Open Book, No Notes.   **Test Time: 45 minutes**

Question One: See Diagram
Steam enters a turbine at point one at a pressure of 3 MPa and 400 degrees C. The input volumetric flow rate is four cubic meters per second. At point two, 15% of the incoming mass flow rate of the steam is extracted at 600 kPa and 200 degrees C.
At point three 85% of the entry mass flow rate leaves the turbine at 20 kPa, quality of 0.90 and a velocity of 20 m/sec.
Determine volumetric flow rate in cubic meters per second and the diameter of the exit pipe at point three.

Question Two: See Diagram
The heat removed from this power plant goes from the condenser to a river eight meters deep by 60 meters wide. The river's velocity is 10 meters per minute. The pressure in the condenser is 15 kPa. Estimate the temperature rise of the river down stream due to the dumping of waste heat from this power plant.
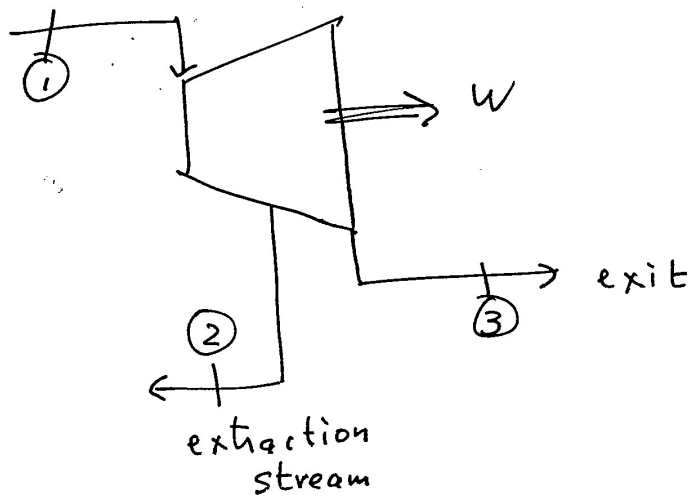
Diagram Problem I

W

exit

① ② ③

extraction
stream

Diagram Problem II

$T_H = 823 K$

$\dot{Q}_H$

1000 mW
electric

Q_L

T_L