

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF MECHANICAL AND PRODUCTION ENGINEERING

Mid Semester Examination
Course No. MCE 6153
Course Title: Boiling and Condensation Heat Transfer

Summer Semester: A.Y. 2021-2022
Time : 1 Hour 30 Minutes
Full Marks : 75

There are 3 Questions. Answer all questions. The symbols have their usual Meanings. The right column indicates the marks allocated for each questions. Assume reasonable values for missing data.

- Q-01(a)** Discuss the Heat transfer mechanism in *nucleate boiling* with a diagram showing the various regions. 13
- Q-01(b)** Briefly describe the *Hydrodynamic Theory of Boiling and Critical Heat Flux* for *horizontal flat surface*. 12
- Q-02(a)** Briefly describe the various regimes of Flow boiling in a *vertical pipe* with a moderate *wall heat flux*. 13
- Q-02(b)** With a diagram, demonstrate Flow patterns and temperature variation in *subcooled flow boiling*. Draw the boiling curve at the vicinity of subcooled boiling region. 12
- Q-03(a)** Saturated air-free steam at temperature $T_i=75^{\circ}\text{C}$ ($P=38.58\text{ kPa}$) condenses on a 0.5 m by 0.5 m vertical plate maintained at a uniform temperature $T_w=45^{\circ}\text{C}$. Calculate the following. 13
- i. The average heat transfer coefficient, h_m for film condensation over the entire length of the plate.
 - ii. The total rate of condensation over the entire surface of the plate.
 - iii. The condensation thickness at the bottom of the plate.
- Q-03(b)** Saturated air-free steam at temperature $T_v=90^{\circ}\text{C}$ ($P=70.15\text{ kPa}$) condenses on a outer surface of a 2.5 cm OD, 6 m long vertical tube maintained at a uniform temperature $T_w=30^{\circ}\text{C}$. Calculate the following. 12
- i. The average heat transfer coefficient over the entire length of the tube.
 - ii. The total rate of condensation over the entire surface of the tube