R09

Code No: 55020

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2016
APPLIED THERMODYNAMICS-II
(Common to AME, ME)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1. The composition by weight of fuel is 65% hexane (C_6H_{14}) having a net calorific value of 43080 kJ/kg and 35% Benzene (C_6H_6) having a net calorific value of 38900 kJ/kg. Determine (a) Air fuel ratio for stoichiometric mixture and the calorific value of 1 m^3 of the mixture at STP treating the fuels as gases. 1 kg-mol of fuel has volume 22.42 m^3 at STP. (b) The CO_2 % by volume in the dry products of combustion from a 30% rich mixture. Assume complete combustion of H_2. [7+8]

2. During a boiler trail the following observations were made:
Duration of trial =1 hour,
Steam generated = 35500 kg,
Steam pressure 12 bar,
Steam temperature= 250^{0}C,
Temperature of water entering economizer = 17 ^{0}C,
Temperature of water leaving economizer = 77 ^{0}C,
Oil burnt = 3460 kg,
Calorific value of the fuel= 39500 kJ/kg.
Calculate a) equivalent evaporation per kg of fuel b) Thermal efficiency of plant
c) % heat energy of the fuel energy utilized by the economizer. [5+5+5]

3. A steam turbine develops 185 kW with consumption of 16.5 kg/kWh. Pressure and temperature of the steam at inlet of nozzle are 12 Bar and 220^0 C respectively. The steam leaves the nozzle at 1.2 Bar. The diameter of nozzle at throat is 7 mm. Find the number of nozzles. [15]

4. A single row impulse turbine develops 132.4 kW at a blade speed of 175 m/s, using 2 kg of steam per sec. Steam leaves the nozzle at 400 m/s. Velocity coefficient of the blades is 0.9. Steam leaves the turbine blades axially. Determine the nozzle angle, Blade angles at entry and exit, assuming no shock. [15]

5.a) Show that for maximum diagram efficiency of a reaction turbine blade steam speed ratio is equal to cos α, where α is angle of absolute inlet velocity.
b) What are the assumptions used in the above problem? And also derive the expression for maximum efficiency. [7+8]

6. The air entering a steam condenser with steam is estimated at 6 kg/hr. The temperature at the inlet to air cooler section is 30 ^{0}C and at the outlet is 26^{0}C. The vacuum in the shell is essentially constant throughout and is 721 mm of Hg, while the barometer reads 758 mm of Hg. Calculate a) The volume of air entering the cooling section per hour b) The mass of moisture contained in the air c) The mass of steam condensed per hr in the cooling section. [5+5+5]

7. A Gas turbine plant works between the temperature limits of 11520 K and 2880 K Isentropic efficiency for compressor and turbines are 0.85 and 0.8 respectively. Determine the optimum pressure ratio for maximum work output and also for maximum cycle thermal efficiency. [15]

8. Explain various types of rocket propellants. Explain Schematically. [15]

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