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

II B. Tech II Semester Supplementary Examinations, Dec - 2015
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 question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART-A

1. a) Draw the cross section of a single cylinder spark ignition engine and mark the important parts.
   b) State the limitations experienced in the evaluation of friction power using Willan's line method.
   c) State how are the air compressors classified?
   d) Where do the centrifugal compressors find application and why?
   e) State the merits and demerits of gas turbines over I.C. engines and steam turbines.
   f) Explain the principle of jet propulsion and mention how the jet propulsion engines are classified. (3M+4M+4M+4M+4M+3M)

PART-B

2. Compare SI and CI engines with respect to i) basic cycle ii) Fuel used iii) introduction of fuel iv) ignition v) compression ratio vi) speed vii) efficiency viii) weight. (16M)

3. a) With a neat sketch explain an Eddy current dynamometer.
   b) What is transmission dynamometer? Explain. (8M+8M)

4. An axial flow compressor with an overall isentropic efficiency of 85% draws air at 20^0C and compresses it in the pressure ratio of 4:1. The mean blade speed and flow velocity are constant throughout the compressor. Assuming 50% reaction blading and taking blade velocity as 180m/s and work input factor as 0.82,calculate:
   i) Flow velocity ii) Number of stages taking $\alpha_1=12^0,\beta_1=42^0$ (16M)

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5. A centrifugal compressor running at 1000r.p.m delivers 660 m^3/min. of free air. The air is compressed from 1bar and 20^0C to a pressure ratio of 4 with an isentropic efficiency of 82%. Blades are radial at outlet of impeller and flow velocity of 62m/s may be assumed throughout constant. The outer radius of impeller is twice the inner and the slip factor may be assumed as 0.9. The blade area co-efficient may be assumed 0.9 at inlet .Calculate:
   i) Final temperature of air. ii) Theoretical power.
   iii) Impeller diameter at inlet and outlet. iv)Breadth of impeller at inlet
   v) Impeller blade angle at inlet. vi) Diffuser blade angle at inlet. (16M)

6. A gas turbine unit has a pressure ratio of 6:1 and maximum cycle temperature of 610^0C .The isentropic efficiencies of the compressor and turbine are 0.80 and 0.82 respectively. Calculate the power output in kilowatts of an electric generator geared to the turbine When the air enters the compressor at 15^0C at the rate of 16kg/s. (16M)

7. The following data pertain to a turbo-jet flying at an altitude of 9500m:
   Speed of the turbo-jet =800km/h
   Propulsive efficiency =55%
   Overall efficiency of the turbine plant=17%
   Density of air at 9500 m altitude =6100N
   Assuming calorific value of the fuels used as 46000 kJ/kg,
   Calculate:
   i) Absolute velocity of the jet ii) Volume of air compressed per min
   iii) Diameter of the jet. iv) Power output of the unit. V) Air fuel ratio. (16M)