MECM–104

M. E./M. Tech. (First Semester)

EXAMINATION, Dec., 2011

(Grading/Non-Grading System)

(Chemical Engg. Branch)

ADVANCED HEAT TRANSFER

(MECM – 104)

Time : Three Hours

Maximum Marks : $\begin{cases} GS: & 70 \\ NGS: & 100 \end{cases}$

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

1. (a) Derive the well posed heat conduction problem and discuss Dirichlet and Newman boundary condition.

   (b) Explain one-dimensional steady state heat conduction with heat source in cylindrical co-ordinates.

2. Explain dimensional analysis of transient heat convolution with electrical and mechanical analogies to the lumped thermal capacity problem.

3. A dozen approximately spherical apples, 10 cm in diameter are taken from a 30° environment and laid out on a rack in a refrigerator at 5°C. They have approximately the same physical properties as water, and it is approximately 6 W/m² °K as the result of natural convection. What will be

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the temperature of the centers of the apples after 1 hour ? How long will it take to bring the centers to 10°C. How much heat will the refrigerator have to carry away to get the centers to 10°C ?

4. Explain the momentum integral method for solving the boundary layer momentum equation and extend it to obtain integral expression of thermal boundary layer :

$$M_{ux} = 0\cdot36\ R_{ex}^{1/2}\ P_{r}^{1/3}$$

5. Explain film condensation : boundary layer analysis and turbulent flow analysis.

6. Describe radiant heat transfer between black bodies and discuss the physical interpretation of the view factor.