The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Diploma in Technology/Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX4232 Automobile Technology**
Academic Year	:	2013/14
Date	:	23rd August 2014
Time	:	0930 hrs. – 1230 hrs.
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 8 questions. All questions carry equal marks.
3. Answer any 5 questions only.

QUESTION 01

(i) Draw a typical valve timing diagram for a single cylinder, four stroke, spark ignition engine and explain why the opening and closing of the intake and exhaust valves do not occur right at the respective dead centres.

(ii) State the equation for the ideal air standard efficiency of the Otto cycle and define each term.

(iii) A 1.2 litre, four cylinder, gasoline engine works on the Otto cycle. The engine has a clearance volume of 2.0×10^{-5} m^3 per cylinder. Calculate the compression ratio and the air standard efficiency of the cycle. Take $\gamma = 1.4$ for air.

QUESTION 02

(i) Table 1 shows a partially filled sequence of operations table for an in line, four cylinder, four stroke engine with a firing order 1-3-4-2. Prepare the complete table.

Cylinder No.	Stroke 1 $0^o - 180^o$	Stroke 2 $180^o - 360^o$	Stroke 3 $360^o - 540^o$	Stroke 4 $540^o - 720^o$
1	**Power**	**Exhaust**		
2				
3				
4				

Table 1

(ii) A spark ignition engine consumes gasoline at a rate of 0.216 kg/min when developing 48 kW of brake power. The engine has a mechanical efficiency of 80%. Calculate the brake thermal efficiency and the indicated power of the engine. Take Calorific value of gasoline as 45 MJ/kg.

(iii) Why is it necessary to have multi cylinder engines instead of single cylinder engines in automobiles? Explain briefly.

QUESTION 03

(i) The following observations were obtained from a "Morse Test" conducted on a four cylinder engine.

BRAKE POWER OF THE ENGINE (kW)				
When all the cylinders are operative	When cylinder **1** is inoperative	When cylinder **2** is inoperative	When cylinder **3** is inoperative	When cylinder **4** is inoperative
64	43	45	46	42

Determine the indicated power and the mechanical efficiency of the engine.

(ii) A four cylinder, four stroke, spark ignition engine with a cylinder bore of 85 mm and a stroke of 95 mm was tested on an engine dynamometer and the following results were obtained.

Engine speed	– 3000 rev/min
Brake torque	– 140 Nm
Rate of consumption of fuel	– 0.24 litres/min
Specific gravity of fuel	– 0.8
Calorific value of fuel	– 45 MJ/kg

Determine the brake power, brake mean effective pressure and brake thermal efficiency of the engine.

QUESTION 04

(i) A diagram of an Electronic Fuel Injection (EFI) system is shown in Fig. Q4. Identify the main components from 1 to 10 and briefly explain the functions of any five components.

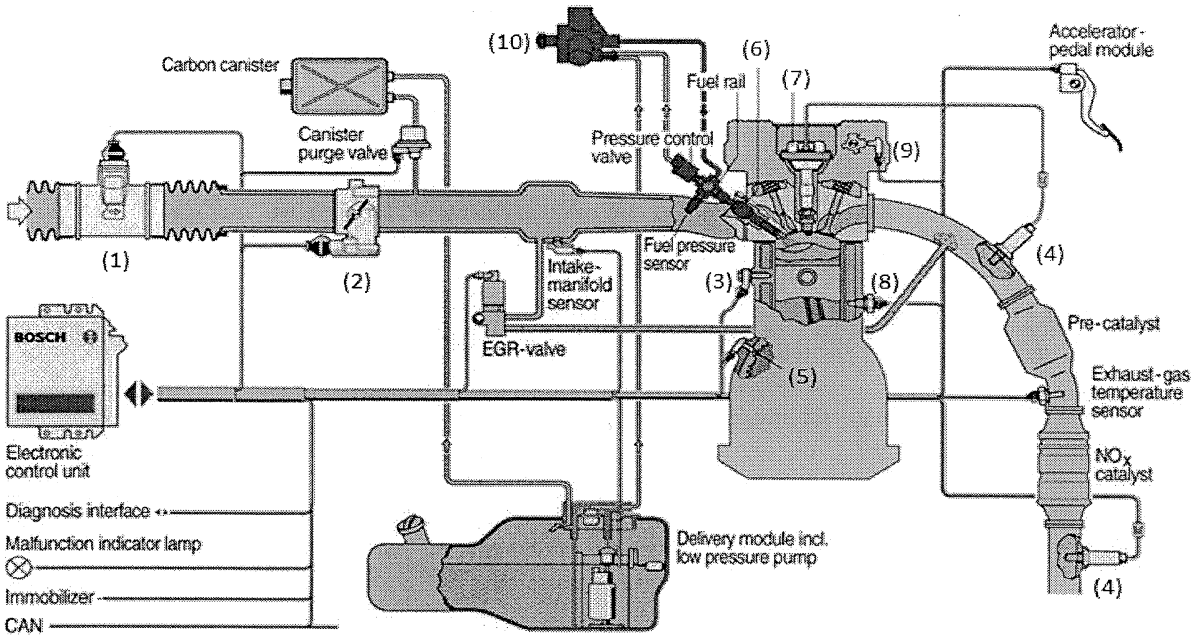


Fig. Q4

(ii) What are the benefits of Common Rail Diesel direct injection fuel system over the conventional diesel direct injection fuel system? Explain briefly.

(iii) What reasons can you attribute for almost complete replacement of conventional carburettor engines with EFI engines? Explain briefly.

QUESTION 05

(i) Explain the operation of one of the following lubrication systems with the aid of neat sketches where necessary.

(a) Wet sump lubrication

(b) Mixture lubrication

(ii) Identify and describe the type of oil filter arrangement shown in Fig. Q5. Also explain the operation of the pressure regulator shown in the figure.

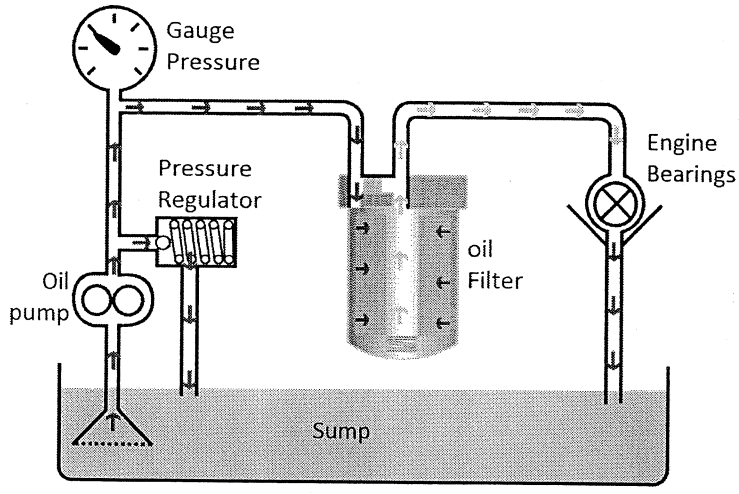


Fig. Q5

(iii) A car owner is complaining that the coolant temperature of his vehicle critically increases while driving in heavy traffic congestion. What are the possible causes for this increase in temperature? Explain briefly.

QUESTION 06

(i) What are the pollutants emitted by an automobile and under what circumstances are they produced? Explain.

(ii) Explain the role of catalytic converter in the exhaust system of a vehicle.

(iii) What are the objectives expected to be achieved by complete air conditioning of a vehicle? Explain.

QUESTION 07

(i) What are the resistances to the motion of a vehicle moving up an incline? Explain briefly. Also state the equations used to calculate these resistances.

(ii) What are the advantages of using diaphragm spring clutches over coil spring type clutches? Explain briefly.

(iii) A four speed manual gear box is shown in Fig. Q7.

(a) Identify the gear box type.

(b) Show the direction of power flow in the 1st, 2nd, 3rd, 4th and Reverse gears separately by using letters from A to K.

(c) Explain the function of gear 'K'.

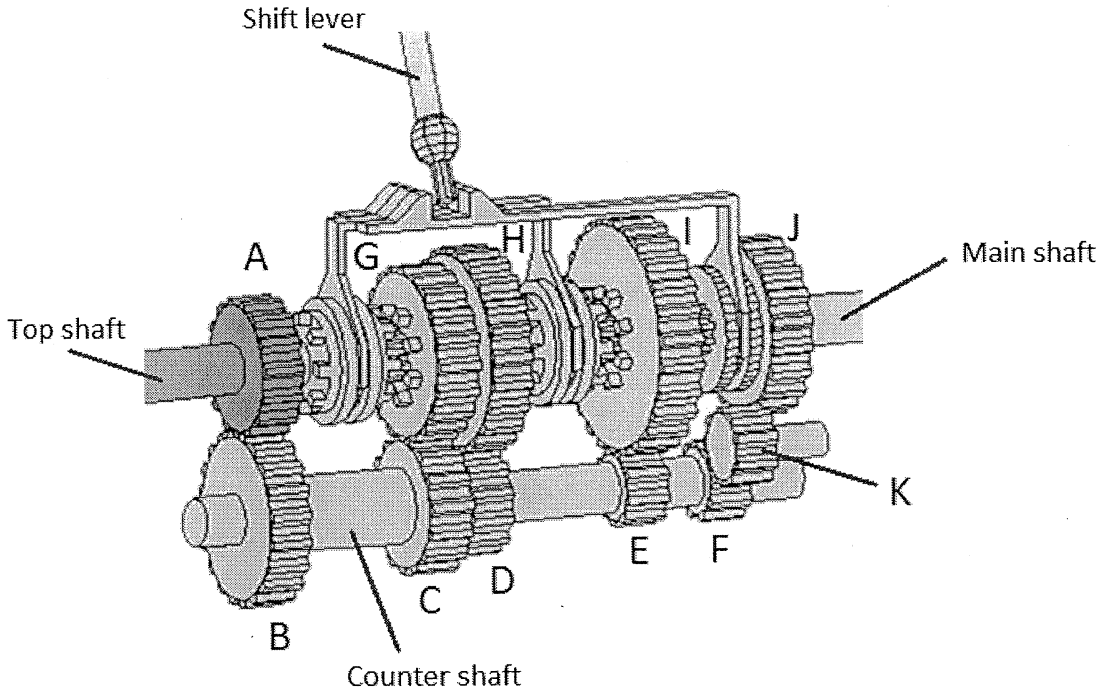


Fig. Q7

QUESTION 08

(i) Explain the operation of a power operated brake system employed in a heavy vehicle.

(ii) Explain the basic functions of a suspension system of a vehicle.

(iii) With the aid of sketches, briefly explain 'caster' and 'camber' in relation to wheel alignment of a vehicle.

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