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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Marine Engineering) (2013 Onwards)/
B.Tech.(ME) (2011 Onwards) (Sem.–3)
APPLIED THERMODYNAMICS–I
Subject Code : BTME-304
Paper ID : [A1141]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Answer briefly :

a) What are stoichiometric coefficients?

b) Enumerate various types of cooling towers used in industry.

c) How does air fuel ratio affect power and efficiency of engine?

d) Enumerate the methods to reduce/control emissions from SI engines.

e) Explain the function of using fusible plug on steam generators.

f) Enumerate various types of mountings and accessories used in steam boilers.

g) Discuss advantages of binary vapour cycles over single vapour cycle.

h) Discuss briefly the factors limiting thermal efficiency of a steam power plant.

i) Differentiate between impulse and reaction turbines.

j) How condensers can be broadly classified on the basis of type of heat exchange?

SECTION-B

Q2. A blast furnace has the following volumetric composition : CO_2 - 11%, CO - 27%, H_2 - 2%, N_2 - 60%. Determine the theoretical volume of air needed for complete combustion of 1 m^3 of the gas and the percentage composition of dry flue gases by volume, by assuming that air comprises of 21% O_2 and 79% N_2.

Q3. Briefly explain the direct injection MPFI systems in Diesel and Petrol engines giving neat sketches.

Q4. Determine the quantity of heat required to produce 1 kg of steam at a pressure of 6 bar at a temperature of 25° C. under the following conditions: (a) when the steam is wet having a dryness fraction 0.9; (b) when the steam is dry saturated ; and (c) when it is superheated at a constant pressure at 250° C assuming the mean specific heat of superheated steam to be 2.3 kJ/kg K.

Q5. Explain the working principle, constructional details of Lancashire boiler giving a neat sketch.

Q6. How air leakage in condenser is damaging to the performance of condenser? Describe the methods to detect and prevent air infiltration in condensers.

SECTION-C

Q7. a) Briefly describe the methods employed to reduce knock in SI and CI engines.

b) Dry saturated steam at a pressure of 10 bar is expanded in a nozzle to a pressure of 0.7 bar. With the help of Mollier diagram find the velocity and dryness fraction of steam issuing the nozzle, if the friction is neglected. Also find the velocity and dryness fraction of the steam, if 15% of the heat drop is lost in friction.

Q8. Following data refer to a De Laval steam turbine having equiangular blades: Steam entering nozzle = 100 m/s, Nozzle Efficiency = 0.90, Blade speed = 200 m/s, Blade velocity coefficient = 0.85, rate of steam mass flow = 3 kg/s, absolute velocity of steam at exit from stage = 90 m/s, angle of absolute velocity of steam at exit from stage with tangent of wheel = 75°. Determine : (a) the blade angles, (b) the nozzle angle, (c) the absolute velocity of steam at inlet, (d) the axial thrust, (e) the HP developed.

Q9. A steam turbine plant operates on Rankine cycle with steam entering turbine at 40 bar, 350°C and leaving at 0.05 bar. Steam leaving turbine condenses to saturated liquid inside condenser. Feed pump pumps saturated liquid into boiler. Determine the net work per kg of steam and the cycle efficiency assuming all processes to be ideal. Also show cycle on T-s diagram. Also determine pump work per kg of steam considering linear variation of specific volume.