Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, July 2020

Programme: B.Tech	**Semester : VI**
Course Name: Automotive HVAC	**Max. Marks : 100**
Course Code: MEAD3009	**No. of page/s: 07**

Instructions:

Read the instruction carefully before attempting.

1. This question paper has two section, Section A and Section B.
2. There are total of six questions in this question paper. One in Section A and five in Section B
3. **Section A** consist of multiple choice based questions and has the total weightage of 25%.
4. **Section A** will be conducted online on BB Collaborate platform
5. **Section B** consist of long answer based questions and has the total weightage of 75%. The questions for section B shall also appear in BB Collaborate
6. The maximum time allocated to **Section A** is one Hrs.
7. **Section B** to be submitted within 24 hrs from the scheduled time (*exceptional provision due extraordinary circumstance due to COVID-19 and due to internet connectivity issues in the far-flung areas*).
8. No submission of **Section B** shall be entertained after 24 Hrs.
9. **Section B** should be attempted after **Section A**
10. **The section B** should be attempted in blank white sheets (hand written) with all the details like programme, semester, course name, course code, name of the student, Sapid at the top (as in the format) and signature at the bottom (right hand side bottom corner)
11. Both section A & B should have questions from entire syllabus.
12. The COs mapping, internal choices within a section is same as earlier.

SECTION B

Q2	A refrigeration system of 10.5 tones capacity at an evaporator temperature of -12^0 C and condenser temperature of 27^0 C is needed in a food locker. The liquid refrigerant ammonia is sub-cool by 6^0 C before entering the expansion valve. The wet vapor leaves the evaporator coil. The compression is isentropic. **(Note- Assume dryness fraction of ammonia vapor at the inlet of the compressor as 42+last two digits of you roll number. Example if your roll number is R160217035.The dryness fraction is 42+35=77 %.)** Determine 1. Condition of vapor at outlet of Compressor. 2. Condition of vapor at entrance to the evaporator.	**15**	**CO1**

<table>
<tr><td></td><td>3. C.O.P
4. Power required in KW.
Take following properties of ammonia.

C_{pv}= 2.8 KJ/kg. K, C_{pL}=4.6 KJ/Kg. K

<table>
<tr><td rowspan="2">Temperature (^{0}C)</td><td colspan="2">Enthalpy(KJ/kg)</td><td colspan="2">Entropy (KJ/Kg. K)</td></tr>
<tr><td>Liquid</td><td>Vapor</td><td>Liquid</td><td>Vapor</td></tr>
<tr><td>-12</td><td>126.16</td><td>1430.54</td><td>0.596</td><td>5.5055</td></tr>
<tr><td>27</td><td>308.63</td><td>1467.22</td><td>1.15</td><td>5.0170</td></tr>
</table>
</td><td></td><td></td></tr>
<tr><td>Q3</td><td>In the hot summer, the dry bulb temperature of air is 45^0 C and barometric pressure is 756 mm of Hg. (<u>Assume suitable value of Wet bulb temperature of air.</u>)

Determine the following properties of air without using Psychrometric Chart

a) Partial Pressure of Water Vapor.
b) Relative Humidity.
c) Dew Point Temperature’
d) Specific Enthalpy
e) Vapor Density.</td><td>15</td><td>CO3</td></tr>
<tr><td>Q4</td><td>The class room design conditions are 22^0 C and 60% relative humidity under the following conditions. (Note-Assume the seating capacity of class room as 50+last two digits of your roll number. Example if your roll number is R160217011. Then seating capacity is 50+11=61)

Outside Condition = 35^{0}C DBT, 25^{0}C WBT. Sensible heat load per student = 8 KW, Latent Heat load per student = 10 KW. Total Infiltration air= 1000 m^3/h, ADP= 12^{0}C, Quantity of recirculated air from room= 60%. If the quantity of recirculated air is mixed with the conditioned air after the cooling coil. Find the following

1. The condition of air leaving the conditioner coil and before mixing with the recirculated sir.
2. The condition of air before entering the room
3. The mass of air entering the cooler
4. The by-pass factor of the cooling coil.
5. The refrigeration load on the cooling coil in TR.</td><td>15</td><td>CO4</td></tr>
</table>

Q5	A rectangular duct made of sheet metal is used to carry 200 m^3/min of air having density of 1.2 kg/m^3 **(Note- Assume the rectangular duct cross-section in cm i.e. Length and Width as Length is equal to last two digits of your roll number and width is half of Length. Example if your roll number is R160217050.Then Length is 50 cm and Width is 25 cm).** Find the equivalent diameter of circular duct if a) quantity carried is same in both the cases b) if the velocity in both cases is same. Also, find the pressure loss per 100 m length of duct. Take f= 0.015 for sheet metal.	**15**	**CO5**
Q6	A main circular duct consist of three branched taking equal air volume at equal interval. Each interval has a friction loss of 1.2 mm of water and state pressure of 4 mm of water is necessary at each branch to cope up with friction loss. If the initial velocity in the main duct of 1.3 m diameter is 9 m/sec. Find out the velocities and diameter of the second and third length where the static pressure regain is sufficient to overcome the friction loss in the succeeding length of main duct up to the next branch. Assume **static pressure regain (SPR)** factor value (**Note- The SPR value should be less than 1 and take SPR value as last two digits of your respective roll number. Example if your roll number is R160217033. Then SPR value will be 0.33).** Also find out static and velocity pressures at appropriate points along the flow. (**Note- First draw line diagram and then solve the question).**	**15**	**CO6**