

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2018

Program: B.Tech. Mechanical
Subject (Course): IC Engine
Course Code : MHEQ 353
No. of page/s : 02

Semester – VI
Max. Marks : 100
Duration : 3 Hrs.

Note: (i) Assume any missing values (ii) Answer the question in the specified order

SECTION A (30 marks)

1. With a neat sketch, explain the functions of MPFI system, Describe D-MPFI and L-MPFI injection system. **(7 marks) [CO 3]**
2. A compression-ignition engine works on dual combustion cycle. The pressure and temperature at the beginning of compression are 1 bar and 27 °C respectively and the pressure at the end of compression is 25 bar. If 420 kJ of heat is supplied per kg of air during constant volume heating and the pressure at the end of adiabatic expansion is found to be 3 bar, find the ideal thermal efficiency. Assume $C_p = 1.004$ kJ/kg K and $C_v = 0.717$ kJ/kg K **(8 marks) [CO 4]**
3. What is the difference between air-standard cycle and fuel-air cycle analysis? Explain the significance of fuel air cycle. **(7 marks) [CO 1]**
4. An engine working on the Otto cycle uses hexane (C_6H_{14}) as fuel. The engine works on chemically correct air fuel ratio and the compression ratio is 8. Pressure and temperature at the beginning of compression are 1 bar and 77 °C respectively. If the calorific value of the fuel is 43000 kJ/kg and $C_v = 0.717$ kJ/kg K, find the maximum temperature and pressure of the cycle. Assume the compression follows the law $pV^{1.3} = C$.

(8 marks)

[CO 3]

SECTION B (45 marks)

5. Describe with suitable sketches the following system of a modern carburetor: (i) main metering system, (ii) idling system, (iii) economizer system, (iv) acceleration pump system, (v) choke **(15marks) [CO 3]**
6. (a) What are the functions of a nozzle? With sketches, explain the various types of nozzles. **(15marks) [CO 1]**

(OR)

- (b) What are the special requirements of an aircraft carburetor? What do you understand by altitude compensation? Explain. **(15marks) [CO1]**
7. A six-cylinder, four-stroke cycle engine has a bore of 8 cm and a stroke of 11 cm and operates at a speed of 2000 rpm with volumetric efficiency of 80 percent. If the diameter of the Venturi section is 2.5 cm, what should be the diameter of the fuel orifice to obtain an A/F ratio of 12 to 1, Assume air density as 1.16 kg/m^3 . **(15marks) [CO 2]**

SECTION C (25 marks)

8. (a) A four-cylinder engine running at 1200 rpm delivers 20 kW. The average torque when one cylinder was cut is 110 Nm. Find the indicated thermal efficiency if the calorific value of the fuel is 43 MJ/kg and the engine uses 360 grams of gasoline per kWh. **(10 marks)**

[CO 2]

- (b) What is supercharger? With the help of a neat sketch, explain the function, types of and their benefits. **(10 marks) [CO 5]**
- (c) Write a short note on the “**effect of stricter emission norms**” on IC engine technology. **(05 marks) [CO 5]**

(OR)

9. (a) Find the brake specific fuel consumption in kg/kWh of a diesel engine whose fuel consumption is 5 grams per second when the power output is 80 kW. If the mechanical efficiency is 75%, calculate the indicated specific fuel consumption? **(10 marks) [CO 2]**
- (b) Explain port injection and throttle body injection system. Explain the effect of various engine variables on SI engine knock. **(10 marks) [CO 1]**
- (c) How are the injection system classified? Describe them briefly. Why the air injection system is not used nowadays? **(05 marks) [CO 4]**