic temperature control system.
- 4.2 Construction & working of vacuum operated devices i.e vacuum reserve tank, vacuum restrictor, vacuum motor, check valve & check relays.
- 4.3 Switches – construction & working of high side temperature switch, low-side temperature switch, high pressure switch, low pressure switch, pressure regulator, ambient switch & superheat switch.
- 4.4 Sensor- Construction & working of sun load sensor, outside temperature sensor & in car temperature sensors.
- 4.5 Construction & working of Aspirator.
- 4.6 Construction & working of blower clutch control, heater control and time delay relay for heater control.
- 4.7 Mode doors and temperature doors.
- 4.8 Electrical circuits – Typical climate control system & Electronic climate control system, their electrical circuits & working.

### **5. Repair & maintenance of Air Conditioning systems**

- 5.1 Visual & acoustic check, side glass, leak test, temperature test, Procedure of charging & discharging. Moisture removal procedure.
- 5.2 Service equipments & tools – Vacuum pump, Manifold & gauge i.e. Low side & high side, gauge calibration, recovery unit & recycling unit, Halide (Freon) & Fluorescent leak detector, nitrogen leak test.
- 5.3 Compressor service – Symptoms, faults, cause & remedy.
- 5.4 Electromagnetic clutch service – Symptoms, faults, cause & remedy.
- 5.5 Performance testing procedure of thermostatic expansion valve & fixed orifice tube.
- 5.6 Refrigerant lubricants – Properties & types.
- 5.7 Refrigerant – types, packaging, storage, restrictions, color code & purity test.  
Hoses & connectors – Construction of system hoses, charging hose with shut off valve & connectors. Retrofitting from CFC-R12 to HFC-134A- need, procedure & Precautions.

### **6. Comfort Heating System**

- 6.1 Function, construction, working, maintenance, general faults and their remedies of Comfort Heating system.

### **TEXT BOOKS**

- 1. Automobile Air Conditioning by Boycee H. Dwiggirs, Thomon Learning.
- 2. Service Manual, Subros Company.
- 3. Refrigeration and Air Conditioning y Domkundwar – Arora Domkundwar, Hanpat Rai & Co.

# DESIGNING AND FABRICATION OF VEHICLE BODY

AET-604

Period Week: 4+1

Total Period: 60

Exam: 3 Hours

End Exam: Th: 70 Marks

CT -20 Marks

TA- 10 Marks

## TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topic	Periods
1.	Introduction	12
2.	Motor vehicle body	12
3.	Design of Automobile body	08
4.	Body constructional details	12
5.	Interior design for passenger vehicle	08
6.	Production of method	08
		Total : 60

### AIM:

Load of vehicle body, force on structural members, seat adjusting mechanism, vehicle comfort, interior fittings, body finishing are to be taken into consideration while designing a vehicle body. An automobile engineering who wishes to design and / or fabricate an automobile must be conversant with this project.

### OBJECTIVE:

On completion of the subject a student will be able to learn

1. Designing of vehicle body with aerodynamic consideration.
2. Chassis construction, frame construction, and types of auto-body.
3. Functional design, loads of vehicle body and importance of body style.
4. Structural member like roof, bonnet, seat adjusting mechanism.
5. Dimensions of vehicle comfort, interior fittings.
6. Body drafting, planning, body finishing, painting etc.

### COURSE CONTENTS:

#### 1. Introduction (12 periods)

- 1.1 Body design for satisfactory, degree of rigidity with minimum weight of material.
- 1.2 Utilisation of inner space in vehicle.
- 1.3 Legal limit and aerodynamic consideration in body design.

#### 2. Motor vehicle body (12 periods)

- 2.1 Types of automobile body & recruitment of various types of vehicle.
- 2.2 Method of construction-Chassis construction unique construction, frame construction.
- 2.3 Testing of body frame.

#### 3. Design of automobile body (8 periods)

- 3.1 Function & design.
- 3.2 Loads on body and stresses in members.
- 3.3 Importance of style in body design.

#### 4. Body constructional details (12 periods)

- 4.1 Doors, windows and window regulating mechanism.
- 4.2 Seat and seat adjusting mechanism.
- 4.3 Structural member and method of flooring them.
- 4.4 Roof bonnet, grills, luggage board.



**5. Interior design for passenger vehicle (8 periods)**

- 5.1 Major dimension of vehicle comfort & utility.
- 5.2 Sitting arrangement & interior fittings.
- 5.3 Trimming, dust proofing.

**6. Production method (8 periods)**

- 6.1 Body drafting, planning & manufacture of body panel.
- 6.2 Fabricating mechanism for body panel.
- 6.3 Body finishing methods-body painting.
- 6.4 Plastic components.

**RECOMMENDED BOOKS**

- 1. Modern coach & Motor Training by M.C. Linatoch S.O.
- 2. Practical motorist encyclopedia by Carram F.G.
- 3. The motor vehicle by Newton & stoods.
- 4. Automotive Chassis by P.M. Heldt.
- 5. Mechanism of the car by A.W. Gudge.
- 6. Motor manual Vol-I Automotive mechanism by Joseph Heitner.
- 7. The automobile by Harban Singh Reyat, S. Chand & Co. Ltd.
- 8. Automobile engineering by G.B.S. Narang, Khanna publishers.
- 9. Automobile engineering by R.B. Gupta, Satya Prakashan.

## **PROJECT WORK & SEMINAR**

AEP-601

Periods / Week :08

Total Periods : 120

Exam : 4 Hours

End Exam-Pr: 100 Marks

Sessional : 50 Marks

Total: 150 Marks

### **AIM:**

The group project is by far the most important single piece of work in the diploma programme. It provides the opportunity for the student to demonstrate independence \_\_\_\_\_ originally, to plan and organize a large project over a long period, and to put \_\_\_\_\_ practice some of the technique you have been taught throughout the course what \_\_\_\_\_ your level of academic achievement so far, a student can show his / her individuality \_\_\_\_\_ inspiration in this project. It should be the most satisfying piece of work in diploma level. It is worth about a quarter of the final year marks.

### **Project Co-ordinator**

The project Co-ordinator is responsible for the overall organization \_\_\_\_\_ the final year group projects. The student can contact him whenever they \_\_\_\_\_ any problem with the organization of their project.

### **Choosing an group project**

The ideas of project which has already been prepared during 5<sup>th</sup> semester studies to be \_\_\_\_\_ executed in their 6<sup>th</sup> semester.

### **Assessment**

It is important when choosing a project to understand the way it will be asses \_\_\_\_\_. A good first-class involves a combination of sound background research, a \_\_\_\_\_ implementation, or piece of theoretical work, and a through evaluation of the project \_\_\_\_\_ output in both absolute and relative terms. A good tip is to try to think of the project \_\_\_\_\_ "investigation", rather than an effort to deliver a fully-functioning 'product'. Pr \_\_\_\_\_ evaluation of the project is thus crucial to achieving high marks.

The very best projects invariable cover some new ground, e.g. by developing a com\_\_\_\_\_ application which does not already exist, or by enhancing some existing application \_\_\_\_\_ method to improve its functionally, performance.

A straightforward implementation project is acceptable, but you must appreciate that \_\_\_\_\_ unlikely to gain high marks, regardless of how well it is done. Likewise, projects we \_\_\_\_\_ are predominantly survey reports, unless they are backed up with

experiment \_\_\_\_\_ implementation, or theoretical analysis, e.g. for performing an objective comparison \_\_\_\_\_ surveyed methods, techniques etc. Pure survey reports, with no support \_\_\_\_\_ implementation or theory, are not acceptable.

### **The Project Report**

The project report is an extremely important aspect of the project. The project report defines a subject or problem: gathers facts in order to present them as completely as possible, and analyses the facts in order to come to conclusion on which the writers chooses certain recommendation the project report demonstrates.

- Understanding the wider context of choice of project, and the approach selected.
- Capability of applying the theoretical and practical techniques taught in the course in solving the problem.
- Capability to criticize project work performed and making constructive suggestions for improvement or suggest further work.

Most of the project assessor will not have followed the project throughout and will only have a short time to listen to a presentation or see a demonstration. For this reason they will rely heavily on the report to judge the project. Also, if in the end your overall degree marks put you on a boundary between two degree classification, the final outcome can be influenced significantly by the quality of your project. You should appreciate that the external examiners, who play a crucial role in the final recommendation, have only the report by which to judge your project performance.

### **THE PROJECT PRESENTATION AND DEMONSTRATION:**

One of the most important skills which the individual project aims to assess is your ability to communicate your ideas and work. As part of the assessment you will be required to give a presentation and demonstration of your project to your assessment team.

## DRIVING PRACTICE

**AEP-602**

**Periods Week: 6**

**Total Periods : 90**

**Exam: 4 Hours**

**End Exam- Pr. 50 Marks**

**Sessional : 50 Marks**

**Total: 100 Marks**

### **AIM:**

An automobile engineer should be capable of making different mechanism or part of an automobile. This allows them to satisfy their inventive / developmental skill as well as get an intimate knowledge about the function of the mechanism / part.

An automobile engineer, throughout his working life will be involved with automobile in one way or another. It is therefore, absolutely essential for an automobile engineer to learn to drive an automobile, at least a light vehicle. This course also gives the students opportunity to learn driving a light vehicle.

### **OBJECTIVE:**

On completing of the course students will be able to

1. Gain confidence of making a product independently.
2. Drive a 4 wheeler car with confidence.

### **COURSE CONTENTS:**

#### **A. DRIVING THEORY**

- |                       |  |
|-----------------------|--|
| 1. Know the vehicle : | Simple introduction to automobile engines and their working.   |
| 2. Vehicle control:   |  |
| Foot controls         | Foot brake, accelerator, clutch-dipper (not in present models) .                                     |
| Hand controls         | Steering wheel, hand brake, horn, light, wipers, ignition switch, starter, dipper and indicators.    |
| Other controls        | Rear-view mirror (right and left side), instrument cluster, gauges, dials wind-screen-their purpose. |
| 3. Pre-driving checks | i) Before sitting on driver's seat and<br>ii) After sitting driver's seat.                           |
| 4. Beginning to drive | Precaution just before moving. While moving sitting point Moving.                                    |

	Steering control.
	Changing of gear.
	Stopping
	Breaking
	Accelerator (gradual, sudden)
	Traffic sense, road sense, judgment, parking and positing according to road users.
5. Driving on the road	Reserving, anticipation, judgment and road positioning according to other road users.
6. Manoeuvres	Merging and diverging maneuvers turning maneuvers to left, right, about 3-point turn, 5-point turn and u-turn, overtaking stationery vehicle, moving vehicle in left side and right side.
8. Reversing	Location reverse gear in sitting position, speed control, steering in reverse gear, weaving the 'S' bend and common errors.
9. Parking	Parallel, angular, perpendicular parking facing, downhill, common errors.
10. Driver's responsibility Competitiveness over while on the road	Driving behavior, consideration for other road uses, courtesy and confidence, impatience and defensive driving. Distance between cars.
11. Priority for certain vehicles	Emergency vehicles. Fire engines and ambulance.

### **B. TRAFFIC EDUCATION-I**

1. Driving regulations Road use regulation made under section 118 of the motor vehicle act, 1988.
2. Hand signals
3. Traffic signs Schedule to the motor vehicles Act, 1988
4. Hand signals of traffic constables / Traffic warden.
5. Introduction to automatic light signals.
6. Introduction to road makings.
7. Speed regulations on high ways and city roads.
8. Parking at objectionable places.

9. Some important provisions of the motor vehicles Act, 1988 section 122, 123, 125 and 128 of the motor vehicles Act, 1988.
10. Test of competence to drive Sub-rule (3) of rule 15 of the central motor vehicles rules, 1989.

### **C. LIGHT VEHICLES DRIVING PRACTICE**

1. Identification of various parts of the vehicles.
2. Pre-driving checks (i) Before sitting on driver's seat &  
(ii) After sitting on driver's seat.
3. Steering practice
4. Bitting point
5. Moving and gear changing
6. Stopping - Normal stopping  
- Emergency stopping
7. Developing judgment and anticipation to drive on road.
8. Reversing - In straight  
- In 's' bends
9. Turning and about parking
10. Licensing

### **D. VEHICLE MECHANISM AND REPAIRS**

1. Layout of vehicle
2. Function of diesel and petrol engines
3. Fuel system - Fuel lines  
- Fuel injection pump  
- Atomiser  
- Air lock  
- Oil block
4. Cooling system - Purpose  
- Radiator  
- Water pump  
- Fan leaf / fan belt  
- Radiator water boiling  
- Rectification
5. Lubrication system - Purpose