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CONFIDENTIAL

SET A

UNIVERSITI KUALA LUMPUR

Malaysia France Institute

FINAL EXAMINATION

SEPTEMBER 2014 SESSION

SUBJECT CODE	:	**FFD33502**
SUBJECT TITLE	:	**FABRICATION ESTIMATION AND COSTING**
LEVEL	:	**DIPLOMA**
TIME / DURATION	:	**12.45 PM – 2.45 PM (2 HOURS)**
DATE	:	**6 JANUARY 2015**

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 and Section B.**
6. **Answer all questions in English.**

THERE ARE 10 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

With the ____(a)_____ per unit area _____(b)_____ method, the unit of analysis is the square foot or square meter of gross floor area of the project. The gross floor area is defined as the area of all ____(c)_____ measured to the _____(d)____ of containing walls. As with the _____(e)_____per unit method, first the construction cost of completed projects have to be analyzed. This time, the known project construction cost is ____(f)_____ by the ____(g)_____ gross floor of the _____(h)_____to obtain a ___(i)___ per unit area. This unit rate can then be applied to future projects to estimate their _____(j)_____ cost

(20 Marks)

Question 2

Vesseltech produce Pressure Vessel as shown in Figure 1 for domestic clients. They expertise in manufactured of tanks, skid, angle leg and tower for process plant. Figure 5 shows the prototype of pressure vessel for one of their clients. You as an estimator need to prepare Bill of Material as Table 1 for the Pressure Vessel.

Specification:

1. Diameter of nozzle is 70 mm and length is 350mm. The thickness is 15mm and material with schedule 80 which service for oil suction. The orientation of the nozzle shall be 75°.

2. Shell tube diameter is 3350mm and length is 4570mm. Material of shell is SA 516 GR 70 and thickness 25mm.

3. Head should be fixed on left and right of the shell with radius equivalent with diameter of shell. A36 was preferred to be the material selection.

4. Saddle support material for fixed from SA 283 GR C and sliding SA 106 GR B. Base plate size 3/4“ x 10 x 10.

5. Both saddles have 4 number of ribs to support the body.

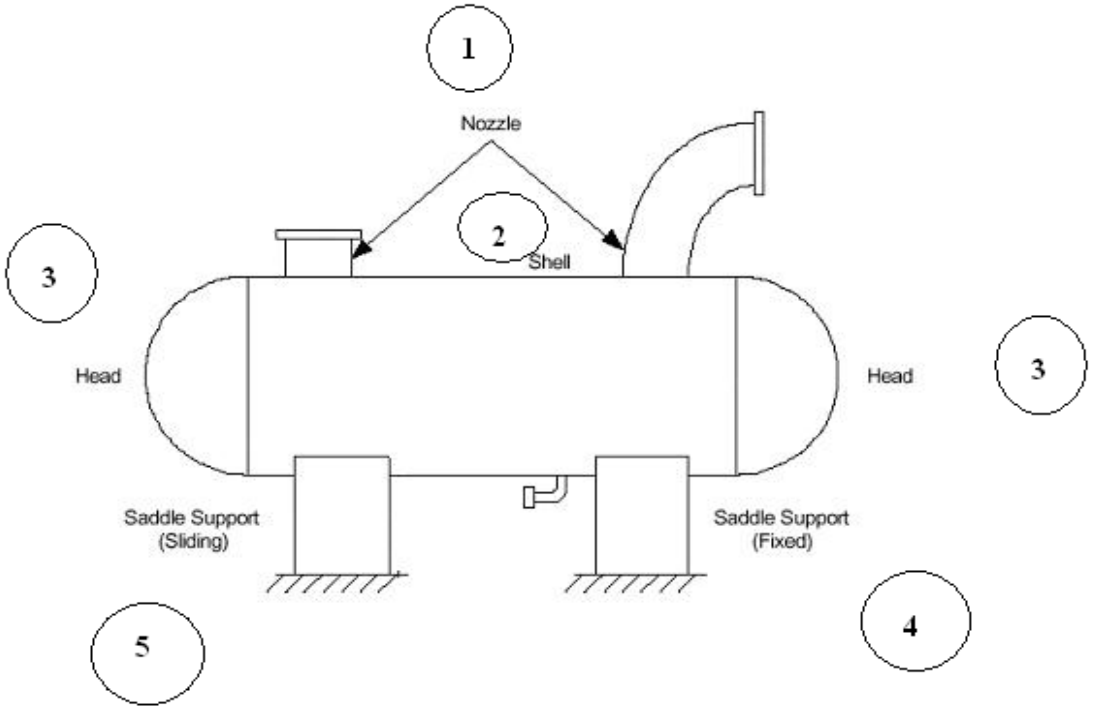


Figure 1 Pressure Vessel

Table 1 Bill Of Material

Item	Quantity	Part Name	Material	Description
1				
2				
3				
4				
5				

(20 Marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Use Appendix 1 and 6 as your guide and references.
Please use the answer booklet provided.

Welded pipes have been a common structural element in the construction industry for decades. As spiral pipes are made from coils, there is a limitation to the thickness it can be produced. Calculate the cost of welding for 1280 ft. of weld metal using CO2 shielded, Flux Cored Arc Welding in double V groove joint. The required data for this process can be finding in Appendix. Given the cost per foot deposited weld metal is $5.34

i. Electrode - 3/32" diameter, E70T-1, operated at 31 volts, 450 amps.
ii. Labor and Overhead - $30.00/hr
iii. Electrode Cost - $0.80/lb
iv. Gas cost - $0.3/cubic foot
v. Power Cost - $0.045/kWh

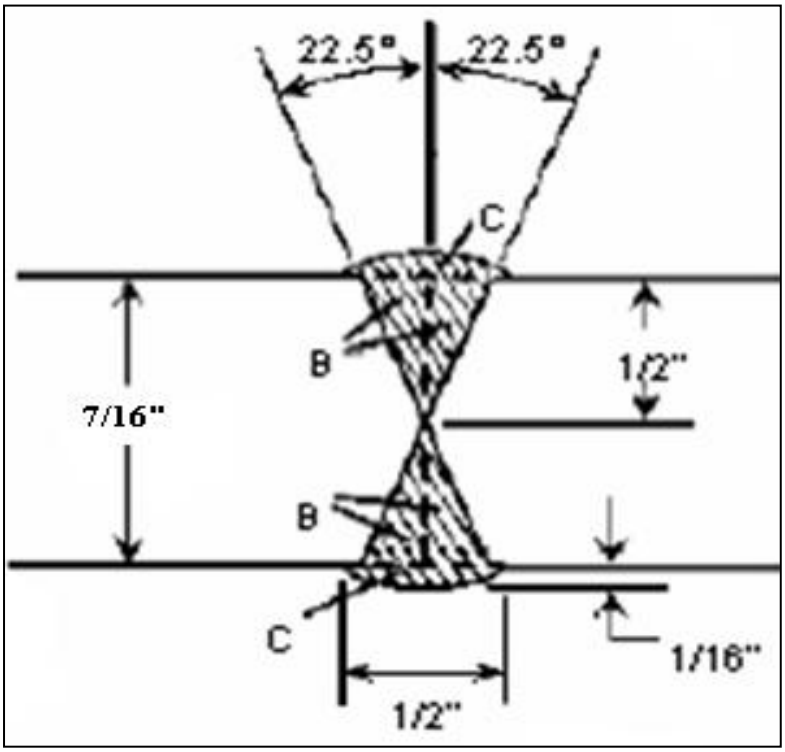


Figure 2 Double Vee Grove joint

a. The cost of labor and overhead per pound of deposited weld

= (Labor and overhead cost) / (Deposition rate x Operating factor)

= _____

=_____ (10 Marks)

b. The cost of the electrode per pound of deposited weld metal

= Electrode cost / Deposition Efficiency (Efficiency of stub loss)

= _____ (10 Marks)

c. Gas Flow Rate

= (Gas Flow Rate x Gas Cost)/ Deposition Rate

= _____ (10 Marks)

d. The cost of electrical power to deposit one pound of weld

Power cost = (Cost of power x Volt x Amp) / (1000 x deposited rate)

= _____ (10 Marks)

e. The cost of depositing one pound weld metal or total cost deposited weld metal

= cost of labor and overhead per pound of deposited + cost of the electrode per pound + electrical power to deposit

= _____ (10 Marks)

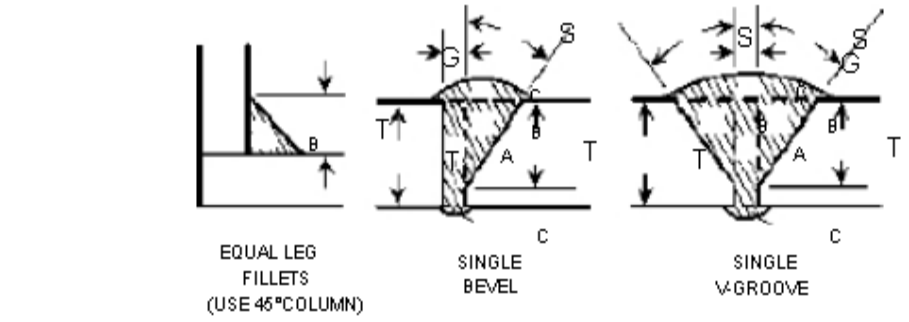
f. The cost of the weld for the total job

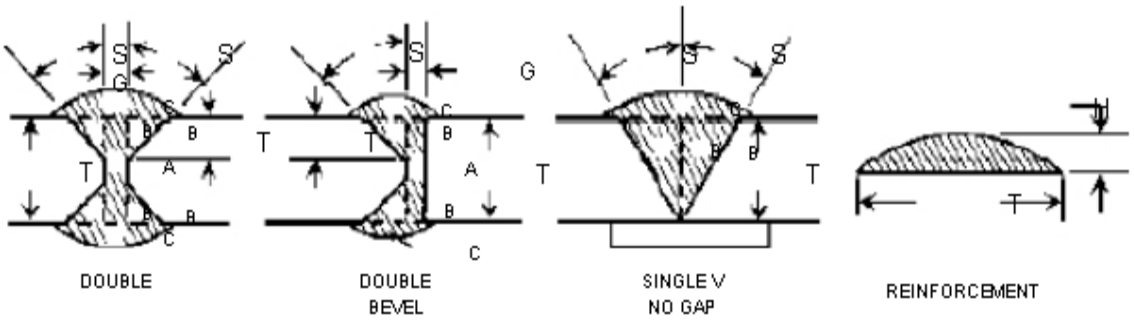
= Total feet of weld X cost per foot

= $ _____ (10 Marks)

END OF QUESTION

Appendix 1 – TABLE WEIGHT PER FOOT OF WELD METAL FOR FILLET WELDS AND ELEMENTS OF COMMON BUTT JOINTS (lbs/ft) STEEL





	lbs./ft. of Rectangle A								lbs./ft. of Triangle B				lbs./ft. Reinforcement C			
T	G								S				H			
Inches	1/16"	1/8"	3/16"	1/4"	3/8"	1/2"	5°	10°	15°	22 1/2°	30°	45°	1/16"	1/8"	3/16"	1/4"
1/8	.027	.053	.080	.106	.159	.212	.002	.005	.007	.011	.015	.027				
3/16	.040	.080	.119	.159	.239	.318	.005	.011	.016	.025	.035	.060	.027			
1/4	.053	.106	.159	.212	.318	.425	.009	.019	.028	.044	.061	.106	.035			
5/16	.066	.133	.199	.265	.390	.531	.015	.029	.044	.069	.096	.166	.044	.884		
3/8	.080	.159	.239	.318	.478	.637	.021	.042	.064	.099	.138	.239	.053	.106		
7/16	.091	.186	.279	.371	.557	.743	.028	.057	.087	.129	.188	.325	.062	.124		
	.106	.212	.318	.425	.637	.849	.037	.075	.114	.176	.245	.425	.071	.141	.212	
9/16	.119	.239	.358	.478	.716	.955	.047	.095	.144	.223	.311	.451	.080	.159	.239	
5/8	.133	.265	.398	.531	.796	1.061	.058	.117	.178	.275	.383	.664	.088	.177	.265	.354
11/16	.146	.292	.438	.584	.876	1.167	.070	.142	.215	.332	.464	.804	.097	.195	.292	.389
3/4	.159	.318	.478	.637	.995	1.274	.084	.169	.256	.396	.552	.956	.106	.212	.318	.424
13/16	.172	.345	.517	.690	1.035	1.380	.098	.198	.301	.464	.648	1.121	.115	.230	.345	.460
7/8	.186	.371	.557	.743	1.114	1.486	.114	.230	.349	.538	.751	1.300	.124	.248	.371	.495
15/16	.199	.398	.597	.796	1.194	1.592	.131	.263	.400	.618	.863	1.493	.133	.266	.398	.530
1	.212	.425	.637	.849	1.274	1.698	.149	.300	.456	.703	.981	1.698	.141	.283	.424	.566
	.239	.478	.716	.955	1.433	1.910	.188	.379	.577	.890	1.241	2.149	.159	.318	.477	.637
1 1/4	.265	.531	.796	1.061	1.592	2.123	.232	.468	.712	1.099	1.532	2.653	.177	.354	.531	.707
1 3/8	.292	.584	.876	1.167	1.751	2.335	.281	.567	.861	1.330	1.853	3.210	.195	.389	.584	.777
1 1/2	.318	.637	.955	1.274	1.910	2.547	.334	.674	1.023	1.582	2.206	3.821	.212	.424	.637	.849
1 5/8	.345	.690	1.035	1.380	2.069	2.759	.393	.792	1.201	1.857	2.589	4.484	.230	.460	.690	.920
1 3/4	.371	.743	1.114	1.486	2.229	2.972	.455	.918	1.393	2.154	3.002	5.200	.248	.495	.743	.990
	.390	.796	1.194	1.592	2.388	3.184	.523	1.053	1.599	2.473	3.447	5.970	.266	.531	.796	1.061
2	.425	.649	1.274	1.698	2.547	3.396	.594	1.197	1.820	2.813	3.921	6.792	.283	.566	.849	1.132
2 1/4	.478	.955	1.433	1.910	2.865	3.821	.752	1.516	2.303	3.561	4.963	8.596	.318	.637	.955	1.273
	.530	1.061	1.592	2.123	3.184	4.245	.928	1.871	2.844	4.396	6.127	10.613	.354	.707	1.061	1.415
2 3/4	.584	1.167	1.751	2.335	3.502	4.669	1.123	2.264	3.441	5.319	7.414	12.841	.389	.778	1.167	1.556
3	.636	1.274	1.910	2.547	3.821	5.094	1.337	2.695	4.095	6.330	8.823	15.282	.424	.849	1.273	1.698

Appendix 2 – SMAW COATED ELECTRODES DEPOSITION DATA

E7016

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
1/8	100	1.7	63.9%
	130	2.3	65.8%
5/32	140	3.0	70.5%
	160	3.2	69.1%
	190	3.6	66.0%
3/16	175	3.8	71.0%
	200	4.2	71.0%
	225	4.4	70.0%
	250	4.8	65.8%
1/4	250	5.9	74.5%
	275	6.4	74.1%
	300	6.8	73.2%
	350	7.6	71.5%

E7024

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
1/8	140	4.2	71.8%
	180	5.1	70.7%
5/32	180	5.3	71.3%
	210	6.3	72.5%
	240	7.2	69.4%
3/16	245	7.5	69.2%
	270	8.3	70.5%
	290	9.1	68.0%
7/32	320	9.4	72.4%
	360	11.6	69.1%
1/4	400	12.6	71.7%

LOW ALLOY, IRON POWDER ELECTRODES TYPES E7018, E8018, E9018, E10018, E11018, AND E12018

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
3/32	70	1.37	70.5%
	90	1.65	66.3%
	110	1.73	64.4%
1/8	120	2.58	71.6%
	140	2.74	70.9%
	160	2.99	68.1%
5/32	140	3.11	75.0%
	170	3.78	73.5%
	200	4.31	73.0%
3/16	200	4.85	76.4%
	250	5.36	74.6%
	300	5.61	70.3%
7/32	250	6.50	75.0%
	300	7.20	74.0%
	350	7.40	73.0%
1/4	300	7.72	78.0%
	350	8.67	77.0%
	400	9.04	74.0%

DEPOSITION DATA - SMAW - COATED ELECTRODES (Con't.)

NOTE: EFFICIENCY RATES DO NOT INCLUDE STUB LOSS

E6010

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
3/32	75	1.5	72.0%
1/8	100	2.1	76.3%
	130	2.3	68.8%
5/32	140	2.8	73.6%
	170	2.9	64.1%
3/16	160	3.3	74.9%
	190	3.5	69.7%
7/32	190	4.5	76.9%
	230	5.1	73.1%

E6011

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
3/32	75	1.3	61.0%
1/8	120	2.3	70.7%
5/32	150	3.7	77.0%
3/16	180	4.1	73.4%
7/32	210	5	74.2%
1/4	250	5.6	71.9%

E6012

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
1/8	130	2.9	81.8%
5/32	165	3.2	78.8%
	200	3.4	69.0%
3/16	220	4	77.0%
	250	4.2	74.5%
7/32	320	5.6	69.8%

6013

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
3/32	85	1.6	73.0%
1/8	125	2.1	73.0%
5/32	140	2.6	75.6%
	160	3	74.1%
	180	3.5	71.2%
3/16	180	3.2	73.9%
	200	3.8	71.1%
	220	4.1	72.9%
7/32	250	5.3	71.3%
	270	5.7	73.0%
	290	6.1	72.7%

E7014

ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
1/8	120	2.4	63.9%
	150	3.1	61.1%
5/32	160	3	71.9%
	200	3.7	67.0%
3/16	230	4.5	70.9%
	270	5.5	73.2%
7/32	290	5.8	67.2%
	330	7.1	70.3%
1/4	350	7.1	68.7%
	400	8.7	69.9%

DEPOSITION DATA - SMAW - COATED ELECTRODES

Appendix 3 – FCAW COATED ELECTRODES DEPOSITION DATA

FLUX CORED ARC WELDING (FCAW) GAS SHIELDED TYPES E70T-1, E71T-1, E70T-2, E70T-5, & ALL LOW ALLOY TYPES			
ELECTRODE DIAMETER	AMPS	DEPOSITION RATE lbs/hr	EFFICIENCY %
3/32	400	12.7	85%
	450	15.0	86%
	500	18.5	86%

Appendix 4 – OPERATING FACTOR

WELDING PROCESS			
SMAW	+ * GMAW	*FCAW	*SAW
30%	50%	45%	40%

*Semi-Automatic Only
+ Metal Cored Wires are Included

APPROXIMATE OPERATING FACTOR

Appendix 5– SHIELDING GAS FLOW RATE

			FCAW/MCAW		
Wire Diameter	.035"		.045"	1/16"	5/64" - 1/8"
CFH	30	35	35	40	45

APPROXIMATE SHIELDING GAS FLOW RATE - CUBIC FEET PER HOUR

Appendix 6 – STUB LOSS EFFICIENCY

STUB LOSS CORRECTION TABLE FOR COATED ELECTRODES EFFICIENCY INCLUDING STUB LOSS

ELEC. LENGTH	DEPOSITION EFFICIENCY	2" STUB	3" STUB	4" STUB	5" STUB
12"	60%	50.0%	45.0%	40.0%	35.0%
	65%	54.2%	48.7%	43.3%	37.9%
	70%	58.3%	52.5%	46.6%	40.8%
	75%	62.5%	56.2%	50.0%	43.7%
	80%	66.6%	60.0%	53.3%	46.6%
14"	60%	51.4%	47.1%	42.8%	38.5%
	65%	55.7%	51.1%	46.4%	41.8%
	70%	60.0%	55.0%	50.0%	45.0%
	75%	64.3%	58.9%	53.6%	48.2%
	80%	68.5%	62.8%	57.1%	51.4%
18"	60%	53.3%	50.0%	46.6%	43.3%
	65%	57.7%	54.2%	50.5%	46.9%
	70%	62.2%	58.3%	54.4%	50.5%
	75%	66.6%	62.5%	58.3%	54.2%
	80%	71.1%	66.6%	62.2%	57.7%

Appendix 7 – WELDING USEFUL FORMULA

$$\frac{\text{LABOR \&}}{\text{OVERHEAD}} = \frac{\text{LABOR \& OVERHEAD COST/HR}}{\text{DEPOSITION RATE (LBS/HR)} \times \frac{\text{OPERATING}}{\text{FACTOR}}}$$

$$\text{EFFICIENCY MINUS STUB LOSS} = \frac{(\text{ELECTRODE LENGTH} - \text{STUB LENGTH}) \times \text{DEPOSITION EFFICIENCY}}{\text{ELECTRODE LENGTH}}$$

$$\frac{\text{ELECTRODE}}{} = \frac{\text{ELECTRODE COST/LB}}{\text{DEPOSITION EFFICIENCY}}$$

$$\frac{\text{POWER}}{} = \frac{\text{COST/KWh} \times \text{VOLTS} \times \text{AMPS}}{1000 \times \text{DEPOSITION RATE}}$$

$$\text{Total Pounds} = \frac{\text{Wt/Ft of Weld x No. of Ft of Weld}}{\text{Deposition Efficiency}}$$

$$\text{Welding Time} = \frac{\text{Wt/Ft of Weld x Ft of Weld}}{\text{Deposition Rate x Operating Factor}}$$

$$\text{GAS} \quad \frac{\text{GAS FLOW RATE (CU FT/HR)} \times \text{GAS COST/CU FT}}{\text{DEPOSITION RATE (LBS/HR)}}$$

Deposition efficiency = Weight of Weld Metal ÷ Weight of Electrode Used
(or)
Deposition Rate (lbs/hr) ÷ Burn-off Rate (lbs/hr)