BME-019

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) BTMEVI

Term-End Examination

December, 2013

BME-019 : ENGINEERING THERMODYNAMICS

Time : 3 hours   *Maximum Marks : 70*

Note :   *Answer **any five** questions. Use of scientific calculator and steam table is permitted. Assume suitable data if any data is missing.*

1. (a)   Define a thermodynamic system. Also   6
         explain open system, closed system and an
         isolated system with the help of suitable
         examples.

    (b)   A closed system undergoes a cycle consisting   8
         of two processes. During the first process,
         40 kg of heat is transfered to the system
         while the system does 60 kJ of work. During
         the second process, 40 kJ of work is done
         on the system. Determine

         (i)   the heat transfer during the second
               process and

         (ii)   the network and heat transfer for the
               cycle.

2. (a) Describe a simple vapour compression **6**
refrigeration cycle with the help of block
diagram.

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(b) A small turbine working under the following
conditions runs an aircraft refrigeration
unit. Air at 4 bar and 40°C flows steadily
in to the turbine at 40m/s. At the turbine
exit, the condition of the air is bar, 2.5°C
and −200 m/s. The shaft delivered by the
turbine is 52 kJ/kg of air. Determine the
heat transfer per kg of air flowing through
the turbine.

3. (a) Differentiate between the working of a **6**
refrigerator and the working of heat pump.
Deduce the relationship between C.O.P. of
refrigerator and C.O.P. of heat pump.

(b) A refrigerator removes heat at an average **8**
rate of 760MJ/h from the cold
compartment. If the co-efficient of
performance of the refrigerator is 4.0,
determine

(i) the power input to the refrigerator and

(ii) the amount of heat rejected by the
refrigerator.

4. (a) What is meant by reversible and irreversible 6
process ? Give examples of each.

(b) A 1 kW electric heating element, 10 cm long 8
and 10mm in diameter, is immersed in
25 kg of water intially at 12°C, in an
insulated container. Determine the time
required for the heater to raise the water
temperature to 65°C. Also, find the entropy
generated during this process.

5. (a) Differentiate between cornot cycle and 6
Rankine cycle used in steam power plants.

(b) Water changes from saturated liquid to 8
saturated vapour as heat is transferred to
it from a source at 300°C, in a steady flow
cornot cycle, heat rejection is at a constant
pressure of 10 kPa. Draw the T-S diagram
for the cycle relative to the saturation lines
and determine the amount of heat rejected,
the thermal efficiency of the cycle and net
work output.

6. (a) Define a volumetric efficiency of compressor 6
and explain why it is less than units.

(b) An air-standard diesel cycle has a 8
compression ratio of 16. At the begining of
compression process, air is at 90 kPa and
40°C. The maximum temperature of the
cycle is 1400°C,
Determine :
(i) cut-off ratio
(ii) the thermal efficiency
(iii) the mean effective pressure of the
cycle.

7. (a) What are the various types of feed water   6
         heaters used in the regenerative Rankine
         cycle ? Explain its properties.

    (b) A refrigerator working on an ideal vapour   8
         - compression refrigeration cycle uses mass
         flow rate of refrigerant is 0.045 kg/s,
         determine :

         (i)   the rate of heat removal from the
                refrigerated space

         (ii)   the power input to the compressor,

         (iii) the rate of heat rejection to the
                environment and

         (iv)   the Co-efficient of Performance (COP).

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