



UNIVERSITY OF RUHUNA

Faculty of Engineering

End - Semester 5 Examination in Engineering: July 2016

Module Number: ME 5214

Module Name: Advanced Automobile Engineering

[Three Hours]

[Answer all questions, each question carries ten marks]

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- Q1. (a) With the help of a neatly drawn sketch, derive the equation for the acceleration (A) of an automobile piston. [3 Marks]
- (b) Discuss the reasons to limit inertia forces acting in a crank mechanism, created by reciprocating masses of the piston complex. [2 Marks]
- (c) By drawing appropriate graphs, briefly discuss the concept of hybridisation. [2 Marks]
- (d) According to the method the energy sources are arranged in modern automobiles, what are the different architectures of hybrid vehicles available in the world? [3 Marks]
- Q2. (a) How the Morse test is used to find out the indicated power and the mechanical efficiency of an engine? Specify under what conditions (assumptions) the Morse test should be carried out. [4 Marks]
- (b) Results of a Morse test of a petrol engine are given below:
- Brake Power with all cylinders working = 73.6 kW
Brake Power with No.1 cylinder cut out = 50.4 kW
Brake Power with No.2 cylinder cut out = 50.8 kW
Brake Power with No.3 cylinder cut out = 52.3 kW
Brake Power with No.4 cylinder cut out = 52.6 kW
- Calculate;
- (i) Friction Power,
(ii) Indicated Power and
(iii) Mechanical Efficiency of the engine. [6 Marks]

Q3. (a) What is the function of a gear box (transmission) in an automobile? [2 marks]

(b) Discuss various types of gear boxes used in automotive vehicles. [4 marks]

(c) With the help of a neat sketch, explain the construction and operation of a sliding mesh gear box. [4 marks]

Q4. (a) "Exhaust gases let out by automobiles may contain toxic substances which produce harmful effects on human beings and the environment around them".

(i) What are the toxic substances (pollutants) emitted during the operation of the piston type internal combustion engines?

(ii) What factors cause emissions of Nitrogen Oxides (NO_x) from an automobile?

(iii) What are the harmful effects of Nitrogen Oxides (NO_x) on human beings and the environment?

[5 marks]

(b) The catalytic converter is the best possible device to meet the strict exhaust emission limits.

(i) Explain the operation of a Three-way Catalytic Converter.

(ii) Clearly state the functions of the 'Reduction Catalyst' and the 'Oxidisation Catalyst'.

(iii) What are the shortcomings associated with catalytic converters? Also, mention possible steps that have been taken to improve the efficiency of such catalytic converters.

[5 marks]

Q5. (a) Define the following terms.

(i) Indicated Specific Fuel Consumption.

(ii) Brake Specific Fuel Consumption.

[2 marks]

(b) Determine the quantity of fuel to be injected per cycle per cylinder for a six-cylinder four-stroke diesel engine having brake specific fuel consumption of 245 g per kW-hr while developing 89 kW at 2500 rpm. Take specific gravity of fuel as 0.84.

[3 marks]

(c) A two-stroke compression ignition engine delivers 5000 kW while using 1000 kW to overcome friction losses. It consumes 2300 kg of fuel per-hour at an air/fuel ratio of 20 to 1. The calorific value of fuel is 42,000 kJ/kg.

Find the,

(i) Indicated Power.

(ii) Mechanical Efficiency.

(iii) Air Consumption per hour.

(iv) Indicated Thermal Efficiency.

(v) Brake Thermal Efficiency.

[5 marks]