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Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021**

COURSE NAME : ENGINEERING ECONOMY
COURSE CODE : BFC 44602 / BPK 30902
PROGRAMME CODE : BFF
EXAMINATION DATE : JULY 2021
DURATION : 2 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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TERBUKA

Q1 Persada Consult is a successful construction company. As the person in charge of the company, you are responsible for ensuring that the company is always in a stable state. In this Covid-19 situation, many companies had to close due to lack of construction projects. Various initiatives have been taken by the Government to ensure that not only this epidemic is eradicated immediately, but also the survival of the people can continue. From this pandemic situation, what planning and strategies do you need to do to ensure the company continues to thrive even in such situations?

(i) Describe **FIVE (5)** strategies to ensure your company continue to thrive in the pandemic situations. (10 marks)

(ii) The development, study and application of any discipline must begin with a basic foundation. Once a problem or need has been clearly defined, the foundation of the discipline can be discussed in term of seven principles. Choose one of issue and list out the process to solve the problem by systematically applying the **SEVEN (7)** fundamental principal of Engineering Economy. (15 marks)

Q2 a) Derive the following equation based on the equation of total cost, total revenue and profit.

(i) Maximum Profit Value

$$D^* = \frac{a - c_v}{2b}$$
 (3 marks)

(ii) Breakeven Point

$$D' = \frac{-(a - c_v) \pm \sqrt{(a - c_v)^2 - 4(-b)(-C_F)}}{2(-b)}$$
 (3 marks)

b) Mega Holding is a contractor company specialise in bridge construction. The company has been offered two projects to construct a bridge at two different locations. However, based on the capability of the company, the company is only able to accept one project at a time. To make decision, cost estimation have to be made. The cost factors relating to the two projects are shown in **Table Q2 (a)**.

Table Q2 (a)

Cost Factors	Project A	Project B
Concrete beams and columns needed	6 beams, 12 columns	8 beams, 16 columns
Equipment rental (per month)	RM1000	RM2500
Site investigation	RM40636	RM30848
Labour cost:		
(i) Design engineer	RM150 per hour	RM130 per hour
(ii) Field/construction engineer	RM100 per hour	RM90 per hour

The design phase for both projects take 3 months and the construction phase take 9 months, Thus total of 12 months to complete (With 6 working days per week and 8 working hours per day). The volume for each beam and column are 500m³ and 314m³ respectively. The cost of concrete is RM65 per unit volume. The revenue for the bridge construction comes from the toll payment by the users of the bridge. The fees for each automobile that passes through the bridge is RM1.10 per automobile on average. The average number of automobile passes through the bridge is 60 000 per year.

- (i) Compute total cost for both projects. (8 marks)

- (ii) Determine the best project based on your answer in **Q2 b(i)**. (6 marks)

- (iii) Calculate how many years the company start making a profit based on the answer in **Q2 b(ii)**. (5 marks)

Q3 (a) Ten years ago, the port of Fatih built a new pier containing a large amount of steel work, at a cost of RM3,000,000, estimating that it would have a life of 50 years. The annual maintenance cost, much of it for painting and repair caused by the environment, has turned out to be unexpectedly high, averaging RM70,000/year. The port manager has proposed to the port commission that this pier be replaced immediately with a reinforced concrete pier at an initial cost of RM4,000,000. He assumes them that this pier will have a life of at least 50 years with annual maintenance costs of not over RM20,000. He estimated that the net present salvage value of the existing pier would amount to RM400,000.

- (i) Draw the Cash Flow Diagram. (4 marks)

- (ii) Assuming a MARR of 10%, what should the port commission’s decision be? Use the Annual Equivalent Values. (6 marks)

- (b) An Excavation Contractor purchased a bulldozer four years ago for RM70,000 estimating that it would have an economic life of 8 years with no salvage value. Present salvage value (book value) of the existing machine is RM10,000. Out-of-pocket disbursements for operation and maintenance are about RM20,000 per year, and in addition because of repeated breakdowns, the company has had to rent another bulldozer for 45 days each year at RM500 per day.

The company is planning to buy a new bulldozer at a cost RM80,000. The economic life of the new bulldozer is 5 years with no salvage. Operation and maintenance costs for the new machine would be the same as for the old machine. The purchase of a new machine would eliminate the need for renting a bulldozer for 4 years necessitating the rental of an extra bulldozer only on the 5th year.

- (i) Determine the value both of the bulldozer if a MARR is 10% per year using the using a proper cash flow diagram. (10 marks)
- (ii) Justify if the machine should be replaced or not. Show the calculation path and give your reason. (5 marks)

- Q4** (a) SNS Corporation is considering a new project to construct new railway sand managing the High Speed Rail (HSR) trains from Kuala Lumpur station to Singapore. The land acquisition is estimated to be RM62 million Construction cost for the railways and other facilities including the high-speed trains is expected to be RM208 million with an additional annual maintenance cost of RM22 million. Finally, the projected increase in public transport travelers will require an additional railways traffic controller costing RM20 millions with an annual cost of RM8 million. Annual benefits of the railways have been estimated as in **Table Q4(a)**.

Table Q4(a)

Descriptions	RM (million)
Tickets collected	36
Rental of shop lots receipts from entrepreneurs	16
Parking lots charges to visitors	14
Convenience benefit to the local community	16
Additional tourism income to the state of Johor	12



Apply the B-C ratio method for both conventional and modified cases using PW and AW methods with the study period of 20 years and a MARR of 12% per year to determine whether the SNS Corporation should proceed with the HSR project.
(10 marks)

- (b) Three mutually exclusive alternatives public-works projects are currently under consideration. Each of the projects has a useful life of 30 years and MARR of 15% per year. Their respective costs and benefits are included in **Table Q4(b)**.

Table Q4(b)

Particulars	Project A (RM)	Project B (RM)	Project C (RM)
Capital Investment	10,300,000	12,500,000	15,700,000
Annual Operating & Maintenance Costs	1,300,000	1,200,000	1,000,000
Salvage Value	1,250,000	1,520,000	1,950,000
Annual Benefits	2,250,000	2,600,000	2,850,000

- (i) Using present worth method, analyse B-C ratio for each alternative.
(10 marks)
- (ii) Select project (mutually exclusive projects) should be considered according to the evaluation by B-C ratio.
(5 marks)

- END OF QUESTIONS -

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LIST OF FORMULA

1. $p (1 + i)^n$
2. $C_n = C_k (I_n/I_k)$
3. $Z_u = K(t^n)$
4. $n = \log s / \log 2$
5.
$$I_n = \frac{W1 (C_{n1}/C_{k2}) + W2 (C_{n2}/C_{k2}) + W... (C_{n...}/C_{k...})}{W1 + W2 + W...} \times I_k$$
6. Conventional B-C ratio with PW
 $B-C = PW(B) \div [(I - PW(MV)) + PW(O\&M)]$
7. Modified B-C ratio with PW
 $B-C = [PW(B) - PW(O\&M)] \div [I - PW(MV)]$
8. Conventional B-C ratio with AW
 $B-C = AW(B) \div [CR + AW(O\&M)]$
9. Modified B-C ratio with AW
 $B-C = [AW(B) - AW(O\&M)] \div CR$

LIST OF DISCRETE COMPOUNDING

- | | |
|--------------------|-------------|
| 1. (F/P, 10%, 4) | : 1.4641 |
| 2. (P/F, 10%, 4) | : 0.6830 |
| 3. (F/A, 10%, 4) | : 4.6410 |
| 4. (P/A, 10%, 4) | : 3.1699 |
| 5. (A/F, 10%, 4) | : 0.2155 |
| 6. (A/P, 10%, 4) | : 0.3155 |
| 7. (F/P, 10%, 5) | : 1.6105 |
| 8. (P/F, 10%, 5) | : 0.6209 |
| 9. (F/A, 10%, 5) | : 6.1051 |
| 10. (P/A, 10%, 5) | : 3.7908 |
| 11. (A/F, 10%, 5) | : 0.1638 |
| 12. (A/P, 10%, 5) | : 0.2638 |
| 13. (F/P, 10%, 40) | : 45.2593 |
| 14. (P/F, 10%, 40) | : 0.0221 |
| 15. (F/A, 10%, 40) | : 442.5926 |
| 16. (P/A, 10%, 40) | : 9.7791 |
| 17. (A/F, 10%, 40) | : 0.0023 |
| 18. (A/P, 10%, 40) | : 0.1023 |
| 19. (F/P, 10%, 50) | : 117.3909 |
| 20. (P/F, 10%, 50) | : 0.0085 |
| 21. (F/A, 10%, 50) | : 1163.9085 |
| 22. (P/A, 10%, 50) | : 9.9148 |
| 23. (A/F, 10%, 50) | : 0.0009 |



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24. (A/P, 10%, 50)	: 0.1009
25. (F/P, 12%, 5)	: 1.7623
26. (P/F, 12%, 5)	: 0.5674
27. (F/A, 12%, 5)	: 6.3528
28. (P/A, 12%, 5)	: 3.6048
29. (A/F, 12%, 5)	: 0.1574
30. (A/P, 12%, 5)	: 0.2774
31. (F/P, 12%, 20)	: 9.6463
32. (P/F, 12%, 20)	: 0.1037
33. (F/A, 12%, 20)	: 72.0524
34. (P/A, 12%, 20)	: 7.4694
35. (A/F, 12%, 20)	: 0.0139
36. (A/P, 12%, 20)	: 0.1339
37. (F/P, 15%, 30)	: 66.2118
38. (P/F, 15%, 30)	: 0.0151
39. (F/A, 15%, 30)	: 434.7451
40. (P/A, 15%, 30)	: 6.5660
41. (A/F, 15%, 30)	: 0.0023
42. (A/P, 15%, 30)	: 0.1523