# UTHM
### Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER II
## SESSION 2021/2022

COURSE NAME            : ENGINEERING ECONOMY

COURSE CODE            : BNQ 21002

PROGRAMME              : BNN

EXAMINATION DATE       : JULY 2022

DURATION               : 3 HOURS

INSTRUCTION            : 1) ANSWER **ALL** QUESTIONS

2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**

3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

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THIS ANSWER SCRIPT CONSISTS OF **SIX** (6) PAGES

**Q1**    Cost estimation techniques are methods, used by project managers in order to calculate the total cost of a project before it even starts.

   (a)    List and describe **TWO (2)** fundamental approaches in Cost Estimation Techniques (CET).

(10 marks)

   (b)    You have been appointed by your company to manage a project involving the construction of a small commercial building with two floors of 14,000 gross square feet each. The ground floor is planned for small retail shops and the second floor is planned for offices. Develop and illustrate the first **THREE (3)** levels of a representative Work Breakdown Structure (WBS) adequate for all project efforts from the first time the decision was made to proceed with the design and construction of the building until initial occupancy is completed.

(15 marks)

**Q2**    (a)    An index is a dimensionless number that indicates how a cost/price has changed with time with respect to a year base.

   (i)    In 2012, Syafiq Engineering Sdn Bhd. (SESB) purchased a camera to detect gas leaking for RM 150,000. The index in 2012 was 200. Now in 2022, SESB considering to buy a new camera and must estimate the cost of the same type of camera. If the current index is 280, calculate the estimated cost of a new camera.

(4 marks)

   (ii)    Based on the following data (**Table Q2(a)(ii)**), determine a weighted index for the price of a product Z (grade A, grade B and grade C) in 2022, when 2012 is the reference year having an index value of 120. The weight placed on Grade A is two times that of either Grade B or Grade C, because roughly two times as many Grade A is sold compared with Grade B or Grade C.

**Table Q2(a)(ii)**

|          | Price in Year | |
|----------|------|------|
|          | **2012** | **2022** |
| Grade A  | 300  | 500  |
| Grade B  | 290  | 470  |
| Grade C  | 250  | 400  |

(6 marks)

   (iii)    If the index in 2032, is estimated to be 240, determine the corresponding 2032 prices of Product Z (Grade A, B and C) from index 2022 **(Q2)(a)(ii).**

(6 marks)

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(b)     The production team in Alpha Automobile required 100 hours to assemble the first car. Their improvement or learning rate is 0.8, which the output is doubled, their time to assemble a car is reduced by 20%. Determine:

    (i)     The time they will take to assemble the 10<sup>th</sup> car.

                                       (3 marks)

    (ii)     The total time required to assemble the first 10 cars.

                                       (4 marks)

    (ii)     The estimated cumulative average assembly time for the first 10 cars.

                                       (2 marks)

**Q3**     The time value of money is a basic financial concept that holds that money in the present is worth more than the same sum of money to be received in the future.

(a)     A visa credit card carries an interest rate of 1% per month on the unpaid balance. Calculate the effective rate per semi-annual and annual periods.

                                       (8 marks)

(b)     (i)     The average price of gasoline in 2005 was RM2.31 per gallon. In 1993, the average price was RM1.07. Determine the average annual rate of increase in the price of gasoline over this 12-year period.

                                       (4 marks)

        (ii)     The average price of gasoline in 2005 was RM2.31 per gallon. We computed the average annual rate of increase in the price of gasoline to be 6.62%. If we assume that the price of gasoline will continue to inflate at this rate, determine how long will it be before we are paying RM5.00 per gallon.

                                       (5 marks)

(c)     You put RM5,000 per year into a XYZ saving plan, which averages 8% interest per year. Five years later, you move to another place and start a new XYZ saving plan. You never get around to merging the funds in the two plans. If the first plan continued to earn interest at the rate of 8% per year for 35 years after you stopped making contributions, calculate the account worth.

                                       (8 marks)

**Q4**    The benefit-cost ratio (BCR) is a ratio that attempts to identify the relationship between the cost and benefits of a proposed project.

(a)    Amran Technologies is considering buying new circuit on software analyzing. The software license sells for RM12,500 for a five-year usage period. The software speeds up the circuit design process and is estimated to yield savings of RM6,000 per year. Upgrades and updates will cost the company RM2,000 annually. Amran uses the present worth index to make all purchasing decisions. The company's MARR is 7%. Calculate the PWI and decide whether Amran Tech. should purchase the software or not.

(8 marks)

(b)    Bavitha Consulting has a contract to design a major highway project that will provide service from Senai to Desaru. Bavhita has been requested to provide a calculation of an estimated B/C ratio for the project.

Relevant data are:
Initial cost RM20,750,000
Right of way maintenance RM550,000
Resurfacing (every 8 years) 10% of first cost
Shoulder grading and re-work (every 6 years) RM750,000
Average number of road users per year 2,950,000
Average time savings value per road user RM2
Determine the B/C ratio if $i = 8\%$.

(10 marks)

(c)    Tires Chan & Brothers is considering the purchase of new tire balancing equipment. The machine will cost RM12,699 and have an annual savings of RM1,500 with a salvage value at the end of 12 years of RM250. If the MARR is 6%, use B/C analysis to calculate the BC to determine whether or not the equipment should be purchased.

(7 marks)

- **END OF QUESTION** –

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## LIST OF FORMULA

1. $p(1+i)^n$
2. $C_n = C_k(I_n/I_k)$
3. $Z_u = K(u^n)$
4. $n = \log s / \log 2$
5.
$$I_n = \frac{W1(Cn1/Ck2) + W2(Cn2/Ck2) + W\ldots(Cn\ldots/Ck\ldots)}{W1 + W2 + W\ldots\ldots} \times Ik$$

6. Conventional B-C ratio with PW
   B-C = PW(B) ÷ [(I − PW(MV)) + PW(O&M)]
7. Modified B-C ratio with PW
   B-C = [PW(B) − PW(O&M)] ÷ [ I − PW(MV)]
8. Conventional B-C ratio with AW
   B-C = AW(B) ÷ [CR + AW(O&M)]
9. Modified B-C ratio with AW
   B-C = [AW(B) − AW(O&M)] ÷ CR
10. $N = \dfrac{\log(F/P)}{\log(1+i)}$
11. $PW_I = \dfrac{PW_{CF}}{PW_{FC}}$

### LIST OF DISCRETE COMPOUNDING

1. (F/P, 5%, 4) : 1.2155
2. (P/F, 5%, 4) : 0.8227
3. (F/A, 5%, 4) : 4.3101
4. (P/A, 5%, 4) : 3.5460
5. (A/F, 5%, 4) : 0.2320
6. (A/P, 5%, 4) : 0.2820
7. (P/G, 5%, 4) : 5.103
8. (A/G, 5%, 4) : 1.4391
9. (F/P, 5%, 10) : 1.6289
10. (P/F, 5%, 10) : 0.6139
11. (F/A, 5%, 10) : 12.5779
12. (P/A, 5%, 10) : 7.7217
13. (A/F, 5%, 10) : 0.0795
14. (A/P, 5%, 10) : 0.1295
15. (P/G, 5%, 10) : 31.652
16. (A/G, 5%, 10) : 4.0991
17. (F/P, 6%, 10) : 1.7908
18. (P/F, 6%, 10) : 0.5584
19. (F/A, 6%, 10) : 13.1808

**FINAL EXAMINATION**

SEMESTER/SESSION: SEM II 2021/2022          PROGRAMME: BNN
COURSE NAME : ENGINEERING ECONOMY          COURSE CODE: BNQ21002

20. (F/A, 8%, 5) = 5.8666
21. (F/P, 8%, 35) = 14.7853
22. (P/A, 7%, 5) = 4.100
23. (A/P, 8%, ∞) = 0.1740
24. (A/F, 8%, 8) = 0.0940
25. (A/F, 8%, 6) = 0.1363

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