Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

BENG 1103

First Semester (Special) Examination – 2013

THERMODYNAMICS

BRANCH : AEIE, BIOTECH, CHEM, CIVIL, CSE, EC, EEE, ELECTRICAL, ETC, FASHION, IT, MECH, TEX

QUESTION CODE : D 180

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.
Steam tables are allowed in the examination hall.

1. Answer the following questions : 2×10

   (a) What do you mean by property and process ?

   (b) Differentiate between open system and a control volume.

   (c) What is pressure ? Mention the different units of pressure.

   (d) State the Zeroth law of thermodynamics.

   (e) What is free expansion ?

   (f) Differentiate between pdv and flow work ?

   (g) Draw the Carnot cycle on p-v and T-s plot.

   (h) What is the mass of air conditioned in a room 6m × 9m × 4m if the pressure is 101.325 kPa and the temperature is 25°C.

   (i) What is the values of

      (i) work out put from constant volume process

      (ii) heat transfer in adiabatic process

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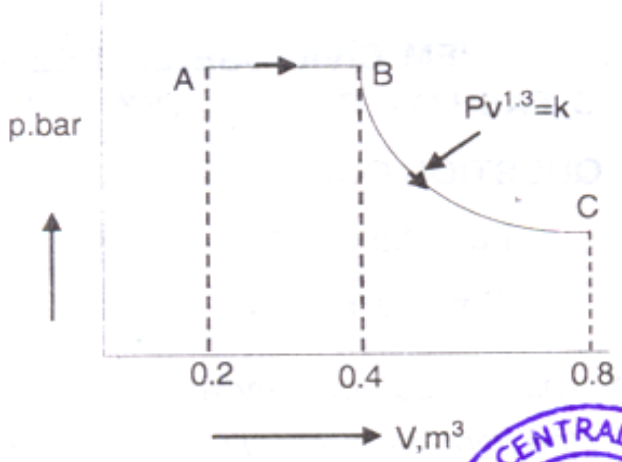
(j) Write the mass conservation equation in steady flow case. Mention the nomenclatures used in it.

2. (a) Derive the expression for the pdv work in case of an isothermal process. 5

(b) Determine the total work done by gas system following an expression process as shown in the following process. 5



3. (a) What is heat transfer ? Mention different modes of heat transfer. 5

(b) 680 kg of fish at 5°C are to be frozen and stored at –12°C. the specific heat of fish above freezing point is 3.182 and below freezing point is 1.717kJ/kgK. The freezing point of fish is 0°C, and the latent heat of fusion is 234.5kJ/kg. How much heat must be removed to cool fish, and what percentage of this is latent heat ? 5

4. Air at –15°C passes through a heat exchanger at a velocity of 30m/s where its temperature is raised to 800°C. It then enters a turbine with a velocity of 30 m/s and expands until the temperature falls to 650°C. On leaving the turbine, air is taken at a velocity of 60 m/s to a nozzle where it expands until the temperature has fallen to 500°C. if the air flow rate is 2 kg/s, calculate

(i) the rate of heat transfer to the air in the heat exchanger.

(ii) the power output from the turbine assuming no heat loss

(iii) the velocity exit from the nozzle, assuming no heat loss. Take the enthalpy of air as $h=c_p t$, where c_p is the specific heat equal to 1005J/kgK and t is the temperature. 10

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5. (a) State the first law of thermodynamics for closed cycle and a process. 4

(b) Explain the terms : 6

(i) Energy

(ii) Enthalpy

(iii) Entropy

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6. (a) Give the Kelvin-Planck and Clausius statement of the second law of thermodynamics. 5

(b) If a refrigerator is used for heating purposes in winter so that the atmosphere becomes the cold body and the room to be heated becomes the hot body, how much heat would be available for heating for each kW input to the driving motor ? The COP of the refrigerator is 5, and the electro-mechanical efficiency of the motor is 90%. How does this compare with resistance heating ? 5

7. (a) Draw the phase equilibrium diagram for water-steam on p-V, T-s plot with relevant property lines. 5

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

8. Write short notes on any **two** of the following : 5×2

(a) Refrigerator and Heat pump

(b) Steam power plant

(c) Internal combustion engines

(d) Air compressor
