



UTHM

Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION SEMESTER I SESSION 2022/2023

COURSE NAME : BUILDING MAINTENANCE

COURSE CODE : BFB 40903

PROGRAMME CODE : BFF

EXAMINATION DATE : FEBRUARY 2023

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 QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

- Q1** (a) Maintenance is the practise of keeping buildings performing and functioning at their optimal levels. Therefore, maintenance practises have a significant impact on organisational performance through a comprehensive maintenance strategy which consists of preventive and corrective maintenance. However, corrective maintenance approach is not a good way to improve organisational performance. Discuss your arguments to support this statement.

(5 marks)

- (b) As a senior maintenance engineer and a team leader in the department of a Municipal Council, you need to ensure that all maintenance procedures and processes are carried out following the organization's standard procedure. You are responsible to explain the department's maintenance procedures and processes to the new staff members. Customer complaints, periodic inspections, and memos or official letters from customer service should be covered in the maintenance work process explanation. The explanation also should include a flow chart diagram that is useful to facilitate the maintenance procedure and to illustrate the overall department's maintenance processes.

(20 marks)

- Q2** (a) Alif Sukran Holding is considering to construct an office building on a plot of 3,000m² land. An appointed architect firm has put forward two design proposals as in **Table Q2a** for the construction. Gross floor area of the building based on plot ratio of 1:3 and land cost of RM 300/m² need to be chose. You, as a building maintenance consultant have been assigned to prepare a detailed life cycle cost analysis (LCCA). Recommend to Ali Sukran Holding the most cost-effective design based on the LCCA.

(15 marks)

- (b) As a building maintenance engineer you are assigned to evaluate the cost of floor finishes replacement for the office building that need to be used for another 15 years. The option of the floor finishes limited to the alternatives as shown in **Table Q2b**. Evaluate and determine the most economical floor finish to be used based on cost/m². The interest rate is assumed to be 10%.

(10 marks)

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Q3 Building inspections is performed to assess the condition of a building by identifying the defects and then providing a rectification solutions to ensure the building continue in service without endangering the safety of its occupants. The Public Works Department (PWD) created the Building Condition Assessment System (BCA) to allow simpler and more uniform building condition inspection method, hence a reliable building maintenance decisions can be made based on the BCA.

(a) Give **ONE (1)** example of inspection work that employs visual protocols, non-destructive tests (NDTs), and destructive tests (DTs).

(3 marks)

(b) Using the PWD 21602 Guideline of Inspection and Condition Assessment, interpret the protocol matrix used for visual inspection and assessment of building conditions.

(8 marks)

(c) State a heritage building in Malaysia that has been occupied for more than 100 years and evaluate **THREE (3)** defects that are commonly identified during building condition assessment (BCA), complete with rating score and action matrix, using the PWD 21602 Guideline of Inspection and Condition Assessment.

(11 marks)

(d) Provide **ONE (1)** appropriate repair proposal for any critical defects discovered in Q3(c).

(3 marks)

Q4 (a) Calculate the progress of maintenance works amount in Malaysian Ringgit (MR) for the contractor of the school building using **Table Q4**. The project is located 60 kilometres from the Public Works Department (PWD) office in Batu Pahat District, Johor. The scope of work includes the following;

- i. Replace and remove of existing door including hinges and lockset.
- ii. Supply and install new panel door complete with hinges and lockset.
- iii. Repair and patch the old wall on both sides
- iv. Supply and install aluminum casement windows including window fittings, frames and sealants.
- v. Supply and install 6mm thick coloured patterned glass as window panel including all necessary works.
- vi. Scraping old paint and others from plastered surfaces, as well washing and repairing all cracks and other flaws.
- vii. Prepare the surface and apply two layers of cement-based paint to a plastered surface.
- viii. Prepare the surface by applying two layers of emulsion paint to a plastered surfaces.

(10 marks)

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- (b) Maintenance planning is the process of determining what maintenance work should be done and how it should be done. As a senior maintenance engineer, provide a preventive maintenance planning of five-story office building for the following services;
- (i) Lift/Elevator system
 - (ii) Sprinkler system
 - (iii) Cold water tank

(15 marks)

-END OF QUESTIONS-

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Table Q2a

Description	Proposal A	Proposal B
Building and infrastructure cost	RM 1,400/m ²	RM 1,600/m ²
Professional fees	12% of construction cost	12% of construction cost
Operation cost	RM 500,000 per annum	RM 700,000 per annum
Minor repair	3% of construction cost at every 5 years	3% of construction cost at every 10 years
Major renovation	RM 2,000,000 every 15 years	RM 1,000,000 every 15 years
Economic life of building	50 years	60 years
Interest rate	12%	12%
Construction period	1 year	1 ½ years

Table Q2b

Description	Carpet (‘Blue ribbon’ looped roll carpet) (RM/m ²)	PVC Tiles (300mm x 30mm x 2mm Thick ‘Polyflor XL’ vinlytiles) (RM/m ²)	Homogeneous Tiles (300mm x 300mm x 7.5mm Thick ‘Redhorse’ homogenous tiles) (RM/m ²)
Initial cost	60	45	75
Annual cleaning cost	5	4	3.50
Replacement cost every 5 years	65		
Replacement cost every 3 years		55	
Replacement cost every 10 years			90

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Table Q4

No	Description	Qty	Rate	Percentage of Work Progress
1	Replace the existing door, including the hinges and lockset.	6 nos	RM 8.00/no	100%
2	Supply and install a new panel door, complete with hinges and a lockset.	6 nos	RM 285.00/no	100%
3	Remove and dispose of defective windows, fittings, frames, and sealants as directed.	4 nos	RM 10.00/no	100%
4	Supply install aluminium casement windows, including window fittings, frames, and sealants, in accordance with the specifications.	3.64 m ²	RM 200.00/m ²	100%
5	Supply and install 6mm thick patterned coloured glass as a window panel, including all necessary work as specified.	3.64 m ²	RM 132.10/m ²	100%
6	Scraping old paint and other related works from plastered surfaces, washing and repairing all cracks and other deformed areas as directed.	100 m ²	RM 4.30/m ²	100%
7	Prepare a surface and apply two layers of cement-based paint to a plastered surface, as directed.	100 m ²	RM 6.00/m ²	0%
8	Prepare a surface and apply two layers of emulsion paint to a plastered surface, as directed.	100 m ²	RM 4.50/m ²	0%
9	Additional factor for location -less than 15km -15 – 30km -30 – 50km >50km		10% 17% 20% 22%	
10	Cost overhead and profit		15%	

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