ME 206
Instructor: Ramesh Singh
HW#2

Date assigned: 06.02.2021
Date due: 16.02.2021

1. Derive the equation of temperature rise under steady-state conditions for infinite line heat source. Determine the expression for maximum temperature rise and its location, can it be evaluated? A steel plate is welded using a high-power laser at a speed of 40 mm/s. The material has a thickness of 5 mm. Determine the power required for a weld bead of 2 mm and determine the extent of HAZ. The weld is formed all through the plate thickness. Assume density = 7870 kg/m^3; specific heat = 452 J/kg K; thermal conductivity = 0.073 W/mm K; melting temperature is 1538°C. Assume transformation temperature to be 850°C.

2. Starting from an instantaneous point heat source, derive the equation for estimating $\tau_{8/5}$ for thick welds.

3. Two 12 mm thick S 355 plates are submerged arc welded together with the following conditions: 25 V, 300 A, and an efficiency of 0.9. The ambient temperature is 25^{0}C. The allowable $\tau_{8/5}$ ranges between 8s to 40s. Find the optimal welding speed range to avoid a fully martensitic zone.

   $\rho = 7.8\times10^3$ Kg/m^3
   $C = 0.5\times10^3$ J/Kg K
   $k = 0.04\times10^3$ W/m K

4. If the weld thickness is increased to 25 mm, how will the speed range change? Explain the physical significance of your findings.

5. What are the advantages of friction welding processes over fusion welding process? Explain some key variants of friction welding.