



ANJUMAN-I-ISLAM'S  
**KALSEKAR TECHNICAL CAMPUS, NEW PANVEL**

School of Engineering & Technology

**DEPARTMENT OF MECHANICAL ENGINEERING**

**CLASS:- T.E.M.E-I**

**SEM:- V**

**SUBJECT:- H.T**

**DATE:- 17/09/2016**

**DURATION:- 60 min.**

**MARKS:- 20**

**UNIT TEST-01**

**Q.01 Attempt any two: (08 Marks)**

1. Define thermal diffusivity and state its significance?
2. What is fin? What are the various types of fins?
3. What is Fourier (Fi) and Biot (Bi) Numbers? What is physical significance of these numbers?

**Q.02 Attempt any two: (12 Marks)**

1. A 15mm diameter mild steel sphere ( $k=42\text{W/m}^\circ\text{C}$ ) is exposed to cooling airflow at  $20^\circ\text{C}$  resulting in the convective coefficient  $h=120\text{W/m}^2\text{C}$ . Determine
  - (i) Time required to cool the sphere from  $550^\circ\text{C}$  to  $90^\circ\text{C}$ .
  - (ii) Instantaneous heat transfer rate 2 minutes after the start of coolingFor mild steel take:  $\rho=7850\text{kg/m}^3$ ,  $C=475\text{J/kg}^\circ\text{C}$ ,  $\alpha=0.045\text{m}^2/\text{h}$ .
2. A refrigerant suction line having outer diameter 30mm is required to be thermally insulated. The outside air film coefficient heat transfer is  $12\text{W/m}^2\text{K}$ . The thermal conductivity of insulation is  $0.3\text{W/mK}$ ,
  - (i) Determine whether the insulation will be effective,
  - (ii) Estimate the maximum value of thermal conductivity of insulation material to reduce heat transfer,
  - (iii) Determine the thickness of cork insulation to reduce the heat transfer to 22% if the thermal conductivity of cork is  $0.038\text{W/mK}$ .
3. Derive the relation for heat transfer through fin with Insulated tip (heat loss from the fin tip is considered negligible). State the assumption clearly.