UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION

SEMESTER I
SESSION 2021/2022

COURSE NAME	:	GENERATOR SYSTEM MAINTENANCE
COURSE CODE	:	BBJ 20905
PROGRAMME CODE	:	BBJ
EXAMINATION DATE	:	JANUARY / FEBRUARY 2022
DURATION	:	2 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS.
		2. THIS FINAL EXAMINATION IS AN **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSED BOOK**.

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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Q1. (a) List five (5) mechanical parts or system in Diesel Generator.

(5 marks)

(b) Give at least four (4) events if Emergency Diesel Generator fails to operate during emergency and explain them briefly.

(8 marks)

(c) Question **Q1(c)** based on **Figure Q1(c)** below.

Manufacturer: Volva Penta Marine Genset
Model: D7AT
Four stroke cycle, Direct Inject, Turbocharger,
In line 6 Cylinder Diesel Engine
Rated output: 1500RPM, 50Hz
Capacity: 108kW
Fuel Consumption: 219 gram/kWh

Figure Q1(c)

Calculate:

(i) Fuel consumption in litre/hour. Assume diesel fuel density is 860 kg/m3.

(2 marks)

(ii) Minimum size of fuel tank.

(4 marks)

(iii) Minimum runtime.

(3 marks)

(iv) Draw and label the minimum fuel tank based on answer **Q1(c)(ii)**.

(3 marks)

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Q2. (a) List five (5) class of insulation for generator winding.

(5 marks)

(b) Governor is very important in generator control scheme.
   (i) Explain the work principle for mechanical hydraulic governor following two mode of operations; Load Increase and Load Decrease.

(6 marks)

   (ii) Sketch the flyweight operation during Load Increase and Load Decrease.

(4 marks)

(c) Question **Q2(c)** is based on **Figure Q2(c)**. **Figure Q2(c)** below shows a generator supplying a load. A second load is to be connected in parallel with the first one. The generator has a no load frequency of 51.5 Hz and a slope, S_p of 1.5 MW/Hz. Load 1 consumes a real power of 1250 kW at 0.85 PF lagging, while load 2 consumes a real power of 500 kW at 0.7 PF lagging.
   (i) Before the switch is closed, what is the operating frequency of the system?

(4 marks)

   (ii) After load 2 is connected, what is the operating frequency of the system?

(4 marks)

   (iii) After load 2 is connected, what action could an operator take to restore the system frequency to 50Hz?
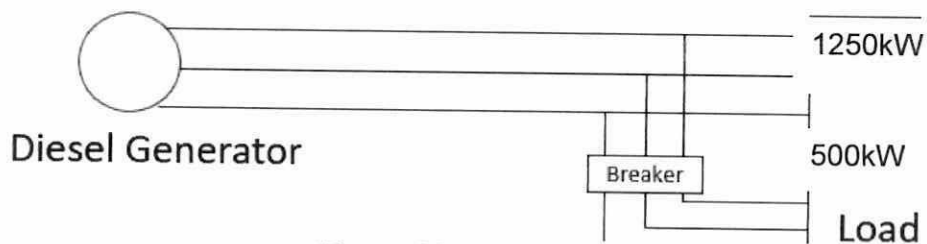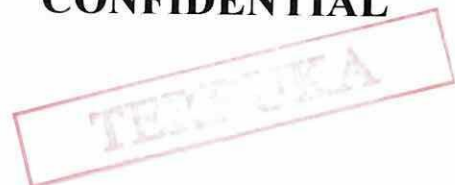
(2 marks)

Figure Q2(c)

Q3.   (a)   Give definition of synchronization and list four (4) main conditions of Diesel Generator that must be met for synchronization.

(5 marks)

(b)   During synchronization process, phase sequence can be examine in two methods.
(i)   Suggest the suitable method to check phase sequence in industry.

(2 marks)

(ii)   Explain briefly the method you suggested in **Q3(b)(i)**.

(4 marks)

(c)   A total load in a factory is 100 kW and had two units of Diesel Generator with each capacity is 150 kVA and 180 kVA. Calculate the value of load in kW that can be shared between both generators to ensure the generator can operate efficiently. Assume power factor is 0.85 lagging.

(14 marks)

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Q4.   (a)   Explain seven (7) benefits of maintenance strategies.

(7 marks)

(b)   Question **Q4(b)** is based on **Figure Q4(b)**. **Figure Q4(b)** below shows Uptime and Downtime for Diesel Generator in XYZ Industrial Sdn. Bhd.
(i)   Calculate Mean Time Between Failure (MTBF) in days.

(4 marks)
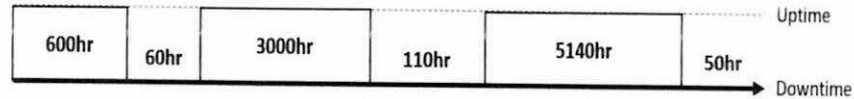(ii)   Calculate Mean Time To Repair (MTTR) in days.

(4 marks)

Figure Q4(b)

(c)   ABC Sdn. Bhd purchase new Emergency Diesel Generator. As maintenance technologist in this company, you need to contruct a new Maintenance Schedule for Emergency Diesel Generator. Develop a schedule based on **Table Q4(c)**.

Components	Engine, Fuel, Electricity, Cooling System and Exhaust System
Actions	Visual Inspection, Check and Replacement
Frequency	Weekly, Monthly, and Yearly.

Table Q4(c)

(10 marks)

-END OF QUESTIONS-

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