CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
OCTOBER 2025 SEMESTER SESSION

SUBJECT CODE	:	**LGB13403**
SUBJECT TITLE	:	**STATICS AND DYNAMICS**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF ENGINEERING TECHNOLOGY (OFFSHORE) WITH HONOURS** **BACHELOR OF ENGINEERING TECHNOLOGY (NAVAL ARCHITECTURE AND SHIPBUILDING) WITH HONOURS**
TIME / DURATION	:	**09.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**28 JANUARY 2026**

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 aper consists of TWO (2) sections; Section A and Section B.
4. Answer **ALL** questions in Section A. For Section B, answer **THREE (3)** questions ONLY.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Formula is appended for your reference.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

With reference to the force vectors.

Figure 1 shows two forces, F_A and F_B acting on the bracket. Given F_B = 600N and $\theta = 20°$.

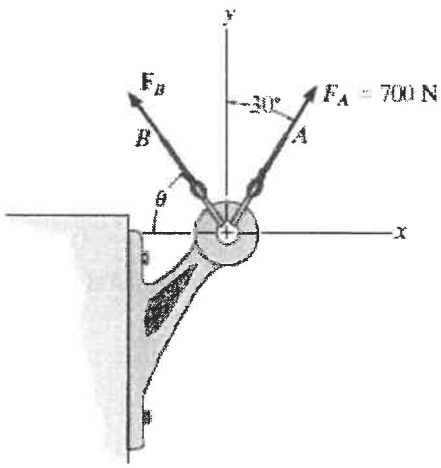


Figure 1: Bracket

i. Draw free body diagram.

(4 marks)

ii. Calculate component x and y for F_A and F_B

(8 marks)

iii. Calculate magnitude and direction of the resultant force, F_R

(8 marks)

Question 2

With reference to the equilibrium of a particle and a rigid body

Figure 2 shows four members of a truss connected at joint O.

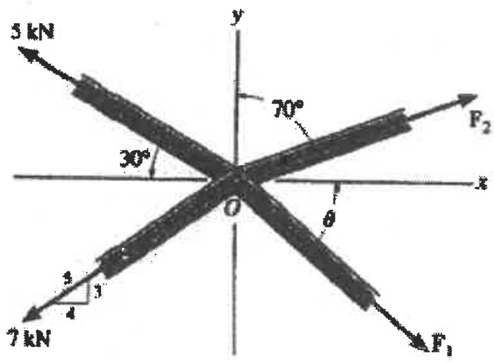


Figure 2: Truss connected at joint O

i. Illustrate a free body diagram indicating all the acting forces.

(4 marks)

ii. Calculate the magnitude of F_1 and F_2, for equilibrium. Set $\theta = 60°$.

(16 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.
Please use the answer booklet provided.

Question 3

With reference to the structural analysis and internal forces: simple trusses

Figure 3 below shows an example of building structure. Using the methods of joint, draw free body diagram and determine force in each member of the truss below:

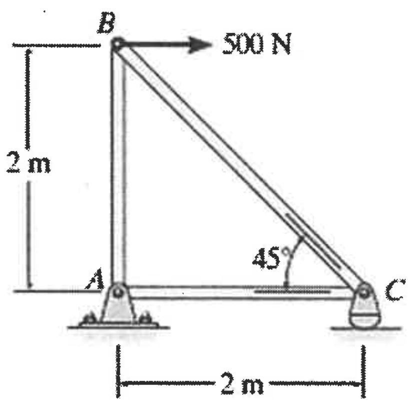


Figure 3: Simple truss

i. Joint B
ii. Joint C
iii. Joint A

(20 marks)

Question 4

With reference to the force, acceleration & Newtons Law.

The crate has a mass of 80 kg and is being towed by a chain which is always directed at 20° from the horizontal as shown in Figure 4.

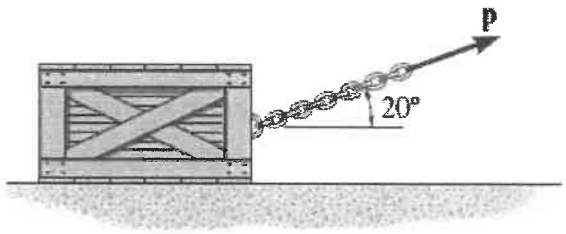


Figure 4: A crate is pulled by a chain exerting a force of magnitude P at an angle $\theta = 20°$

i. Draw a free body diagram showing all the external force that act on the crate.

(4 marks)

ii. Calculate normal force, F_N and magnitude of P if the crate is in equilibrium. Given the coefficient of static friction is $\mu_s = 0.5$

(8 marks)

iii. Determine the crate's initial acceleration if the kinetic friction is $\mu_k = 0.3$.

(8 marks)

Question 5

With reference to the kinetic of a particle: Work, power, and energy.

Figure 5 shows a crate with mass of 100 kg is subjected to the action of the two forces. The coefficient of kinetic friction between the crate and the surface is $\mu_k = 0.2$.

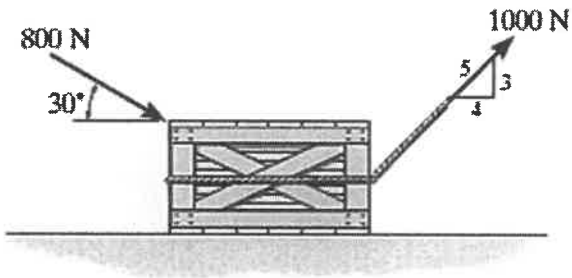


Figure 5: A crate with a mass of 100kg.

i. Draw a free body diagram showing all the external force that act on the crate.
(5 marks)

ii. Calculate normal force, F_N and friction force, F_f.
(7 marks)

iii. If the crate is at rest, determine the distance it slides in order to attain a speed of 6m/s.
(8 marks)

Question 6

With reference to the principle of impulse and momentum:

a) When the 5kg block is 6 m from the wall, it is sliding at an initial velocity, V_1=14 m/s. Given the coefficient of kinetic friction between the block and the horizontal plane is μ_k = 0.3.

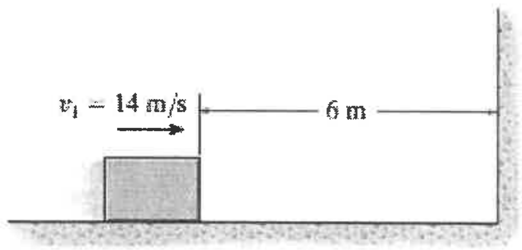


Figure 6: A block is at velocity V_1=14 m/s.

i. Calculate normal force, F_N and acceleration of the block.

(4 marks)

ii. Determine the impulse of the wall on the block necessary to stop the block. Neglect the friction impulse acting on the block during the collision.

(8 marks)

b) Two rail cars with masses of m_A = 30 Mg and m_B = 15 Mg and velocities as shown Figure 7 below. If the rail cars collide and move together, determine the speed of both cars just after the coupling

(8 marks)

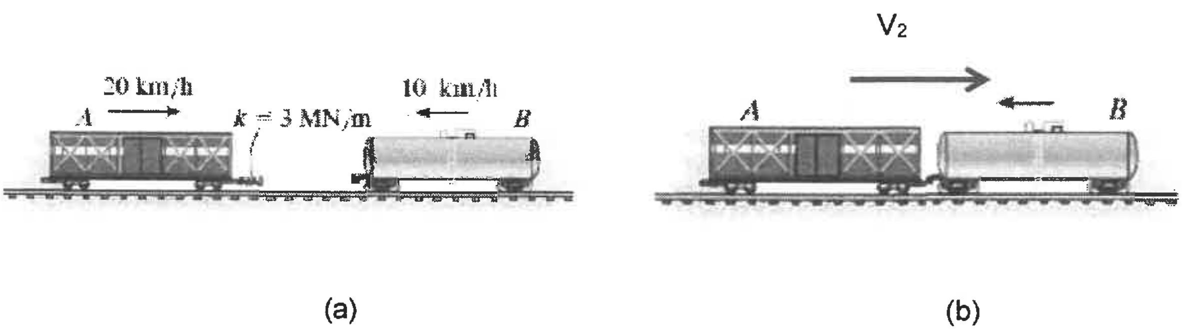


Figure 7: a) Before collision b) After collision

END OF EXAMINATION PAPER

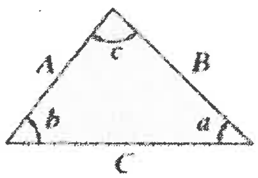
APPENDIX

1. TABLE OF FORMULAE

Multiple	Exponential form	Prefix	SI Symbol
1 000 000 000	10^9	giga	G
1 000 000	10^6	mega	M
1000	10^3	kilo	k
Submultiple			
0.001	10^{-3}	Mili	m
0.000 001	10^{-6}	Micro	μ
0.000 000 001	10^{-9}	nano	n

Vector:

Parallelogram Law:



Cosine law:

$$C = \sqrt{A^2 + B^2 - 2AB\cos c}$$

Sine law:

$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$$

Pythagorean Theorem:

$$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2} \quad \text{and}\, \theta = \tan^{-1}\left|\frac{F_{Ry}}{F_{Rx}}\right|$$

Kinematics

Particle Rectilinear Motion:

Variable a	*Constant $a = a_c$*
$a = \frac{dv}{dt}$	$v = v_0 + a_c t$
$v = \frac{ds}{dt}$	$s = s_0 + v_0 t + \frac{1}{2}a_c t^2$.
$a\,ds = v\,dv$	$v^2 = v_0^2 + 2a_c(s - s_0)$

Equations of motion: $\sum F = ma$	Principles of Work and Energy: $T_1 + \Sigma U_{1-2} = T_2$
Kinetic Energy Particle: $T = \frac{1}{2}mv^2$	***Work*** *Variable force* $U_F = \int F \cos\theta\, ds$ *Constant force* $U_F = (F_c \cos\theta)\,\Delta s$
Power and efficiency: $P = \frac{dU}{dt} = \mathbf{F} \cdot \mathbf{v}$ $\varepsilon = \frac{P_{out}}{P_{in}} = \frac{U_{out}}{U_{in}}$	Conservation of Energy Theorem $T_1 + V_1 = T_2 + V_2$

Principles of Linear Impulse and Momentum:

Particle	$m\mathbf{v}_1 + \Sigma \int \mathbf{F}\,dt = m\mathbf{v}_2$
Rigid Body	$m(\mathbf{v}_G)_1 + \Sigma \int \mathbf{F}\,dt = m(\mathbf{v}_G)_2$

Conservation of Linear Momentum:

$$m_A(v_{A1}) + m_B(v_{B1}) = (m_A + m_B)\,v_2$$