UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY

FINAL EXAMINATION
JANUARY 2016 SEMESTER

COURSE CODE	:	LDD 21002
COURSE NAME	:	STRENGTH OF MATERIALS
PROGRAMME NAME	:	DIPLOMA OF ENGINEERING TECHNOLOGY SHIP DESIGN & SHIP CONSTRUCTION
DATE	:	20 MAY 2016
TIME	:	9.00 AM – 11.00 AM
DURATION	:	2 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. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer TWO (2) questions only.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.
7. Formulae table has been appended for your reference.

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

a) Strength of materials is basically a study of behaviour of materials under various types of load and moment. **Distinguish** briefly between load and stress. **List** five (5) classifications of load.

(4 marks)

b) A load of 5kN is to be raised with the help of a steel wire. **Compute** the diameter of the steel wire, if the maximum stress is not to exceed 100 MN/m^2.

(4 marks)

c) A hollow cast-iron cylinder 4 m long, 300 mm outer diameter, and thickness of metal 50 mm is subjected to a central load on the top when standing straight. The stress produced is $75000kN/m^2$. Assume Young's modulus for cast iron as 1.5×10^8 kN/m^2 **determine**:

(i) the magnitude of the load,
(ii) the longitudinal strain produced and
(iii) the total decrease in length

(12 marks)

Question 2

a) Briefly **describe** the following materials classification:

(i) Homogeneous and isotropic material
(ii) Rigid and linearly elastic material
(iii) Plastic material and rigid-plastic material
(iv) Ductile mid brittle material

(8 marks)

b) The following observations were made during a tensile test on a mild steel specimen 40 mm in diameter and 200 mm long. Elongation with 40 kN load (within limit of proportionality),δL = 0.0304 mm
Yield load =161 kN
Maximum load = 242 kN
Length of specimen at fracture = 249 mm
Evaluate:

(i) Young's modulus of elasticity
(ii) Yield point strength
(iii) Ultimate tensile strength
(iv) Percentage of elongation.

(12 marks)

Question 3

a) **Explain** briefly with an aid of example the superposition method in solving statically indeterminate problem.

(4 marks)

b) The A-36 steel rod shown in Figure 1 below has a diameter of 10 mm. It is fixed to the wall at A, and before it is loaded there is a gap between the wall at B' and the rod of 0.2 mm. **Determine** the reactions at A and neglect the size of the collar at C by using principle of superposition. Take E = 200GPa.

(16 marks)

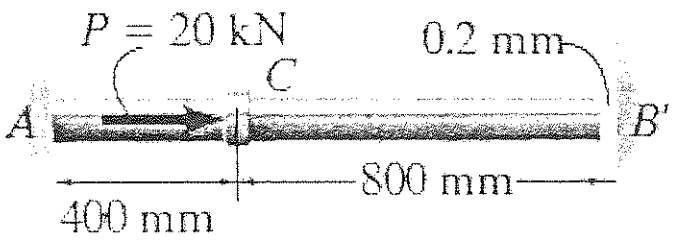

Figure 1 A-36 steel rod fixed one side to wall

Question 4

a) **Resolve** the reactions and **draw** the shear force diagram for the simply supported beam shown in Figure 2 below.

(8 marks)

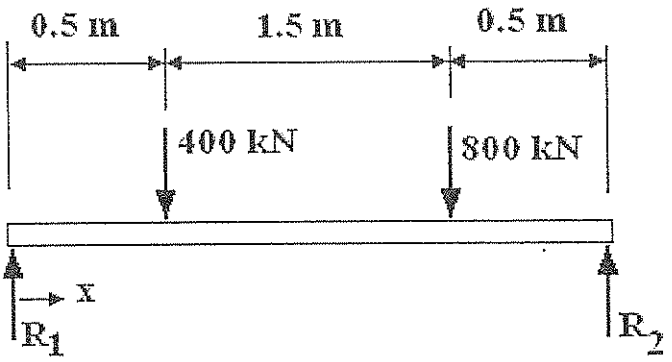

Figure 2 Simply Supported Beam

b) **Resolve** the reactions and **draw** the bending moment diagram for a uniform load of 50 N/m added along the entire length of the beam as shown in Figure 3 below.

(12 marks)

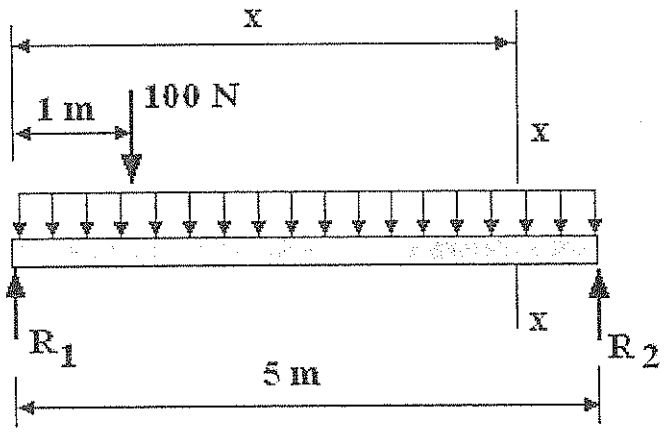

Figure 3 Uniformly Distributed Load

Question 5

a) **Describe** the terms below:

i) Normal Stress (σ)

ii) Shear Stress (r)

(4 marks)

b) The steel bar in Figure 4 has a constant width of 35mm and thickness of 10mm.

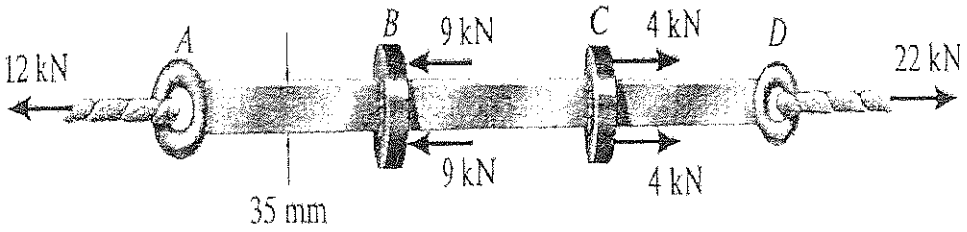

Figure 4 Loaded Steel Bar

Analyse:

i) Internal forces at each section of AB, BC, and CD

(6 marks)

ii) Average normal stress at each section AB, BC and CD

(10 marks)

Question 6

a) **Explain** briefly what is meant by shaft with the aid of its function and material made of.

(4 marks)

b) **Differentiate** between torsion and torque. List four (4) examples of torsion in engineering practice.

(4 marks)

c) A solid circular shaft transmits 75kW power at 200 rpm. **Select** the most appropriate shaft diameter, if the twist in the shaft is not to exceed 1° in 2m length and the shear strength is limited to 50 MN/m^2. Take G = 100GN/m^2.

(12 marks)

END OF QUESTION

FORMULAE TABLE

$$\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$$ **Torque**

$U = (\sigma^2/2E)$ x volume of the bar **direct stress**

$U = (\tau^2/4G)$ x volume of the bar **torsion**

$$J = \frac{\pi D^4}{32}$$

$$J = \frac{\pi\left(D^4 - d^4\right)}{32}$$

$$P = \frac{2\pi NT}{60}$$ **Power**

$$\text{Yield strength} = \frac{\text{Load at yield point}}{A_0}$$

$$\text{Ultimate strength} = \frac{\text{Ultimate load}}{A_0}$$

$$\% \text{ Elongation} = \frac{L_F - L_0}{L_0} \times 100$$

$$\delta = \frac{PL}{AE}$$