INDIAN INSTITUTE OF TECHNOLOGY

ENERGY CONSERVATION AND WASTE HEAT RECOVERY (ME 60234)
WASTE HEAT RECOVERY (ME 60086)

Spring 2018: Class Test 2

Full marks: 20 | *Attempt all questions* | Time: 1 Hour

1. Consider a 30 cm long heat pipe with water having a rating of 20 W in horizontal orientation. The heat pipe is subsequently shortened to 20 cm and the water mixed with additives to reduce its viscosity by 20%. What is the power rating of the modified heat pipe? 3

2. A flywheel in the form of a circular disc is slowed down from 5000 rps to 2000 rps. The device weighs 20 kg and has a radius of 30 cm. Calculate the energy released. 3

3. A TEG is made of elements with the following properties $\alpha_{p,n}$ at 1250 K = 0.0012 V/K; ρ_p = 0.01 ohm-cm, ρ_n = 0.012 ohm-cm; Kp = 0.2 W/cm-K, Kn = 0.03 W/cm-K. Calculate the value of ZT_{max} at 1250 K. 4

4. Consider a Compressed Air Energy Storage Facility. Calculate air flow, compressed air temperature & storage volume for a 1500 MW-hr peaking unit charging for 7.5 hrs. Assume compressor inlet is at 1 bar, 20°C, compressor exit at 100 bar, compressor and peaking turbine efficiencies to be 70% and 60% respectively. Make and state necessary assumptions, if required (C_p *for air = 1.05 kJ/kg-K; R = 0.28475 kJ/kg*). 4+3+3 = 10