

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Textile and Apparel Technology



Study Programme	: Bachelor of Technology (Honours) in Engineering/ Bachelor of Industrial studies (Honours)
Name of the Examination	: Final Examination
Course Code and Title	: TAX5534/TAX5547 Plant Utilities
Academic Year	: 2020/2021
Date	: 22 nd February 2022
Time	: 1400 -1700hrs
Duration	: 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of Eight (8) questions in Four (4) pages.
3. Write down your Index Number on all the pages of answer scripts.
4. Answer question one (01), which is compulsory, and five (05) more questions from 02 to 08. Question one (01) carries twenty-five (25) marks, and questions two (02) to eight (08) carry fifteen (15) marks each.
5. Answer for each question should commence from a new page. If a question has many parts, all the parts should be answered in chronological order under the same question.
6. Write down the answered question numbers in the answer book.
7. Do not write answers to additional questions.
8. Answers should be in clear handwriting.
9. Do not use red colour pens to write the answers.

Compulsory question**01.**

- a) What do you understand by the terms “Renewable” and “Non-renewable” energy? (02 marks)
- b) State four (04) primary sources of energy. (02 marks)
- c) Define the terms “Dearation” and “Scrubbing”. (04 marks)
- d) Mention four (04) functions of heat exchangers. (02 marks)
- e) Briefly explain the importance of quality of light. (02 marks)
- f) What do you understand by a “Luminaire”? (02 marks)
- g) According to the definition of air conditioning, what are the four (04) factors that need to be controlled to meet the requirement of air conditioning? (04 marks)
- h) What are the three (03) main types of organic matter involved in water quality control? (02 marks)
- i) Briefly explain the three (03) classes of wastewater treatment processes. (03 marks)
- j) State four (04) accidents that are caused by different forms of energy. (02 marks)

Answer any five (05) questions from the following seven (07) questions.

- 02. (a) Explain the environmental issues that can occur when using coal to generate energy? (09 marks)
- (b) What are the different types of solar water heating systems? Explain their applicability. (06 marks)
- 03. (a) Explain the principle behind the process of steam engines using the Rankine cycle. (09marks)
- (b) Briefly explain how the conservation of energy principle can be applied to energy in a moving fluid. (06 marks)

04. a) Following readings at 8 bar are taken from the steam table.

p in bars.	t_s in °C	v_g in m^3/kg	u_f in kJ/kg	u_g in kJ/kg.	h_f in kJ/kg	h_{fg} in kJ/kg	h_g in kJ/kg
8.0	170.4	0.2403	720	2577	721	2048	2769

Calculate the specific Internal Energy and Specific Enthalpy Values at 90% dry steam at 8 bar. (09 marks)

b) Using a suitable diagram, explain the behavior of water at different temperatures and pressures. (06 marks)

05. (a) Define the following terms related to lighting. (06 marks)

- i. Luminous intensity
- ii. Luminous efficiency
- iii. Luminous efficacy

(b) A room of 8m x 6m is illuminated by twelve 100W lamps, each having a mean spherical candle power of 150. If the coefficient of utilization is 0.5 and the depreciation factor is 1.2, calculate the luminous efficiency of one lamp and the average illumination of the floor by the twelve lamps. (09 marks)

06. (a) Briefly explain the following terms related to air conditioning. (06 marks)

- i. Dry bulb temperature
- ii. Wet bulb temperature
- iii. Dew point temperature

(b) Locate the points for the following conditions on the psychrometric chart. (06 marks)

- i. Conditions of 40°C dry bulb temperature and 0.011kg moisture in 1kg of dry air.
- ii. Condition of 45°C dry bulb temperature and 21°C wet bulb temperature
- iii. Condition of 50% relative humidity and 0.012kg moisture in 1kg of dry air

(c) Define the term "Dehumidification". Illustrate following process on the psychrometric chart at 35°C dry bulb temperature and 0.015kg moisture in 1 kg of dry air. (03 marks)

- i. Illustrate process A as dehumidification with the cooling
- ii. Illustrate process B as dehumidification with the heating

07. a) Discuss the activated sludge process of wastewater treatment. (09 marks)

b) Briefly explain the following primary treatment processes of wastewater treatment. (06 marks)

- i. Screening and straining
- ii. Micro-straining
- iii. Grit removal

08. a) Giving suitable examples, discuss three (03) common industrial hygiene hazards. (09 marks)

b) Briefly explain three (03) fire safety measures that a factory can adopt to eliminate/minimize fire hazards. (06 marks)

-End of the question paper-

Registration No.....

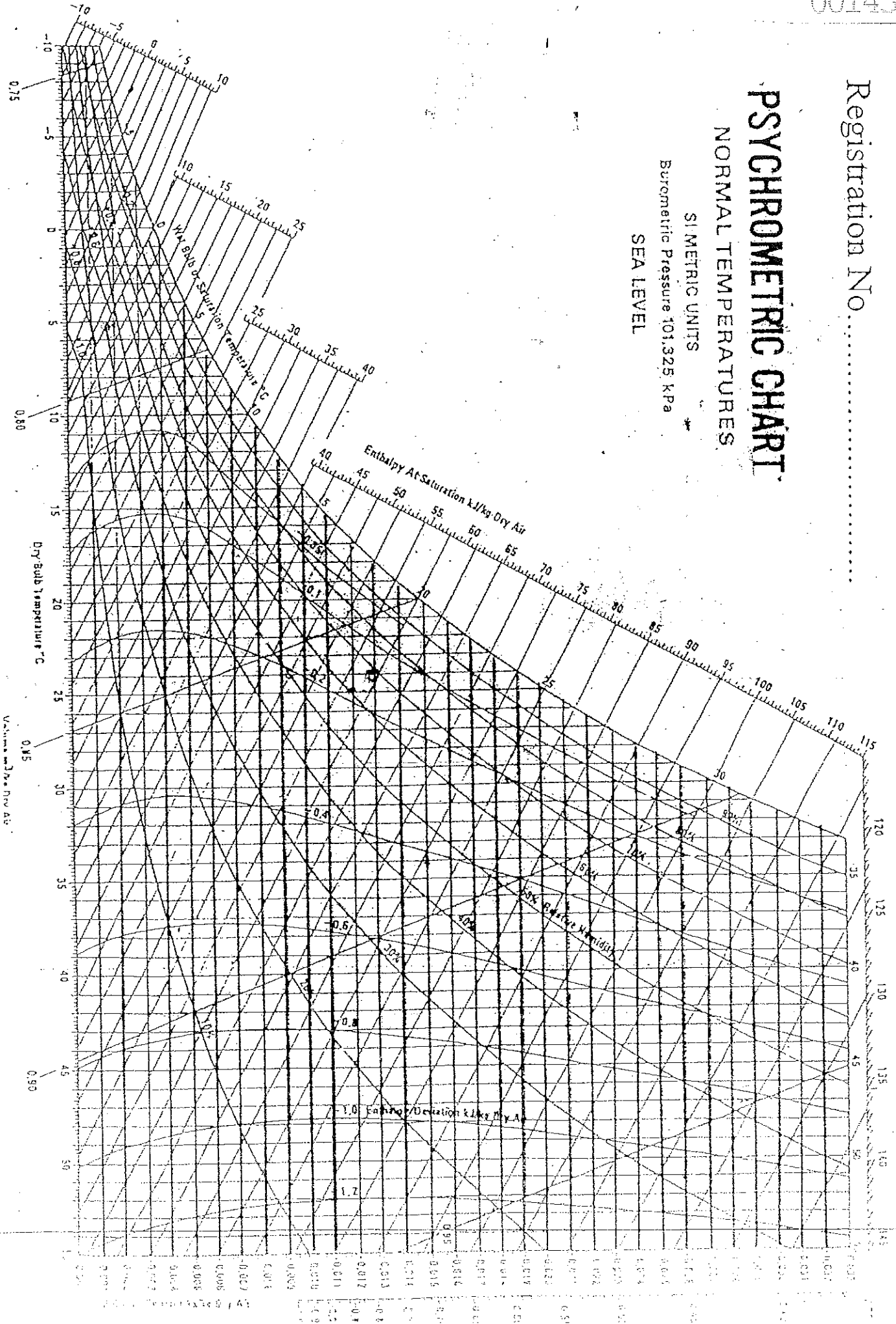
PSYCHROMETRIC CHART

NORMAL TEMPERATURES

SI METRIC UNITS

Barometric Pressure 101,325 KPa

SEA LEVEL



p (bar)	t_a (°C)	v_g (m ³ /kg)	u_f (kJ/kg)	u_g (kJ/kg)	h_f	h_{fg} (kJ/kg)	h_g	s_f	s_{fg} (kJ/kgK)	s_g
1.0	99.6	1.694	417	2506	417	2258	2675	1.303	6.056	7.359
1.1	102.3	1.549	429	2510	429	2251	2680	1.333	5.994	7.327
1.2	104.8	1.428	439	2512	439	2244	2683	1.361	5.937	7.298
1.3	107.1	1.325	449	2515	449	2238	2687	1.387	5.884	7.271
1.4	109.3	1.236	458	2517	458	2232	2690	1.411	5.835	7.246
1.5	111.4	1.159	467	2519	467	2226	2693	1.434	5.789	7.223
1.6	113.3	1.091	475	2521	475	2221	2696	1.455	5.747	7.202
1.7	115.2	1.031	483	2524	483	2216	2699	1.475	5.707	7.182
1.8	116.9	0.9774	491	2526	491	2211	2702	1.494	5.669	7.163
1.9	118.6	0.9292	498	2528	498	2206	2704	1.513	5.632	7.145
2.0	120.2	0.8856	505	2530	505	2202	2707	1.530	5.597	7.127
2.1	121.8	0.8461	511	2531	511	2198	2709	1.547	5.564	7.111
2.2	123.3	0.8100	518	2533	518	2193	2711	1.563	5.533	7.096
2.3	124.7	0.7770	524	2534	524	2189	2713	1.578	5.503	7.081
2.4	126.1	0.7466	530	2536	530	2185	2715	1.593	5.474	7.067
2.5	127.4	0.7186	535	2537	535	2182	2717	1.607	5.446	7.053
2.6	128.7	0.6927	541	2539	541	2178	2719	1.621	5.419	7.040
2.7	130.0	0.6686	546	2540	546	2174	2720	1.634	5.393	7.027
2.8	131.2	0.6462	551	2541	551	2171	2722	1.647	5.368	7.015
2.9	132.4	0.6253	556	2543	556	2168	2724	1.660	5.344	7.004
3.0	133.5	0.6057	561	2544	561	2164	2725	1.672	5.321	6.993
3.5	138.9	0.5241	584	2549	584	2148	2732	1.727	5.214	6.941
4.0	143.6	0.4623	605	2554	605	2134	2739	1.776	5.121	6.897
4.5	147.9	0.4139	623	2558	623	2121	2744	1.820	5.037	6.857
5.0	151.8	0.3748	639	2562	640	2109	2749	1.860	4.962	6.822
5.5	155.5	0.3427	655	2565	656	2097	2753	1.897	4.893	6.790
6	158.8	0.3156	669	2568	670	2087	2757	1.931	4.830	6.761
7	165.0	0.2728	696	2573	697	2067	2764	1.992	4.717	6.709
8	170.4	0.2403	720	2577	721	2048	2769	2.046	4.617	6.663
9	175.4	0.2149	742	2581	743	2031	2774	2.094	4.529	6.623
10	179.9	0.1944	762	2584	763	2015	2778	2.138	4.448	6.586
11	184.1	0.1774	780	2586	781	2000	2781	2.179	4.375	6.554
12	188.0	0.1632	797	2588	798	1986	2784	2.216	4.307	6.523
13	191.6	0.1512	813	2590	815	1972	2787	2.251	4.244	6.495
14	195.0	0.1408	828	2593	830	1960	2790	2.284	4.185	6.469
15	198.3	0.1317	843	2595	845	1947	2792	2.315	4.130	6.445
16	201.4	0.1237	857	2596	859	1935	2794	2.344	4.078	6.422
17	204.3	0.1167	870	2597	872	1923	2795	2.372	4.028	6.400
18	207.1	0.1104	883	2598	885	1912	2797	2.398	3.981	6.379
19	209.8	0.1047	895	2599	897	1901	2798	2.423	3.936	6.359
20	212.4	0.09957	907	2600	909	1890	2799	2.447	3.893	6.340
22	217.2	0.09069	928	2601	931	1870	2801	2.492	3.813	6.305
24	221.8	0.08323	949	2602	952	1850	2802	2.534	3.738	6.272
26	226.0	0.07689	969	2603	972	1831	2803	2.574	3.668	6.242
28	230.0	0.07142	988	2603	991	1812	2803	2.611	3.602	6.213
30	233.8	0.06665	1004	2603	1008	1795	2803	2.645	3.541	6.186
32	237.4	0.06246	1021	2603	1025	1778	2803	2.679	3.482	6.161
34	240.9	0.05875	1038	2603	1042	1761	2803	2.710	3.426	6.136
36	244.2	0.05544	1054	2602	1058	1744	2802	2.740	3.373	6.113
38	247.3	0.05246	1068	2602	1073	1729	2802	2.769	3.322	6.091
40	250.3	0.04977	1082	2602	1087	1714	2801	2.797	3.273	6.070