Code No: 09A50306

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B. Tech III Year I Semester Examinations, May/June – 2013
Applied Thermodynamics-II
(Common to ME, AME)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

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1.a) Explain the construction and working of a simple vertical boiler with the help of a neat diagram.

b) A thermal power station works on natural draught. The height of the chimney is restricted to 40 m. The ambient temperature of the air is 20^0C and the temperature of the fuel-gas passing through the chimney at its base is 300^0C. The air-fuel ratio is 17:1. Calculate the diameter of the chimney at the base, if head lost due to friction is 25% of the ideal draught. [15]

2.a) Establish the energy balance in a boiler. How can its performance be improved?

b) Calculate the equivalent evaporation of a boiler per kg of coal fired, if the boiler produces 50,000 kg of wet steam per hour with a dryness fraction of 0.95 and operating at 10 bar. The coal burnt per hour in the furnace is 5500 kg and feed-water temperature is 40^0C. [15]

3.a) What is the significance of critical pressure ratio on discharge though a nozzle?

b) Steam at 15 bar and 200^0C is supplied to a convergent –divergent nozzle against a back pressure of 4 bar. Expansion is superheated up to the throat and the nozzles are rectangular in shape, its width being 2.5 times the breadth. For a mass-flow rate of 0.3 kg/s, find
i) Dimensions of undercooling at the throat at the exit,
ii) Degree of undercooling and super saturation,
iii) Increase in entropy. [15]

4.a) Differentiate between Jet and Surface condensers.

b) During a trial on a condenser, the following readings were recorded:
Barometer reading   = 766 mm of Hg
Actual vacuum recorded by gauge = 716 mm of Hg
Temperature of exhaust steam   = 35^0C
Temperature of hot well   = 29^0C
Inlet temperature of cooling water = 15^0C
Outlet temperature of cooling water = 24^0C
Calculate
a) Corrected vacuum to standard barometer reading of 760 mm of mercury,
b) Vacuum efficiency,
c) Under cooling of condensate, and
d) Condenser efficiency. [15]