คณะวิศวกรรมศาสตร์
มหาวิทยาลัยสงขลานครินทร์

การสอบปลายภาค ประจำภาคการศึกษาที่ 2 ประจำปีการศึกษา 2555

วันที่ 27 กุมภาพันธ์ 2556 เวลา 13.30-16.30 น.

วิชา 215-231 Engineering Thermodynamics I ห้อง S 201

216-231 Engineering Thermodynamics I ห้อง S 203

คำสั่ง

1. ข้อสอบมีทั้งหมด 6 ข้อ ให้ทำลงในข้อสอบทุกข้อ, กระดาษไม่พอให้ทำด้านหลังข้อสอบ
2. อนุญาตนำกระดาษ A4 จำนวน 1 แผ่น เข้าห้องสอบได้
3. อนุญาตให้ใช้เครื่องคิดเลขได้

รศ.กำพล ประทีปชัยกูร
ผู้ออกข้อสอบ

รหัส..... ชื่อ-สกุล.....

รหัส..... ชื่อ-สกุล.....

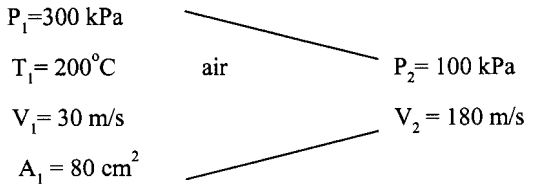
1) A spherical hot air balloon is initially filled with air at 120 kPa, 20^oC with an initial diameter of 5 m. Air enters this balloon at 120 kPa, 20^oC with a velocity of 3 m/s through a 1-m. diameter opening. How many minutes will it take to inflate this balloon to a 15-m. diameter when the pressure and temperature of the air in the balloon remain the same as the air entering the balloon. Given: for air gas constant $R = 0.287 \frac{kPa.m^3}{kg.K}$, volume of the sphere $V = \frac{\pi D^3}{6}$

(10 marks)

รหัส..... ชื่อ-สกุล.....

2) Air enters an adiabatic nozzle steadily at 300 kPa, 200°C, and 30 m/s and leaves at 100 kPa and 180 m/s. The inlet area of the nozzle is 80 cm^2. Determine a) the mass flowrate through the nozzle b) the exit temperature of the air and c) the exit area of the nozzle.

Given: for air $R = 0.287 \frac{kPa.m^3}{kg.K}$, $C_p = 1.02 \frac{kJ}{kg.^oC}$ (15 marks)



รหัส..... ชื่อ-สกุล.....

3) A household refrigerator that has a power input of 450 W and a COP of 2.5 is to cool five large watermelons, 10 kg. each to 8°C. If the watermelons are initially at 20°C, determine how long it will take for the refrigerator to cool them. The watermelons can be treated as water whose specific heat is 4.2 kJ/kg.°C. Is your answer realistic or optimistic ? Explain. (10 marks)

รหัส..... ชื่อ-สกุล.....

4) A heat engine os operating on a Carnot cycle and has a thermal efficiency of 55 %. The waste heat from this engine is rejected to a nearby lake at 16°C at a rate of 844 kJ/min. Determine a) the power output of the engine and b) the temperature of the source . (10 marks)

รหัส..... ชื่อ-สกุล.....

5) Air is compressed by a 12-kW compressor from P_1 to P_2. The air temperature is maintained constant at 25°C during this process as a result of heat transfer to the surrounding medium at 10°C. Determine the rate of entropy change of the air. State the assumptions made in solving this problem. (10 marks)

รหัส..... ชื่อ-สกุล.....

6) A 0.5 m^3 rigid tank contains refrigerant-134a initially at 200 kPa and 40 % quality. Heat is transferred now to the refrigerant from a source at 35°C until the pressure rise to 400 kPa. Determine a) the entropy change of the refrigerant b) the entropy change of the heat source and c) the total entropy change of this process. (25 marks)

รหัส..... ชื่อ-สกุล.....

TABLE A–12

Saturated refrigerant-134a—Pressure table

Press., P MPa	Temp., T_{sat} °C	*Specific volume,* m³/kg: Sat. liquid, v_f	*Specific volume,* m³/kg: Sat. vapor, v_g	*Internal energy,* kJ/kg: Sat. liquid, u_f	*Internal energy,* kJ/kg: Sat. vapor, u_g	*Enthalpy,* kJ/kg: Sat. liquid, h_f	*Enthalpy,* kJ/kg: Evap., h_{fg}	*Enthalpy,* kJ/kg: Sat. vapor, h_g	*Entropy,* kJ/kg · K: Sat. liquid, s_f	*Entropy,* kJ/kg · K: Sat. vapor, s_g
0.06	−37.07	0.0007097	0.3100	3.41	206.12	3.46	221.27	224.72	0.0147	0.9520
0.08	−31.21	0.0007184	0.2366	10.41	209.46	10.47	217.92	228.39	0.0440	0.9447
0.10	−26.43	0.0007258	0.1917	16.22	212.18	16.29	215.06	231.35	0.0678	0.9395
0.12	−22.36	0.0007323	0.1614	21.23	214.50	21.32	212.54	233.86	0.0879	0.9354
0.14	−18.80	0.0007381	0.1395	25.66	216.52	25.77	210.27	236.04	0.1055	0.9322
0.16	−15.62	0.0007435	0.1229	29.66	218.32	29.78	208.18	237.97	0.1211	0.9295
0.18	−12.73	0.0007485	0.1098	33.31	219.94	33.45	206.26	239.71	0.1352	0.9273
0.20	−10.09	0.0007532	0.0993	36.69	221.43	36.84	204.46	241.30	0.1481	0.9253
0.24	−5.37	0.0007618	0.0834	42.77	224.07	42.95	201.14	244.09	0.1710	0.9222
0.28	−1.23	0.0007697	0.0719	48.18	226.38	48.39	198.13	246.52	0.1911	0.9197
0.32	2.48	0.0007770	0.0632	53.06	228.43	53.31	195.35	248.66	0.2089	0.9177
0.36	5.84	0.0007839	0.0564	57.54	230.28	57.82	192.76	250.58	0.2251	0.9160
0.4	8.93	0.0007904	0.0509	61.69	231.97	62.00	190.32	252.32	0.2399	0.9145
0.5	15.74	0.0008056	0.0409	70.93	235.64	71.33	184.74	256.07	0.2723	0.9117
0.6	21.58	0.0008196	0.0341	78.99	238.74	79.48	179.71	259.19	0.2999	0.9097
0.7	26.72	0.0008328	0.0292	86.19	241.42	86.78	175.07	261.85	0.3242	0.9080
0.8	31.33	0.0008454	0.0255	92.75	243.78	93.42	170.73	264.15	0.3459	0.9066
0.9	35.53	0.0008576	0.0226	98.79	245.88	99.56	166.62	266.18	0.3656	0.9054
1.0	39.39	0.0008695	0.0202	104.42	247.77	105.29	162.68	267.97	0.3838	0.9043
1.2	46.32	0.0008928	0.0166	114.69	251.03	115.76	155.23	270.99	0.4164	0.9023
1.4	52.43	0.0009159	0.0140	123.98	253.74	125.26	148.14	273.40	0.4453	0.9003
1.6	57.92	0.0009392	0.0121	132.52	256.00	134.02	141.31	275.33	0.4714	0.8982
1.8	62.91	0.0009631	0.0105	140.49	257.88	142.22	134.60	276.83	0.4954	0.8959
2.0	67.49	0.0009878	0.0093	148.02	259.41	149.99	127.95	277.94	0.5178	0.8934
2.5	77.59	0.0010562	0.0069	165.48	261.84	168.12	111.06	279.17	0.5687	0.8854
3.0	86.22	0.0011416	0.0053	181.88	262.16	185.30	92.71	278.01	0.6156	0.8735