UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

OCTOBER 2025 SEMESTER SESSION

SUBJECT CODE	:	**LCD12203**
SUBJECT TITLE	:	**MARINE MACHINERY**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DET NAVAL ARCHITECTURE AND SHIPBUILDING**
TIME / DURATION	:	**9.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**28 JANUARY 2026**

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper **CAREFULLY.**
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. Answer **ALL** questions in the answer booklet provided.
6. Answer **ALL** questions in English only.

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

INSTRUCTION: Answer ALL questions.
Please use the objective answer sheet provided.

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 recommendation, considering various technical, economic, and environmental factors.

a. Discuss the impact of specific IMO conventions, such as SOLAS and MARPOL, on the type approval process for marine equipment.

(10 marks)

b. Explain the general layout of a typical machinery space on a vessel and discuss the key considerations in the design and installation of marine propulsion systems. In your explanation, highlight the importance of compliance with the rules of Classification Societies such as the International Association of Classification Societies (IACS).

(10 marks)

Question 2

a. Regarding engine performance and power, M/V Bunga Permai is a container ship installed with a Sulzer RND 96 series engine which is a typical modem slow-speed, two-stroke, crosshead type, long-stroke diesel engine. It has 9 cylinders, a bore of 840 mm, a stroke of 2500 mm, and an operating speed of 102 rpm. Its mean indicated pressure and torque, measured by an engine indicator and a torsion meter at 102 rpm is 19.5 bar and 1,080 kNm respectively. Using the above ship's engine data, calculate (in S.I. units):

i. Indicated power.

(5 marks)

ii. Shaft (brake) power.

(5 marks)

iii. Mechanical efficiency.

(5 marks)

b. Consider a scenario where a ship operates in warm tropical waters. As a naval architect, discuss the potential challenges and considerations related to the cooling system of the marine diesel engine in such conditions

(5 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 (^oC)	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

(10 marks)

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

(10 marks)

SECTION B (Total: 40 marks)

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

Question 4

(a) With reference to a Controllable-Pitch Propeller (CPP) system, describe the structural arrangement and operational principles of a controllable-pitch propeller, incorporating 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. Exclude maneuverability-related factors.

(5 marks)

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

(5 marks)

Question 5

(a) Sketch a schematic diagram of a gas turbine cycle with the components listed below.

(i) Low pressure compressor
(ii) High pressure compressor
(iii) Intercooler between the HP and LP compressor
(iv) Combustor
(v) High pressure turbine
(vi) Low pressure turbine

[6 marks]

(b) Sketch a practical gas turbine cycle on a T-s diagram. The practical gas turbine shall consist of a single compressor, a combustor and a single turbine.

[2 marks]

(c) A General Electric 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 followings:

(i) Compressor work input

[7 marks]

(ii) Turbine work output

[1 mark]

(iii) Network output

[1 mark]

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

[1 mark]

(v) Thermal efficiency

[2 marks]

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

$\gamma = 1.333$ in the expansion process

Question 6

a. Explain how the unique characteristics of gas turbines contribute to the speed and acceleration requirements of fast ferries.

(5 marks)

b. Discuss the significance of hybrid propulsion systems in the context of meeting stringent environmental regulations in the maritime industry.

(5 marks)

c. Propose a hybrid propulsion system that combines gas turbines and an alternative power source, justifying your choices based on efficiency and emission considerations.

(10 marks)

END OF EXAMINATION PAPER