Code No: RT31035 **R13** SET - 1

III B. Tech I Semester Supplementary Examinations, May - 2018

THERMAL ENGINEERING – II

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1 a) What do you understand by heat of reaction? [3M]
b) What are the functions of a boiler chimney? Why chimney is not provided in a locomotive boiler? [4M]
c) Explain the term nozzle efficiency, velocity coefficient and discharge coefficient as applied to nozzles. [3M]
d) Explain degree of reaction. [4M]
e) What are the requirements of a good combustion chamber for a gas turbine? [4M]
f) What is the essential difference between rocket propulsion and turbo-jet propulsion? [4M]

PART -B

2 a) Discuss the effect of dissociation on flame temperature. [7M]
b) A power generating plant uses steam as working fluid and operates at boiler pressure of 50bar, dry saturated and a condenser pressure of 0.1bar. Calculate for these limits: i) The cycle efficiency; ii) The work ratio and specific steam consumption for Rankine cycle. Take pumping work also into account. [9M]

3 a) Discuss the advantages and disadvantages of artificial draught system over natural draught system? [7M]
b) The equivalent evaporation of boiler from and at 100^0C is 1300kg/hr. Calculate the actual evaporation if the feed water is supplied at 110^0C and the steam is generated at a pressure of 15bar and temperature 200^0C. if the efficiency of this boiler is 72%, find i) The fuel consumption per hour taking calorific value of coal as 25500 kJ/kg, and ii) The grate area if the rate of evaporation is 100kg/m^2 per hour. [9M]

4 a) Discuss the process of super saturation in steam nozzles with the help of enthalpy-entropy diagram. Define degree of super-saturation and degree of under-cooling. Explain in detail the physical significance of abrupt change at Wilson`s line. [8M]
b) Derive the condition of maximum blade efficiency in single-stage impulse turbine? What is its value? Sketch how efficiency varies with blade-steam velocity ratio. [8M]

5 a) Deduce an expression for work done per stage of a reaction blading? [8M]
b) A condensing plant condenses 13750kg of steam per hour and the leakage of air in the system is 1kg per 2500kg of steam. The vacuum in the air pump suction is 71.5cm (barometer 76cm) and the temperature 32.9^0C. Compute the capacity of the air pump which removes both air and water in m^3/min, taking the volumetric efficiency as 80%. [8M]
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6 a) Discuss the relative advantages and disadvantages of gas turbines and steam turbines. [6M]

b) A simple turbine jet unit was tested when stationary and the ambient conditions were 1bar and 15^0C. The pressure ratio for the compressor was 4:1. A fuel consumption of 0.37kg/s was obtained for an air flow of 23kg/s. Calculate the thrust produced if the exhaust gases from the turbine were expanded to atmospheric pressure in a convergent nozzle. Assume the following data: [10M]

Isentropic efficiency of compressor-80%
Isentropic efficiency of turbine-85%
Efficiency of nozzle-93%
Transmission efficiency-98%
Calorific value of fuel-42000kJ/kg
Assuming working fluid to be air throughout.

7 a) Describe with a suitable sketch the constant pressure open cycle gas turbine. [7M]

b) Derive expressions for the thrust and propulsion efficiency of rockets and compare with those of turbojet. [9M]

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