



UNIVERSITY OF RUHUNA

Faculty of Engineering

End - Semester 5 Examination in Engineering: August 2015

Module Number: ME 5214 Module Name: Advanced Automobile Engineering
[Three Hours]

[Answer all questions, each question carries ten marks]

Q1. a) By drawing a schematic diagram of the assembly of Piston-Connecting Rod-and Crankshaft mechanism, derive the equations for stroke (S), velocity (V) and acceleration (A) of an automobile piston.

[3 Marks]

b) With the use of a neatly drawn sketch, show the forces acting in a Piston-Connecting Rod-and Crankshaft mechanism and derive the equations for the above forces. Clearly state the assumptions made.

[5 Marks]

c) Discuss why we should limit inertia forces created by reciprocating masses of the piston complex, acting in a crank mechanism.

[2 Marks]

Q2. a) How is Morse test 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) While testing a 4-cylinder, 4-stroke automobile engine using the principle of rope-brake absorption type dynamometer, the following data were noted.

Diameter of the cylinder, [D]	= 101 mm
Stroke of the piston, [S]	= 114 mm
Engine speed, [n]	= 1600 rpm
Fuel consumption, [m _f]	= 0.204 kg/min
Calorific value of fuel, [C.V.]	= 41800 kJ/kg
Difference in tension on either side of brake pulley, [W]	= 378 N
Brake circumference, [2πr]	= 3.35 m
Assume mechanical efficiency, [η _m]	= 83%

The law of brake power, $bp = \frac{2 \pi n T}{60000}$ [kW], where Torque, T = r · W [Nm]

Calculate:

- (i) Brake thermal efficiency of the engine [1.5 Marks]
- (ii) Indicated thermal efficiency of the engine [1.5 Marks]
- (iii) Mean effective pressure inside a cylinder [1.5 Marks]
- (iv) Brake specific fuel consumption [1.5 Marks]

- Q3. a) With respect to the automobile engine emissions, what are the primary pollutants released to the atmosphere? What are the origins of these primary pollutants?
[3 Marks]
- b) Briefly explain the mechanism of pollution formation in an automobile engine. You may use chemical formulae for the explanation.
[3 Marks]
- c) What is a "Three-way Converter"? Explain clearly how it is used to convert the pollutants emitted from an internal combustion engine.
[4 Marks]
- Q4. a) "The most vital factor in the running and controlling a modern vehicle is the braking system which brings the moving vehicle to rest or slowdown in the shortest possible time".
(i) Explain the purpose of a braking system in an automobile.
(ii) What are the two main requirements of a braking system?
[4 Marks]
- b) List out different types of brakes used in automobiles and classify them according to the nature of the power employed.
[4 Marks]
- c) "Hydraulic Braking System is more efficient than Mechanical Braking System". Prove this statement by giving reasons.
[2 Marks]
- Q5. a) With the help of a suitable cross-sectional sketch, show the construction of an automobile tyre. Name the various parts in the tyre construction.
[3 Marks]
- b) State the various functions performed by an automobile tyre. Discuss the properties expected in the same
[3 Marks]
- c) Describe in detail constructional features of the **tubed** and **tubeless** tyres for automotive use. Discuss their **relative merits and demerits**.
[4 Marks]