

Take  $\gamma$  for air is 1.4.

### 1. Compression Ignition Engine

Assumed to be operating in an ideal air standard diesel cycle, it has a compression ratio of 6 +  $\varphi$  and a cut off ratio of 3.6, the maximum cycle temperature is 1400 +  $\varphi$  °C and the minimum cycle temperature is 75 +  $\varphi$  °C.  $\text{m}^3$

### 2. Spark Ignition Engine

Due to lack of other information, it is assumed to be operating on the ideal air standard Otto cycle, this four-cylinder engine has a swept volume of 1.4 litres and the clearance volume in each cylinder is 70 +  $\varphi$  °C  $\text{cm}^3$ . The inlet temperature of the air is 27°C and the maximum cycle temperature is 1900 +  $\varphi$  °C.

Having determined the efficiency of different above engines, you should review these efficiencies by comparing them with each other and comparing values with published efficacy data for these types of engines.

## Part 02

- a) The training division of your company has decided to conduct training program about the Engines and their working principals. As a partial requirement of the training programme, you are asked to compile a research report describing operation conditions of *spark ignition engines* and *compression ignition engines*. It also said to describe the sequence of operation with the help of necessary diagrams to aid comprehension.
- b) A further booklet is to be produced, focusing purely on spark ignition engines. After a detailed description of the *otto cycle*, further describing the use of *Atkins cycles* in a hybrid vehicle engine would be an added advantage.

For this report you must compare and evaluate the performance of both *2 stroke and 4 stroke petrol engines* and evaluate the differences between the *hybrid petrol engines and naturally aspirated petrol engines*, the validate typical applications and discuss the techniques that were used to improve the efficiency of the engine.

## Part 03

- a) Coolant flowing through a radiator at the rate of 3 kg/s are cooled from 105 °C to 81 °C. The specific heat capacity of coolant and air are 4.19 kJ/kg K and 1.13 kJ/kJ/K respectively. The overall heat transfer coefficient from gas to water is 140 W/m<sup>2</sup> K. Calculate the surface area required for the radiation if the vehicle speed is 100 km/h. Consider the density of air as 1.225 kg/m<sup>3</sup>.
- b) The wall of the furnace is 30.48 mm thick and is insulated from outside. Thermal conductivity of the wall material is 0.1 W/m K and the insulation material is 0.01 W/m K.

# Hnd Mechanical Thermodynamic Exam Paper 24

**Wolfgang Guggemos**

A red circular graphic with a gradient, appearing as a semi-circle or a partial circle, located to the right of the author's name.

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