THE OPENUNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF TECHNOLOGY (MECHANICAL – LEVEL 6)
FINAL EXAMINATION
MEX6331/MEX6231 AUTOMOBILE ENGINEERING
DATE : 30th November 2017
TIME : 09:30 Hrs to 12:30 Hrs
DURATION : Three hours

Instructions. : **This question paper consists of seven (07) questions. You are required to answer anysix (06) questions. All questions carry equal marks.**

Question 01.

a) Briefly explain how an ASTM standard distillation test is carried out for a fuel and its importance.What is the initial boiling point in a distillation test?

b) Following observations were made when a six cylinder four stroke engine with a modern gasoline fuel injection was tested on an engine dynamometer.

Speed	-5400rev/min
Rate of delivery	-0.081*ml*/ms
stroke	-120mm
Bore	-140mm
Volumetric efficiency	-72%
Atmospheric Pressure	-103kN/m^2
Temperature	-31C
Gas const	-0.287kJ/kg.K
Air fuel ratio	-14
Specific gravity of fuel	-0.8

Determine the injection-duration of fuel by each injector

Question 02

a) Primary components of an electronic engine control system is shown in figure Q2. Briefly explain the construction and operating principle of sensors, controller, ignition driver circuit, Mass Air Flow sensor (MAF) and Fuel injector driver circuit.

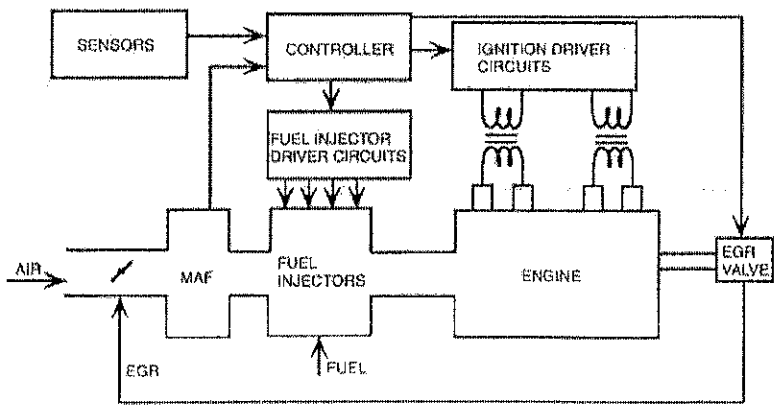


Figure Q2 - Primary components of an electronic engine control system

b) Three main combustion systems namely,spray-guided, wall-guided and air-guided are used in different stratified engines, to form an ignitable mixture near spark plug at the instant of ignition. Briefly explain how the mixture is formed in each system

Question 03

The following parameters are given for a typical gasoline engine

- Volumetric efficiency – 80%
- Mechanical efficiency – 70%
- Calorific value of gasoline – 42 MJ/kg
- Excess air factor – 15%
- Pressure of the mixture at the end of suction stroke – 8.24×10^4 N/m^2.
- Temperature of the mixture at the end of suction stroke – 333K.
- Gas constant for air – 0.287 kJ/kgK
- Stoichiometric air/fuel ratio – 14.5:1

Find the cylinder dimensions of a six cylinder fourstroke engine if the engine is to develop 180 kW at 5600 rev/min. Assume that the ratio, S/B = 1.25, thermal efficiency is 24%, and densitiy of petrol vapour in the mixture is twice that of air.

Question 04

(a) Main components of an ABS system are shown in the figure Q4.1. Explain the operation of all major sensors and the ABS modulator involved in the operation of the system.

(b) Explain the operating principle of a traction control system and how the ABS system can be integrated with traction control system to ensure the vehicle safety.

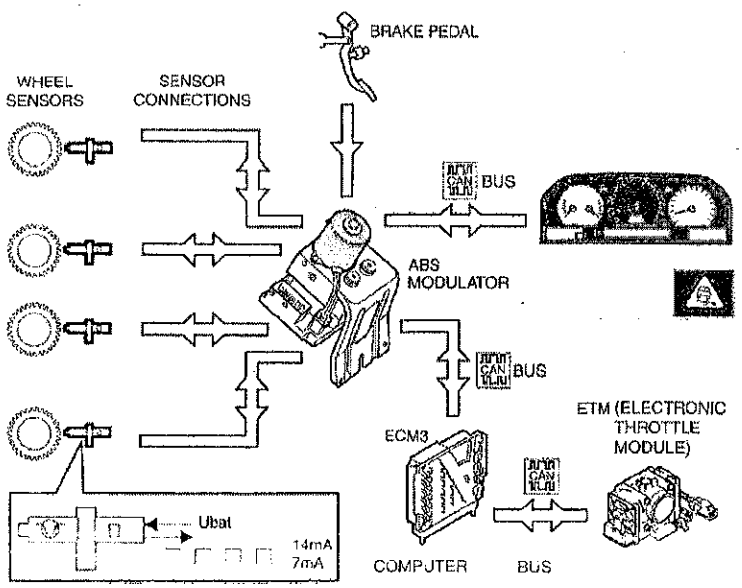
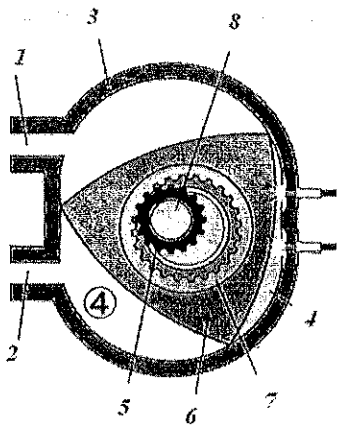


Figure Q4.1 - Main components of an ABS system

(c) A Typical Wankel engine is shown in the figure Q 4.2. Using additional sketches, explain its operating principle.



1. engine inlet
2. exhaust outlet
3. housing
4. combustion chambers
5. stationary gear
6. rotor
7. internal gear
8. eccentric shaft
9. spark plugs

Figure Q 4.2 – Typical Wankel engine

Question 05

During a rope brake dynamometer test on a four stroke,four-cylinder engine running on gasoline, the following observations were made

Calorific value of the gas	-45000 kJ/*l*
Fuel consumption	-4.5 *l*/h
Density of fuel	-0.82 kg/*l*
Speed of the engine	-2600 rev/min
Effective pulley diameter	-0.25 m
Dead weight on brake	-800 N
Spring balance reading	-40 N
Rate of flow of jacket cooling water	-395 kg/h
Temperature rise of jacket cooling water	-30 C
IMEP	-600 N/m^2
Cylinder bore diameter	-165 mm
Piston stroke length	-305 mm
Specific heat capacity of water	-4.18 kJ/kg K

Determine:

a) Mechanical Efficiency
b) Indicated Thermal Effective Pressure
c) Brake Thermal Efficiency

Question 06

a) Plot the variation of NOx, CO and HC emissions against air fuel ratio for an engine without exhaust emission treatment system, and briefly explain the reasons for characteristics depicted by the graph

b) Briefly explain the operating principle and applications of following types of sensors in automobiles:

i) variable reluctance ,
ii) hall effect
iii) variable resistance

Question 07

Schematic diagram of a typical two stage automatic gear system is shown in Figure Q7. The input can be made either to the compound sun gear via C2, or front ring gear via C1. The front carrier and rear ring gear car comounded. Four possible gear combinations and activated components are indicated by X in Table 7. In the Figure Q7, C referes to a clutch, B to a band Brake, and F to one way clutch.

Position no	C_1	C_2	B_1	B_2	B_3	F_1	F_2
1		X			X		
2	X			X		X	
3	X						X
4	X	X		X			

Table 7 – activated componets for different gear ratios

If the sun gear has 20 teeth and each planetary gear has 24 teeth, determine the gear ratios for position No. 1 to No. 4 indicated in the Table 7 and identify them in terms of 1st gear, 2nd gear, 3rd gear and reverse gear.

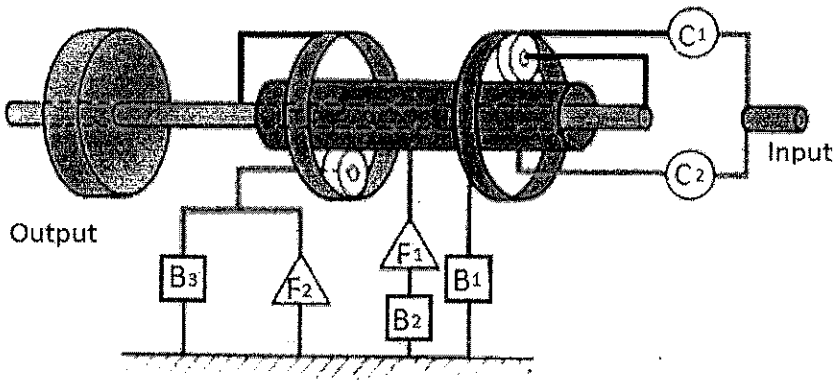


Figure Q7 - Typical two stage automatic gear system

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