UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	: LGD 10703
COURSE NAME	: ENGINEERING SCIENCE
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: DIPLOMA
DATE	: 25 MAY 2016
TIME	: 2.00 pm – 5.00 pm
DURATION	: 3 HOURS

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. Answer all question in Section A, and only TWO (2) questions in Section B.
4. Please write your answers in the answer booklet provided.
5. Answer all questions in English language ONLY.
6. Table of formulae has been appended for your reference.

THERE ARE 7 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

QUESTION 1

(a) Base quantity is a quantity that cannot be defined in term of other physical quantity. List THREE (3) examples of the base quantity and state their SI units.

(6 marks)

(b) A car starts from rest and accelerates uniformly for 10 s. After 10 s, the displacement of the car is 30 m. Calculate :

i. the velocity of the car at t = 10 s,
ii. the accelerations of the car,
iii. the velocity and displacement in the next 15 s if the car continues its motion with the same acceleration.

(14 marks)

QUESTION 2

(a) Define scalar quantity and vector quantity. State ONE (1) example for each of them.

(4 marks)

(b) Figure 1 shows two industrial workers sliding a coffer straight toward their truck. Worker 1 pushed the coffer 12 N directed at an angle 30° downward from horizontal. Worker 2 pulled 10 N and 40° above the horizontal.

i. Calculate the x-component and y-component of F_1 and F_2.

(8 marks)

ii. Determine the magnitude and direction of the resultant force.

(8 marks)

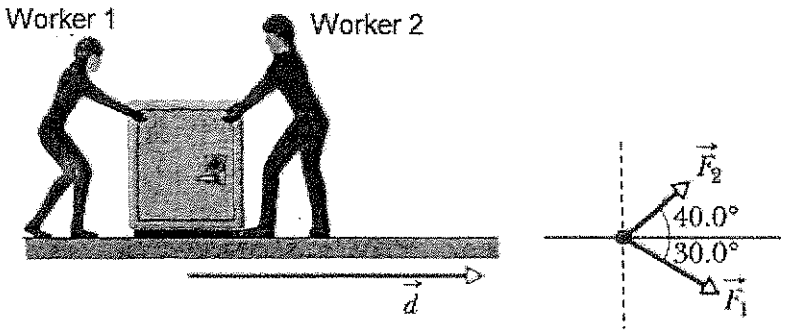

Figure 1 : Two worker sliding a coffer

QUESTION 3

In Figure 2, the coefficient of kinetic friction, μ between m_1 and the table is 0.2. Given m_1 = 25 kg and m_2 = 15 kg. When the system is released, m_1 is moving forward and m_2 drops.

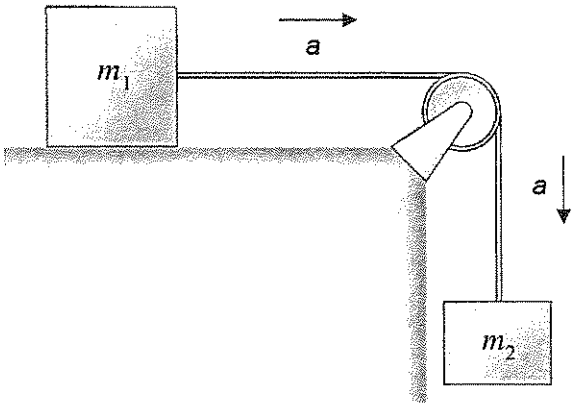

Figure 2 : Pulley system

(a) Sketch the free body diagram for both objects.

(3 marks)

(b) Determine the frictional force acted between m_1 and the table.

(6 marks)

(c) Calculate the acceleration of the system and the tension in the string.

(8 marks)

(d) If the system is released from rest, find the falling distance of m_2 after 2.0 s.

(3 marks)

SECTION B (Total: 40 marks)

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

QUESTION 4

(a) A crane is pulling a debris vertically upward with a constant speed through a distance 13 m. The time taken to achieve that height is 8 s. If the power expanded by the crane is 1.5 kW, calculate :

i. the work done by the crane,
ii. the pulling force of the crane,
iii. the mass of the debris.

(9 marks)

(b) i. State TWO (2) conditions for an object to be in static equilibrium.

(4 marks)

ii. A plank of weight 200 N has a length 5 m. It is supported at its ends by two ropes. A man of mass 80 kg stands on the plank 2 m from the right-end as in Figure 3. Determine the tension in the two ropes, T_A and T_B.

(7 marks)

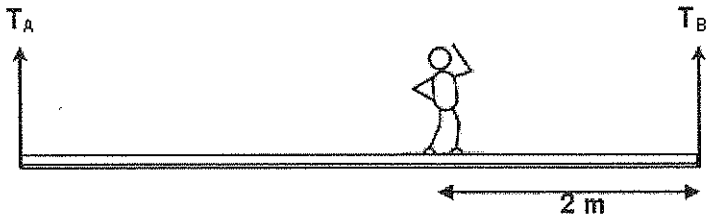

Figure 3 : A plank supported by ropes

QUESTION 5

(a) A helium gas of 18.75 mol has a gauge pressure of 3.5×10^4 Pa at 10°C.

i. Determine the number of molecules of the helium gas.

(3 marks)

ii. Calculate the volume of the gas under the above conditions.

(4 marks)

iii. Determine the new temperature if the gas is compressed to 1.01×10^5 Pa at a constant volume.

(4 marks)

(b) A hydraulic jack has two pistons which are connected via a fluid chamber. A force of 300 N is applied to a small piston to lift 800 kg load on the large piston. The area of a small piston is 0.06 m^2.

i. Determine the pressure at a large piston.

(3 marks)

ii. Calculate the radius of a large piston.

(6 marks)

QUESTION 6

(a) Using P-V graph, describe Isobaric process.

(4 marks)

(b) A steam of mass 0.2 kg is heated from 130°C to 190°C. During this process, the pressure is maintained at 1.5×10^5 Pa and the volume of the steam has expanding from 0.02 m^3 to 0.05 m^3. Given the specific heat capacity of steam, c = 2010 J/mol.°C.

i. Determine the work done by the steam.

(3 marks)

ii. Calculate the change in internal energy of the steam

(6 marks)

(c) i. Atoms are basic unit of matter and made up of three particles. List those THREE (3) particles.

(3 marks)

ii. Explain the formation of positive and negative ions.

(4 marks)

END OF EXAMINATION PAPER

APPENDIX

1. TABLE OF FORMULAE

$s = \frac{1}{2}(u+v)t$	$v = u + at$	$s = ut + \frac{1}{2}at^2$
$v^2 = u^2 + 2as$	$\cos\theta = \frac{adj}{hyp}$	$\sin\theta = \frac{opp}{hyp}$
$\tan\theta = \frac{A_y}{A_x}$	$\text{Magnitude}, A = \sqrt{\sum A_x^{\ 2} + \sum A_y^{\ 2}}$	$F = ma$
$F_g = mg$	$F_f = \mu F_N$	$W = (F\cos\theta)s$
$PE = mgh$	$P = \frac{W}{t}$	$M = (F\sin\theta)s$
$T_K = T_C + 273$	$n = \frac{N}{N_A}$	$PV = nRT$
$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$	$P = \frac{F}{A}$	$A = \pi r^2$
$W = P\Delta V$	$Q = mc\Delta T$	$\Delta U = Q - W$

2. CONSTANT VALUES:

Gravitational acceleration, g = 9.81 m/s^2

Universal gas constant, R = 8.314 J/mol.K

Avogadro's number, N_A = 6.02 x 10^{23} mol^{-1}

Atmospheric pressure, P_{atm} = 1.013 x 10^5 Pa