PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

SUMMER TERM / MAKE UP END TERM EXAMINATION

Semester: Summer Term 2019 | **Date**: 23 July 2019

Course Code: ME A 201 | **Time**: 3 Hours

Course Name: Applied Thermodynamics | **Max Marks**: 100

Program & Sem:B.Tech & III Sem (2015 Batch) | **Weightage**: 50%

Instructions:

i. *Read the question properly and answer accordingly.*

ii. *Question paper consists of 3 parts*

iii. *Scientific and Non-programmable calculators are permitted.*

Part A

Answer **all** the Questions. **Each** question carries **five** marks. (6Q×5M=30M)

1. Draw the PV curve of dual cycle and write the various processes. Also write the expression for thermal efficiency of the same.
2. Define 1 TR. Write the value of 1 TR in KJ/min and Kcal/min.
3. Draw the TS curve of a Reversed Carnot Cycle and write the various processes.
4. Show that $(COP)_{HP} = (COP)_R + 1$.
5. Write any five desirable properties of a refrigerant.
6. Draw the psychrometric chart and show the DBT, Specific humidity, RH and Enthalpy lines in it.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks. (4Qx10M =40M)

7. Explain VARS with a neat diagram.
8. Define Dry Bulb temperature, Wet Bulb temperature, specific humidity, relative humidity and dew point temperature.
9. Show the effect on thermal efficiency and quality of steam with the help of T-S curve for the following variation in parameters-
   (a) Increase in Boiler pressure.
   (b) Decrease in Condenser pressure.
   (c) Superheating the steam
   (d) Reheating the steam

10. Draw the T-S curve and block diagram for reheating in a rankine cycle. Also write the expression for Q_s and W_{net}.

Part C

Answer **all** the Questions. **Each** question carries **fifteen** marks. (2Qx15M =30M)

11. Consider a steam power plant operating on the ideal reheat Rankine cycle. Steam enters the high-pressure turbine at 15 MPa and 600^{0}C and is condensed in the condenser at a pressure of 10 kPa. If the moisture content of the steam at the exit of the low-pressure turbine is not to exceed 10.4 %. Draw the T-S curve and determine:-
    (a) Quality of steam leaving the turbine
    (b) Enthalpy of steam at turbine exit
    (c) Reheater pressure
    (d) Pump Work
    (e) Heat Supplied
    (f) Heat Rejected
    (g) Thermal Efficiency

12. Refrigerant 134a is the working fluid in an ideal vapor-compression refrigeration cycle that communicates thermally with a cold region at 0°C and a warm region at 26°C. Saturated vapor enters the compressor at 0°C and saturated liquid leaves the condenser at 26°C. The mass flow rate of the refrigerant is 0.08 kg/s. Determine (a) the compressor power, in kW, (b) the refrigeration capacity, in tons, (c) the coefficient of performance. Now, let the isentropic efficiency of the compressor be 80%, condenser temperature be 30^{0}C and evaporator temperature be -10^{0}C. Then, determine (d) the compressor power, in kW, (e) the refrigeration capacity, in tons, (f) the coefficient of performance.

Use following data for saturated refrigerant R134a :

At T=0^{0}C, h_g = 247.23 KJ/Kg, s_g = 0.9190KJ/KgK

At T= -10^{0}C, h_g=241.35KJ/Kg, s_g = 0.9253KJ/KgK

At T= 26^{0}C, h_f = 85.75 KJ/kg and at T= 30^{0}C, h_f = 91.49 KJ/kg

Use following data for superheated refrigerant R134a :-

At T= 26^{0}C, P_{sat} = 6.85 bar and at T= 30^{0}c , P_{sat} = 9 bar

At P_{sat} = 6.85 bar, s = 0.9190 KJ/KgK, h = 264.7 KJ/Kg

At P_{sat} = 9 bar, s =0.9253 KJ/KgK, h= 272.39 KJ/Kg

Use following data for steam :

At P= 10 KPa, s_f = 0.6492 KJ/KgK, s_{fg} =7.4996 KJ/KgK, h_f = 191.81, h_{fg} = 2392.1, v_f = 0.00101 m3/kg

At T= 600^{0}C and s = 7.3688 KJ/Kgk, P_{sat} = 4 MPa, h= 3674.9 KJ/Kg

At P= 15 MPa and T = 600^{0}C, h= 3583.1 KJ/Kg, s= 6.6796 KJ/KgK

At P= 15 MPa and s = 6.6796 KJ/KgK, h= 3155 KJ/Kg