60 Kg/s. The overall heat transfer coefficient is 480 W/m² °C. Calculate :

(a) The number of tubes required. The tubes arc to be of 25 mm outer diameter, 2 mm thickness and 4.85 m length.

(b) The number of tube passes. The velocity of the cooling water is not to exceed 2 m/s.

9. A condenser is to be designed to condense 225 kg of steam per 20 hr at a pressure of 0.15 bar. A square array of 400 tubes, each of 6mm in diameter, is available for the task. If the tube surface temperature is to be maintained at 26°C. make calculations for the length of each tube.

Roll No. .....

24356

B. Tech. (ME) 6th Semester (Reappear) Examination – October, 2020

HEAT TRANSFER

Paper : ME-306-F

Time : 1.45 Hours] ***[Maximum Marks : 100***

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt any ***three*** questions. All questions carry equal marks.

1. Explain the following :

(a) Explain the modes of Heat Flow.

(b) What do you mean by steady state heat conduction ?

(c) Classify the Heat Exchanger.

(d) What is Transit Heat Conduction ?

(e) What is types of Heat Flow ?

(f) Define thermal diffusivity and explain its physical significance.

(g) Fin effectiveness

(h) Stefan Boltzmans law

(i) Utility of extended surfaces

(j) Equation of Continuity

2. Drive the general heat conduction equation for Cartesian Co-ordinates.

3. A spherical vessel of 0.45m outside radius is insulated with 0.2m thickness of insulation of thermal conductivity 0.04W/m-deg. The surface temperature of the vessel is – 195°C and outside air is at 10°C. Determine :

(a) Heat Flow

(b) Heat flow per m^2 based on inside and outside area, and

(c) Temperature gradients at the inner and outside surface.

4. The handle of a saucepan, 30 cm long and 2 cm in diameter, is subjected to 100°C temperature during a certain cooking operation. The average unit surface

conductance over the handle surface is 7.35 W/m^2-deg in the kitchen air at 24°C. The cook is likely to grasp the last 10 cm of the handle and hence the temperature in this region should not exceed 38°C. What should be the thermal conductivity of the handle material to accomplish it ? The handle may be treated as a fin insulated at the tip.

5. An egg with mean diameter of 4 cm and initially at 25°C is placed in a boiling water pan for 4 minutes and found to be boiled to the consumer's taste. For how long should a similar egg for same consumer be boiled when taken from a refrigerator at 5°C ? Assume following property K=12W/Mk, $h=125W/m^2K$, specific heat C=2 KJ/kg K, Density= 1250 kg/m^3.

6. Derive a relation for laminar film condensation on a vertical plate.

7. Explain Stephan Boltzman law and also explain shape factor and their relationship.

8. A heat exchanger is to be designed to condense 8Kg/S of an organic liquid (t_{sat}= 80°C h_{fg} = 600 KJ/Kg) with cooling water available at 15°C and at a flow rate of