Code No: 07A40302 **R07** **Set No. 2**

**II B.Tech II Semester Examinations,April/May 2012**
**FLUID MECHANICS AND HEAT TRANSFER**
**Mechatronics**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. A pipeline 16 km long supplies 40 million liters of water per day to city. The first 5km length of the pipe is of 1m diameter and the remaining part is 0.8 m diameter pipe. If the water to the city is to be supplied at a residual head of 15 m of water calculate the supply head at the inlet end. Neglect minor losses and take f=0.03 for the entire Pipe line. Skecth the hydraulic gradient for the pipe line. [16]

2. A composite wall is to be made of 1 cm stainless steel (k = 16.3 W/mK), 7.5 cm of cork board (k=0.04 W/mK) and 2 cm of plastic (k=2.25 W/mK). The outside surface of stainless steel is at $120^0$C and the temperatuare of the plastic surface is $15^0$C. Determine
   (a) the thermal resisance of each layer of material
   (b) the heat flux and
   (c) the temperature at each surface of cork board. [16]

3. (a) Define fluid surface tension property. What are its examples?
   (b) The velocity distribution in a viscous flow over plate is given by u = 4y-$y^2$ where u is velocity at distance y from the plate. If the coefficient of dynamic viscosity is 1.5 Pa.sec, determine the shear stress at y = 0 and at y = 2. [6+10]

4. (a) State and prove Bernoulli's theorem. Mention its limitations.
   (b) An oil of specific gravity 0.84 flows through a uniform diameter pipe at the rate of 375 lit/sec. The energy head losses are 25 m/Km length of the pipe. Find the slope of the hydraulic gradient and total energy lines and the power lost per km of pipe. [8+8]

5. (a) When a body is said to be black? What is the range of wave lengths it absorbs?
   (b) Compute the radiant energy loss from 1 cm diameter opening in a thin walled furnace located in a large enclosure, if the temperature with in the furnace is $900^0$C and the surroundings are at $20^0$C. [6+10]

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

7. (a) Obtain an expression for the overall heat transfer coefficient of a shell and tube exchanger taking into consideration scale formation on the inside surface and film coefficients on the inside and outside surface of the tube.

(b) A steam condenser works at a temperature of $60^0$C transferring 250 kW of energy. The cooling water enters the condenser at $20^0$C with a flow rate of 2kg/sec. find the logarithmic mean temperature difference. [8+8]

8. (a) Calculate the Reynolds number for the following data: D = 15 cm, V = 3m/sec; $\rho$ = 14.4 kg/m $^3$ and $\mu$ = 0.0372 kg/m-sec.

(b) Using dimensional analysis show that the ratio of heat transfer q from a body of linear dimension d, submerged in a fluid flowing at velocity $V_\alpha$ is given by:

$$\frac{q}{kd\Delta t} = C\left(\frac{k}{\rho C_p dV\alpha}\right)^n$$ [6+10]

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Code No: 07A40302 **R07** **Set No. 4**

**II B.Tech II Semester Examinations,April/May 2012**
**FLUID MECHANICS AND HEAT TRANSFER**
**Mechatronics**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

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1. (a) Define fluid surface tension property. What are its examples?
   (b) The velocity distribution in a viscous flow over plate is given by u = 4y-$y^2$ where u is velocity at distance y from the plate. If the coefficient of dynamic viscosity is 1.5 Pa.sec, determine the shear stress at y = 0 and at y = 2. [6+10]

2. (a) When a body is said to be black? What is the range of wave lengths it absorbs?
   (b) Compute the radiant energy loss from 1 cm diameter opening in a thin walled furnace located in a large enclosure, if the temperature with in the furnace is $900^0$C and the surroundings are at $20^0$C. [6+10]

3. (a) Calculate the Reynolds number for the following data: D = 15 cm, V = 3m/sec; $\rho = 14.4$kg/$m^3$ and $\mu = 0.0372$ kg/m-sec.
   (b) Using dimensional analysis show that the ratio of heat transfer q from a body of linear dimension d, submerged in a fluid flowing at velocity $V_\alpha$ is given by:

$$\frac{q}{kd\Delta t} = C\left(\frac{k}{\rho C_p dV\alpha}\right)^n$$ [6+10]

4. A pipeline 16 km long supplies 40 million liters of water per day to city. The first 5km length of the pipe is of 1m diameter and the remaining part is 0.8 m diameter pipe. If the water to the city is to be supplied at a residual head of 15 m of water calculate the supply head at the inlet end. Neglect minor losses and take f=0.03 for the entire Pipe line. Skecth the hydraulic gradient for the pipe line. [16]

5. A composite wall is to be made of 1 cm stainless steel (k = 16.3 W/mK), 7.5 cm of cork board (k=0.04 W/mK) and 2 cm of plastic (k=2.25 W/mK). The outside surface of stainless steel is at $120^0$C and the temperatuare of the plastic surface is $15^0$C. Determine
   (a) the thermal resisance of each layer of material
   (b) the heat flux and
   (c) the temperature at each surface of cork board. [16]

6. (a) Obtain an expression for the overall heat transfer coefficient of a shell and tube exchanger taking into consideration scale formation on the inside surface and film coefficients on the inside and outside surface of the tube.
   (b) A steam condenser works at a temperature of $60^0$C transferring 250 kW of energy. The cooling water enters the condenser at $20^0$C with a flow rate of 2kg/sec. find the logarithmic mean temperature difference. [8+8]

7. (a) State and prove Bernoulli's theorem. Mention its limitations.
   (b) An oil of specific gravity 0.84 flows through a uniform diameter pipe at the rate of 375 lit/sec. The energy head losses are 25 m/Km length of the pipe. Find the slope of the hydraulic gradient and total energy lines and the power lost per km of pipe. [8+8]

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

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Code No: 07A40302 **R07** **Set No. 1**

**II B.Tech II Semester Examinations,April/May 2012**
**FLUID MECHANICS AND HEAT TRANSFER**
**Mechatronics**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

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   (b) A steam condenser works at a temperature of $60^0$C transferring 250 kW of energy. The cooling water enters the condenser at $20^0$C with a flow rate of 2kg/sec. find the logarithmic mean temperature difference. [8+8]

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

3. A composite wall is to be made of 1 cm stainless steel (k = 16.3 W/mK), 7.5 cm of cork board (k=0.04 W/mK) and 2 cm of plastic (k=2.25 W/mK). The outside surface of stainless steel is at $120^0$C and the temperatuare of the plastic surface is $15^0$C. Determine
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   (c) the temperature at each surface of cork board. [16]

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   (b) Using dimensional analysis show that the ratio of heat transfer q from a body of linear dimension d, submerged in a fluid flowing at velocity $V_\alpha$ is given by:

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8. (a) State and prove Bernoulli's theorem. Mention its limitations.
   (b) An oil of specific gravity 0.84 flows through a uniform diameter pipe at the rate of 375 lit/sec. The energy head losses are 25 m/Km length of the pipe. Find the slope of the hydraulic gradient and total energy lines and the power lost per km of pipe. [8+8]

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Code No: 07A40302 **R07** **Set No. 3**

**II B.Tech II Semester Examinations,April/May 2012**
**FLUID MECHANICS AND HEAT TRANSFER**
**Mechatronics**

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

**Answer any FIVE Questions**
**All Questions carry equal marks**

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   (b) the heat flux and

   (c) the temperature at each surface of cork board. [16]

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