CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

JUNE 2020 **ADVANCED LEVEL**

Specialty Name (Specialty Code)	**ELECTRICAL POWER SYSTEM-EPS (F3) & ELECTRONICS-ELN (F2)**
Subject Title	**ELECTRICAL/ ELECTRONICS APPLIED MECHANICS**
Paper No.	**2**
Subject Code No.	**7218**

Three hours

INSTRUCTIONS TO CANDIDATES

- The paper comprises three compulsory sections :
  - Section A (STATICS): Candidate should answer TWO Questions
  - Section B (KINEMATICS): Candidate should answer ALL Questions
  - Section C (DYNAMICS): Candidate should answer ONE Question
- Illustrate your answers with neat sketches wherever necessary.
- Preferably, write the answers in sequential order.
- Use of non-programmable calculator is permissible
- This paper carries 35% of the total marks.

You are reminded of the necessity for good English and orderly presentation in your answers.

You are advised to read carefully through the question paper, before you begin your answers.

SECTION A
STATICS
(Attempt any **TWO** of the following questions)

QUESTION 1: **(10marks)**

Figure 1below represents a "clamp" of rapid tightening of machining represented at a small scale. The piece to machine4 is put on a frame **0** to assure tightening and maintain of the piece at point **F**. The effort is given by the hydraulic Jack 1+2. The jack is joined at **A**on **0** and on the axle **B** where the pieces **3** and **6** are joined. The fork **6**transmits the tightening effort by the intermediary of the axis **D** and assures the maintaining of the clamp at **E**, by the intermediary of the frame **0**. We suppose that all the links are perfects and all the forces are on the plane of the paper.

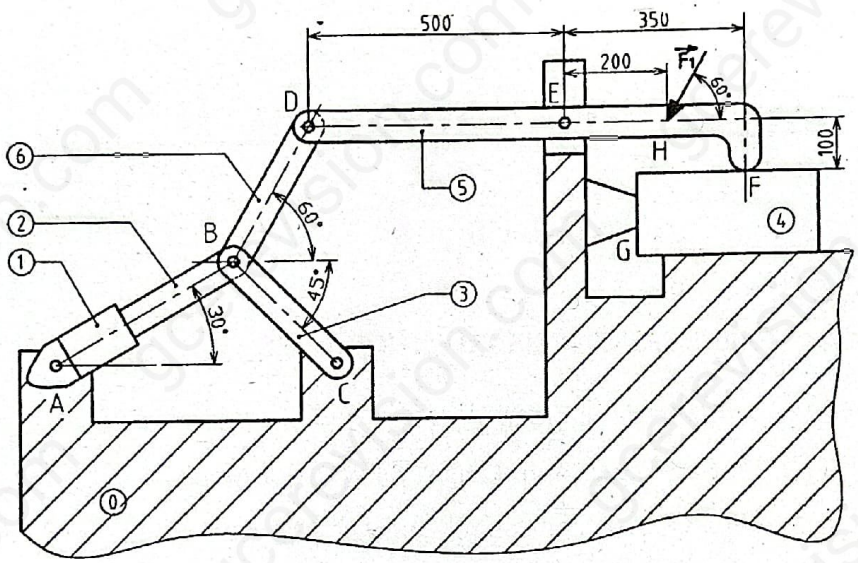


Figure 1

Hypothesis:
-The jack 1+2exerts a pressure of **0.1MPa** (1Pa = 1N.m^{-2}), having a diameter of **12cm**.
-The force $\overrightarrow{F_1}$ is of magnitude **50daN**.
-We consider **4**to be held firm.
- Coefficient of friction between**5** and **4** at **F** is $f_0 = 0.2$

1. Determine the force $\overrightarrow{B_{2/7}}$ **(3 marks)**

2. Figure 1.a below represents the mechanical actions applied at point B acting on pin 7.

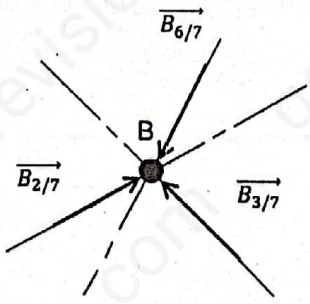


Figure 1a

a- Determine analytically the reactions on the axle **B**, $\|\overrightarrow{B_{3/7}}\|$ and $\|\overrightarrow{B_{6/7}}\|$. Take: $\|\overrightarrow{B_{2/7}}\|$=1130N **(3 marks)**

b-The free body diagram of the clamp 5 is given on the figure 2 below.

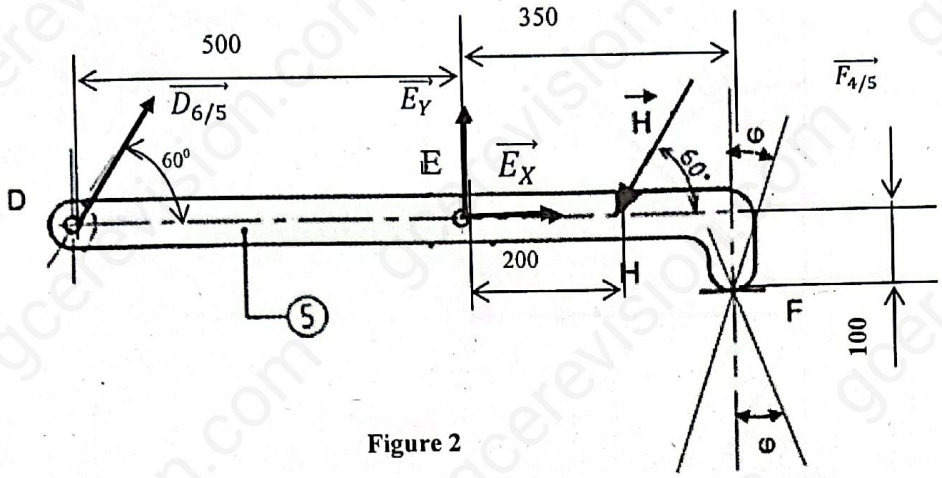


Figure 2

Determine analytically the magnitudes $\|\overrightarrow{E_{0/5}}\|$ and $\|\overrightarrow{F_{4/5}}\|$. **(4marks)**

Take $\|\overrightarrow{D_{5/6}}\|$=1130N and $\|\overrightarrow{F_1}\|$ = 50daN.

QUESTION 2: **(10 marks)**

The jib crane shown below on figure 3 is supported by a pin at C and rod AB

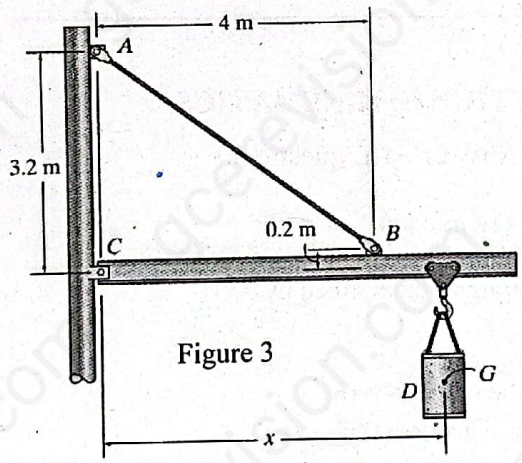


Figure 3

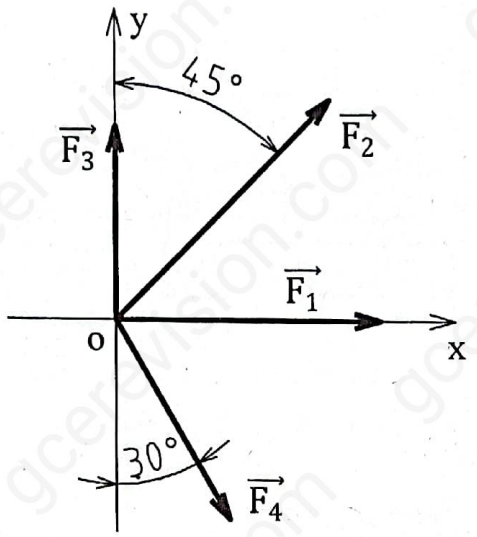
The load has a mass of 200 Kg with its center of mass located at G.

a- Draw the free body diagram of the jib crane. **(3 marks)**

b- Determine the components of the reaction at the pin C and the force developed in rod AB on the cranewhen x =5m. **(7marks)**

QUESTION 3: **(10marks)**

The figure 5 below represents four coplanar forces F_1, F_2, F_3 and F_4.



a- Determine analytically the X and Y components of each of the forces on the figure above. **(4 marks)**

b- Determine analytically the components Rx and Ry of the resultant of the forces. **(4 marks)**

c- Determine the magnitude and the line support of the resultant withrespect to the **x**-axis. **(2 marks)**

Given Data: F_1=35N; F_2=40N; F_3=25N; F_4=30N.

SECTION B: KINEMATICS

(Answer ALL questions)

QUESTION 1: **(10 marks)**

The position of a particle which moves along a straight line defined by $X=t^3 - 6t^2 - 15t + 40$ where X is expressed in meter and t in seconds. Determine:

a- The time when the velocity will be equal to zero. **(2 marks)**

b- The distance travelled by the particle at that time. **(2 marks)**

c- The acceleration of the particle at the time. **(3 marks)**

d- The distance travelled by the particle from t= 4 seconds to t= 6seconds. **(3 marks)**

QUESTION 2: **(10marks)**

Figure 5 below represents a pulley assimilated to a full cylinder with radius R = 80 mm and mass M = 3 kg.

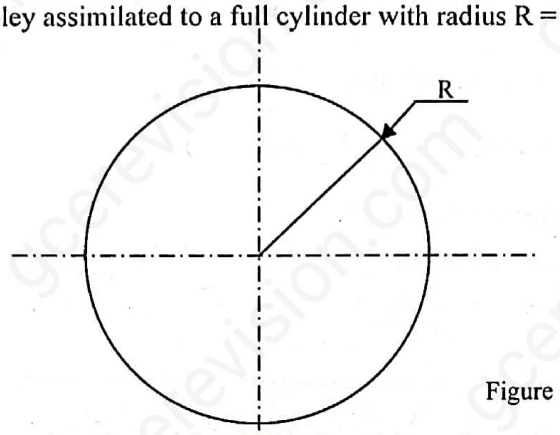


Figure 5

During the starting phase of its motion, the rotational velocity of the pulley passes from N_0 =0 to N_1 = 51rev/min with time t =1.5 s describing a uniformly accelerated circular motion.

a- Determine the angular acceleration of the pulley at the starting phase; **(6 marks)**

b- Determine the number of revolution done by the pulley during the starting phase. **(4marks)**

SECTION C: DYNAMICS

Attempt any **ONE** of the following questions.

QUESTION 1: **(10 marks)**

Figure 6 below represents a lorry of 4 tonestowing a load mass of 7 tones upward an inclined road by $30^0$with the horizontal axis to a distance of 500 m. The resistance to rolling is 22 N/tonne and the acceleration $0.5m/s^2$.

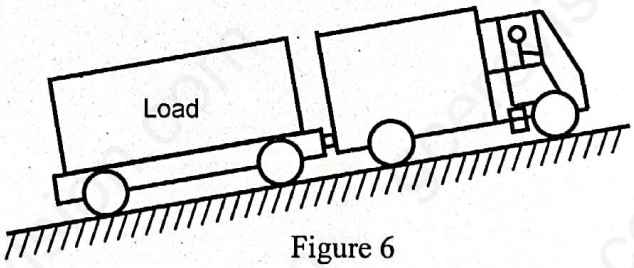


Figure 6

a- Calculate the pulling force of the lorry's engine. **(2 marks)**

b- Determine the total work done. **(3 marks)**

c- Determine the velocity of the lorry if it is starting from rest. **(3 marks)**

d- Calculate the power developed. **(2 marks)**

QUESTION 2: **(10marks)**

A basketball of mass 600 g which was resting on a hoop falls to the ground 3.05 m below.

a- Calculate themaximum kinetic energy of the ball when it falls. **(6 marks)**

On bouncing from the ground the ball loses 6 joules of energy.

b- Explain what happens to the energy lost by the ball. **(3 marks)**

c- Calculate the height of the first bounce of the ball. **(3 marks)**

Take: $g=9.81\ m/s^2$