PART-B

1. Given the compression ratio rrr and the heat capacities CPC_PCP and CVC_VCV, derive the thermal efficiency of the Otto cycle. Given specific values for rrr, CPC_PCP, and CVC_VCV, calculate the thermal efficiency.
2. For an Otto engine operating at a compression ratio of 8 and with air-standard assumptions, calculate the work output per cycle if the maximum and minimum temperatures are 1500 K and 300 K, respectively.
3. Derive the expression for the thermal efficiency of the Brayton cycle in terms of the pressure ratio rpr_prp and the heat capacity ratio γ\gammaγ. Calculate the efficiency for a gas turbine operating with a pressure ratio of 8 and γ=1.4\gamma = 1.4γ=1.4.
4. Given the temperatures of the heat source (THT_HTH) and heat sink (TCT_CTC), calculate the thermal efficiency of the Carnot vapor cycle. For example, calculate the efficiency if TH=500 KT_H = 500 \, \text{K}TH=500K and TC=300 KT_C = 300 \, \text{K}TC=300K.
5. For a Rankine cycle operating with water as the working fluid, derive the efficiency when the boiler pressure is increased. Use steam tables to determine the enthalpies at different pressures and calculate the cycle efficiency for a boiler pressure of 5 MPa and a condenser pressure of 10 kPa.
6. Analyze the effect of increasing the reheat temperature on the efficiency of the Reheat Rankine cycle. Calculate the cycle efficiency for reheat temperatures of 400°C and 500°C, keeping the boiler pressure and condenser pressure constant.