

5. i) A reversible heat engine interacts with three thermal reservoirs at 750K, 650K and 550K respectively. The engine absorbs 2400kJ/min of energy as heat from the reservoir at 750K and does 400kJ/min of net work. Determine the magnitude and direction of heat interactions of the engine with other two reservoirs. (4)
- ii) A reversible engine operates between a source at 1200K and two sinks, one at 400K and another at 300K. The heat rejected at both the sinks is same. Determine the thermal efficiency of the engine. (4)

SECTION-C

6. An ideal Diesel cycle using air as the working fluid has a compression ratio of 16 and a cutoff ratio of 2. The intake conditions are 100 kPa, 20°C, and 2000cm³. Using the cold air standard assumptions; determine

- i) the T and P at the end of each process
 ii) the net work output
 iii) thermal efficiency
 iv) the mean effective pressure

(4×2)

7. In order to check the validity of the second law, m_1 kg of water at temperature T_1 is isobarically mixed with m_2 kg of water at temperature T_2 ($T_1 > T_2$). Determine the change in the entropy of the universe and find an expression for the same for equal mass of water. Also prove that the change is necessarily positive. (8)

8. i) Locate the centroid of a T -section 10 cm x 10 cm x 2 cm. (4)

- ii) Find the mass moment of inertia of circular ring of radius R and mass M . (4)

9. i) Give a neat sketch of the theoretical and actual pV diagrams for a four stroke Petrol engine. Describe briefly the factors which account for deviations between these plots. (4)

- ii) What is cast iron? What are its uses? What is the effect of carbon, silicon, sulphur and phosphorus on its properties? (4)