College of Engineering, Pune

End Semester Exam – Nov 2014

F.Y. M. Tech. (Automotive Technology)

IC Engines AT-503

Day & Date Monday, 24 Nov 2014 | Time: - 02.00 pm to 05.00 pm

Maximum Marks: 60 | Duration –03.00 Hrs.

Instructions:

1. All the questions are compulsory
2. Assume suitable data wherever necessary

Q. 1 Determine the engine capacity and the *bmep* of a four-stroke diesel engine working at sea level where pressure is 1 bar and temperature is 17°C that develops a brake power of 280 kW with a volumetric efficiency of 80% at sea level conditions. The engine works at an air-fuel ratio of 18:1, with a specific fuel consumption of 0.240 kg/kW h. The engine runs at 1800 rpm. 10

This engine is taken to an altitude of 3 km where the ambient temperature and pressure are -23°C and 0.715 bar. A mechanically coupled supercharger is fitted to the engine which consumes 12% of the total power developed by the engine. The temperature of air leaving the supercharger is 37°C. Determine the degree of supercharging required to maintain the same brake power of sea level. Also calculate the isentropic efficiency of the compressor. Assume that air-fuel ratio, thermal efficiency and volumetric efficiency remain the same for naturally aspirated and supercharged engine.

Q. 2 A The air-fuel ratio of a Diesel engine is 31:1. If the compression ratio is 15:1 and the temperature at the end of compression is 1000 K, find at what percentage of stroke is the combustion complete if the combustion begins at *TDC* and continuous at constant pressure. Calorific value of the fuel is 40000 kJ /kg. Assume the variable specific heat, 5

$Cp = a + bT$, where $a = 1$ and $b = 0.28 \times 10^{-4}$.

B Factors tending to increase detonation in SI engines tend to reduce knock in CI engines". Discuss the validity of the above statement in the light of the differences in the nature of the two phenomenon and indicate the methods used to reduce knock in CI engines. 5

Q. 3 A What is the difference between the swirl and squish? What are the three methods of generating swirl in CI engine combustion chambers 5

B Explain with figures various types of combustion chambers used in CI engines. For each of the combustion chamber, suggest the type of most suitable fuel injectors with justification. 5

Q. 4	A	Why is the compression ratio of an SI engine often reduced when the engine is redesigned to be used with a turbocharger? (i) Is brake power increased or decreased? (ii) Is thermal efficiency increased? (iii) Why isn't reducing the compression ratio as important when a turbocharger is added to a CI engine design?	5
	B	What are the challenges involved in design of combustion chambers for GDI engine vis-a-vis MPFI engines.	5
Q. 5	A	The following changes in combustion chamber design increase the mass burning rate in a spark-ignition engine at fixed compression ratio, bore, speed, and inlet mixture conditions. Explain how each change affects the burning rate. (a) Reducing the amount of EGR. (b) Using two spark plugs per cylinder instead of one. (c) Generating swirl within the cylinder using a mask on the cylinder head. (d) Using a combustion chamber with higher clearance height near the spark plug and a more central plug location.	5
	B	For controlling non-exhaust emissions from SI engines a unit known as charcoal canister is used. Explain its working with a neat sketch.	5
Q.6	A	Explain with figures various types of combustion chambers used in CI engines. For each of the combustion chamber, suggest the type of most suitable fuel injectors with justification.	5
	B	How combustion is controlled in conventional gasoline and diesel engines? In HCCI combustion control is necessary for successful engine operation and hence a combustion control is a tougher challenge. List all the possible methods of controlling HCCI combustion. Explain two methods of combustion control in HCCI.	5