II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING-I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours   Max Marks: 80
Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. An axial compressor stage has a mean diameter of 60 cm and runs at 15000 r.p.m. If the actual temperature rise and pressure ratio developed are 30^0C and 1.4 respectively, determine :

   (a) the power required to drive the compressor while delivering 57 kg/s of air; assume mechanical efficiency of 86.0% and an initial temperature of 35^0C,

   (b) the stage loading coefficient,

   (c) the stage efficiency, and

   (d) the degree of reaction if the temperature at the rotor exit is 55^0C.   [16]

2. The fuel supplied to a Diesel engine has a gross calorific value of 44800 kJ/kg and contains 85.4% C and 12.3% H_2. The average temperature of the exhaust gases is 260^0C and their volumetric analysis gives CO_2 : 5.77%, CO : 0.12%, O_2 : 13.09%, N_2 (by difference) : 81.02 %. Find

   (a) the heat carried away by the exhaust expressed as percentage of the heat supplied and

   (b) the mass of air per kg of fuel in excess of that theoretically required for complete combustion. Take mean specific heat of the dry exhaust gases as 1 kJ/kg K and atmospheric temperature as 17^0C. Air contains 23% oxygen on mass basis.   [16]

3. (a) Explain the combustion phenomenon in C.I.Engine and discuss the quantity of energy released in each stage.

   (b) Differentiate among air swirl, pre-combustion and air cell combustion chambers.   [8+8]

4. Discuss the fans with counter rotating guide vanes and derive the expressions for the pressure rise and degree of reaction.   [16]

5. (a) What are different fuel injection systems for C.I engines? Explain any one.

   (b) Sketch and explain the valve timing diagram for 4 stroke S.I engines.   [8+8]

6. (a) Why is evaporator pressure kept above atmospheric in most refrigeration systems?

   (b) What is the advantage of using secondary refrigerants? What are the common secondary refrigerants?

(c) Explain with a suitable diagram, the working of cascade refrigeration system. Why and where does this system find itself particularly useful? [16]

7. For an air-conditioned space, the RSH and RLH are 25 kW and 5 kW respectively. The room condition is 25^0C DBT, 50% RH. The outdoor condition is 40^0C DBT, 50% RH. The ventilation requirement is such that on mass flow rate basis 20% of fresh air is introduced and 80% of supply air is recirculated. The bypass factor of the cooling coil is 0.15.
   (a) Determine enthalpy and humidity ratio of indoor and outdoor air then considering adiabatic mixing determine temperature, humidity ratio and enthalpy of air at inlet of cooling coil.
   (b) Let t_2 and W_2 be the conditions of air leaving the cooling coil. Set up three equations for the unknowns t_2, W_2 and t_{ADP}, one using ratio of RSH/RLH and two equations by definition of bypass factor. [16]

8. (a) Does the anti knock quality of a fuel have any effect on detonation in S.I.Engine? In what way it will effect?

   (b) Discuss briefly the various methods of knock rating of spark ignition fuel.[8+8]

$\star\star\star\star\star$

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING-I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours   Max Marks: 80
Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Discuss the fans with counter rotating guide vanes and derive the expressions for the pressure rise and degree of reaction. [16]

2. The fuel supplied to a Diesel engine has a gross calorific value of 44800 kJ/kg and contains 85.4% C and 12.3% H_2. The average temperature of the exhaust gases is 260^0C and their volumetric analysis gives CO_2 : 5.77%, CO : 0.12%, O_2 : 13.09%, N_2 (by difference) : 81.02 %. Find

   (a) the heat carried away by the exhaust expressed as percentage of the heat supplied and

   (b) the mass of air per kg of fuel in excess of that theoretically required for complete combustion. Take mean specific heat of the dry exhaust gases as 1 kJ/kg K and atmospheric temperature as 17^0C. Air contains 23% oxygen on mass basis. [16]

3. (a) Why is evaporator pressure kept above atmospheric in most refrigeration systems?

   (b) What is the advantage of using secondary refrigerants? What are the common secondary refrigerants?

   (c) Explain with a suitable diagram, the working of cascade refrigeration system. Why and where does this system find itself particularly useful? [16]

4. (a) Explain the combustion phenomenon in C.I.Engine and discuss the quantity of energy released in each stage.

   (b) Differentiate among air swirl, pre-combustion and air cell combustion chambers. [8+8]

5. An axial compressor stage has a mean diameter of 60 cm and runs at 15000 r.p.m. If the actual temperature rise and pressure ratio developed are 30^0C and 1.4 respectively, determine :

   (a) the power required to drive the compressor while delivering 57 kg/s of air; assume mechanical efficiency of 86.0% and an initial temperature of 35^0C,

   (b) the stage loading coefficient,

   (c) the stage efficiency, and

   (d) the degree of reaction if the temperature at the rotor exit is 55^0C. [16]

6. (a) What are different fuel injection systems for C.I engines? Explain any one.

(b) Sketch and explain the valve timing diagram for 4 stroke S.I engines.   [8+8]

7. (a) Does the anti knock quality of a fuel have any effect on detonation in S.I.Engine? In what way it will effect?

(b) Discuss briefly the various methods of knock rating of spark ignition fuel.[8+8]

8. For an air-conditioned space, the RSH and RLH are 25 kW and 5 kW respectively. The room condition is 25^0C DBT, 50% RH. The outdoor condition is 40^0C DBT, 50% RH. The ventilation requirement is such that on mass flow rate basis 20% of fresh air is introduced and 80% of supply air is recirculated. The bypass factor of the cooling coil is 0.15.

(a) Determine enthalpy and humidity ratio of indoor and outdoor air then considering adiabatic mixing determine temperature, humidity ratio and enthalpy of air at inlet of cooling coil.

(b) Let t_2 and W_2 be the conditions of air leaving the cooling coil. Set up three equations for the unknowns t_2, W_2 and t_{ADP}, one using ratio of RSH/RLH and two equations by definition of bypass factor.   [16]

★ ★ ★ ★ ★

4

Code No: R05220304   **R05**   **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING-I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours   Max Marks: 80
Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) What are different fuel injection systems for C.I engines? Explain any one.

   (b) Sketch and explain the valve timing diagram for 4 stroke S.I engines.   [8+8]

2. An axial compressor stage has a mean diameter of 60 cm and runs at 15000 r.p.m. If the actual temperature rise and pressure ratio developed are 30^0C and 1.4 respectively, determine :

   (a) the power required to drive the compressor while delivering 57 kg/s of air; assume mechanical efficiency of 86.0% and an initial temperature of 35^0C,

   (b) the stage loading coefficient,

   (c) the stage efficiency, and

   (d) the degree of reaction if the temperature at the rotor exit is 55^0C.   [16]

3. For an air-conditioned space, the RSH and RLH are 25 kW and 5 kW respectively. The room condition is 25^0C DBT, 50% RH. The outdoor condition is 40^0C DBT, 50% RH. The ventilation requirement is such that on mass flow rate basis 20% of fresh air is introduced and 80% of supply air is recirculated. The bypass factor of the cooling coil is 0.15.
   (a) Determine enthalpy and humidity ratio of indoor and outdoor air then considering adiabatic mixing determine temperature, humidity ratio and enthalpy of air at inlet of cooling coil.
   (b) Let t_2 and W_2 be the conditions of air leaving the cooling coil. Set up three equations for the unknowns t_2, W_2 and t_{ADP}, one using ratio of RSH/RLH and two equations by definition of bypass factor.   [16]

4. Discuss the fans with counter rotating guide vanes and derive the expressions for the pressure rise and degree of reaction.   [16]

5. (a) Does the anti knock quality of a fuel have any effect on detonation in S.I.Engine? In what way it will effect?

   (b) Discuss briefly the various methods of knock rating of spark ignition fuel.[8+8]

6. (a) Explain the combustion phenomenon in C.I.Engine and discuss the quantity of energy released in each stage.

(b) Differentiate among air swirl, pre-combustion and air cell combustion chambers. [8+8]

7. The fuel supplied to a Diesel engine has a gross calorific value of 44800 kJ/kg and contains 85.4% C and 12.3% H_2. The average temperature of the exhaust gases is 260^0C and their volumetric analysis gives CO_2 : 5.77%, CO : 0.12%, O_2 : 13.09%, N_2 (by difference) : 81.02 %. Find

(a) the heat carried away by the exhaust expressed as percentage of the heat supplied and

(b) the mass of air per kg of fuel in excess of that theoretically required for complete combustion. Take mean specific heat of the dry exhaust gases as 1 kJ/kg K and atmospheric temperature as 17^0C. Air contains 23% oxygen on mass basis. [16]

8. (a) Why is evaporator pressure kept above atmospheric in most refrigeration systems?

(b) What is the advantage of using secondary refrigerants? What are the common secondary refrigerants?

(c) Explain with a suitable diagram, the working of cascade refrigeration system. Why and where does this system find itself particularly useful? [16]

⋆ ⋆ ⋆ ⋆ ⋆

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING-I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours   Max Marks: 80
Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. Discuss the fans with counter rotating guide vanes and derive the expressions for the pressure rise and degree of reaction. [16]

2. (a) Does the anti knock quality of a fuel have any effect on detonation in S.I.Engine? In what way it will effect?

   (b) Discuss briefly the various methods of knock rating of spark ignition fuel.[8+8]

3. The fuel supplied to a Diesel engine has a gross calorific value of 44800 kJ/kg and contains 85.4% C and 12.3% H_2. The average temperature of the exhaust gases is 260^0C and their volumetric analysis gives CO_2 : 5.77%, CO : 0.12%, O_2 : 13.09%, N_2 (by difference) : 81.02 %. Find

   (a) the heat carried away by the exhaust expressed as percentage of the heat supplied and

   (b) the mass of air per kg of fuel in excess of that theoretically required for complete combustion. Take mean specific heat of the dry exhaust gases as 1 kJ/kg K and atmospheric temperature as 17^0C. Air contains 23% oxygen on mass basis. [16]

4. (a) Explain the combustion phenomenon in C.I.Engine and discuss the quantity of energy released in each stage.

   (b) Differentiate among air swirl, pre-combustion and air cell combustion chambers. [8+8]

5. For an air-conditioned space, the RSH and RLH are 25 kW and 5 kW respectively. The room condition is 25^0C DBT, 50% RH. The outdoor condition is 40^0C DBT, 50% RH. The ventilation requirement is such that on mass flow rate basis 20% of fresh air is introduced and 80% of supply air is recirculated. The bypass factor of the cooling coil is 0.15.
   (a) Determine enthalpy and humidity ratio of indoor and outdoor air then considering adiabatic mixing determine temperature, humidity ratio and enthalpy of air at inlet of cooling coil.
   (b) Let t_2 and W_2 be the conditions of air leaving the cooling coil. Set up three equations for the unknowns t_2, W_2 and t_{ADP}, one using ratio of RSH/RLH and two equations by definition of bypass factor. [16]

6. (a) Why is evaporator pressure kept above atmospheric in most refrigeration systems?

   (b) What is the advantage of using secondary refrigerants? What are the common secondary refrigerants?

   (c) Explain with a suitable diagram, the working of cascade refrigeration system. Why and where does this system find itself particularly useful? [16]

7. An axial compressor stage has a mean diameter of 60 cm and runs at 15000 r.p.m. If the actual temperature rise and pressure ratio developed are 30^0C and 1.4 respectively, determine :

   (a) the power required to drive the compressor while delivering 57 kg/s of air; assume mechanical efficiency of 86.0% and an initial temperature of 35^0C,

   (b) the stage loading coefficient,

   (c) the stage efficiency, and

   (d) the degree of reaction if the temperature at the rotor exit is 55^0C. [16]

8. (a) What are different fuel injection systems for C.I engines? Explain any one.

   (b) Sketch and explain the valve timing diagram for 4 stroke S.I engines. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆