Code No: RT22032 **R13** SET - 1

II B. Tech II Semester Supplementary Examinations, Nov/Dec-2016
THERMAL ENGINEERING-I
(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the questions in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) What are the important basic components of IC engine? Explain them briefly.
   b) List various methods available for finding friction power of an engine.
   c) Enumerate the applications of compressed air.
   d) What is a centrifugal compressor and what are its advantages?
   e) What do you mean by the term 'gas turbine'? How are gas turbines classified?
   f) What is meant by jet propulsion? What are the basic differences between jet propulsion cycle and shaft power cycle? (3M+4M+4M+4M+4M+3M)

PART-B

2. Draw the ideal and actual indicator diagrams of a two-stroke SI engine. How are they different from a four stroke cycle engine? (16M)

3. Explain the use of prony brake and rope brake dynamometers in measuring the power output of an engine. (16M)

4. An axial flow compressor having eight stages and with 50% reaction compresses air in the pressure ratio of 4:1. The air enters the compressor at 20^0C and flows through it with a constant speed of 90m/s. The rotating blades of compressor rotate with a mean speed of 180m/s. Isentropic efficiency of the compressor may be taken as 82%. Calculate:
   i) Work done by the machine,
   ii) Blades angles. (16M)

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5. A centrifugal compressor used as a supercharger for aero-engines handles 150kg/min of air. The suction pressure and temperature are 1 bar and 290K. The suction velocity is 80m/s. After compression in the conditions are 1.5bar, 345K and 220m/s. Calculate:
   i) Isentropic efficiency.
   ii) Power required to drive the compressor.
   iii) The overall efficiency of the unit.

   It may be assumed that K.E. of air gained in the impeller is entirely into pressure in the diffuser. (16M)

6. The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1bar and temperature of 20^0C. The pressure of the air after compression is 4bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air fuel ratio used is 90:1. If flow rate of air is 3.0 kg/s, find:

   i) Power developed.

   ii) Thermal efficiency of the cycle. Assume C_p=1.0 kJ/kg.K and γ=1.4 of air and gases. Calorific value of fuel =41800 kJ/kg.

   (16M)

7. A turbo jet engine consumes air at the rate of 60.2 kg/s when flying at a speed of 1000km/h.Calculate:

   i) Exit velocity of the jet when the enthalpy change for the nozzle is 230 kJ/kg and velocity co-efficient is 0.96.

   ii) Fuel flow rate in kg/s when air fuel ratio is 70:1.

   iii) Thrust specific fuel consumption.

   iv) Thermal efficiency of the plant when the combustion efficiency is 92% and calorific value of the fuel used is 42000 kJ/kg.

   v) Propulsive power.

   vi) Propulsive efficiency.

   vii) Overall efficiency. (16M)

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