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NAG203

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 180221

Roll No.

B. Tech.

(SEM. II) THEORY EXAMINATION, 2014-15

THERMODYNAMICS & HEAT ENGINE

Time : **3** Hours] [Total Marks : **100**

Note : The question paper is divided in three sections. Attempt each section. Assume missing data suitably if necessary. The use of calculator is permitted.

SECTION - A

1 Attempt each short answer type question: **10×2=20**

(a) What do you mean by Flow and non-flow processes?
(b) What do you mean by internal energy?
(c) Define COP of a refrigerator.
(d) What is a cyclic heat engine?
(e) Mention any four causes of entropy increase.
(f) What is entropy principle?
(g) Where does the locomotive boiler is used?
(h) What is boiler drought?
(i) What do you mean by heat balance?
(j) Draw an indicator diagram.

SECTION - B

2 Attempt any three parts of the following : **10×3=30**

(a) What is a Diesel cycle? Explain the four processes which constitute this cycle.

(b) Which is the property introduced by first law of thermodynamics. A stationary mass of gas is compressed without friction from an initial state of $0.3m^3$ and 0.105 MPa to a final state of $0.15m^3$ and 0.105MPa, the pressure remaining constant during the process. There is a transfer of 37.6 kJ of heat from the gas during the process. How much does the internal energy of a gas change?

(c) State and prove Carnot' theorem?

(d) What is the function of boiler mountings in steam boilers? Enlist their names and describe, with the help of neat and labeled sketch, anyone of them.

(e) State and discuss the Carnot cycle.? A Carnot engine absorbs 200 J of heat from a reservoir at the temperature of the normal boiling point of water and rejects heat to a reservoir at the temperature of the triple point of water. Find the heat rejected, the work done by the engine and the thermal efficiency.

SECTION-C

3 Attempt any five parts of the following : **10×5=50**

(a) An engine equipped with a cylinder having a bore of 15 cm and a stroke of 45 cm operates on an Otto cycle. If the clearance volume is $2000cm^3$, compare the air Standard efficiency.

OR

What is a spark ignition engine? What is the air standard cycle of such a engine? What are its four processes?

(b) What do you mean by compound heat engine? Where are they used?

OR

Discuss a Rankine cycle and compare it with Carnot cycle.

(c) Prove the change of entropy of a gas at reversible adiabatic process.

OR

Two kg of water at 80°C are mixed adiabatically with 3 kg of water at 30°C in a const. pressure processes of 1 atmosphere. Find the increase in the entropy of the total mass of water due to mixing processes. (C_p of water= 4.187KJ/kg-K)?

(d) Discuss the Clussius statement for the second law of thermodynamics.

OR

A heat engine receives half of its heat supply at 1000 K and half at 500 K while 'rejecting heat to a sink at 300 K. What is the maximum thermal efficiency of the heat engine?

(e) A blower handles 1 kg/s of air at 20°C and consumes a power of 15 KW. The inlet and met velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic conditions. Take Cp of air is 1.005 KJ/Kg-K.

OR

Define internal energy. How is energy stored in molecules and atoms? What is the difference between heat and internal energy?