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1)   A long 8-cm-diameter steam pipe whose external surface temperature is 80°C passes through some open area that is not protected against the winds. Determine the rate of heat loss from the pipe per unit of its length when the air is at 1 atm pressure and 7°C and the wind is blowing across the pipe at a velocity of 20m/s.

 2)   A stainless steel ball (ρ=8055 kg/m3, Cp = 480 J/kg °C) of diameter D = 25 cm is removed from the oven at a uniform temperature of 350°C. The ball is then subjected to the flow of air at 1 atm pressure and 30°C with a velocity of 8 m/s. The surface temperature of the ball eventually drops to 250°C. Determine the average convection heat transfer coefficient during this cooling process and estimate how long this process has taken.

3)   Consider the flow of a fluid across a cylinder maintained at a constant temperature. Now the free-stream velocity of the fluid is doubled. Determine the change in the drag force on the cylinder and the rate of heat transfer between the fluid and the cylinder.

4) The components of an electronic system are located in a 1-m-long horizontal duct whose cross section is 10 cm*10 cm. The components in the duct are not allowed to come into direct contact with cooling air, and thus are cooled by air at 30°C flowing over the duct with a velocity of 4 m/s . If the surface temperature of the duct is not to exceed 70°C, determine the total power rating of the electronic devices that can be mounted into the duct.

- Please write on A4 papers.