The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX4232/ DMX4532/ DMX4208 Automobile Technology**
Academic Year	:	2019/20
Date	:	04th October 2020
Time	:	1330 hours - 1630 hours
Duration	:	**3 hours**

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **seven (07) questions and three (03) pages**.
3. **Answer any 05 questions only**. All questions carry equal marks.
4. Answer for each question should commence from a new page
5. Relevant charts/ equations are provided and do not use Red colour pen.
6. This is a Closed Book Test (CBT).
7. Answers should be in clear handwriting.

Question 01 – (*20 marks*)

An internal combustion Engine which develops 40 kW brake power has a pressurized, forced water circulation system, for cooling. This Engine converts 25% of the heat energy available in fuel into useful work and the energy lost to cooling water accounts for 30% of the heat energy of the fuel. If the maximum and minimum temperatures of cooling water are 90° C and 80°C, respectively, calculate the flow rate of water in the Engine. (specific heat of water is 4.2 KJ/Kg°C) (Assume that there is no thermostat installed in the system).

Question 02 – (*20 marks*)

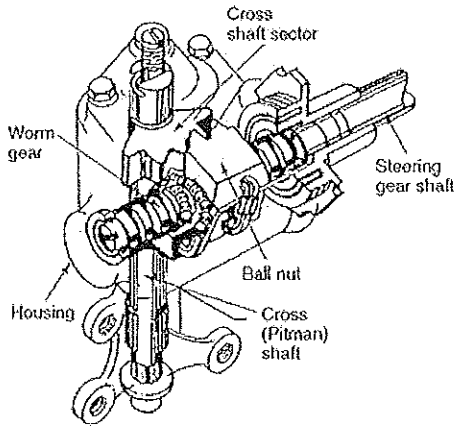
(a) By means of suitable sketches, explain the operating principle of Common rail diesel injection system.

(b) Draw a valve timing diagram for a single cylinder four stroke spark ignition engine and explain the sequence of valve opening and closing.

(c) Explain why the shaft connecting the steering wheel to the steering gear (rack) is made in two or more separate parts linked together by means of universal joints.

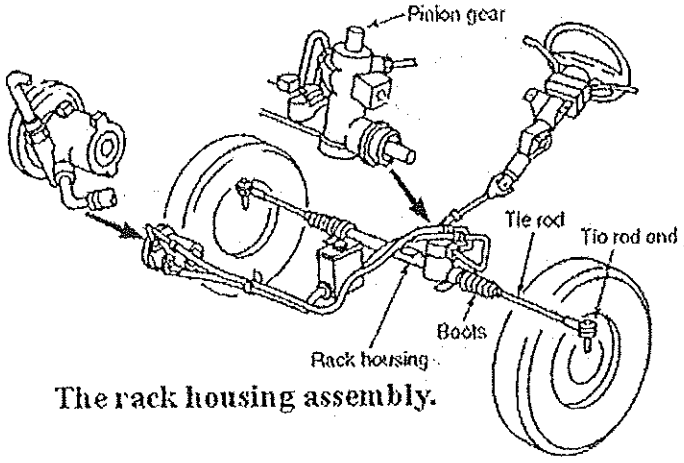
Question 03 – (*20 marks*)

(a) Explain the operating principle of the rack and pinion gear and re-circulating ball and nut steering mechanism shown in Figure Q03.1 and Figure Q03.2



Cross- sectional view of the recirculating ball gear

Figure 03.1



The rack housing assembly.

Figure 03.2

(b) Explain the following terms with respect to a compression ignition internal combustion engine.

i) Compression ratio
ii) Volumetric efficiency
iii) Specific fuel consumption
iv) Turbo inter-cooling

Question 04 – (*20 marks*)

A four cylinder four stroke engine was tested in an engine dynamometer. During the test, the engine consumed 0.24 kg of fuel per minute and developed 43 kW at 3400 rev/min. A Morse test is carried out for the engine and the cylinders are cut out in the order of 1, 2, 3, 4 with corresponding brake torques of 87, 89, 83 and 89 Nm, respectively at 3400 rev/min. If the calorific value of the fuel is 45000kJ/kg.

Calculate the following.

i) Indicated power
ii) Mechanical Efficiency
iii) Specific fuel consumption in kg/kWh
iv) Brake Thermal efficiency

Question 05 – (*20 marks*)

(a) Explain what a naturally aspirated engine is.

(b) By means of rough sketches explain the difference between turbo charging and super charging.

(c) Compare the operating condition of a turbo charged engine in relation to a naturally aspirated engine.

Question 06 – (*20 marks*)

(a) A typical automotive air-conditioning system is shown in figure Q06. Name the components from 1 to 7 and identify their location (within the passenger cabin or outside the passenger cabin).

(b) Explain the operating principle of the automotive air-conditioning system shown in Figure Q06.

(c) Give three reasons for a noisy air-conditioning system and suggest remedial actions.

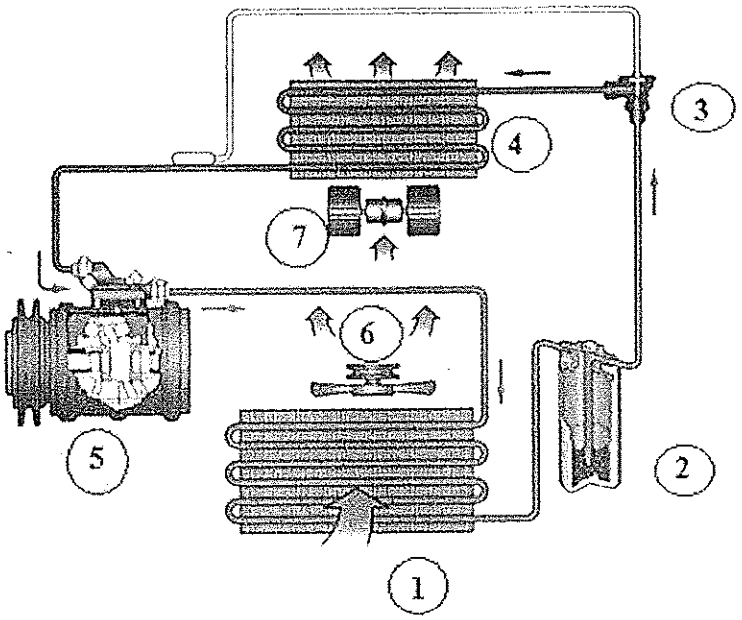


Figure Q06: Diagram of a typical automotive air-conditioning system

Question 07 – (*20 marks*)

(a) What are the two basic types of pneumatic tyres presently used in motor vehicles? Explain their construction.

(b) Figure Q8 show the construction of an automobile engine piston. Explain why the boss for the piston pin is located with a slight offset to the centre line.

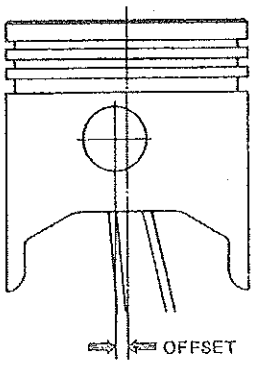


Figure Q7- Piston of an Automobile Engine

(c) With the aid of a sketch, explain dwell angle.