	Mechanical Engineering Department **T Sheet-I** **Subject : Applied Thermodynamics-I** **Topic: Vapour Power Cycles** **Due date of Submission: 6th May 2020**
Q.1	(a) Steam is supplied, dry saturated at 40 bar to a turbine and the condenser pressure is 0.035 bar. If the plant operates on the Rankine cycle, calculate, per kilogram of steam: (i) the work output neglecting the feed-pump work; (ii) the work required for the feed pump; (iii) the heat transferred to the condenser cooling water, and the amount of cooling water required through the condenser if the temperature rise of the water is assumed to be 5.5 K; (iv) the heat supplied; (v) the Rankine efficiency; (vi) the specific steam consumption. (b) For the same steam conditions calculate the efficiency and the specific steam consumption for a Carnot cycle operating with wet steam. (986 kJ; 4 kJ; 1703 kJ; 74 kg; 2685 kJ; 36.6%; 3.67 kg/kW h; 42.7%; 4.92 kg/kW h)
Q.2	**Repeat the above problem for a steam supply condition of 40 bar and 350°C and the same condenser pressure of 0.035 bar.** (1125 kJ; 4 kJ; 1857 kJ; 80.7 kg; 2978 kJ; 37.6%; 3.21 kg/kW h)
Q.3	Steam is supplied to a two-stage turbine at 40 bar and 350 °C. It expands in the first turbine until it is just dry saturated, then it is re-heated to 350 °C and expanded through the second-stage turbine. The condenser pressure is 0.035 bar. Calculate the work output and the heat supplied per kilogram of steam for the plant, assuming ideal processes and neglecting the feed-pump term. Calculate also the specific steam consumption and the cycle efficiency. (1290 kJ; 3362 kJ; 2.79 kg/kW h; 38.4%)
Q.4	A steam turbine is to operate on a simple regenerative cycle. Steam is supplied dry saturated at 40 bar, and is exhausted to a condenser at 0.07 bar. The condensate is pumped to a pressure of 3.5 bar at which it is mixed with bleed steam from the turbine at 3.5 bar. The resulting water which is at saturation temperature is then pumped to the boiler. For the ideal cycle calculate, neglecting feed-pump work, (i) the amount of bleed steam required per kilogram of supply steam; (ii) the cycle efficiency of the plant; (iii) the specific steam consumption. (0.1906; 37%; 4.39 kg/kW h)

Q.5	Steam is supplied to a two-stage turbine at 40 bar and 500 °C. In the first stage the steam expands isentropically to 3.0 bar at which pressure 2500 kg/h of steam is extracted for process work. The remainder is reheated to 500 °C and then expanded isentropically to 0.06 bar. The by-product power from the plant is required to be 6000 kW. Calculate the amount of steam required from the boiler, and the heat supplied. Neglect feed-pump terms, and assume that the process condensate returns at the saturation temperature to mix adiabatically with the condensate from the condenser. (14 950 kg/h; 15 880 kW)
Q.6	In a regenerative steam cycle employing three closed feed heaters the steam is supplied to the turbine at 42 bar and 500 °C and is exhausted to the condenser at 0.035 bar. The bleed steam for feed heating is taken at pressures of 15, 4, and 0.5 bar. Assuming ideal processes and neglecting pump work, calculate: (i) the fraction of the boiler steam bled at each stage; (ii) the power output of the plant per unit mass flow rate of boiler steam; (iii) the cycle efficiency. (0.0952, 0.0969, 0.0902; 1133.6 kW per kg/s; 43.6%)
Q.7	**Explain a) isentropic efficiency .b) work ratio c) feed water heater**