Code No: RR320306 **RR** **Set No. 2**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER
Common to Mechanical Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the terms
    i. absorptivity
    ii. reflectivity and
    iii. transmissivity.
   (b) Differentiate between specular and diffuse reflections.
   (c) Derive Stefan-Boltzmann's law from Plank's law. [6+4+6]

2. Steam is condensed in a single pass condenser at a pressure of 0.5 bar. The condenser consists of 100 thin walled tubes of 2.5 cm nominal diameter and 2m length. The cooling water enters and leaves at a temperature of 10 ^{0}C and 50^{0}C with a mean velocity of 2 m/Sec. The condensing heat transfer coefficient is 5 KW/m^2-K. Find
   (a) Overall heat transfer coefficient for heat exchanger
   (b) Condensation rate of steam
   (c) Mean temperature of metal at the center of condenser length. [16]

3. (a) The surface of steel plate measuring 0.9m long x 0.6m wide x 0.025m thick is maintained at a uniform temperature of 300^{0}C, and the plate loses 250 watt by radiation. If air at 15^{0}C temperature and 20 w/m^2-deg convective heat transfer coefficient blows over the plate, calculate the temperature on inside surface of the plate. Take thermal conductivity of plate as 45w/m-deg.
   (b) Derive expressions for temperature distribution during steady sate heat conduction in a solid sphere with internal heat generation. [8+8]

4. (a) Distinguish between filmwise and dropwise condensation. Which of the two gives a higher heat transfer coefficient? Why?
   (b) Dry saturated steam at a pressure of 2.5 bar condenses on the surface of a vertical tube of height 1.5m. The tube surface temperature is 120^{0}C. Estimate the thickness of the condensate film and the local heat transfer coefficient at a distance of 0.3m from the upper end of the tube. [6+10]

5. A horizontal cylindrical heat exchanger of shell diameter 40 cm and surface temperature 200^{0}C is to be cooled by the ambient air at 30^{0}C, workout the convective coefficient and the rate of heat loss from unit surface area of the heat exchanger.[16]

   v = 16 x $10^{-6} m^2$/s ; k = 2.67 x 10^{-2}w/m-deg
   Pr = 0.701

6. (a) Define the overall heat transfer coefficient? Obtain the expression composite wall with three layer with convective conditions over the wall?

   (b) A wall consists of three layers of 0.2 m concreter, 0.08 m of fibre glass insulation and 0.015 m gypsum board (0.04 W/mK). The convective heat transfer coefficients at inside and outside surfaces are 15 and 45 W/m^2K respectively. The inside and outside surface temperatures are 25^0C and -10^0C respectively. Calculate the overall heat transfer coefficients for the wall and heat loss per unit area. [7+9]

7. (a) Sketch temperature and velocity profile of free convection of vertical wall.

   (b) Water at 20^0C was flowing over a plate of uniform heat flux of 9000 w/m^2. The flow velocity was 200 mm/s. The length of the plate was 1.3 m. Determine the temperature of the plate. [10+6]

8. (a) Derive the expression for temperature distribution with solid slab with heat generation of 'q' w/m^3. Both surface temperatures of the slab are T_w K and at the center is T_0 K.

   (b) A long cylinder rod of radius 50 cm with thermal conductivity of 10 W/mK contains radioactive material, which generates heat uniformly within the cylinder at rate of 3X10^5 W/m^3. The rod is cooled by convection from its cylindrical surface into the ambient air at $T_\alpha = 50^0$C with a heat transfer coefficient of 60 W/m^2K. Determine the temperature at the end center and at the outer surface of the cylindrical rod? [7+9]

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Code No: RR320306 **RR** **Set No. 4**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER
Common to Mechanical Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Distinguish between filmwise and dropwise condensation. Which of the two gives a higher heat transfer coefficient? Why?
   (b) Dry saturated steam at a pressure of 2.5 bar condenses on the surface of a vertical tube of height 1.5m. The tube surface temperature is 120^0C. Estimate the thickness of the condensate film and the local heat transfer coefficient at a distance of 0.3m from the upper end of the tube. [6+10]

2. A horizontal cylindrical heat exchanger of shell diameter 40 cm and surface temperature 200^0C is to be cooled by the ambient air at 30^0C, workout the convective coefficient and the rate of heat loss from unit surface area of the heat exchanger.[16]

   v = 16 x $10^{-6} m^2$/s ; k = 2.67 x 10^{-2}w/m-deg
   Pr = 0.701

3. (a) Sketch temperature and velocity profile of free convection of vertical wall.
   (b) Water at 20^0C was flowing over a plate of uniform heat flux of 9000 w/m^2. The flow velocity was 200 mm/s. The length of the plate was 1.3 m. Determine the temperature of the plate. [10+6]

4. (a) Define the overall heat transfer coefficient? Obtain the expression composite wall with three layer with convective conditions over the wall?
   (b) A wall consists of three layers of 0.2 m concreter, 0.08 m of fibre glass insulation and 0.015 m gypsum board (0.04 W/mK). The convective heat transfer coefficients at inside and outside surfaces are 15 and 45 W/m^2K respectively. The inside and outside surface temperatures are 25^0C and -10^0C respectively. Calculate the overall heat transfer coefficients for the wall and heat loss per unit area. [7+9]

5. (a) The surface of steel plate measuring 0.9m long x 0.6m wide x 0.025m thick is maintained at a uniform temperature of 300^0C, and the plate loses 250 watt by radiation. If air at 15^0C temperature and 20 w/m^2-deg convective heat transfer coefficient blows over the plate, calculate the temperature on inside surface of the plate. Take thermal conductivity of plate as 45w/m-deg.
   (b) Derive expressions for temperature distribution during steady sate heat conduction in a solid sphere with internal heat generation. [8+8]

6. (a) Derive the expression for temperature distribution with solid slab with heat generation of 'q' w/m^3 . Both surface temperatures of the slab are T_w K and at the center is T_0 K.

(b) A long cylinder rod of radius 50 cm with thermal conductivity of 10 W/mK contains radioactive material, which generates heat uniformly within the cylinder at rate of 3X10^5 W/m^3. The rod is cooled by convection from its cylindrical surface into the ambient air at $T_\alpha = 50^0$C with a heat transfer coefficient of 60 W/m^2K. Determine the temperature at the end center and at the outer surface of the cylindrical rod? [7+9]

7. Steam is condensed in a single pass condenser at a pressure of 0.5 bar. The condenser consists of 100 thin walled tubes of 2.5 cm nominal diameter and 2m length. The cooling water enters and leaves at a temperature of 10^0C and 50^0C with a mean velocity of 2 m/Sec. The condensing heat transfer coefficient is 5 KW/m^2-K. Find

   (a) Overall heat transfer coefficient for heat exchanger
   (b) Condensation rate of steam
   (c) Mean temperature of metal at the center of condenser length. [16]

8. (a) Define the terms
      i. absorptivity
      ii. reflectivity and
      iii. transmissivity.
   (b) Differentiate between specular and diffuse reflections.
   (c) Derive Stefan-Boltzmann's law from Plank's law. [6+4+6]

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Code No: RR320306 **RR** **Set No. 1**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER
Common to Mechanical Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the terms
   i. absorptivity
   ii. reflectivity and
   iii. transmissivity.

   (b) Differentiate between specular and diffuse reflections.

   (c) Derive Stefan-Boltzmann's law from Plank's law. [6+4+6]

2. (a) Define the overall heat transfer coefficient? Obtain the expression composite wall with three layer with convective conditions over the wall?

   (b) A wall consists of three layers of 0.2 m concreter, 0.08 m of fibre glass insulation and 0.015 m gypsum board (0.04 W/mK). The convective heat transfer coefficients at inside and outside surfaces are 15 and 45 W/m^2K respectively. The inside and outside surface temperatures are 25^0C and -10^0C respectively. Calculate the overall heat transfer coefficients for the wall and heat loss per unit area. [7+9]

3. (a) The surface of steel plate measuring 0.9m long x 0.6m wide x 0.025m thick is maintained at a uniform temperature of 300^0C, and the plate loses 250 watt by radiation. If air at 15^0C temperature and 20 w/m^2-deg convective heat transfer coefficient blows over the plate, calculate the temperature on inside surface of the plate. Take thermal conductivity of plate as 45w/m-deg.

   (b) Derive expressions for temperature distribution during steady sate heat conduction in a solid sphere with internal heat generation. [8+8]

4. (a) Derive the expression for temperature distribution with solid slab with heat generation of 'q' w/m^3. Both surface temperatures of the slab are T_w K and at the center is T_0 K.

   (b) A long cylinder rod of radius 50 cm with thermal conductivity of 10 W/mK contains radioactive material, which generates heat uniformly within the cylinder at rate of 3X10^5 W/m^3. The rod is cooled by convection from its cylindrical surface into the ambient air at $T_\alpha = 50^0$C with a heat transfer coefficient of 60 W/m^2K. Determine the temperature at the end center and at the outer surface of the cylindrical rod? [7+9]

5. (a) Distinguish between filmwise and dropwise condensation. Which of the two gives a higher heat transfer coefficient? Why?

(b) Dry saturated steam at a pressure of 2.5 bar condenses on the surface of a vertical tube of height 1.5m. The tube surface temperature is 120^0C. Estimate the thickness of the condensate film and the local heat transfer coefficient at a distance of 0.3m from the upper end of the tube. [6+10]

6. Steam is condensed in a single pass condenser at a pressure of 0.5 bar. The condenser consists of 100 thin walled tubes of 2.5 cm nominal diameter and 2m length. The cooling water enters and leaves at a temperature of 10^0C and 50^0C with a mean velocity of 2 m/Sec. The condensing heat transfer coefficient is 5 KW/m^2-K. Find

   (a) Overall heat transfer coefficient for heat exchanger
   (b) Condensation rate of steam
   (c) Mean temperature of metal at the center of condenser length. [16]

7. A horizontal cylindrical heat exchanger of shell diameter 40 cm and surface temperature 200^0C is to be cooled by the ambient air at 30^0C, workout the convective coefficient and the rate of heat loss from unit surface area of the heat exchanger.[16]

   v = 16 x $10^{-6} m^2$/s ; k = 2.67 x 10^{-2}w/m-deg
   Pr = 0.701

8. (a) Sketch temperature and velocity profile of free convection of vertical wall.
   (b) Water at 20^0C was flowing over a plate of uniform heat flux of 9000 w/m^2. The flow velocity was 200 mm/s. The length of the plate was 1.3 m. Determine the temperature of the plate. [10+6]

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Code No: RR320306 **RR** **Set No. 3**

III B.Tech II Semester Examinations,December 2010
HEAT TRANSFER
Common to Mechanical Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Steam is condensed in a single pass condenser at a pressure of 0.5 bar. The condenser consists of 100 thin walled tubes of 2.5 cm nominal diameter and 2m length. The cooling water enters and leaves at a temperature of 10^0C and 50^0C with a mean velocity of 2 m/Sec. The condensing heat transfer coefficient is 5 KW/m^2-K. Find
   (a) Overall heat transfer coefficient for heat exchanger
   (b) Condensation rate of steam
   (c) Mean temperature of metal at the center of condenser length. [16]

2. (a) The surface of steel plate measuring 0.9m long x 0.6m wide x 0.025m thick is maintained at a uniform temperature of 300^0C, and the plate loses 250 watt by radiation. If air at 15^0C temperature and 20 w/m^2-deg convective heat transfer coefficient blows over the plate, calculate the temperature on inside surface of the plate. Take thermal conductivity of plate as 45w/m-deg.
   (b) Derive expressions for temperature distribution during steady sate heat conduction in a solid sphere with internal heat generation. [8+8]

3. A horizontal cylindrical heat exchanger of shell diameter 40 cm and surface temperature 200^0C is to be cooled by the ambient air at 30^0C, workout the convective coefficient and the rate of heat loss from unit surface area of the heat exchanger.[16]

   v = 16 x $10^{-6}m^2$/s ; k = 2.67 x 10^{-2}w/m-deg
   Pr = 0.701

4. (a) Derive the expression for temperature distribution with solid slab with heat generation of 'q' w/m³. Both surface temperatures of the slab are T_wK and at the center is T_0 K.
   (b) A long cylinder rod of radius 50 cm with thermal conductivity of 10 W/mK contains radioactive material, which generates heat uniformly within the cylinder at rate of 3X10^5 W/m^3. The rod is cooled by convection from its cylindrical surface into the ambient air at $T_\alpha = 50^0$C with a heat transfer coefficient of 60 W/m^2K. Determine the temperature at the end center and at the outer surface of the cylindrical rod? [7+9]

5. (a) Define the terms
      i. absorptivity

ii. reflectivity and

iii. transmissivity.

(b) Differentiate between specular and diffuse reflections.

(c) Derive Stefan-Boltzmann's law from Plank's law. [6+4+6]

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(b) A wall consists of three layers of 0.2 m concreter, 0.08 m of fibre glass insulation and 0.015 m gypsum board (0.04 W/mK). The convective heat transfer coefficients at inside and outside surfaces are 15 and 45 W/m^2K respectively. The inside and outside surface temperatures are 25^0C and -10^0C respectively. Calculate the overall heat transfer coefficients for the wall and heat loss per unit area. [7+9]

7. (a) Distinguish between filmwise and dropwise condensation. Which of the two gives a higher heat transfer coefficient? Why?

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8. (a) Sketch temperature and velocity profile of free convection of vertical wall.

(b) Water at 20^0C was flowing over a plate of uniform heat flux of 9000 w/m^2. The flow velocity was 200 mm/s. The length of the plate was 1.3 m. Determine the temperature of the plate. [10+6]

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