The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title		**DMX5208 Automobile Engineering**
Academic Year	:	2021/22
Date	:	March 07, 2023
Time	:	09:30 hrs. – 12:30 hrs.
Duration	:	3 hours

General instruction
1) Read all instructions carefully before answering the questions
2) This question paper consists of 07 questions. All questions carry equal marks.
3) Answers any 06 questions only.

Question 01.

A four-stroke petrol engine was tested using a rope brake dynamometer and the following results were obtained.

Dynamometer

Effective diameter of the brake pulley	- 600 mm
Difference in tensions on either side of the brake pulley	- 885 N

Engine

No of cylinder	- 06
Bore of diameter	- 90 mm
Stroke length	- 110 mm
Speed of the engine	- 3600 rev/min
Ratio of indicated thermal efficiency to air standard efficiency	- 0.55
Compression ratio	- 11
Air fuel ratio	- 15:1
Specific fuel consumption	- 0.27 kg/kWh
The calorific value of fuel	- 42 MJ/kg
Temperature of air inhaled	- 31
Pressure of air inhaled	- 103 kPa
Gas constant for air	- 0.287 kJ/kgk
Ratio of specific heats of air γ	- 1.4

By using the above data, calculate the following.

(1). Air standard efficiency

(2). Indicated thermal efficiency

(3). Brake power

(4). Brake mean effective pressure

(5). Volumetric efficiency

(6). Mechanical efficiency

Question 02.

A 4- cylinder, 4-stroke petrol engine having 90 mm bore and 130mm stroke develops 30 kW of power while running at 1500 r.p.m and using a 20% rich mixture. The theoretical air-fuel ratio is 15:1. Calorific value of petrol is 46,000 kJ/ kg. Volumetric efficiency measured at 15°C and 760 mm of mercury as standard temperature and pressure is 70% and mechanical efficiency is 90%.

By using the data given in above, calculate the,

1. Indicated Thermal efficiency

2. Brake mean effective pressure

3. Brake Thermal efficiency

Question 03.

a). With the aid of a neat sketch of "Rate of Energy Release vs. Crankshaft Position" graph of a CI engine, describe the following events taking place during the combustion process
   1. Start of injection
   2. Injection delay
   3. Ignition
   4. Premix combustion
   5. Diffusion combustion

b).Further briefly explain the undesirable effects due to premix combustion, in the combustion process of a CI engine.

c.) The high-voltage battery is a vital component of a hybrid system. Briefly describe how the battery ECU keeps the high voltage battery in an optimal condition and protects it.

d). With suitable diagrams describe, how the Toyota Prius uses regenerative braking

Question 04.

a).Name the main components of a Common Rail Diesel System and explain the technical function of each component.

b).Injection noise and emission are lower in a modern Common Rail Diesel System, compared to a conventional diesel system, briefly explain how a common rail diesel system achieves these.

c). The Injection Pulses of a Modern Common Rail Diesel Engine is shown in Fig Q2. Briefly explain these injection phases.
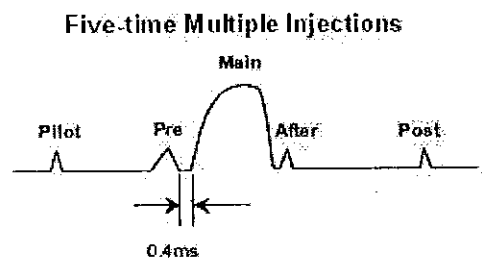
Five-time Multiple Injections

Main

Pilot   Pre   After   Post

0.4ms

Fig Q4: Injection Pulses of a Modern Common Rail Diesel Engine

Question 05.

(a). Briefly describe the construction and function of the following sensors

(1). Transverse (Lateral) Acceleration Sensor
(2). Rotation Rate Sensor
(3). Steering Angle Sensor (Lew)

(b). Consider a vehicle that comes to standstill on an ice-inclined surface. Starting the journey again might cause the driving wheels to slip and loss of steering control. Briefly explain how a modern ABS system with traction control would mitigate such danger.

(c). Briefly describe the CAN interface used in modern vehicles and its advantages.

Question 06.

(a). Some of the advantages of "Adaptive transmission control" in modern transmissions are enhancement of driving safety, lowering fuel consumption and reduction of transmission wear. Considering following scenarios, briefly describe how the above-mentioned advantages are achieved by Adaptive transmission control.

(1). Start and stop

(2). Curve learning

(3). Winter driving

(b). Briefly explain how automatic transmission prevents damage, from accidentally selecting the reverse gear during the forward drive

(c). What is the torque converter lockup clutch and explains its advantages.

Question 07.

(a). Name and describe the main pollutant produced by automobiles

(b). Diesel engines tend to produce more NOx emissions and particular matter (PM). Briefly explain the reason for this.

(c). The emission of a modern petrol car was tested by a four-gas analyzer. The analyzer showed a high HC concentration of 1200 ppm and a lambda value of 1.079 and O2 value of 2.25 % V/V.

1. Give possible reasons for higher oxygen level in the exhaust system

2. Why the HC concentration is higher in the exhaust system.