Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	PIPING ENGINEERING
COURSE CODE	:	BNL 30403
EXAMINATION DATE	:	JULY 2022
PROGRAMME CODE	:	BNL
DURATION	:	2 HOURS AND 30 MINUTES
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIALOR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Piping engineers apply the principles of mathematics, physics and chemistry to assure the design of pipe systems used to convey liquid or gas from one location to another. List **FIVE (5)** spesific task of Piping Engineer.

(5 marks)

(b) Calculate the Internal Diameter for a 12NPS (DN 300 mm) pipe, schedule 40, the OD and wall thickness are 12.75 inches (324 mm) and 0.406 inches (10.4 mm) respectively. The reference schedule refers to **Table Q1 (b)**.

(6 marks)

(c) Differentiates between pipe and tube based on piping enginnering.

(4 marks)

(d) In a piping system, expansion joints alternately known as bellows. Identifies the purpose of expansion joint and describe the functions of expansion joint shown in **Figure Q1 (d)**.

(5 marks)

Q2 (a) In pipeline, traps are one of the important components to support the functional of the piping system to be more efficient. Identifies the functions of traps and give **THREE (3)** examples of traps usually used.

(4 marks)

(b) Steam traps play the important role in maintaining the productivity and efficiency of steam system. It trap holds back steam and discharges condensate under varying pressures or loads. Demonstrates the working principles of thermostatic traps.

(4 marks)

(c) Threaded joints are detachable joints of two or more component parts either directly connected with each other where it requires forces to produce and maintain the joining. Identify the functions of **THREE (3)** types of threaded joint with schematic diagram.

(6 marks)

(d) Annealing and normalizing process are two most commonly used heat treatment methods in metallurgy which use a combination of heating and cooling operation for carbon and low allow steel heat treatment. Compares temperature range between normalizing, full annealing and spheroidizing including percentage of carbons.

(6 marks)

Q3 **(a)** In piping engineering, there are certain standard codes that need to be follow while designing or manufacturing any piping system. ASME B31, Code for Pressure Piping is developed, published, and maintained by the American Society of Mechanical Engineers (ASME). As a piping engineer, analyse the scopes of ASME 31.1 (Power Piping codes) and identify what does the ASME 31.1 covers and not covers.

(3 marks)

(b) The ASME B31 Code for Pressure Piping consists of several individually published sections. The rules contained in each Section reflect the kinds of piping installations that the responsible subcommittee had in mind during development of that section. Outlines the properties of ASME B31.8 for gas transmission and distribution piping system.

(3 marks)

(c) Steel pipes are long, hollow tubes that are used for a variety of purposes. The first methods for producing steel pipe were introduced in the early 1800s, and they have steadily evolved into the modern processes that are used today. Differentiates the working principle between open-hearth furnace and electric arc furnace.

(6 marks)

(d) Rotary tube piercing, also called roll piercing process, is a hot forming process that can manufacture long lengths of seamless tube and pipe. Through the process, compressive forces will be applied to a cylinder that create internal stresses at the center. Illustrates in details the roll piercing process and sketch the component involves in the process.

(4 marks)

(e) In the extrusion process, the heated copper or copper alloy billets are formed into shells by heavy hydraulic presses. Select the proper steps for seamless pipe production through hot extrusion process system.

(4 marks)

Q4 (a) Compares the linear motion and rotary valve. Then draw the schematic diagram.

(4 marks)

(b) Identifies the **THREE (3)** most common types of flow characteristic of valves in piping engineering applications and draw the graph particular percentage

(4 marks)

(c) Compares the characteristic, application , advantages and disadvantages of valve as follows:-

(i) Ball Valve
(ii) Diaphragm Valve
(iii) Butterfly Valve

(6 marks)

(d) Calculate the longitudinal principle stresses (LDS) and circumferential principle stress (CPS) in a DN 350, 9.5 mm (NPS 14, 0.375 inch) wall thickness pipe operating at 8275 kPa (1,200 psig) internal pressure.

(3 marks)

(e) The internal diameter of the galvanized iron pipe is 350 mm while the thickness is 48.5 mm under pressure of 5 N/mm^2 shown in **Figure Q4(e)**. This pipe is used to carry out waste water from the industrial site to water treatment plantation. Calculate the tangential stress at the inner, middle (radius = 225 mm) and outer (radius = 175 mm).

(3 marks)

Q5 (a) **Figure Q5 (a)** shows the x-t trace measured from a part of a pipeline after it was struck with a hammer. The effective mass of the pipeline was 20 kg with undamped natural frequency, $\omega = 63$ rads^{-1}, damping factor, $\alpha = 0.8$ s^{-1}. Calculate the natural frequency and damping ratio.

(4 marks)

(b) The maximum distance a flame may travel to exit is from the bottom of the sugar silo to the top (6m) shown in **Figure Q5 (b)**. However, the flame does not spread in an optimum fashion in a cone and allows just one third of the cone height to be used instead. Calculate the length to diameter (L/D) ratio.

(4 marks)

(c) Piping is used for the long distances transport for liquid and gases which have to fulfill high demands on safety, relialibility and efficiency. Thus, maintenance department must maintained the piping indefinitely without leakage. Summarize **FOUR (4)** guidances of hydrostatic test for leak detection.

(4 marks)

(d) Non-destructive examination (NDE) are most often referenced by code and applied to the fabrication and installation of piping components and system. Compares the NDE working principles includes advantages and shortcoming based on the techniques as follows:

(i) Ultrasonic Testing.
(ii) Magnetic particles.

(8 marks)

- END OF QUESTION –

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2021/2022
COURSE NAME : PIPING ENGINEERING

PROGRAMME CODE : BNL
COURSE CODE : BNL30403

Table Q1 (b) : Pipe Schedule

Projects Oil & Gas

ArcelorMittal

Pipe Schedules (according to ASME/ANSI B36.10M)

Nominal pipe size mm/ inch	OD mm	20	30	STD	40	60	XS	80	100	120	140	160	XXS	Weight kg/m
15 / ½	21.3			2.77 1.27	2.77 1.27		3.73 1.62	3.73 1.62				4.78 1.95	7.47 2.55	0.0004
20 / ¾	26.7			2.87 1.69	2.87 1.69		3.91 2.20	3.91 2.20				5.56 2.90	7.82 3.64	0.0007
25 / 1	33.4			3.38 2.50	3.38 2.50		4.55 3.24	4.55 3.24				6.35 4.24	9.09 5.45	0.0011
32 / 1¼	42.2			3.56 3.39	3.56 3.39		4.85 4.47	4.85 4.47				6.35 5.61	9.70 7.77	0.0017
40 / 1½	48.3			3.68 4.05	3.68 4.05		5.08 5.41	5.08 5.41				7.14 7.25	10.15 9.56	0.023
50 / 2	60.3			3.91 5.44	3.91 5.44		5.54 7.48	5.54 7.48				8.74 11.11	11.07 13.44	0.036
65 / 2½	73.0			5.16 8.63	5.16 8.63		7.01 11.41	7.01 11.41				9.53 14.92	14.02 20.39	0.0053
80 / 3	88.9			5.49 11.29	5.49 11.29		7.62 15.27	7.62 15.27				11.13 21.35	15.24 27.68	0.0079
90 / 3½	101.6			5.74 13.57	5.74 13.57		8.08 18.63	8.08 18.63				-	-	0.0103
100 / 4	114.3			6.02 16.07	6.02 16.07		8.56 22.32	8.56 22.32		11.13 28.32		13.49 33.54	17.12 41.03	0.0130
125 / 5	141.3			6.55 21.77	6.55 21.77		9.53 30.97	9.53 30.97		12.70 40.28		15.88 49.11	19.05 57.43	0.0199
150 / 6	168.3			7.11 28.26	7.11 28.26		10.97 42.56	10.97 42.56		14.27 54.03		18.26 67.56	21.95 80.22	0.028
200 / 8	219.1	6.35 33.31	7.04 36.81	8.18 42.95	8.18 42.95	10.31 53.08	12.70 64.64	12.70 64.64	15.09 75.93	18.26 90.44	20.62 100.92	23.01 111.27	22.23 107.03	0.048
250 / 10	273.1	6.35 41.77	7.80 51.03	9.27 60.31	9.27 60.31	12.70 81.55	12.70 81.55	15.09 96.01	18.26 114.75	21.44 133.08	25.40 155.15	28.58 172.32	25.40 155.15	0.074
300 / 12	323.9	6.35 49.53	8.38 65.20	9.53 73.88	10.31 79.73	14.27 108.96	12.70 97.46	17.48 132.09	21.44 159.31	25.40 186.97	28.58 208.14	33.32 238.76	25.40 188.09	0.104
350 / 14	355.6	7.92 67.00	9.53 81.33	9.53 81.33	11.13 94.55	15.09 126.71	12.70 107.32	19.05 158.10	23.83 194.36	27.79 224.65	31.75 253.56	35.71 281.70		0.126
400 / 16	406.4	7.92 77.03	9.53 93.27	9.53 93.27	12.70 123.30	16.66 160.12	12.70 123.30	21.44 203.53	26.19 245.56	30.96 286.64	36.53 333.19	40.49 365.35		0.165
450 / 18	457.2	7.92 87.31	11.13 122.38	9.53 105.16	14.27 155.88	19.05 205.74	12.70 139.15	23.88 254.55	29.36 309.62	34.93 363.56	39.67 408.26	45.24 459.37		0.207
500 / 20	508.0	9.53 117.15	12.70 155.12	9.53 117.15	15.09 183.42	20.62 247.83	12.70 155.12	26.19 316.17	32.54 381.53	38.10 441.49	44.45 508.11	50.01 564.81		0.258
550 / 22	558.8	9.53 128.13	12.70 171.04	9.53 128.13	-	22.23 286.25	12.70 171.09	28.58 373.83	34.93 451.43	41.28 527.02	47.63 600.63	53.98 673.26		0.312
600 / 24	609.6	9.53 141.12	14.27 200.64	9.53 141.12	17.48 255.41	24.61 355.26	12.70 187.06	30.96 442.08	38.89 547.71	46.02 640.03	52.37 720.15	59.54 808.22		0.372

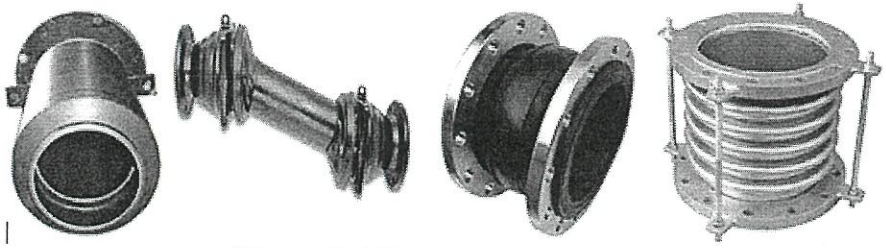

Figure Q1(d) :Types of bellow

FINAL EXAMINATION

SEMESTER / SESSION : SEM II / 2021/2022 PROGRAMME CODE : BNL
COURSE NAME : PIPING ENGINEERING COURSE CODE : BNL30403

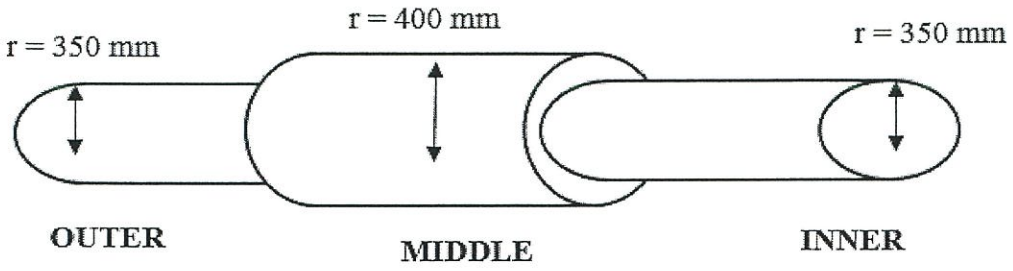

Figure Q4 (e): Galvanized iron piping section

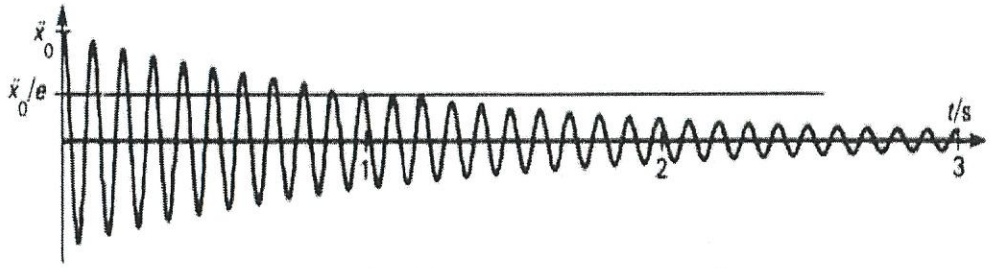

Figure Q5 (a) : x-t trace measured

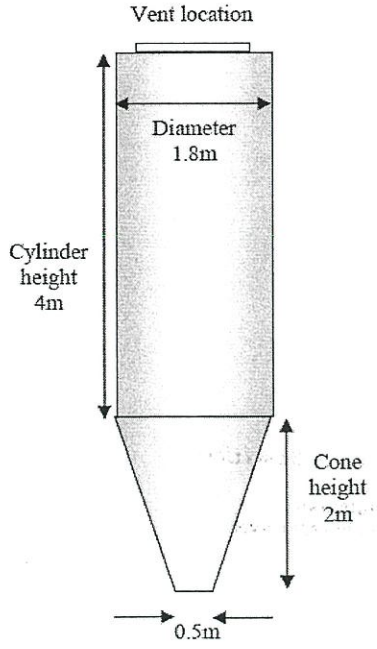

Figure Q5 (b) : Building tower sugar silo dimension