Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2019/2020

COURSE NAME	:	PRESSURE VESSEL DESIGN
COURSE CODE	:	BNL 40103
PROGRAMME CODE	:	BNL
EXAMINATION DATE	:	DECEMBER 2019 / JANUARY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	i) ANSWER **ALL** QUESTIONS ii) ASME VIII DIV I CODE BOOK IS ALLOWED IN THE EXAMINATION

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1 (a) In designing a pressure vessel according to the ASME BPV Division 1 Section VIII code, list **FOUR (4)** parameters need to be consider before start the pressure vessel design?

(4 marks)

(b) As a designer engineer in pressure vessel industry, explain **THREE (3)** reason why stress analysis is needed and important in pressure vessel design?

(3 marks)

(c) Most of engineer was practice used ASME BPV Section VIII to design the pressure vessel. State **THREE (3)** difference between ASME BPV Code Division I and Division II in pressure vessel design.

(6 marks)

(d) The clients from Palm Oil Sdn. Bhd. required a new design for horizontal pressure vessel to replace the existing pressure vessel in their plant. The parameter of design pressure is 300 kPa, actual shell thickness is 0.5625 m, and both shell and nozzle allowable stress is 12000 kPa, respectively. There are no reinforcing element and no inward nozzle. Determine the reinforcement area requirements for 8.625 m diameter opening in a cylindrical pressure vessel and 0.487 m in internal diameter of shell. Assume all factors and constants are equals to 1.00 and the joint efficiency, E is 1.

(12 marks)

Q2 A torispherical head commonly refer to flanged and dished head having a knuckle radius of 20 mm is subjected to an internal pressure of 25 MPa. The allowable stress of SA 285 Grade A plate is 138 MPa for both heads and shell. Efficiency factor of joints of shell and head to shell is 0.85, while the joint efficiency of seamless heads is 1.00. Assume corrosion allowance, CA is 0.125 mm.

(a) Calculate the spherical radius of the torispherical head.

(3 marks)

(b) Calculate the thickness of the cylindrical shell and the maximum allowable working pressure.

(10 marks)

(c) Calculate the thickness of torispherical head and the maximum allowable working pressure.

(10 marks)

(d) Illustrate and label the vessel with the dimensions calculated in **Q2 (a), Q2 (b)** and **Q2 (c).**

(2 marks)

Q3 (a) Describe **FIVE (5)** assumptions in designing thin cylinder pressure vessel.

(5 marks)

(b) Explain the strategy how to design and fabricate cylindrical pressure vessel according to subsection in ASME BPV Division I Section VIII code.

(15 marks)

(c) As a maintenance worker in oil and gas industry, one of test should be done for a pressure vessel is hydrostatic test procedure according to ASME BPV Division I Section VIII code. The pressure vessel design has MAWP of 20 bar at 425°C. The material's allowable stress is 138 MPa at 30°C and 109 MPa at 425°C. Calculate;

(i) hydrostatic test pressure

(3 marks)

(ii) minimum inspection test pressure

(2 marks)

Q4 (a) Determine **TWO (2)** major problems on designing of support skirts.

(4 marks)

(b) List **TWO (2)** major considerations during designing of openings and nozzles.

(4 marks)

(c) Explain main disadvantage of reinforcement method.

(2 marks)

(d) A cylinder pressure vessel in vertical arrangement with internal diameter of 3000 mm is made of material SA-515-60 with ultimate tensile strength of 298 MPa. The MAWP of the cylinder pressure vessel is 10 bar. The welds are double-welded and has been stamped RT-3. The top of the shell section is 1.2 m from the top of the cylinder pressure vessel, and the bottom of this shell section is 15.8 m from the top of the vessel. Determine the minimum required thickness.

(15 marks)

-END OF QUESTIONS -