Code No: RR211401 **RR** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS AND FLUID MECHANICS
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the governing equation for the adiabatic process. [8]
   (b) Explain Joules experiment in detail. [8]

2. (a) A pressure vessel has a volume of 1 m^3 and contains air at 1.4 MPa, 175^0 C. The air is cooled to 25^0C by heat transfer to the surroundings at 25^0C. Calculate the availability in the initial and final states and the irreversibility for the process. Assume for air Cp= 1.005 kJ/kg.K and R = 0.287kJ/kg.K. [8]
   (b) What is third law of thermodynamics? State its significance. [8]

3. (a) What is thermodynamic equilibrium? Explain the significance of it in quasi-static process? [2+2]
   (b) Identify the proper type of system in each case and explain the reason for your choice.
      i. Electric generator
      ii. Domestic tea kettle
      iii. Electric fan
      iv. A living human being. [4x3=12]

4. A Rankine cycle operates between a boiler pressure of 4 MPa, 300^0C and a condenser pressure of 50 kPa. Determine the thermal efficiency of the cycle, the work ratio and specific steam flow rate? [16]

5. (a) What is capillarity ? What are the reasons for its presence? [6]
   (b) The relative density of a fluid is 1.26 and its dynamic viscosity is 1.5 Pa-S Calculate its specific weight and kinematic viscosity. [10]

6. (a) What is the relation between velocity potential and stream function ? [8]
   (b) Find the equation of streamline passing through (1,1) if the velocity field is given by V = (3x)i + (3y)j. [8]

7. Ten grammes of water at 20^0C is converted to ice at -10^0C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2 J/g^{0}C and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0^0C to be 335J/g, calculate the total entropy change of the system. [16]

8. (a) Explain different methods of preventing the separation of boundary layer in detail. [8]

(b) Water is flowing over as thin smooth plate of length 4.5m and width 2.5m at a velocity of 0.9 m/sec. If the boundary layer flow changes from laminar to turbulent at a Reynolds number 5×10^5 find

i. The distance from leading edge up to which boundary layer is laminar

ii. Thickness of boundary layer at the transition point.

iii. The drag force on one side of the plate. Take viscosity of water as 0.01 poise. [8]

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Code No: RR211401 **RR** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS AND FLUID MECHANICS
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) A pressure vessel has a volume of 1 m^3 and contains air at 1.4 MPa, 175^0 C. The air is cooled to 25^0C by heat transfer to the surroundings at 25^0C. Calculate the availability in the initial and final states and the irreversibility for the process. Assume for air Cp= 1.005 kJ/kg.K and R = 0.287kJ/kg.K. [8]
   (b) What is third law of thermodynamics? State its significance. [8]
2. (a) Derive the governing equation for the adiabatic process. [8]
   (b) Explain Joules experiment in detail. [8]
3. Ten grammes of water at 20^0C is converted to ice at -10^0C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2 J/g^{0}C and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0^0C to be 335J/g, calculate the total entropy change of the system. [16]
4. (a) What is the relation between velocity potential and stream function ? [8]
   (b) Find the equation of streamline passing through (1,1) if the velocity field is given by V = (3x)i + (3y)j. [8]
5. (a) What is capillarity ? What are the reasons for its presence? [6]
   (b) The relative density of a fluid is 1.26 and its dynamic viscosity is 1.5 Pa-S. Calculate its specific weight and kinematic viscosity. [10]
6. (a) What is thermodynamic equilibrium? Explain the significance of it in quasi-static process? [2+2]
   (b) Identify the proper type of system in each case and explain the reason for your choice.
      i. Electric generator
      ii. Domestic tea kettle
      iii. Electric fan
      iv. A living human being. [4x3=12]
7. A Rankine cycle operates between a boiler pressure of 4 MPa, 300^0C and a condenser pressure of 50 kPa. Determine the thermal efficiency of the cycle, the work ratio and specific steam flow rate? [16]
8. (a) Explain different methods of preventing the separation of boundary layer in detail. [8]

(b) Water is flowing over as thin smooth plate of length 4.5m and width 2.5m at a velocity of 0.9 m/sec. If the boundary layer flow changes from laminar to turbulent at a Reynolds number 5×10^5 find

i. The distance from leading edge up to which boundary layer is laminar

ii. Thickness of boundary layer at the transition point.

iii. The drag force on one side of the plate. Take viscosity of water as 0.01 poise. [8]

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Code No: RR211401 **RR** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS AND FLUID MECHANICS
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A Rankine cycle operates between a boiler pressure of 4 MPa, 300^0C and a condenser pressure of 50 kPa. Determine the thermal efficiency of the cycle, the work ratio and specific steam flow rate? [16]

2. (a) What is the relation between velocity potential and stream function ? [8]
   (b) Find the equation of streamline passing through (1,1) if the velocity field is given by V = (3x)i + (3y)j. [8]

3. (a) Explain different methods of preventing the separation of boundary layer in detail. [8]
   (b) Water is flowing over as thin smooth plate of length 4.5m and width 2.5m at a velocity of 0.9 m/sec. If the boundary layer flow changes from laminar to turbulent at a Reynolds number 5×10^5 find
      i. The distance from leading edge up to which boundary layer is laminar
      ii. Thickness of boundary layer at the transition point.
      iii. The drag force on one side of the plate. Take viscosity of water as 0.01 poise. [8]

4. (a) What is capillarity ? What are the reasons for its presence? [6]
   (b) The relative density of a fluid is 1.26 and its dynamic viscosity is 1.5 Pa-S Calculate its specific weight and kinematic viscosity. [10]

5. (a) What is thermodynamic equilibrium? Explain the significance of it in quasi-static process? [2+2]
   (b) Identify the proper type of system in each case and explain the reason for your choice.
      i. Electric generator
      ii. Domestic tea kettle
      iii. Electric fan
      iv. A living human being. [4x3=12]

6. (a) Derive the governing equation for the adiabatic process. [8]
   (b) Explain Joules experiment in detail. [8]

7. Ten grammes of water at 20^0C is converted to ice at -10^0C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2 J/g^{0}C and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0^0C to be 335J/g, calculate the total entropy change of the system. [16]

8. (a) A pressure vessel has a volume of 1 m^3 and contains air at 1.4 MPa, 175^0 C. The air is cooled to 25^0C by heat transfer to the surroundings at 25^0C. Calculate the availability in the initial and final states and the irreversibility for the process. Assume for air Cp= 1.005 kJ/kg.K and R = 0.287kJ/kg.K. [8]

   (b) What is third law of thermodynamics? State its significance. [8]

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Code No: RR211401 **RR** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
THERMODYNAMICS AND FLUID MECHANICS
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is thermodynamic equilibrium? Explain the significance of it in quasi-static process? [2+2]
   (b) Identify the proper type of system in each case and explain the reason for your choice.
      i. Electric generator
      ii. Domestic tea kettle
      iii. Electric fan
      iv. A living human being. [4x3=12]
2. (a) Explain different methods of preventing the separation of boundary layer in detail. [8]
   (b) Water is flowing over as thin smooth plate of length 4.5m and width 2.5m at a velocity of 0.9 m/sec. If the boundary layer flow changes from laminar to turbulent at a Reynolds number 5×10^5 find
      i. The distance from leading edge up to which boundary layer is laminar
      ii. Thickness of boundary layer at the transition point.
      iii. The drag force on one side of the plate. Take viscosity of water as 0.01 poise. [8]
3. (a) Derive the governing equation for the adiabatic process. [8]
   (b) Explain Joules experiment in detail. [8]
4. (a) What is capillarity ? What are the reasons for its presence? [6]
   (b) The relative density of a fluid is 1.26 and its dynamic viscosity is 1.5 Pa-S Calculate its specific weight and kinematic viscosity. [10]
5. (a) A pressure vessel has a volume of 1 m^3 and contains air at 1.4 MPa, 175^0 C. The air is cooled to 25^0C by heat transfer to the surroundings at 25^0C. Calculate the availability in the initial and final states and the irreversibility for the process. Assume for air Cp= 1.005 kJ/kg.K and R = 0.287kJ/kg.K. [8]
   (b) What is third law of thermodynamics? State its significance. [8]
6. A Rankine cycle operates between a boiler pressure of 4 MPa, 300^0C and a condenser pressure of 50 kPa. Determine the thermal efficiency of the cycle, the work ratio and specific steam flow rate? [16]

7. (a) What is the relation between velocity potential and stream function ? [8]
   (b) Find the equation of streamline passing through (1,1) if the velocity field is given by V = (3x)i + (3y)j. [8]

8. Ten grammes of water at 20^0C is converted to ice at -10^0C at constant atmospheric pressure. Assuming the specific heat of liquid water to remain constant at 4.2 J/g^{0}C and that of ice to be half of this value, and taking the latent heat of fusion of ice at 0^0C to be 335J/g, calculate the total entropy change of the system. [16]

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