THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
DEPARTMENT OF MECHANICAL ENGINEERING
DIPLOMA IN TECHNOLOGY – LEVEL 4
FINAL EXAMINATION

MEX 4232– AUTOMOBILE TECHNOLOGY

DATE : 26th March 2009
TIME : 1400 hrs to 1700 hrs
DURATION : THREE HOURS

WRITE YOUR INDEX NUMBER CLEARLY ➡

READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTION PAPER

Instructions.

1. 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) Illustrate the PV diagram of an engine operating on the Otto cycle.

b) An engine consumes 8.24 litres of gasoline per hour when developing 24 kW brake power. If the specific gravity of gasoline is 0.8 and its heating value is 45,000 kJ/kg, determine.

(i) Fuel consumed in kg/s
(ii) Heat supplied per second
(iii) Brake thermal efficiency of the engine

Question 02

a) Explain the term "mean effective pressure" with regard to operation of internal combustion engines.

b) The idle circuit and the acceleration circuit of a typical carburetor is shown in Figure Q2(a) and Figure Q2(b) respectively. Briefly explain the main operating principles of the above two circuits separately.

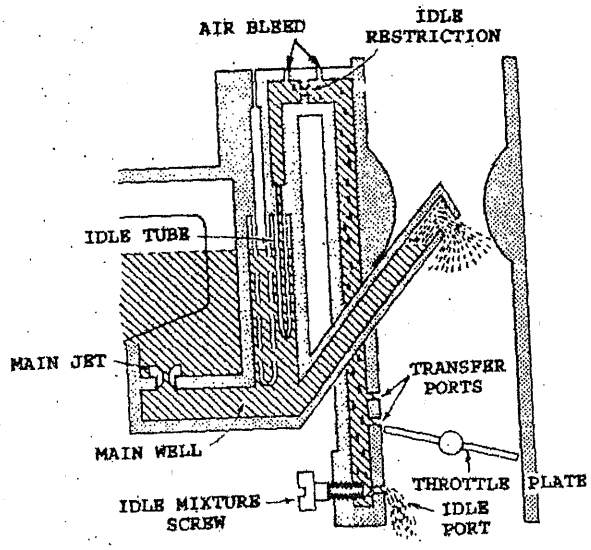


Figure Q2(a)

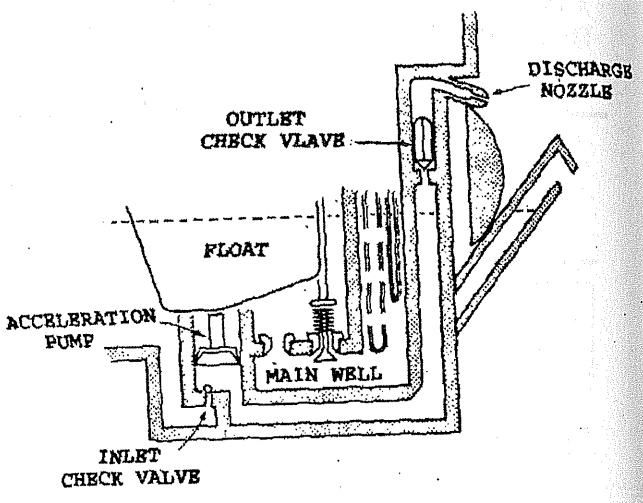


Figure Q2(b)

Part B

Question 03

a) Draw a valve timing diagram for a single cylinder four stroke spark ignition engine and explain why the valve opening and closing do not take place at TDC and BDC.

b) 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.

c) Calculate the stroke length of a single cylinder engine if the bore diameter is 110 mm, the clearance volume is 0.13×10^{-3} m^3 and the compression ratio is 17.

Question 04

You are given the following information with respect to a four stroke internal combustion engine.

P – mean effective pressure, N/m^2
D- diameter of a cylinder, m
L – length of stroke, m
N – revolutions per minute
n – number of cylinders
f - number of effective strokes, or combustions per revolution per cylinder (= 0.5 for a four stroke engine).

Show that the power developed by the engine in Watts is given by, $\frac{P\pi D^2 LfnN}{4\times 60}$

You may follow the following steps from (1) to (6) to get the final answer.

(1) The force acting on one piston (N)
(2) Work done during the power stroke (J)
(3) Work done per revolution (J)
(4) Work done per minute (J)
(5) Work done per second (W)
(6) Work done per second by the whole engine.

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Question 05

a) A recirculating ball and nut steering gear is shown in the figure Q5(a). Identify components indicated from (1) to (5)
b) Briefly explain the operating principle of the recirculating ball and nut steering gear shown in figure Q5(a).

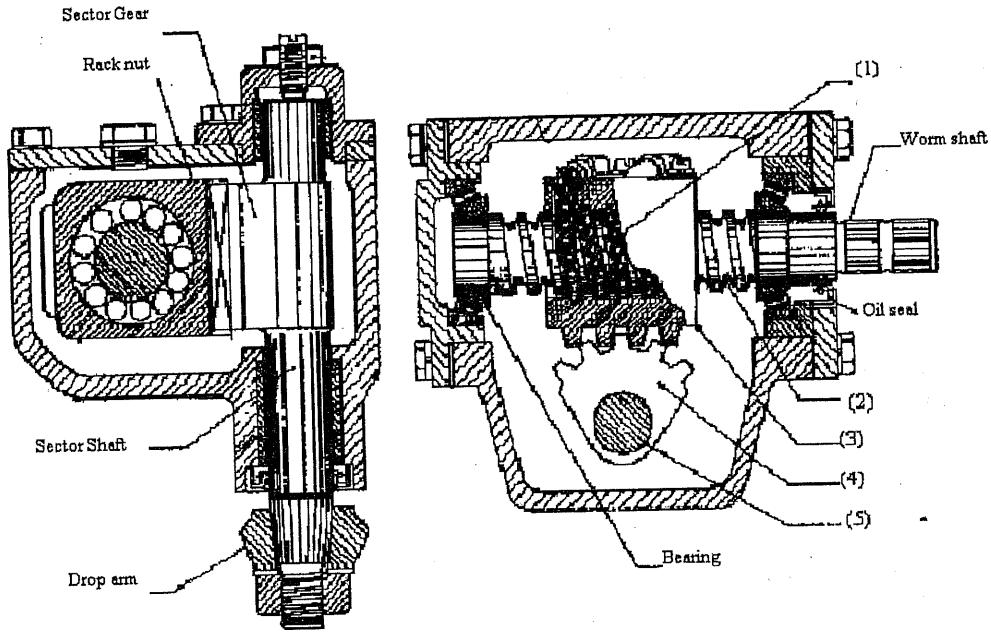


Figure Q5(a)

c) A distributor-less ignition system of a spark ignition engine and details of engine speed and engine position sensing method are shown in Figure Q5(b) and Figure Q5(c) respectively.

i. Explain the operating principle of the distributor less ignition system shown in Figure Q5 (b)

ii. Explain how the TDC sensor and the Engine Speed Sensor shown in Figure Q5 (c), pick up signals

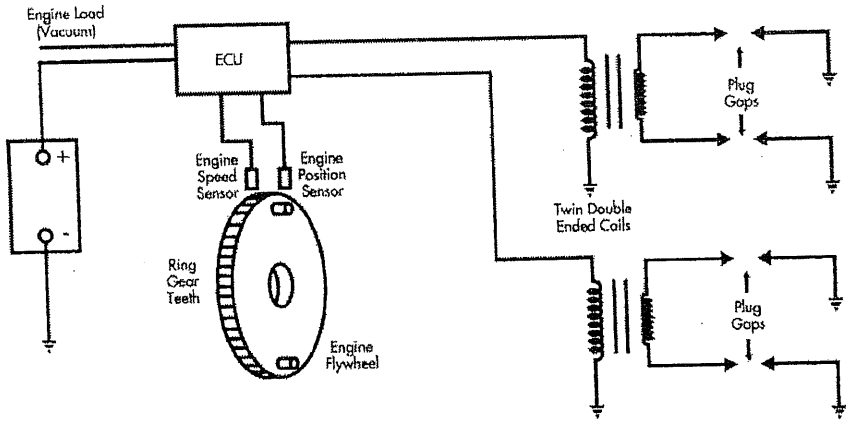


Figure Q5 (b)

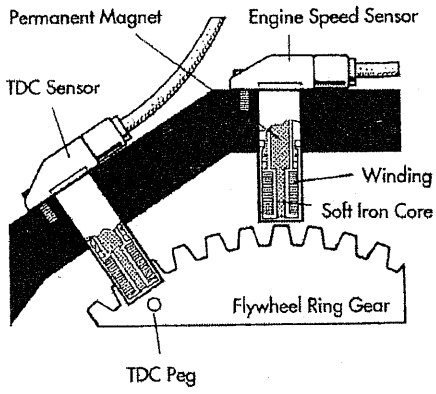


Figure Q5 (c)

Question 06

a. Two major different cylinder head and valve operating system designs are shown in Figure Q6 (a) and Figure Q6 (b). List out major constructive differences in Figure Q6 (b) compared to Figure Q6 (a) and explain which design is more advantages in terms of the volumetric efficiency of an engine.

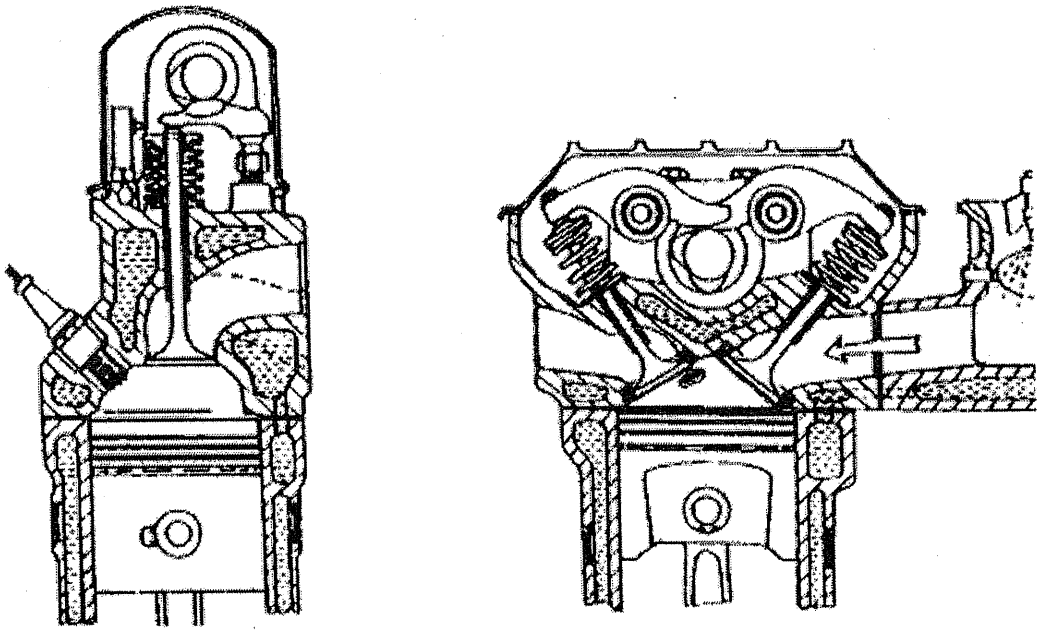


Figure Q6

b) Graphically explain the variation of HC, CO and NOx concentrations in the exhaust gas with the air/fuel ratio for a non emission controlled gasoline engine.

Question 07

a) With aid of sketches, explain "caster, camber, toe in-out" in relation to wheel alignment of an automobile.

b) With aid of a sketch, explain the operating principle of a conventional distributor type ignition system.

c) The variation of power available at the road wheel vs road speed for 1st 2nd 3rd and 4th gear ratios of a particular vehicle traveling on a level road is shown in the figure Q7. Show the gear changing pattern if the vehicle is starting from reset and attains a final speed of 110 km/h.

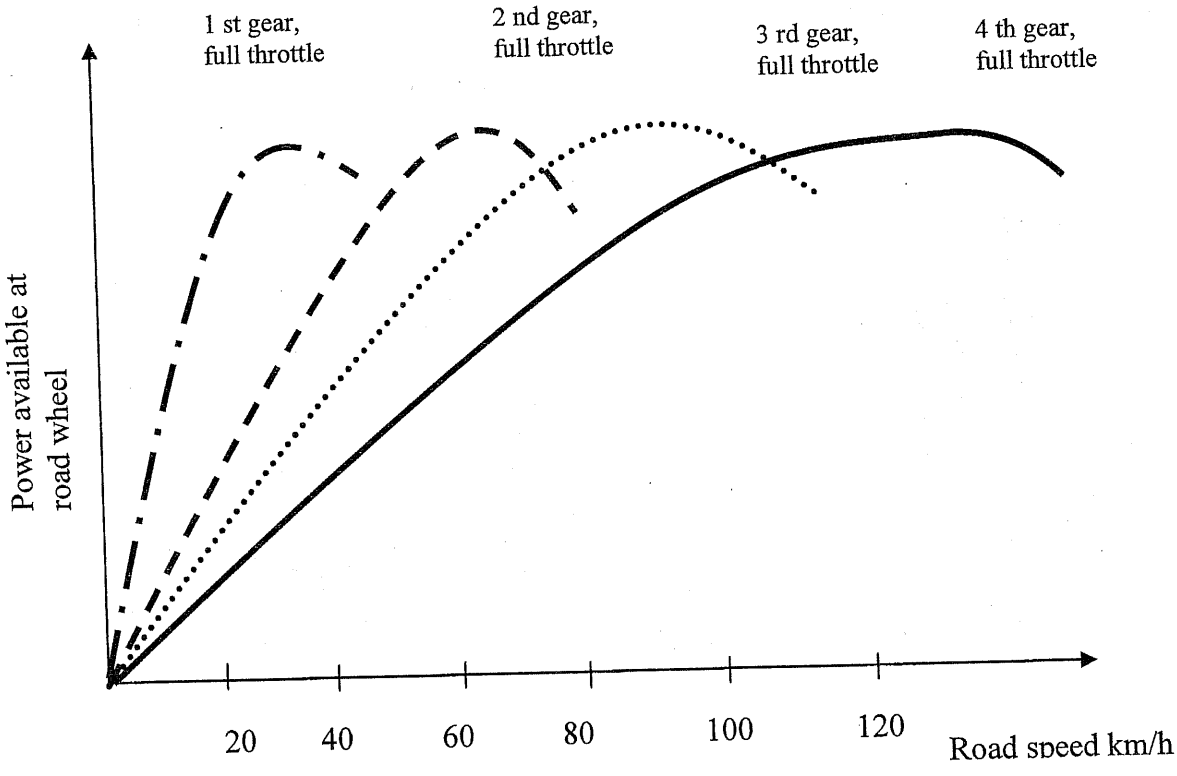


Figure Q7

Question 08

a) Explain the term volumetric efficiency with regard to operation of internal combustion engines.

b) A schematic diagram of a gasoline fuel injection system is shown in figure Q8. List out the sensors and actuators numbered from 1 to 6.

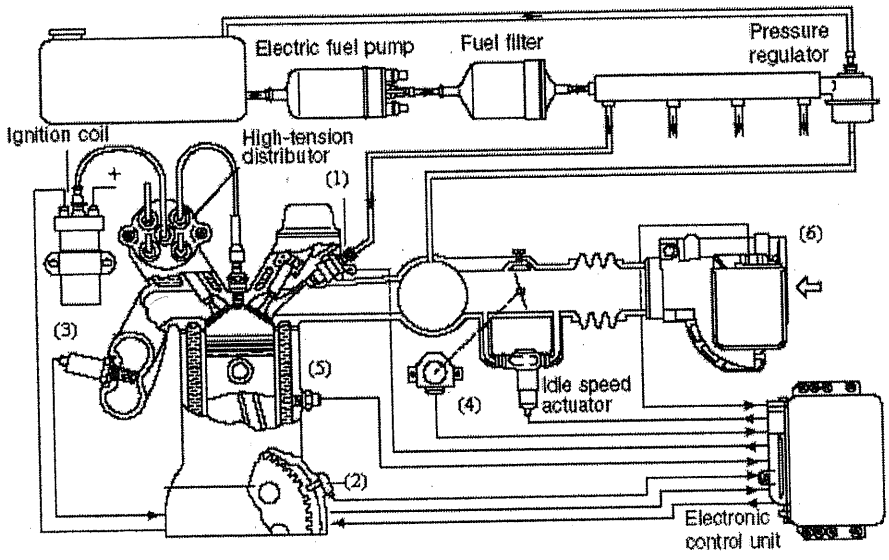


Figure Q8

END.