I D NO.	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 40 % Max Marks: 80 Max Time: 2 hrs. 7 May 2018, Monday

ENDTERM FINAL EXAMINATION MAY 2018

Even Semester 2017-18 Course: **MEC 208 Applied Thermodynamics** IV Sem. Mechanical

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Instructions:

(i) *Read the question properly and answer accordingly.*
(ii) *Question paper consists of 3 parts.*
(iii) Scientific and Non-programmable calculators are permitted
(iv) *Write answers pointwise.*
(v) ***Use of Refrigeration chart / table and steam chart / table is permitted.***

Part A

(5 Q x 6 M = 30 Marks)

1. Define the following terms:
   a. Specific humidity
   b. Dry bulb temperature
   c. Degree of saturation
2. What is Convergent – Divergent nozzle? How does flow take place in Convergent – Divergent nozzle?
3. How does pressure and velocity change in Impulse turbine? Show pressure and velocity distribution for Impulse turbine.
4. Give classification of an air compressor. Mention minimum four applications of an air compressor.
5. Show isentropic, polytropic and isothermal processes of an air compressor on T-s diagram. What is the effect of clearance volume on volumetric efficiency?

Part B

(2 Q x 15 M = 30 Marks)

6. Dry saturated steam at 10 bar is expanded isentropically in a nozzle to 0.1 bar. Using steam table only, find the dryness fraction of the steam at exit. Also find the velocity of steam leaving the nozzle when
   a. Initial velocity is negligible.
   b. Initial velocity of the steam is 135 m/s.
   c. 15% of the heat drop is lost in friction with negligible velocity.

7. 0.004 kg of water vapour per kg of atmospheric air is removed and temperature of air after removing the water vapour becomes 20^{o}C. Assume that initial conditions of atmospheric air is 30^{o}C, relative humidity is 55% and pressure is 1.0132 bar. Determine (a) the relative humidity, and (b) the dew point temperature of final condition by analytical method and by Psychrometric chart individually.

Part C

(1 Q x 20 M = 20 Marks)

8. A single-cylinder, single-acting air compressor of 200 mm bore by 250 mm stroke is constructed so that its clearance can be altered by moving the cylinder head, the stroke being unaffected.

   Data: Clearance volume is set at 700 cm^3; rotational speed, 300 rev/min; delivery pressure, 5 bar; suction pressure and temperature, 1 bar; and 32^{o}C; free air conditions, 1.013 bar and 15^{o}C; index of compression and re-expansion, 1.25; mechanical efficiency, 80%.

   a. Using the data above, calculate:
      i. The free air delivery (FAD).
      ii. The power required from the drive motor.

   b. To what minimum value can the clearance volume be reduced when the delivery pressure is 4.2 bar, assuming that the same driving power is available and that the suction conditions, speed, value of index, and mechanical efficiency, remain unaltered?

ID NO:	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20% Max Marks: 40 Max Time: 1 hr. 27 March Tuesday 2018

TEST – 2 **SET B**

Even Semester 2017-18 Course: **MEC 208 Applied Thermodynamics** IV Sem. Mechanical

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Instruction:

(i) *Read the question properly and answer accordingly.*
(ii) *Question paper consists of 3 parts.*
(iii) Scientific and Non-programmable calculators are permitted.
(iv) Refrigeration tables & charts are permitted.

Part A

(4 Q x 3 M = 12 Marks)

1. Show the processes of Brayton cycle with two-stage compression and two stage expansion including intercooling and reheating respectively using "schematic block diagram and T-s diagram".
2. Write any three advantages and disadvantages of gas turbine plant.
3. What is the physical significance of sub-cooling and superheating in vapour compression refrigeration system?
4. What is the function of expansion valve in refrigeration system?

Part B

(1 Q x 14 M = 14 Marks)

5. A gas turbine unit takes in air at 17^{o}C, 1.01 bar and pressure ratio is 8. The HP turbine drives the compressor and the LP turbine drives a separate power shaft. Calculate the pressure and the temperature of the gases entering the power turbine, the net power developed by the unit, the cycle efficiency, and the back work ratio. The maximum cycle temperature is 650^{o}C. Take C_p = 1005 J/kgK and γ=1.4 for compression process and C_p = 1150 J/kgK and γ=1.33 for expansion process.

Part C

(1Q x 14 M = 14 Marks)

6. Consider, a Coca Cola is stored at 5^{o}C in a chilling plant. To produce this chilled temperature, an R-12 refrigerant is used in the vapour compression cycle. The refrigerant is rejecting heat in the condenser at a temperature of 60^{o}C and leaving the condenser at the saturated liquid condition. After evaporator, it entering the compressor at saturated vapour. Determine (a) work required to run the compressor in kJ/kg, (b) cooling capacity of the evaporator in tonnes, if mass flow rate of the refrigerant is 0.4 kg/s, (c) heat rejected by the condenser in kW (d) COP of the system, (e) Carnot COP (f) Relative COP. Also, draw the p-h diagram for the given configuration. Take C_p (vapour) = 0.615 kJ/kg^{0}K.

ID NO:	

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20 % Max Marks: 40 Max Time: 1 hr. 22 Feb Thursday 2018

TEST – 1

Even Semester 2017-18 Course: **MEC 208 Applied Thermodynamics** IV Sem. Mechanical

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Instruction:

(i) *Read the question properly and answer accordingly.*
(ii) *Question paper consists of 3 parts.*
(iii) Scientific and Non-programmable calculators are permitted.
(iv) Steam tables are permitted.

Part A

(3 Q x 4 M = 12 Marks)

1. Show the different processes of Dual Combustion cycle in P-v and T-s diagrams.
2. Write advantages of reheat and regeneration Rankine cycle.
3. Give answer of the followings in one/two sentence.
   a.) Why is the Carnot cycle not suitable as an ideal cycle for all power-producing cyclic devices?
   b.) As a car gets older, will its compression ratio change?. How about the mean effective pressure?

Part B

(2 Q x 8 M = 16 Marks)

4. An ideal Otto cycle has a compression ratio of 8. At the beginning of the compression process, the air is at 100 kPa and 17ºC and 800 kJ/kg of heat is transferred to the air during the constant volume heat addition process. Determine (a) the maximum temperature and pressure that occur during the cycle (b) the net-work output (c) air standard efficiency.
5. An ideal Diesel cycle with air as a working fluid has a compression ratio of 18 and a cut-off ratio of 2. At the beginning of compression, the air is at 100 kPa, 27ºC and 1917 cm^3. Determine (a) the pressure and temperature of air at each point, (b) the net work, and (c) the thermal efficiency.

Part C

(1Q x 12 M = 12 Marks)

6. Steam is supplied to a two stage Turbine at 40 bar and 350^0C. It expands in the first turbine until it is just dry saturated, then it is reheated to 350^0C and expanded through the second stage turbine. The condenser is at 0.035 bar. Calculate the work output and the heat supplied per kg of steam for the plant, assuming ideal process and neglecting the feed pump. Also, calculate the specific steam consumption and the cycle efficiency.