UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

JULY 2010 SEMESTER

SUBJECT CODE	:	FFB 32203
SUBJECT TITLE	:	DESIGN AND FABRICATION (VESSELS)
LEVEL	:	BACHELOR
DURATION	:	4.00pm – 6.00pm (2 HOURS)
DATE / TIME	:	08 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.

2. This question paper is printed on both sides of the paper.

3. Please write your answers on the answer booklet provided.

4. Answer should be written in blue or black ink except for sketching, graphic and illustration.

5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer TWO (2) question only.

6. Answer all questions in English.

THERE ARE 10 PRINTED PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

1. ASME primarily focuses on

   A. Rules on the selection of materials for pressure vessels.

   B. Rules on the construction of pressure vessels.

   C. Rules and regulation on the construction of boilers.

   D. Rules on the construction of tall towers.

   (2 marks)

2. What does ASME II, Part A, B, C and D encompasses on?

   A. Selection of material.

   B. Standardization on the material.

   C. Selection of nozzles and manway.

   D. Selection on the stamps.

   (2 marks)

3. How would you understand design pressure of pressure vessel?

   A. It is the pressure of used gas going out of the pressure vessel.

   B. It is the pressure used in the gas regulator.

   C. It is the pressure used to allow good gas flow.

   D. It is the pressure used in the pressure vessel.
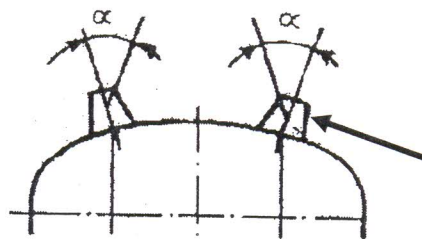
   (2 marks)

4. Name the part indicated by the arrow?

Figure 1

(3 marks)

5.   Label the parts of the four types of dish heads with the necessary labeling
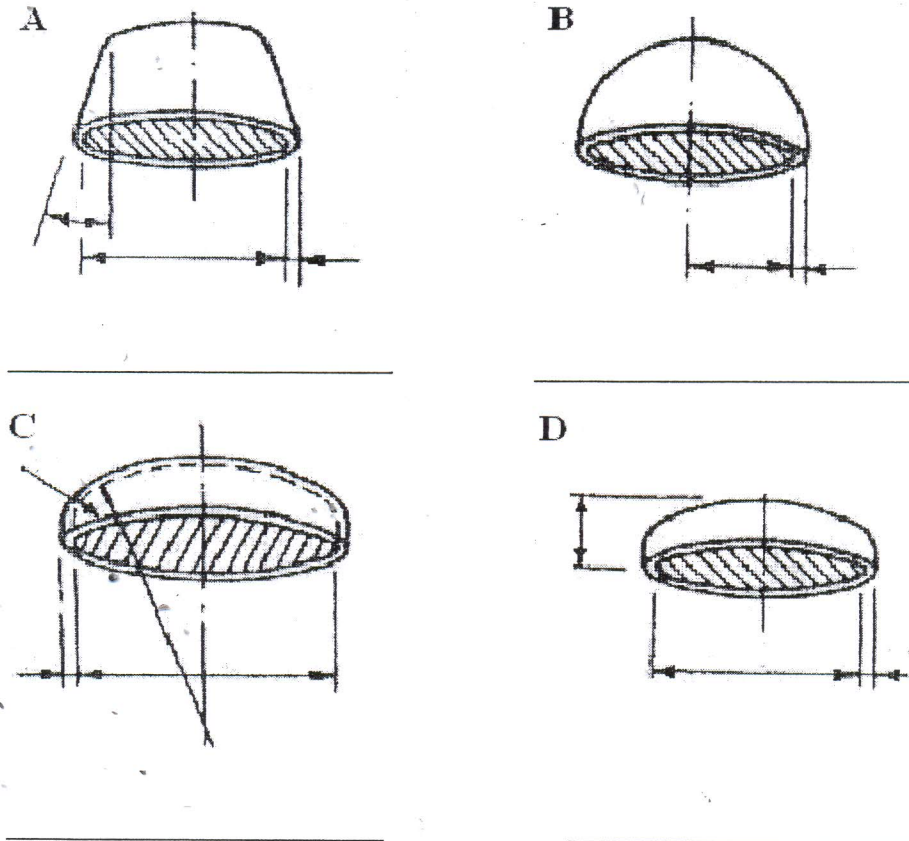   from the given list below

A   B

C   D

Figure 2 Types of dish heads

Dish head types
Hemispherical, Elliptical, Toriconical, Semicircle, Triangulation, ASME Flanged and Dished, Exceptional, Helical, and Spherical.   (Source: Pressure Vessel Handbook, 13th Ed., 2004, Eugene F. Megyesy)

(10 marks)

6.   State the main function of flanges.

   A.   to provide means for coupling with the pipeline of fluid entry or exit.

   B.   to provide means for couples and the pipeline of fluid entry or exit.

   C.   to provide means for coupling with the pipeline and fluid.

   D.   to provide means for communication in the pipeline of fluid.

(2 marks)

7.   "Relief valve" is an automatic safety device, which of the following are relief
      devices main functions?

      A.   Pressure-relieving device to prevent
            over-pressurization.
      B.   Pressure-relieving device to prevent
            under-pressurization.
      C.   Pressure-relieving device to assist
            over-pressurization.
      D.   Pressure-relieving device to assist pressurization.
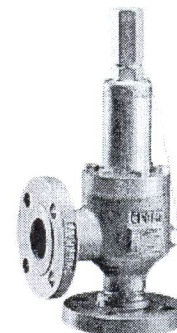

Figure 3 Relief valve

(2 marks)

8.   The desired life time of a vessel is an economical question. Design of major
      vessels and minor vessels are as follows:
      A.   Major vessels 15 – 20 years and minor vessels 8 – 10 years.
      B.   Major vessels 20 – 30 years and minor vessels 10 – 15 years.
      C.   Major vessels 10 – 50 years and minor vessels 12 – 15 years.
      D.   Major vessels 18 – 40 years and minor vessels 5 – 10 years.

(2 marks)

9.   A pressure vessel has to retain to pressure. In doing this the pressure applies
      two types of stresses. They are?
      A.   Circumferential and length of shell.
      B.   Circumferential and longitudinal.
      C.   Circumferential and magnitude.
      D.   Hoop and circumferential.

(2 marks)

10.   How is thin-walled pressure vessel categorized?
      A.   1/10 of the external diameter.
      B.   Circular, triangular or obround.
      C.   1/10 of the inner radius.
      D.   Circular, elliptical or oblong.

(2 marks)

11. The preservation of the pressure vessel is usually done by

    A. painting.

    B. embossing.

    C. plating.

    D. sand-blasting.

    (2 marks)

12. The transportation of vessels by truck requires some considerations. Name THREE (3) of the considerations.

    ....

    ....

    ....

    (3 marks)

13. The use of only two saddles is preferred because

    A. it is static and easier to move.

    B. it is statically and ergonomic over other type of supporting system.

    C. it is statically and economical over multiple supporting system.

    D. it is ergonomic and economical.

    (2 marks)

14. All pressure vessels for use with compressed air and those subject to internal corrosion, erosion or mechanical abrasion, shall be furnished with suitable manholes. What are the purposes of manholes?

    A. For cleaning and washing.

    B. For cleaning and inspection.

    C. For examination and cleaning.

    D. For examination and inspection.

    (2marks)

15.   The types of preferred opening of pressure vessel are

   A.   Circular, square and rectangle.

   B.   Circular, spherical or obround.

   C.   Circular, elliptical or obround.

   D.   Circular, round or elliptical.

                                                            (2 marks)

16.   For types of welded joints state the joint efficiency, E.

   A.   Full RT=1.00, Spot Examined=0.85 and Not Examined=0.70.

   B.   Full RT=1.00, Full Examined=1.00 and Not Examined=0.50.

   C.   Full RT=1.00, Full Spot Examined=1.00 and Half-Examined=1.00.

   D.   Half-Full RT=0.90, Spot Examined=0.85 and Not Examined=0.70.

                                                            (2 marks)

17.   In term of fabrication the minimum plate thickness for shell and heads is?

   A.   ¼ inch minimum.

   B. $\frac{1}{8}$ inch minimum.

   C.   ½ inch minimum.

   D.   ¾ inch minimum.

                                                            (2 marks)

18.   Before the pressure vessel is ready to be delivered, the manufacturer shall

   furnish the purchaser with the following documentations.

   A.   MDR, "as built" shop drawings, copies of hydrostatic test and
        temperature of PWHT and rubbing of name plate.

   B.   MDR, "as built" erection drawings, copies of static test and temperature
        of PWHT and rubbing of plate number.

   C.   MDT, "as built" detailed drawings, copies of hydrostatic test and
        temperature of PWHT and rubbing of hot plate.

   D.   MRD, "as built" shop drawings, copies of hydrographic test and
        temperature of PWHT and rubbing of test plate.

   (2 marks)

19.   For horizontal pressure vessel, the preferred movable saddle is

      A.   the one on the same side of the man holes.

      B.   the one on the opposite side of the pipe connection.

      C.   the one on the opposite side of the man holes.

      D.   the one on the same side of the dish head.

                                                                          (2 marks)

20.   The use of stiffener rings can be on the inside or outside of the pressure
      vessels. One of the determining factors is as follow.

      A.   The compression, S_1 is more than the maximum allowable stress.

      B.   The compression, S_1 is less than the maximum allowable stress.

      C.   The compression, S_1 is equal to the maximum allowable stress.

      D.   The compression, S_1 is close to the maximum allowable stress.

                                                                          (2 marks)

21.   The sum of the erection weight a vessel of items 1 through 18 is 14,850 kg.
      For items 1 through 11 the weight is 11,310 kg.

      a)   What is the weight of items 13 through 18?

      b)   If the overweight of plate items 1 through 11 is 467 kg, what is the
              weight in kg and percentage of the weight added by weldings? (*Take
              +6% of weight of items 1 through 11 for overweight of the plates and
              weight added by weldings*)

                                                                          (6 marks)

22.   What is the most appropriate explanation for the center of gravity of an area
      or body?

      A.   The point which about any axis the moment of the area or body is zero.

      B.   The point of the compression about the moment it become zero.

      C.   The point zero of the compression is equal to the area of the body.

      D.   The moment of the area or body when it is bend equal to zero.

                                                                          (2 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer TWO (2) questions only.

Please use the answer booklet provided.

Question 1
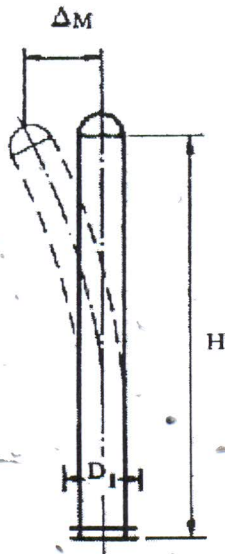
Formula

$$\Delta_M = \frac{P_w D_1 H (12H)^3}{8EI}$$

NOTATIONS

Δ_M = Maximum deflection (at the top), in.
D_I = Width of the tower with insulation, etc. ft.
E = Modulus of elasticity, psi
H = Length of vessel, included skirt, ft.
I = $R^3 \pi \, t$, moment of inertia for thin cylindrical shell (when $R > 10t$)
R = Mean radius of the tower, in.
t = Thickness of skirt, in.
P_w = Wind pressure, psf

Given:

D_I = 2 ft., 6 in.
E = 30,000,000
H = 48 ft., 0 in.
I = $R^3 \pi \, 0.3125$
P_w = 30 psf
R = 12 in.
t = 0.3125 in.

a) Determine the maximum deflection: Δ_M **(15 marks)**

b) Determine the maximum allowable deflection 6"/100' of height for a 48' tower.

   Take 1 inch = 25.4mm and convert your answer to mm with one decimal place.

                                                                        (15 marks)

Question 2

1. List down the FIVE (5) design considerations.

(7 marks)

2. Pressure relief devices or safety valve is a must in terms of design consideration. State its main purpose of installation.

(8 marks)

3. Under the description of Maximum Allowable Working Pressure, the internal pressure at which it weakest element of the vessel is loaded to the ultimate permissible point. What are the assumptions to it allowances.

(15 marks)

Question 3

1. Tall towers design considers stress conditions. List the FOUR (4) locations where the stresses can be calculated.

(8 marks)

2. The height of tall towers depends greatly on its functions. Loadings such as wind and earthquakes are also included when necessary. Explain why with different height stages different plate thicknesses are utilizes.

(10 marks)

3. The bending moment due to wind is decreasing from the bottom to the top of the tower, thus the plate thickness can also be decreased accordingly. Table A is a convenient aid to find the distance down from the top tower for which a certain thickness is adequate.

t_w/t_p	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7
m	1.0	0.91	0.84	0.79	0.74	0.71	0.67	0.64	0.62	0.6	0.58	0.56	0.54
t_w/t_p	1.8	1.9	2	2.2	2.4	2.6	2.8	3.0	3.3	3.6	4.0	4.5	5.0
m	0.53	0.51	0.5	0.48	0.46	0.44	0.42	0.41	0.39	0.37	0.35	0.33	0.32
Table A, VALUES OF FACTOR, m													

From Table A, using factor m can be found the distance X down from the top
tangent line within which the thickness calculation for internal pressure
satisfactory also to resist the wind pressure.
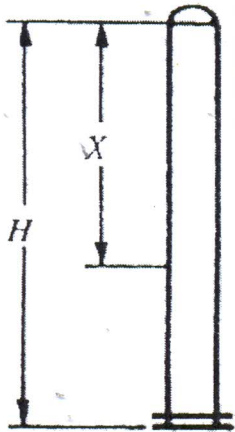
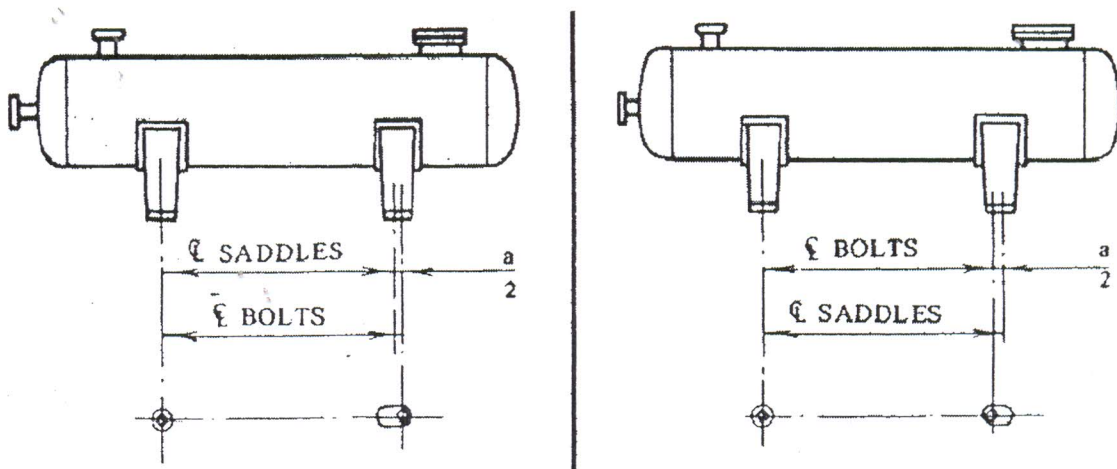| X	=	H x m			
t_p	=	Hoop tension (in)			
t_w	=	the required thickness for wind pressure at the bottom head joint to shell, in.			
t_p	=	0.233 in.,	t_w	=	0.644 in.
H	=	100 ft.			

Find   X

(12 marks)

Question 4

1.   Horizontal vessels supported by saddles are subjected to different types of
stresses. Name the THREE (3) types of stresses.

(9 marks)

2.   Base on the given diagram of a horizontal vessel, state the vessel condition.

(9 marks)

3. The length of the slots shall be determined by the expected magnitude of the movement. The table below shows the minimum length of the slot. The dimension "a" calculated for the linear expansion of carbon steel is between 70^0F and the indicated temperature.
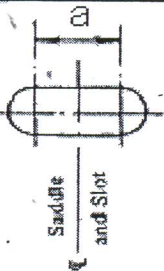
a — The width of the slot equals the diam. of anchor bolt + ¼".	DISTANCE BETWEEN SADDLES Ft.	FOR TEMPERATURE OF									
		-50	100	200	300	400	500	600	700	800	900
	10	0	0	0	1/4	3/8	3/8	1/2	5/8	3/4	3/4
	20	0	0	1/4	3/8	5/8	3/4	1	1-1/8	1-1/4	1-3/8
	30	1/4	1/8	3/8	5/8	7/8	1-1/8	1-3/8	1-5/8	1-5/8	2
	40	1/4	1/8	3/8	3/4	1-1/8	1-1/2	1-7/8	2-1/8	2-3/8	2-1/2
	50	3/8	1/4	1/2	1	1-3/8	1-5/8	2-1/4	2-5/8	3	3-3/8
	60	3/8	1/4	5/8	1-1/4	1-5/8	2-1/8	2-3/4	3-1/8	3-5/8	4-1/8
	70	1/2	1/4	3/4	1-3/8	1-7/8	2-1/2	3-1/8	3-5/8	4-1/4	4-5/8
	80	1/2	3/8	3/4	1-1/2	2-1/8	2-7/8	3-5/8	4-1/8	4-7/8	5-3/8
	90	5/8	3/8	7/8	1-3/4	2-3/8	3-1/4	4	4-5/8	5-3/8	6
	100	5/8	3/8	1	1-7/8	2-5/8	3-5/8	4-1/2	5-1/8	6	6-5/8

(Table title: MINIMUM LENGTH OF SLOT (DIM. "a"))

Table 1

Given:

Anchor bolt diameter is 5/8 inches,

Temperature 200^0F, and

Distance between saddles is 30 ft.

Calculate:

a) The width of the slot. Answer in inches.

b) The total length of the slot. Answer in inches.

(12 marks)

END OF QUESTION