



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JULY 2025 SEMESTER SESSION (7-WEEK)

SUBJECT CODE : LNB30602

SUBJECT TITLE : OFFSHORE AND SUBSEA STRUCTURES

PROGRAMME NAME : BET (NAVAL ARCHITECTURE AND SHIPBUILDING)
(FOR MPU: PROGRAMME LEVEL) WITH HONOURS

TIME / DURATION : 09.00 AM - 12.00 PM
(3 HOURS)

DATE : 17 SEPTEMBER 2025

INSTRUCTIONS TO CANDIDATES

1. Please read **CAREFULLY** 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 **SIX (6)** questions.
4. Answer **ALL** question in Section A and **THREE (3)** questions **ONLY** in Section B.
5. Please write your answers on the answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS COVER PAGE

SECTION A.

INSTRUCTION: Answer ALL questions.

Question 1

When designing a fixed offshore platform, it is essential to consider both static and dynamic loads that will impact the structure throughout its operational life.

- a) Explain the static and dynamic loads that need to be considered when designing a fixed offshore platform.

(5 marks)

- b) Hydrodynamic forces play a significant role in the stability of offshore structures. Explain the importance of understanding hydrodynamic forces and their effect on the design of offshore platforms, particularly in extreme weather conditions.

(5 marks)

- c) Buckling is a failure mode that occurs when a structural element, such as a thin plate, experiences compressive forces that cause it to bend or collapse suddenly. Analyze the factors that contribute to buckling failure in thin plates used in offshore platform topsides and design strategies to prevent it.

(10 marks)

Question 2

A client has commissioned the design of a jacket structure for a new offshore oil field located in deep waters, at a depth of 800 meters. The offshore site is subject to extreme environmental conditions, including high wave forces, strong winds, and unpredictable current patterns. Your task is to design the jacket structure to meet the specific engineering requirements for the location, ensuring stability, durability, and safety under these harsh environmental conditions.

- a) Explain the preliminary layout and sizing process for the jacket structure, considering hydrostatic pressure and conical transitions between tubular sections.

(5 marks)

- b) Identify the key factors you would consider when selecting tubular members and tubular joints, emphasizing the role of corrosion protection in harsh offshore environments.

(5 marks)

- c) Apply the principles of load distribution and environmental forces (wave, wind, and current) to design the tubular members of the jacket structure and describe how you would determine the appropriate sizes and materials to ensure the platform's stability and safety under dynamic loading conditions.

(10 marks)

SECTION B

INSTRUCTION: Answer THREE (3) questions only.

Question 3

- a) The top side of an offshore structure accommodates the equipment and supports modules for the production and processing of hydrocarbon products. Analyze the key factors that must be considered when conducting a topside lifting operation on an offshore platform.

(10 marks)

- b) Analyze the safety risks involved in transporting topside modules to offshore platforms, focusing on potential hazards such as equipment failure, severe weather, and human error.

(10 marks)

Question 4

- a) A new deepwater oil and gas field has been discovered 200 km northwest offshore Sabah Basin, East Malaysia in water depths of around 1,400 m. The area is close to the seismic region and consists of one large reservoir and a number of scattered marginal reservoirs with a production capacity of 100,000 barrels per day. Evaluate the most appropriate production system for this field and justify your recommendation.

(10 marks)

- b) The construction of a Truss Spar is being completed at a fabrication yard in Lumut shipyard. The structure will be installed in deep water at offshore Sarawak Basin for a new oil field Block 2F located 190 km from the shore.

- i. Explain why it is more efficient to transport the sub-structure using the barge method as compared to the self-floating method.
- ii. Evaluate options for the installation method of the topsides.

(10 marks)

Question 5

- a) Hydrocarbons can be produced from regions that are difficult or expensive to develop using an offshore platform by using a subsea production system. Describe five (5) examples of subsea equipment. (5 marks)
- b) All subsea equipment located on the seafloor in both shallow and deep water needs to be operated remotely. Explain the methods employed to control subsea equipment on the locations from which these systems are remotely operated. (5 marks)
- c) Analyze the challenges and advantages of utilizing Remotely Operated Vehicles (ROVs) for surveys and maintenance in subsea environments compared to traditional diver access methods. (10 marks)

Question 6

An FPSO is deployed in an offshore field with varying environmental conditions. The platform is designed for station-keeping and crude oil offloading operations in waters up to 500 meters deep. The mooring system needs to cope with waves, wind, and current.

- a) Analyze the performance of the catenary mooring system compared to a taut leg mooring system. (6 marks)
- b) Analyze the maintenance and monitoring requirements of the mooring system. (6 marks)
- c) Evaluate the efficiency of the Single-Point Mooring (SPM) system for this field, considering factors such as the mooring line configuration, load distribution, and dynamic response to environmental forces. (8 marks)

END OF QUESTION PAPER