EXAMINATION COVERSHEET

Autumn 2020 Final Examination

UNIVERSITY OF WOLLONGONG IN DUBAI

THIS EXAMINATION CONTENT IS STRICTLY CONFIDENTIAL

Students must comply with requirements stated in the Online Examination Procedures

Student Number:	
First Name:	
Family Name:	
Date of Examination: (DD/MM/YY)	**13/12/2020**
Subject Code:	**ENGG102**
Subject Title:	**Fundamentals of Engineering Mechanics**
Time Permitted to Write Exam:	02 Hours and 00 Minutes
Time Permitted to Upload Exam Paper:	15 Minutes
Total Number of Questions:	**4**
Total Number of Pages *(including this page):*	**4**

INSTRUCTIONS TO STUDENTS FOR THE EXAM (*FURTHER TO INSTRUCTIONS POSTED ON MOODLE SITE*)

1) Download the final examination question paper onto your laptop/desktop.
2) Answers should be submitted within the time-frame specified above.
3) Answer all / Four questions. The marks are shown next to each question and the total is 100 marks.
4) Total marks for this Final Exam is 100. This Exam is worth 50 % of your final marks.

INSTRUCTIONS TO STUDENTS FOR UPLOADING EXAMS

- Please solve the exam on paper and scan as pdf. No image or word files will be accepted.
- Name the scanned pdf file as **(Your Student Number_Subject Code)**
- Attach picture of any drawing, figure etc and attach it to your document. Attach all calculations and leave nothing out.
- **Problem Solving Format questions** – answer the questions on paper with clear indication of which solution belongs to which question.
- Ensure to take clear scan or pictures/images of all your working and solutions.
- Save all your solutions of the final examination in a single pdf file.
- Keep your answer sheets for reference in case the images are not readable or corrupted.
- Upload your submission document by the deadline specified above.
- If you are unable to upload the answer paper(s) before the due time, DO NOT PANIC. Email it to the lecturer at sanaamir@uowdubai.ac.ae within the time-limit or (use the upload link to upload it to the box as instructed by the lecturer).
- You will be permitted only one single attempt to upload your submission for the final examination.
- The Lecturer will have the discretion to conduct viva on the submission made, if needed.
- Answers must to be posted on Moodle/Turnitin or through an online portal as specified by the Lecturer.
- **Exam time is 2 hrs. After 2 hrs, you have 15 minutes to scan and upload. Any late submissions will have a heavy penalty or may not be accepted at all. The responsibility for uploading the exam on time lies with the student.**

Note: Attempt all questions. Draw the free body diagrams where required. Show all steps for the calculations.

Question 1 (25 marks)

A horizontal force of magnitude 40 N pushes a block of mass 3.00 kg across a floor where the coefficient of kinetic friction is 0.50.

(a) Draw the free body diagram of the block-floor system showing all the forces acting on the block. (2 marks)

(b) How much work is done by the 40 N force on the block–floor system when the block slides through a displacement of 2.5 m across the floor in the direction of the force? (6 marks)

(c) During a 2.5 m displacement, the thermal energy of the block increases by 30.0 J. What is the increase in the thermal energy of the floor? (10 marks)

(d) What is the increase in the kinetic energy and the final velocity of the block? (7 marks)

Question 2 (25 marks)

For the truss shown in Figure Q2, carry out the following tasks:

(a) Find out the support reactions. (5 marks)
(b) Determine the forces in member CD, CF, GF, DE and FE. Make sure to draw the free body diagram whether you are using method of sections or method of joints. Show all calculations. (20 marks)

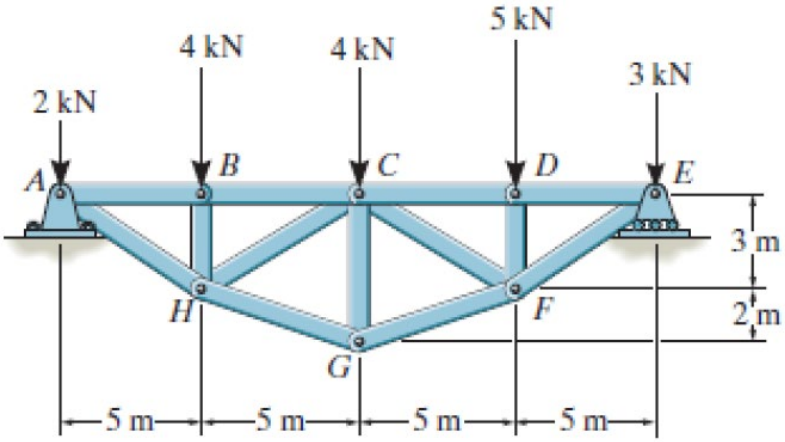


Figure Q2

Question 3 (25 marks)

Find out the area and the centroid $(\bar{x}, \bar{y})$ of the shaded region shown in Figure Q3.

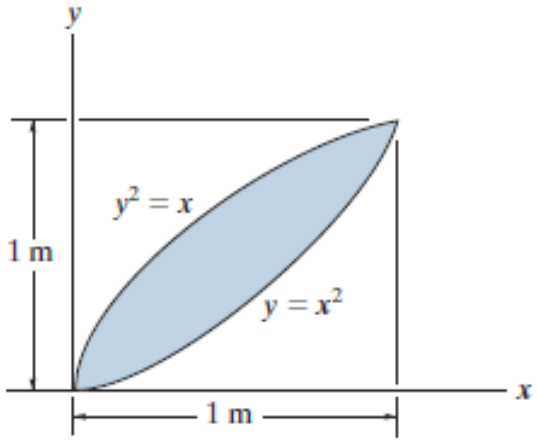


Figure Q3

Question 4 (25 marks)

Determine the moment of inertia with respect to the y axis of the section shown in the Figure Q4. Calculate your results in cm^4.

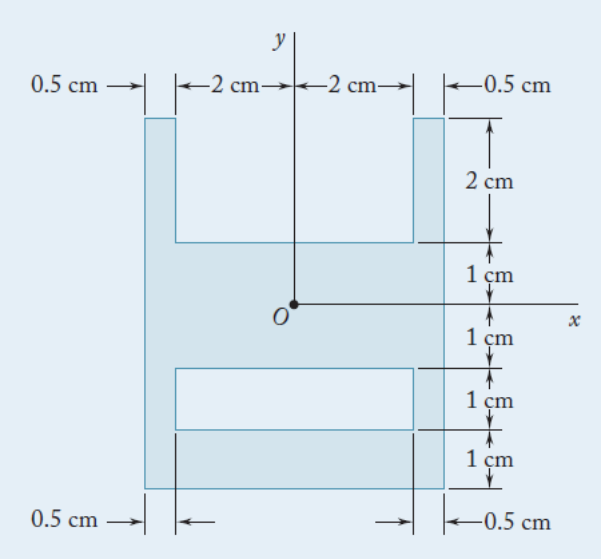
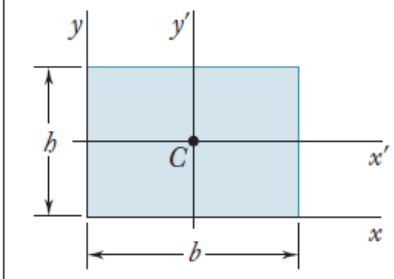


Figure Q4

Useful formulas

Moment of inertia

Rectangle		$\bar{I}_{x'} = \frac{1}{12} bh^3$ $\bar{I}_{y'} = \frac{1}{12} b^3 h$ $I_x = \frac{1}{3} bh^3$ $I_y = \frac{1}{3} b^3 h$ $J_C = \frac{1}{12} bh(b^2 + h^2)$

$$I_x = I_{x'} + Ad_y^2 \qquad I_y = I_{y'} + Ad_x^2$$

$$I_x = \int_A y^2 dA$$

$$I_y = \int_A x^2 dA$$

$$\bar{x} = \frac{\int_A \tilde{x} dA}{\int_A dA}; \quad \bar{y} = \frac{\int_A \tilde{y} dA}{\int_A dA}; \quad \bar{z} = \frac{\int_A \tilde{z} dA}{\int_A dA}$$

$$\Delta E_{\text{mec}} = \Delta K + \Delta U = 0.$$

$$\Delta U = -W.$$

$$\Delta U = mg(y_f - y_i) = mg\,\Delta y.$$

$$W = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2.$$

$$W_s = \tfrac{1}{2}kx_i^2 - \tfrac{1}{2}kx_f^2 \qquad \text{(work by a spring force).}$$