UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

OCTOBER 2025 SEMESTER SESSION

SUBJECT CODE	:	**LGB31803**
SUBJECT TITLE	:	**MARINE POWERPLANT AND AUXILARY SUPPORT SYSTEM**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BET IN NAVAL ARCHITECTURE AND SHIPBUILDING WITH HONOURS**
TIME / DURATION	:	**9.00 AM – 12.00 PM (3 HOURS)**
DATE	:	**30 JANUARY 2026**

INSTRUCTIONS TO CANDIDATES

1. Please **CAREFULLY** read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of **TWO (2)** sections; Section A and Section B.
4. Answer **ALL** questions in Section A and **TWO (2)** questions from Section B.
5. Please write your answers in the answer booklet provided.
6. Answer **ALL** questions in English only.

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS COVER PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.

Question 1

You are a marine engineering consultant advising a ship owner who is considering the installation of a new propulsion system for a medium-sized container vessel. Your task is to provide a detailed analysis and recommendations, considering various technical, economic, and environmental factors.

a. Discuss the impact of specific IMO conventions such as SOLAS and MARPOL influence 'type approval' requirements for marine equipment and how these regulatory standards contribute to the United Nations SDG 14: Life Under Water goals.

(10 marks)

b. Analyze the engineering considerations that influence propulsion system selection and machinery space configuration, and why meeting International Association of Classification Societies (IACS) requirements is critical for vessel certification.

(10 marks)

Question 2

A four stroke, four cylinder diesel engine running at 1800 rpm develops 55 kW. Brake thermal efficiency is 35% and calorific value of fuel (C_V) is 35 MJ/kg. Take a = 1.15 kg/m^3 , air to fuel ratio = 15 : 1 and mechanical efficiency ,η_m= 0.85 engine. Calculate :-

a. Therefore, calculate the followings:

(i) fuel consumption (kg/s);

(4 marks)

(ii) air consumption (m^3/s);

(4 marks)

(iii) indicated thermal efficiency, η_{th};

(4 marks)

b. Explain the ways engineers use these performance indicators to optimize engine design and enhance overall system reliability.

(8 marks)

Question 3

a. Marine steam propulsion systems can be computed taking into consideration the appropriate levels of work input across the pump, heat input at the boiler, work output at the turbine and the heat output at the condenser in terms of the enthalpies and entropies as appropriate. Make use of the data in the steam table provided in Table 1 for condenser and boiler conditions of 60°C and 250°C, calculate the thermal efficiency, η.

T (^{o}C)	P (kPa)	vf (m^3/kg)	vfg (m^3/kg)	vg (m^3/kg)	sf (KJ/kgK)	sfg (KJ/kgK)	sg (KJ/kgK)	hf (KJ/kg)	hfg (KJ/kg)	hg (KJ/kg)
60	19.916	0.001017	7.678	7.679	0.8302	7.0802	7.9104	250.918	2358.89	2609.80
250	3974.26	0.001251	0.048850	0.050100	2.7815	3.2880	6.0696	1085.58	1715.58	2801.16

Table 1: Steam Table

(14 marks)

b. Analyze three (3) significant operational challenges faced by marine steam turbines with potential solutions or improvements to enhance overall steam turbine performance.

(6 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions.
Please use the answer booklet provided.

Question 4

a. Compare the power-to-weight ratio of gas turbines with other propulsion systems used in fast ferries and assess the extent to which the unique characteristics of gas turbines support the speed and acceleration demands of these vessels.

(5 marks)

b. A naval vessel using a gas turbine unit has a pressure ratio of 11/1 and a maximum cycle temperature of 755 degrees Celsius. The isentropic efficiencies of the compressor and turbine are 0.82 and 0.85 respectively. The air enters the compressor at 17 degrees Celsius at a rate of 15.5 kg/s. Therefore, calculate the following:

(i) Compressor work input

(3 marks)

(ii) Turbine work output

(3 marks)

(iii) Network output

(3 marks)

(iv) Power output to an electric generator geared to the turbine

(3 marks)

(v) Thermal efficiency

(3 marks)

Assume that $\gamma = 1.4$ in the compression process

$\gamma = 1.333$ in the expansion process

Question 5

a. Analyze the two key factors a pump must overcome to move fluid from one location to another.

(6 marks)

b. Analyze the differences between centrifugal pumps and positive displacement pumps used in marine applications, focusing on the advantages and limitations of each type.

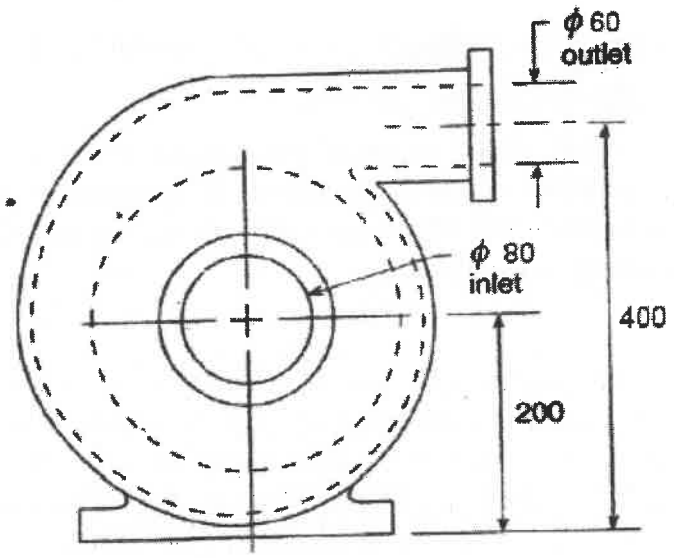
(6 marks)

c. A centrifugal pump as illustrated in Figure 5.1 below delivers 30 L/s of water with the total head 20 m. Determine for this pump the following heads and their percentage of the total head:

i. pressure head

ii. velocity head

iii. potential head



(unit in mm)

Figure 5.1

(8 marks)

Question 6

(a) With reference to a controllable-pitch propeller (CPP) system, describe the equipment arrangement and the operating principles of the CPP, and include relevant schematic sketches to support your explanation.

(10 marks)

(b) Analyze the strategic advantages of equipping a vessel with a CPP when operating in dynamic environmental conditions such as heavy seas, tidal currents, and restricted waterways.

(5 marks)

(c) Discuss how energy-efficient propulsion contributes to SDG 14: Life Below Water, particularly with respect to reducing marine pollution and underwater noise.

(5 marks)

END OF QUESTION PAPER