Individual assignment No 6

1. An ideal Otto cycle has a compression ratio of (8+N/10). At the beginning of the compression process, air is at (100+N) kPa and (5+N)°C, and (800+N) kJ/kg of heat is transferred to air during the constant-volume heat-addition process. Neglecting the variation of specific heat of air with temperature, determine (a) the maximum temperature and pressure that occur during the cycle, (b) the net work output, (c) the thermal efficiency, and (d) the mean effective pressure for cycle.

2. The compression ratio of an air-standard Otto cycle is (10+N/10). Prior to the isentropic compression process, the air is at (100+N) kPa, (10+N) °C, and (600+N) cm^3. The temperature at the end of the isentropic expansion process is (800+5·N) K. Using specific heat values at room temperature, determine (a) the highest temperature and pressure in the cycle; (b) the amount of heat transferred in, in kJ; (c) the thermal efficiency; and (d) the mean effective pressure.

3. A gas-turbine power plant operating on an ideal Brayton cycle has a pressure ratio of N. The gas temperature and pressure are (250+2*N) K and (100+N) kPa at the compressor inlet and (1300+10*N) K at the turbine inlet. Utilizing the air-standard assumptions, determine (a) the gas temperature at the outlets of the compressor and the turbine, (b) the back work ratio (turbine work to compressor work ratio), and (c) the thermal efficiency.

4. A large stationary Brayton cycle gas-turbine power plant delivers a power output of (100+10*N) MW to an electric generator. The minimum temperature in the cycle is (300+N) K, and the maximum temperature is (1500+10*N) K. The minimum pressure in the cycle is 100 kPa, and the compressor pressure ratio is 20 to 1. Calculate the power output of the turbine if relative efficiency of turbine and compressor is (0,9-N/20). What fraction of the turbine output is required to drive the compressor? What is the thermal efficiency of the cycle?