THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
BACHELOR OF TECHNOLOGY (MECHANICAL – LEVEL 6)
FINAL EXAMINATION 2011/2012
MEX6331 AUTOMOBILE ENGINEERING
DATE : 14rh March 2012
TIME : 1400 hrs to 1700
DURATION : Three hours

Instructions. : This question paper consists of two parts. Part A consists of two (02) questions and part B consists of six (06) questions. You are required to answer only five (05) questions selecting at least one (01) question from part A. All questions carry equal marks.

PART A

Question 01

(a) Starting from first principles, show that the air standard efficiency of an engine, working on the Otto cycle is given by

$$\eta = 1 - \frac{1}{r^{\gamma-1}}$$

(b) A four cylinder four-stroke engine was tested for five minutes in a rope brake dynamometer at a speed of 1600 rev/min. A total of 1.20 kg of fuel was consumed. The radius of the brake pulley was 600 mm. The difference in tension on either side of the brake pulley was 420 N. Assuming the bore diameter to be 78 mm, stroke 80 mm and mechanical efficiency 80%,

calculate the following. (Take the calorific value of fuel as 45000 kJ/kg)

(i) Brake thermal efficiency.
(ii) Indicated thermal efficiency.
(iii) Mean effective Pressure.
(iv) Specific fuel consumption.

Question 02.

The following parameters are given for a typical gasoline engine

- Volumetric efficiency – 80%
- Mechanical efficiency – 82%
- Calorific value of gasoline – 42 MJ/kg
- Excess air factor – 20%
- 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
- Stoitiometric air/fuel ratio – 14.5:1

Find the cylinder dimensions for a six cylinder four stroke engine if the engine is to develop 75 kW at 3600 rev/min. Assume that the S/B = 1.25, thermal efficiency is 20%, densitiy of petrol vapour in the mixture is twice that of air.

Part B

Question 03.

i. A gasoline fuel injection system is shown in Figure Q3. Explain the operation of fuel injection and fuel ignition system referring to the figure.

ii. The lambda closed loop system is a method that has been adopted in gasoline fuel injection systems to meet stringent emission regulations. Explain the operating principle of the lambda closed loop system.

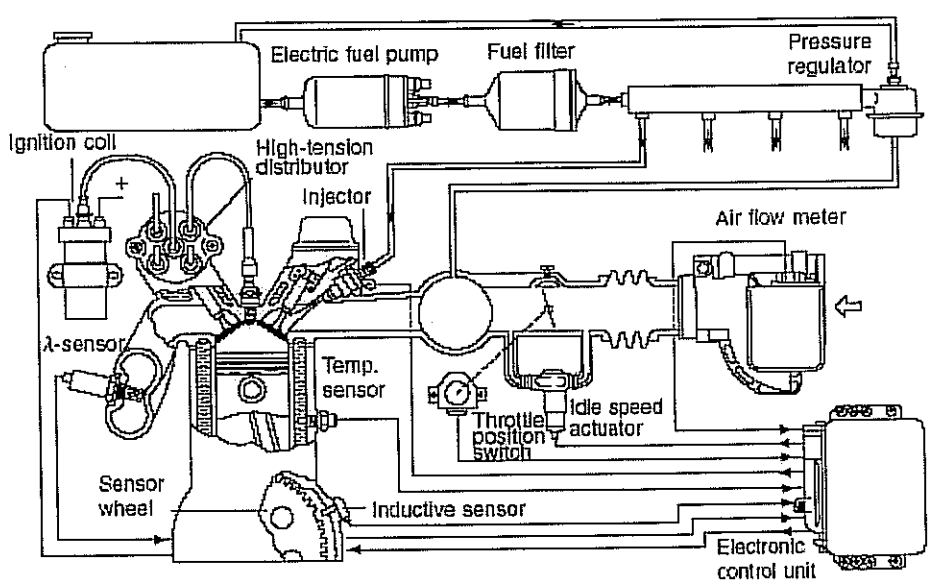


Figure Q3

Question 04

i. Using a rough sketch explain the configuration of series and parallel hybrid configurations.
ii. Discuss the merits and demerits of each configuration
iii. Referring to the configuration used in "Toyota prius", explain how a higher fuel economy is achieved compared to a conventional gasoline powered vehicle.

Question 05

Briefly explain the consequences of excessive camber and toe out on tyre wear patterns separately.

Explain the application, construction and operating principle of following sensors used in electronically controlled gasoline fuel injection systems.

i. Hot wire type air flow meter
ii. Throttle position sensor
iii. Oxygen sensor
iv. Knock sensor
v. Crankshaft position sensor

Question 06

(c) Using a neat sketch, briefly explain the operating principle of a hydraulic power steering system.
(d) A four cylinder four-stroke engine was tested for three minutes in a rope brake dynamometer at a speed of 1600 rev/min. A total of 0.714 kg of fuel was consumed. The radius of the brake pulley was 450 mm. The difference in tension on either side of the brake pulley was 435 N. Assuming the bore diameter to be 108 mm, stroke 122 mm and mechanical efficiency 82%,

calculate the following. (Take the calorific value of fuel as 42000 kJ/kg)

(i) Brake thermal efficiency.
(ii) Indicated thermal efficiency.
(iii) Mean effective Pressure.
(iv) Specific fuel consumption.

Question 07

i. The data communication system of a typical Antilock Braking System is shown in Figure Q 7.1. Briefly explain the data communication and operating principle of the system during braking.

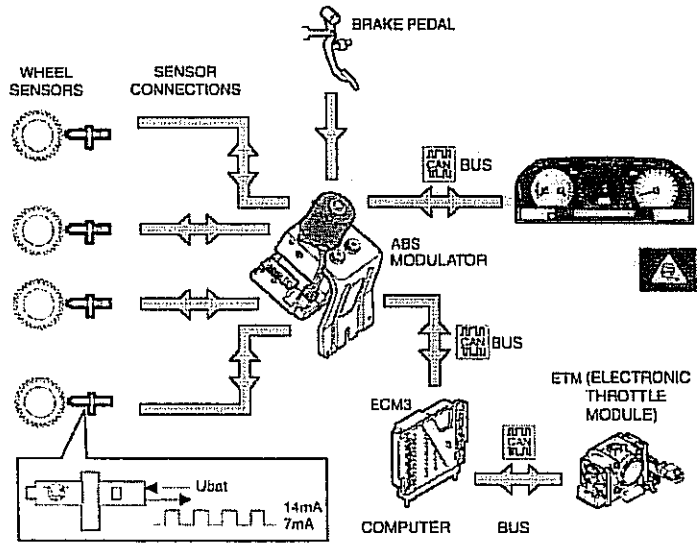


Figure Q7.1

ii. schematic representation of steering linkages for a vehicle is shown in Figure Q7.2 The point O is the common centre and the point of turning OA, OD, OB[1] OC[1] are the turning radii of the front and rear wheels about O. Angles α and θ are the angles through which the front stub axles have turned

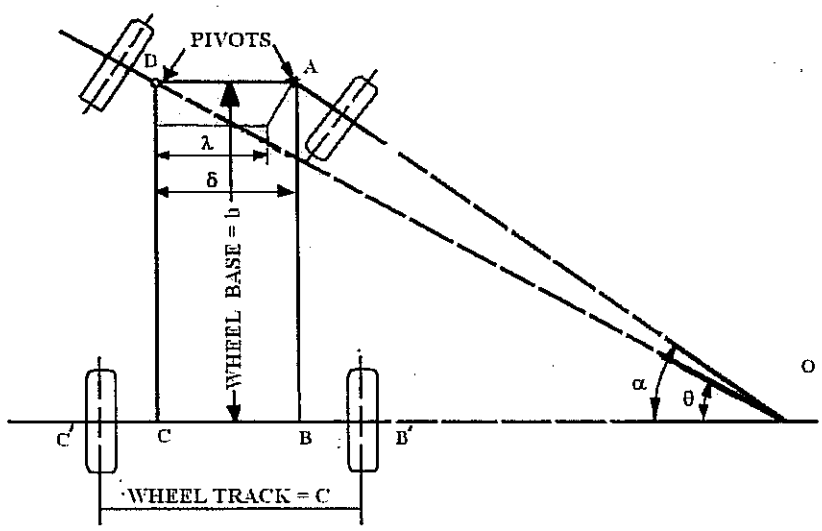


Figure Q7.2

Show that the turning radius for the above configuration is given by,

$$\left[\delta^2 + \frac{2\delta\lambda}{\tan\alpha} + \left(\frac{\lambda}{\sin\alpha}\right)^2\right] + \frac{(c-\delta)}{2}$$

Question 08

i. A typical hydraulic operating system of an Antilock Braking System (ABS) is shown in Figure Q8. Explain its – Pressure build-up, Pressure hold and pressure release modes during operation.

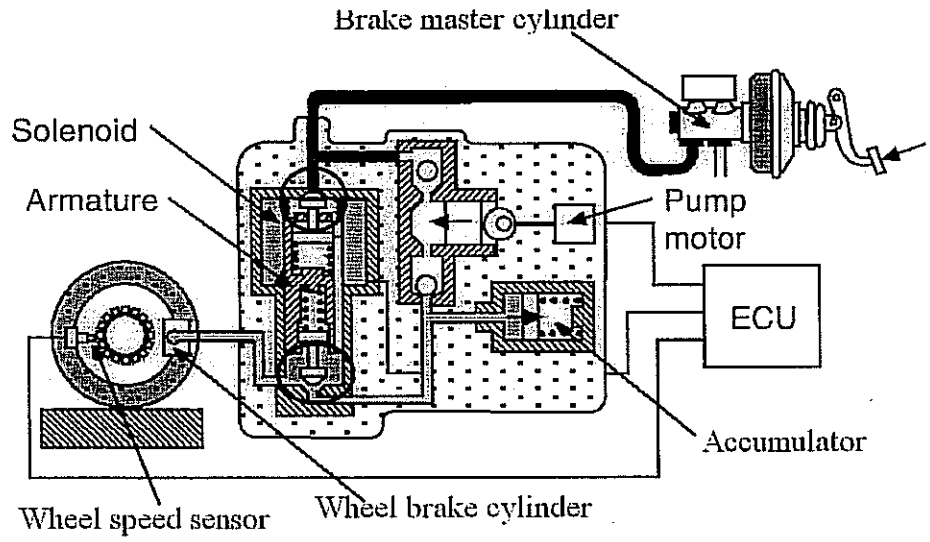


Figure Q8

ii. Briefly explain the operating principle of a Traction Control System (TCS) and how a TCS can be integrated into the ABS system.

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