Code No: R05221402 **R05** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
FLUID MECHANICS AND HEAT TRANSFER
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) Explain the difference between monochromatic emissive power and the total emissive power of a black body.
   (b) Determine the heat lost by radiation per meter length of a 8 cm diameter pipe at 300^0C if it is
      i. located in a large room with red brick walls at a temperature of 27^0C and
      ii. enclosed in a 16 cm diameter red brick conduit at a temperature of 27^0C. Given emissivity of steel pipe as 0.79 and emissivity of brick conduit as 0.93. [6+10]

2. (a) Hydrostatic pressure of a fluid always acts normal to the surface with which it is in contact. Why? [8]
   (b) If the pressure at a point below the sea is 200 KN /m^2, what is the pressure 30m below this point? [8]

3. (a) What are different modes of heat transfer? Discuss the mechanism of conduction heat transfer in solids.
   (b) Identify the various modes of heat transfer in the following cases.
      i. Heat transfer from an auto radiator
      ii. Condensation of steam in condenser
      iii. Heat loss from a thermos flask
      iv. Protection of human body with warm clothing in winter. [8+8]

4. A pipe 50 mm dia is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. what loss of head and the corresponding power would be saved if the central 2m length of pipe was replaced by 75mm dia pipe, the change of section being sudden? Take f= 0.04 for the pipes of both diameter. Consider the minor losses also. [16]

5. (a) Explain the advantages of Dimensional Analysis.
   (b) Using dimensional analysis obtain an expression for frictional loss in pipes. [6+10]

6. (a) How will you find the drag on a flat plate due to laminar and turbulent boundary layers. [8]

(b) A smooth flat plate of length 5m and width 2m is moving with a velocity of 4 m/sec in stationary air of density as 1.25 kg/m^3 and kinematic viscosity 1.5× 10^{-5} m^2/sec. Determine thickness of boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning . [8]

7. (a) For the following flows , determine the rotation components about all the three axes. [9]

   i. u = xy^3z, v= -y^2z^2 and w = yz^2 - $y^3z^2/2$

   ii. u = 3xy , v= 1.5 x^2 - 1.5 y^2

   iii. u = y^2 , v = -3x

   (b) What are the different types of fluid flows ? Elaborate . [7]

8. (a) Derive an expression for effectiveness of a counter flow heat exchanger using NTU method.

   (b) Water (C_p = 4200 J/kg K) enters a counter flow double pipe heat exchanger at 39^0C at the rate of 273.6 kg/hr. It is heated by oil (C_p = 1880 J/kg-K) flowing at the rate of 547.2 kg/hr from an inlet temperature of 118^0C find the total heat transfer rate per m^2. Take U = 342 W/m^2-K.v. [8+8]

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Code No: R05221402 **R05** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
FLUID MECHANICS AND HEAT TRANSFER
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) How will you find the drag on a flat plate due to laminar and turbulent boundary layers. [8]
   (b) A smooth flat plate of length 5m and width 2m is moving with a velocity of 4 m/sec in stationary air of density as 1.25 kg/m^3 and kinematic viscosity 1.5$\times$ 10^{-5} m^2/sec. Determine thickness of boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning . [8]

2. (a) Explain the advantages of Dimensional Analysis.
   (b) Using dimensional analysis obtain an expression for frictional loss in pipes. [6+10]

3. (a) Hydrostatic pressure of a fluid always acts normal to the surface with which it is in contact. Why? [8]
   (b) If the pressure at a point below the sea is 200 KN /m^2, what is the pressure 30m below this point? [8]

4. (a) Explain the difference between monochromatic emissive power and the total emissive power of a black body.
   (b) Determine the heat lost by radiation per meter length of a 8 cm diameter pipe at 300^{0}C if it is
      i. located in a large room with red brick walls at a temperature of 27^{0}C and
      ii. enclosed in a 16 cm diameter red brick conduit at a temperature of 27^{0}C. Given emissivity of steel pipe as 0.79 and emissivity of brick conduit as 0.93. [6+10]

5. (a) Derive an expression for effectiveness of a counter flow heat exchanger using NTU method.
   (b) Water (C_p = 4200 J/kg K) enters a counter flow double pipe heat exchanger at 39^{0}C at the rate of 273.6 kg/hr. It is heated by oil (C_p = 1880 J/kg-K) flowing at the rate of 547.2 kg/hr from an inlet temperature of 118^{0}C find the total heat transfer rate per m^2. Take U = 342 W/m^2-K.v. [8+8]

6. (a) What are different modes of heat transfer? Discuss the mechanism of conduction heat transfer in solids.
   (b) Identify the various modes of heat transfer in the following cases.

i. Heat transfer from an auto radiator
ii. Condensation of steam in condenser
iii. Heat loss from a thermos flask
iv. Protection of human body with warm clothing in winter. [8+8]

7. (a) For the following flows , determine the rotation components about all the three axes. [9]
   i. u = xy^3z, v= $-y^2z^2$ and w = $yz^2 - y^3z^2/2$
   ii. u = 3xy , v= 1.5 x^2 - 1.5 y^2
   iii. u = y^2 , v = -3x
   (b) What are the different types of fluid flows ? Elaborate . [7]

8. A pipe 50 mm dia is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. what loss of head and the corresponding power would be saved if the central 2m length of pipe was replaced by 75mm dia pipe, the change of section being sudden? Take f= 0.04 for the pipes of both diameter. Consider the minor losses also. [16]

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Code No: R05221402 **R05** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
FLUID MECHANICS AND HEAT TRANSFER
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) Explain the advantages of Dimensional Analysis.
   (b) Using dimensional analysis obtain an expression for frictional loss in pipes. [6+10]

2. (a) For the following flows , determine the rotation components about all the three axes. [9]
      i. $u = xy^3z$, $v = -y^2z^2$ and $w = yz^2 - y^3z^2/2$
      ii. $u = 3xy$, $v = 1.5\ x^2 - 1.5\ y^2$
      iii. $u = y^2$, $v = -3x$
   (b) What are the different types of fluid flows ? Elaborate . [7]

3. (a) What are different modes of heat transfer? Discuss the mechanism of conduction heat transfer in solids.
   (b) Identify the various modes of heat transfer in the following cases.
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      ii. Condensation of steam in condenser
      iii. Heat loss from a thermos flask
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5. (a) How will you find the drag on a flat plate due to laminar and turbulent boundary layers. [8]
   (b) A smooth flat plate of length 5m and width 2m is moving with a velocity of 4 m/sec in stationary air of density as 1.25 kg/m^3 and kinematic viscosity 1.5×10^{-5} m^2/sec. Determine thickness of boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning . [8]

6. (a) Hydrostatic pressure of a fluid always acts normal to the surface with which it is in contact. Why? [8]
   (b) If the pressure at a point below the sea is 200 KN /m^2, what is the pressure 30m below this point? [8]

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   (b) Water (C_p = 4200 J/kg K) enters a counter flow double pipe heat exchanger at 39^0C at the rate of 273.6 kg/hr. It is heated by oil (C_p = 1880 J/kg-K) flowing at the rate of 547.2 kg/hr from an inlet temperature of 118^0C find the total heat transfer rate per m^2. Take U = 342 W/m^2-K.v. [8+8]

8. (a) Explain the difference between monochromatic emissive power and the total emissive power of a black body.

   (b) Determine the heat lost by radiation per meter length of a 8 cm diameter pipe at 300^0C if it is

      i. located in a large room with red brick walls at a temperature of 27^0C and

      ii. enclosed in a 16 cm diameter red brick conduit at a temperature of 27^0C. Given emissivity of steel pipe as 0.79 and emissivity of brick conduit as 0.93. [6+10]

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Code No: R05221402 **R05** **Set No. 3**

II B.Tech II Semester Examinations,December 2010
FLUID MECHANICS AND HEAT TRANSFER
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 are different modes of heat transfer? Discuss the mechanism of conduction heat transfer in solids.
   (b) Identify the various modes of heat transfer in the following cases.
      i. Heat transfer from an auto radiator
      ii. Condensation of steam in condenser
      iii. Heat loss from a thermos flask
      iv. Protection of human body with warm clothing in winter. [8+8]

2. (a) Explain the advantages of Dimensional Analysis.
   (b) Using dimensional analysis obtain an expression for frictional loss in pipes. [6+10]

3. (a) Hydrostatic pressure of a fluid always acts normal to the surface with which it is in contact. Why? [8]
   (b) If the pressure at a point below the sea is 200 KN /m^2, what is the pressure 30m below this point? [8]

4. (a) How will you find the drag on a flat plate due to laminar and turbulent boundary layers. [8]
   (b) A smooth flat plate of length 5m and width 2m is moving with a velocity of 4 m/sec in stationary air of density as 1.25 kg/m^3 and kinematic viscosity 1.5×10^{-5} m^2/sec. Determine thickness of boundary layer at the trailing edge of the smooth plate. Find the total drag on one side of the plate assuming that the boundary layer is turbulent from the very beginning . [8]

5. A pipe 50 mm dia is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. what loss of head and the corresponding power would be saved if the central 2m length of pipe was replaced by 75mm dia pipe, the change of section being sudden? Take f= 0.04 for the pipes of both diameter. Consider the minor losses also. [16]

6. (a) Derive an expression for effectiveness of a counter flow heat exchanger using NTU method.
   (b) Water (C_p = 4200 J/kg K) enters a counter flow double pipe heat exchanger at 39^0C at the rate of 273.6 kg/hr. It is heated by oil (C_p = 1880 J/kg-K) flowing at the rate of 547.2 kg/hr from an inlet temperature of 118^0C find the total heat transfer rate per m^2. Take U = 342 W/m^2-K.v. [8+8]

7. (a) For the following flows , determine the rotation components about all the three axes. [9]
   i. $u = xy^3z$, $v = -y^2z^2$ and $w = yz^2 - y^3z^2/2$
   ii. $u = 3xy$, $v = 1.5\ x^2 - 1.5\ y^2$
   iii. $u = y^2$, $v = -3x$

   (b) What are the different types of fluid flows ? Elaborate . [7]

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   i. located in a large room with red brick walls at a temperature of 27^0C and
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