Code No: 54015 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year II Semester Examinations, May-2015
APPLIED THERMODYNAMICS – I
(Common to ME, AME)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

- - -

1.a) What are the different losses associated with the gas exchange process during combustion in the combustion chamber? Explain the reasons for these losses.
b) Draw the diagram of A/F ratio versus throttle opening for different operating conditions of simple carburetor and explain salient features. [8+7]

2.a) Find the percentage change in efficiency of dual cycle having the compression ratio 16 and cut off ratio 10% of swept volume and the specific heat at constant pressure increases by 2%. Given that the ratio of temperatures during constant volume heat addition process is 1.67.
b) Explain major differences between actual and air standard cycles of I.C. Engines. [8+7]

3.a) What are generally faced problems in S.I. Engine combustion chamber? Identify the suggestions to rectify the problems.
b) What are different auxiliary components required in S.I. Engine for achieving better performance? Explain in detail. [8+7]

4.a) How the antiknock additives prevent detonation in S.I. Engine? What are different additives used in S.I. Engine?
b) What do you understand from homogeneous and heterogeneous mixtures? In which engines these mixtures are used? Explain. [8+7]

5.a) A nine-cylinder petrol engine of bore 150 mm and stroke 200 mm has a compression ratio 6:1 and develops 360 kW at 2000 rpm when running on a mixture of 20% rich. The fuel used has a calorific value of 43 MJ/kg and contains 85.3% carbon and 14.7% hydrogen. Assuming volumetric efficiency of 70% at 17^0C and mechanical efficiency of 90%, find the indicated thermal efficiency of the engine.
b) Explain the procedure to determine the mean effective pressure with the diagram. [9+6]

6.a) Derive an expression for the optimum inter cooler pressure for a two stage reciprocating air compressor with perfect inter cooling.
b) A single stage double acting reciprocating air compressor is driven by a 39 kW electric motor with a transmission efficiency of 95%. Air is drawn in at 0.98 bar and 288 K and compressed according to the law $pV^{1.2} = C$ to 5.8 bar. The compressor runs at 100 rpm with a piston speed of 151.5 m/s. [6+9]

7.a) Derive an expression for the efficiency of roots blower in terms of pressure ratio and ratio of specific heats based on p-v and T-s diagrams.

b) A rotary vane compressor compresses 4.5m^3 of air per minute from 1 bar to 2 bar when running at 450 rpm. Find the power required to drive the compressor when (i) the ports are so placed that there is no internal compression and (ii) the ports are so placed that there is 50% increase in pressure due to compression before the back flow occurs. [6+9]

8.a) What is meant by a stage of axial flow air compressor? Explain in detail about the stage velocity triangles.

b) Air at 1.01325 bar and 288 K enters an axial flow compressor stage with an axial velocity of 150 m/s. There are no inlet guide vanes. The rotor stage has a tip diameter of 60 cm and a hub diameter of 50 cm and rotates at 100 rps. The air enters the rotor and leaves the stator in the axial direction with no change in its velocity or radius. The air is turned through 30.2^0 as it passes through the rotor. Assume a stage pressure of 1.2, calculate power required and degree of reaction. [6+9]

---ooOoo----