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

II B. Tech II Semester Supplementary Examinations, April-2018
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)What are the main objectives in studying the theory of IC engines?
b) Explain the principle involved in the measurement of brake power.
c) State the conditions which lower the volumetric efficiency.
d) With a neat sketch explain the essential parts of a centrifugal compressor.
e) Enumerate the various uses of gas turbines.
f) What do you understand by the term air breathing engines? How are they classified?
(3M+4M+4M+4M+4M+3M)

PART-B

2. Describe with a neat sketch the working principle of crankcase scavenged two-stroke engine. (16M)

3. a) Classify the meters used for measuring air flow and explain.
b) Explain an automatic fuel flow meter. (9M+7M)

4. In an eight stage axial flow compressor, the overall stagnation pressure ratio achieved is 5:1 with an overall isentropic efficiency of 92 per cent. The inlet stagnation temperature and pressure at inlet are 290K and 1 bar. The work is divided equally between the stages. The mean blade speed is 160m/s and 50% reaction is used. The axial velocity through the compressor is constant and is equal to 90m/s. Calculate:
i) The blade angles. ii) The power required. (16M)
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5. A centrifugal blower compresses 4.8m^3/s of air from 1 bar and 20^{0}C to 1.5 bar .The index of compression 'n' is 1.5. The flow velocity at inlet and outlet of the machine is the same and equal to 65m/s.The inlet and outlet impeller diameters are 0.32m and 0.62m respectively. The blower rotates at 8000r.p.m. Calculate:
   i) The blade angles at inlet and outlet of the impeller.
   ii) The absolute angle at the impeller.
   iii) The breadth of blade at inlet and outlet.

   It may be assumed that no diffuser is employed and the whole pressure increase takes place in the impeller and the blades have negligible thickness. (16M)

6. A gas turbine unit receives air at 1 bar and 300K and compresses it adiabatically to 6.2bar. The compressor efficiency is 88% .The fuel has a heating value of 44186kJ/kg and the fuel air ratio is 0.017 kJ/kg of air. The turbine internal efficiency is 90%. Calculate the work of turbine and compressor per kg of air compressed and thermal efficiency.
   For products of combustion, C_p=1.147kJ/kg.K and γ=1.333. (16M)

7. A turbo –jet engine travels at 216m/s in air at 0.78 bar and -7.2^{0}C .Air first enters diffuser in which it is brought to rest relative to the unit and it is then compressed in a compressor through a pressure ratio of 5.8 and fed to a turbine at 1110^{0}C. The gases expand through the turbine and then through the nozzle to atmospheric pressure (i.e.,0.78 bar).The efficiency of diffuser, nozzle and compressor are each 90%.The efficiency of turbine is 80%. Pressure drop in the compression chamber is 0.168 bar. Determine: i) Air-fuel ratio; ii) Specific thrust of the unit;
   iii) Total thrust, if the inlet cross-section of diffuser is 0.12 m^2. Assume calorific value of fuel as 44150kJ/kg of fuel. (16M)