



UNIVERSITY OF RUHUNA

Faculty of Engineering

-End- Semester 5 Examination in Engineering: July 2017

Module Number: ME5214

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) Describe the Morse Test as applied to a multi-cylinder compression ignition engine and explain how the results of this test may be used to find the mechanical efficiency of the engine. Comment on assumptions made in this test. [5 Marks]
- (b) A Morse Test on a turbocharged, 12 cylinder, 2 stroke compression ignition diesel engine of bore 38 cm and stroke 50 cm gave the following readings.

Engine speed = 200 rpm

Condition	Brake Load, [N]		Condition	Brake Load, [N]
All firing	2000		No. 7 out	1800
No. 1 out	1795		No. 8 out	1824
No. 2 out	1814		No. 9 out	1785
No. 3 out	1814		No. 10 out	1804
No. 4 out	1795		No. 11 out	1814
No. 5 out	1804		No. 12 out	1795
No. 6 out	1819		All firing	2020

The law of brake power is, $b. p. = \frac{W.n}{180}$ [kW], where W = load in Newton, n = rpm

Calculate the brake mean effective pressure (bmep) in bar, indicated power (ip), friction power (fp) and mechanical efficiency (η_M) with all cylinders firing.

[5 Marks]

Q3. (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.

[2 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.

[3 marks]

(d) It is found following specifications printed on an automobile tyre. Interpret all the specifications.

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[2 marks]

Q4. (a) "The combustion process in an internal combustion engine produces some harmful products. These are discharged from the engine to environment and become air pollutants".

(i) What are the primary pollutants entering the atmosphere from internal combustion engines?

(ii) What are the sources of evaporative emission in petrol engine?

(iii) Briefly explain the mechanism of pollution formation in an automobile engine. You may use chemical formulae for the explanation.

[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) Discuss the current transportation scenario in the world emphasizing the economic and environmental problems faced and the hybrid electric vehicles (HEV) as a possible solution to above problems.

[2 marks]

(b) Why electric vehicles (EV) are not the solution for above problems discussed in Q5(a) in Sri Lanka?

[2 marks]

(c) With neatly drawn diagrams discuss the three (03) available architectures of hybrid electric vehicles according to the method the energy sources are arranged.

[6 marks]