UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	ENERGY MANAGEMENT IN BUILDING
COURSE CODE	:	MDL 10703
PROGRAMME CODE	:	MDL
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS **ONLY** **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) The energy requirements of a building are largely dependent on the needs of the building occupants and the activities conducted in the building. The provision of comfort for the occupants is the primary function of the building. Classify and elaborate the main **THREE (3)** aspects of comfort in a building.

(6 marks)

(b) Differentiate the benefits of the following green energy ratings and certifications in Malaysia:

(i) Building Energy Index (BEI); and
(ii) MyCREST.

(7 marks)

(c) Recommend and elaborate the 3-tier approach to reduce energy requirement for cooling that are suitable to be implemented in Malaysia building design.

(12 marks)

Q2 (a) The concept of Roof Thermal Transfer Value (RTTV) is applied if the roof is provided with skylight and the entire enclosure below is fully air-conditioned. Determine the importance of thermal transmittance (U-value) in the concept of RTTV.

(5 marks)

(b) Provide recommendation on how to reduce Overall Thermal Transfer Value (OTTV) and Roof Thermal Transfer Value (RTTV).

(8 marks)

(c) Differentiate the following process with adequate elaboration:

(i) Electricity generation;
(ii) Electricity transmission;
(iii) Electricity distribution; and
(iv) Electricity classification.

(12 marks)

Q3 (a) Air conditioning and refrigeration cycle involves **FOUR (4)** major components. Brief the function of each component.

(4 marks)

(b) In an air-handling unit, re-circulated air from an office space at 24 ºC dry-bulb temperature, 50% relative humidity and 2.65 m^3/s volumetric flow rate is first mixed with outdoor fresh air at 35 ºC dry-bulb temperature, 25 ºC wet-bulb temperature and 1.79 m^3/s volumetric flow rate.

(i) Identify the mixed condition of re-circulated and outdoor air;
(ii) Determine cooling duty and moisture removal if the mixture is cooled to 13 ºC dry-bulb temperature and 90% relative humidity; and
(iii) Examine the rates of heat transfer required for these processes.

(15 marks)

(b) Evaluate monthly electricity cost saving in Q3 (b) if a chiller system of COP 5.0 is opted instead COP 3.5. The building operates 12 hours/day, 20 days/month. Given Electricity Tariff (B), RM 0.435/kWh.

(6 marks)

Q4 (a) Describe energy saving option that should be prioritized based on the Energy Pyramid.

(3 marks)

(b) Sri Perdana Hub is a 5 storey building to consist of retail, office and residential. Due to high energy consumption of the building, the top management has decided to implement Sustainable Energy Management System. An assessment of current energy has been conducted using Energy Management Matrix, with organizational profile established as shown in **Table Q4 (b)**.

(i) Analyse and interpret the current organizational profile; and

(ii) Set proper action plans to achieve Energy Management Gold Standard (1-Star).

(10 marks)

(c) In the first six months of 2021, XYZ Sheet Enterprise produces 618, 256 sheets of A4 papers. Base on energy use and production, in **Table Q4 (c)**:

(i) Calculate thermal, electrical and total Energy Efficiency Index (EEI) monthly; and

(ii) Using a scatter diagram, establish relationship between energy consumption and production.

(12 marks)

Q5 (a) Will the threat of global climate change stimulate the development of renewable energy generation? If so, which technologies are likely to prosper?

(5 marks)

(b) Elaborate the principles of following technologies to save energy and cost in building:

(i) Solar photovoltaic; and

(ii) Rain water harvesting.

(8 marks)

(c) Evaluate the lowest life cycle cost between two boiler systems. Alternative A has a first cost of $80,000, will last for 20 years, and has a salvage value of $7,000 at the end of its useful life. Alternative B has a first cost of $35,000 and a useful life of 10 years. Alternative B has no salvage value and will have to be replaced completely in year 11 with the same annual costs.

(12 marks)

- END OF QUESTIONS -

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Table Q4 (b): Organisational profile of Sri Perdana Hub

	Policy	Organising	Training	Performance Measurement	Communicating	Investment
4	Energy policy action plan and regular review have active commitment of top management	Fully integrated into management structure with clear accountability for energy consumption	Appropriate and comprehensive staff training tailored to identified needs, with evaluation	Comprehensive performance measurement against targets with effective management reporting	Extensive communication of energy issues within and outside organisation	Resources routinely committed to energy efficiency in support of business objectives
3	Formal policy but not active commitment from top	Clear line management accountability for consumption and responsibility for improvements	Energy training targeted at major users following training needs analysis	Weekly performance measurement for each process, unit or building	Regular staff briefings, performance reporting and energy promotion	Same appraisal criteria used as for other cost reduction projects
2	Unadopted policy	Some delegation of responsibility but line management and authority unclear	Ad-hoc internal training for selected people as required	Monthly monitoring by fuel type	Some use of company communication mechanisms to promote energy efficiency	Low or medium cost measures considered if short payback period
1	Unwritten set of guidelines	Informal mainly focused on energy supply	Technical staff occasionally attend specialist courses	Invoice checking only	used to promote energy efficiency	Only low or no-cost measures taken
0	No explicit energy policy	No delegation or responsibility for managing energy	No energy related staff training provided	No measurement of energy costs of consumption	No communication or promotion of energy issues	No investment in improving energy efficiency

Table Q4 (c): Production and energy consumption data of XYX Sheet Enterprise in 2021

Month	Jan	Feb	Mar	Apr	May	Dec
Production (Sheet)	101,856	90,846	98,242	111,838	109,772	105,702
Installed Capacity (Sheet)	125,000	125,000	125,000	125,000	125,000	125,000
Hrs of Operation	744	744	744	744	720	720
Electrical Energy (MWh)	1,098.68	1,030.64	1,077.6	1,333.96	1,310.6	1,270.16
Diesel Oil (1000 liter)	4.73	0.51	38.93	11.75	8.73	3
NG (MMBTU)	21,715	21,366	20,753	28,407	21,971	22,953