

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – WINTER 2013

Subject Code: 161902**Date: 29-11-2013****Subject Name: Internal Combustion Engines****Time: 02:30 pm to 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** The compression ratio of an engine working on Otto cycle is 7 and A: F ratio used is 15:1 and C.V. of fuel used is 40000 KJ/kg. The temperature and pressure at the beginning of compression are 47°C and 1 bar. Determine the maximum pressure reached in cycle. The compression follows the law $p\gamma^{1.38} = C$, $C_v = (0.7 + 20 \times 10^{-5} T)$ KJ/kg.K, where T is in K., also determine maximum pressure of cycle if $C_v = 0.7$ KJ/kg. K, **07**
- (b)** A petrol engine consumes 6.8 kg/hr. The choke diameter of the engine carburetor is 2 cm. The density of the fuel used is 700 kg/m³ and A:F ratio of the mixture supplied by the carburetor is 15:1. Determine the carburetor jet diameter if the top of jet is 5 mm above the petrol level in float chamber. Take $R = 287$ Nm/kg-K. The Ambient pressure and temperature are 1 bar and 32°C. Take $C_{da} = 0.9$, $C_{df} = 0.7$. **07**
- Q.2 (a)** Explain with neat sketch actual valve timing diagram of petrol engine and state reason of early opening of exhaust and late closing of inlet valve. What is meant by overlay? **07**
- (b)** Explain following terms: burning time loss factor, heat loss factor, pumping and friction loss. **07**
- OR**
- (b)** State basic requirements of diesel fuel and discuss suitability of hydrogen as alternate fuel in I.C. engine. **07**
- Q.3 (a)** Explain with neat sketch different devices used to meet the requirements of an ideal carburetor. **07**
- (b)** Explain different methods of measurement of pollutants in exhaust gases. **07**
- OR**
- Q.3 (a)** Explain with neat sketch air-less injection system. **07**
- (b)** Define uniflow engine and discuss its merits over other scavenging system. **07**
- Q.4 (a)** What are the effects of following variables on diesel Knock. **07**
- i. Injection timing and rate of fuel infection
 - ii. Surface to volume ratio of combustion chamber
 - iii. Turbulence caused in combustion chamber
- (b)** List basic requirements of a good combustion chamber of S.I. engine. **07**
- OR**
- Q.4 (a)** Discuss the effects of following factors on knocking tendency of an engine **07**
- i. Compression ratio
 - ii. Spark timing
 - iii. Flame velocity
 - iv. Pressure and temperature of mixture at inlet
- (b)** Define squish, swirl, unidirectional movement and turbulence. Explain their importance in design of C.I. combustion chambers. **07**

- Q.5 (a)** List advantages and disadvantages of Magneto System over battery ignition system. **07**
- (b)** The following data is referred to a 2-stroke engine running for 20 minutes at full load. **07**
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|---|-------------------------------|
| Crank shaft speed=350 RPM. | Room temperature=20°C |
| MEP=3 bar. | Exhaust gas temperature=300°C |
| Net brake load=1.5kg | D=20 cm and L=28 cm |
| Jacket cooling water=160kg | Brake drum diameter =1 cm |
| Water inlet temperature=35°C | C.V. of fuel=42000kJ/kg. |
| Water outlet temperature=60°C | C_p (steam)=2.1 kJ/kgK. |
| A:F ratio by mass =30:1 | |
| Steam formed per kg of fuel in exhaust=1.35kg. | |
| C_{pg} (dry gases)=1.01 KJ/kg-K. | |
| Determine: a) Indicated thermal efficiency b) I.S.F.C. and B.S.F.C. | |
| c) Heat balance sheet on % basis. | |

OR

- Q.5 (a)** Write brief note on Stirling engine **07**
- (b)** A 4-stroke diesel engine develops 100 KW at 1500 RPM when ambient condition is 1.013bar and 300 K with a volumetric efficiency of 80%. The amount of free air used by the engine is 7 kg/min. Find the bore and stroke of the engine assuming $L=D$. **07**
- This engine is required to operate at an altitude of 3 km and is fitted with a blower for supercharging the engine which is operated directly by the engine. The power required to run the blower is 8 KW. The temperature of the air leaving the supercharger is 53°C. Determine the excess air required to be inducted by the blower to maintain the power output of 100 KW and delivery pressure of the blower.
