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| COURSE CODE: | <i>MCE 504</i> |
| COURSE TITLE: | <i>Automobile Engineering</i> |
| NUMBER OF UNITS: | <i>3 Units</i> |
| COURSE DURATION: | <i>Three hours per week</i> |

COURSE DETAILS:

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| Course Coordinator: | Engr. Dr. Bukola Olalekan Bolaji <i>B.Eng., M.Eng., PhD</i> |
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| Office Location: | HOD MCE's Office, COLENG |
| Other Lecturers: | None |

COURSE CONTENT:

Mechanics of vehicles. Vehicle component and design. Traction engine and transmission data. Fuel system, clutches, gear boxes – manual and automatic. Transmissions, steering systems. Brakes, tyres. Air conditioning. Electrical system. Exhaust system. Ignition system. Body and chassis.

COURSE REQUIREMENTS:

This is an elective course for 500 level students in the Department of Mechanical Engineering. In view of this, students who registered for this course are expected to participate in all the course activities and have minimum of 75% attendance to be able to write the final examination.

READING LIST:

1. Bolaji, B.O. Automobile Air Pollutant Emission and Control. In: Environmental Sustainability and Conservation in Nigeria, Okoko, E. and Adekunle, V.A.J. (Editors); *Book of Readings of Environmental Conservation and Research Team* (ECRT), Chap. 18, 2005.
2. Heywood, J.B. Internal Combustion Engines Fundamentals. New York: McGraw-Hill, 1988.
3. Taylor, C.F. Internal Combustion Engines in Theory and Practice. Vols. 1 and 2. Cambridge: The MIT Press, 1977.
4. Eastop, T.D., McConkey, A. 1996. Applied Thermodynamics for Engineering Technology, Longman Publishers, Singapore.

LECTURE NOTES

1.0 INTRODUCTION

Automobile is a self-propelled vehicle used for transportation of goods and passengers on the ground. Automobile or Automotive means a vehicle which can move by itself. It differs from aeronautical vehicle ship, like aeroplanes, helicopters, rockets e.t.c which fly in air as well as from marine vehicles like motor boat which sail in water.

The automobile is essentially a transportation equipment unit. It is made up of a frame supporting the body and certain power-developing and transmitting units. These are further supported by tyres and wheels through the springs and axles. The engine supplies the power. It is delivered by the transmitting system and the rear axles through the clutch or fluid coupling to the rear wheels. The automobile is propelled through the friction of the contact between the road and the wheels. The various units are held together in proper arrangement on the frame. The protection and comfort is provided by the body of the vehicle.

Germany is the birth place of automobile. It was invented there. It went through its first phases there and it was developed there to a high level of technical maturity. The list of German automobile pioneers is a long one starting with Nicholas Cugnot, August, Otto, Carl Benz, Gottlieb, Daimler, Wilhelm Maybach and Rudolf Diesel and going all the way up to Ferdinand Posche and Felix Wankel.

The leading manufactures or motor vehicles in the world are as follows:

- i. U.S.A: General Motors, Ford-Ford Cars, Chrysler
- ii. Japan: Toyota, Nissan
- iii. West Germany: Volkswagon
- iv. Italy: Fiat
- v. France: Renault
- vi. U.K: B.L.M.C, Austin / Morris BL, 1.

1.1 GENERAL CLASSIFICATION OF VEHICLES

There are numerous types of automobiles used in the world. In general, there are three main classifications of the various types of vehicles:

- i.) The single unit vehicles or load carriers
- ii.) Articulated vehicles
- iii.) The heavy tractor vehicles

1.1.1 Single Unit Vehicle

There are conventional four-wheel types. The great majority of vehicles are of two axle design. In these vehicles the front axle is a steering non-driving axle. With the passage of time, a great many changes have taken place in the number of axles and the driving arrangements.

1.1.2 Articulated Vehicles

A lower powered three-wheeler with a single steering wheel in front and a conventional rear driving axle is an example of articulated vehicles. It has a greater handling ability in awkward places. It can be turned about its own tail due to the three-wheel construction. The coupling mechanism between semi-trailer and tractor in most of these vehicles is arranged for automatic connection and coupling up necessitating only its reversing into the position. But for uncoupling operation, a lever is provided within the driver's cabin

to reverse the whole process. A pair of retractable wheels in front is also provided. Along with the coupling or uncoupling operation, they can be raised or lowered automatically.

1.1.3 Heavy Tractor Vehicles

Heavy tractor or independent tractor vehicles are used to move heavy loads, they commonly operate in pair either I tandem or as 'puller' and 'pusher.' While descending appreciable gradients, stability is provided by the later arrangement.

1.2 TYPES OF AUTOMOBILES

There are numerous types of automobiles found in different parts of the world. With respect to different purposes, the various type of automobiles are classified as under:

1.2.1 With Respect to the Use

- i.) Auto-cycles and Mopeds
- ii.) Scooters and Motorcycles
- iii.) Cars, Station wagons and Pick-ups
- iv.) Lorries (Buses) and Trucks
- v.) Tractors

1.2.2 With Respect to Capacity

- i.) H.T.V. or Heavy Transport Vehicles or Heavy Motor Vehicles: Bus, Coaches, Truck, Tractor.
- ii.) L.T.V. or Light Transport Vehicles, or Light Motor Vehicles: Cars, Jeeps, Motor cycles
- iii.) Medium Vehicles: Minibus, Station wagon

1.2.3 With Respect to Fuel Used

- i.) Petrol Vehicles: Jeeps, cars, Motor Cycles
- ii.) Diesel Vehicles: Truck, Bus, Tractor, Bulldozer, Mercedes
- iii.) Gas Vehicles- Coal gas, Gas turbine or Producer gas Vehicles.
- iv.) Electric Vehicles- Using electric storage batteries or accumulators to drive electric motors attached to the front or rear wheels, e.g. Heavy cranes, battery truck, cars and forklifts.
- v.) Steam vehicles: Steam road rollers, it is now obsolete.

1.2.4 With Respect to Wheels and Axles

- i.) Two wheelers: Motor cycles
- ii.) Three wheelers: Tempos, Auto Rickshaws, Tricycles
- iii.) Four wheelers: Cars, Jeeps, Buses, Trucks (some buses and trucks have six tyres out of which four are carried on the rear wheels for additional traction.
- iv.) Six axle wheelers (10 tyres) vehicles.

1.2.5 With Respect to the Motion

- i.) Reciprocating – piston engines
- ii.) Rotary – Wankel engine, Gas turbine

1.2.6 With Respect to the Suspension

- i.) Conventional – leaf spring
- ii.) Independent – coil, torsion bar, pneumatic

1.3 TYPES OF CYLINDER ENGINE

By enlarging the size of a single cylinder or having more cylinders of same size increases the power developed by an engine. Although a single large cylinder has fewer parts to manufacture and maintain, yet the advantage of are over – weighed by the disadvantages. This is due to the fact that the power may be increased by increasing the size of the cylinder, but the engine power varies as the square of the bore with the weight varying as the cube of the bore for a given speed and cylinder pressure. Therefore, by doubling the bore in size, the power would become four times as great while the weight would become eight times . hence the weight increase at a greater rate in comparison to the power providing a lower power to weight ratio.

The multi – cylinder engines are capable of producing higher power output due to increase in revolution per minute in comparison to single cylinder engines. The benefits derived from multi – cylinder engines all developing the same horse power will be clear from Table 1.1

Table 1.1: Number of cylinders and their diameter, power and weight.