Registration no: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech**
BE2103

1st Semester Back Examination 2016-17
THERMODYNAMICS
BRANCH(S): ALL
Time: 3 Hours
Max Marks: 70
Q.CODE:Y621

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Distinguish between change of change of state, path and process.
b) What is an indicator diagram?
c) State the first law for a closed system undergoing a change of state.
d) What is PMM2? Why
e) Define entropy principle and write two application of it.
f) Draw phase equilibrium diagram on T-s plot for water.
g) Differentiate between refrigerator and heat pump
h) What do you mean by saturation pressure and saturation temperature?
i) What are indicated power and brake power of an engine?
j) What is the difference between work transfer and heat transfer?

Q2 What are the causes of entropy increase? One kg of ice at -5 ^{0}c is exposed to the atmosphere which is at 20^{0}c. The ice melts and comes into thermal equilibrium with the atmoshphere.(a) Determine the entropy increase of the universe. (b) What is the minimum amount of work necessary to convert the water back into ice at -5^{0}c? c_p of ice is 2.093 KJ/kg K and the latent heat of fusion of ice is 333.3KJ.kg **(2+8)**

Q3 **a)** Show that energy is a property of system. **(5)**

b) The following data refers to a 12 cylinder single acting two stroke marine diesel engine speed 150 rpm cylinder diameter 0.8 m, stoke of piston 1.2 m, area of indicator diagram 5.5 x 10 $^{-4}$m^2 , length of diagram 0.06m, spring value 147 Mpa per m. Find net rate of work transfer from gas to piston in kW. **(5)**

Q4 **a)** What is carnot cycle? What are the four process which constitute the cycle? Explain with T-S and P-V diagram. **(5)**

b) A reversible heat engine operates between two reservoirs at temperature of 600^0c and 40^0c . The engine drives a reversible refrigerator which operates between reservoirs at temperature of 40^0c and -20^0c. The heat transfer to the heat engine is 2000Kj and the net work output of the combined engine refrigerator plant is 360Kj. **(5)**

(a) Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40^0c.

(b) Reconsider (a) given that the efficiency of the heat engine and the COP of the refrigerator are each 40% of their maximum possible values.

Q5 **a)** What do you understand by path function and point function? Show that work is path function and not property? **(5)**

b) Steam at 0.8 Mpa 250 ^{0}c and flowing at the rate of 1kg/s passes into a pipe carrying wet steam at 0.8 Mpa 0.95 dry, After adiabatic mixing the flow rate is 2.3 kg/s. Determine the condition of steam after mixing. The mixture is now expanded in a frictionless nozzle isentropic ally to a pressure of 0.4 Mpa. Determine the velocity of steam leaving the nozzle. Neglect the velocity of steam in the pipeline. **(5)**

Q6 **a)** Draw the phase equilibrium diagram for a pure substance on P-T coordinates. Why does the fusion line for water have negative slope? **(5)**

b) A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250 ^{0}c. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and the internal energy. **(5)**

Q7 Show that through one point there can pass only one reversible adiabatic. Establish the inequality of clausius. **(10)**

Q8 **Write short answers on any TWO:** **(5 x 2)**

a) Domestic Refrigerator

b) Internal combustion engine

c) Heat pump

d) steam power plant