UNIVERSITY OF RUHUNA

Faculty of Engineering

End - Semester 6 Examination in Engineering: December 2015

Module Number: ME 6251 **Module Name: Advanced Automobile Engineering (O/C)**

[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, [$2\pi r$]	= 3.35 m
Assume mechanical efficiency, [η_m]	= 83%

The law of **brake power**, $bp = \frac{2\pi nT}{60000}$ [kW], where $\mathbf{Torque, T = r \cdot W}$ [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]