

The Open University of Sri Lanka
Faculty of Engineering Technology



Department of Agricultural & Plantation Engineering

Study Programme : Bachelor of Science Honors in Engineering
(Agricultural Engineering) Programme
Name of the Examination : Final Examination
Course Code and Title : **AGX4302 Design of Agricultural
Machine Elements**
Academic Year : 2023/2024
Date : 16th March 2025
Time : 9.30 - 12.30 hrs

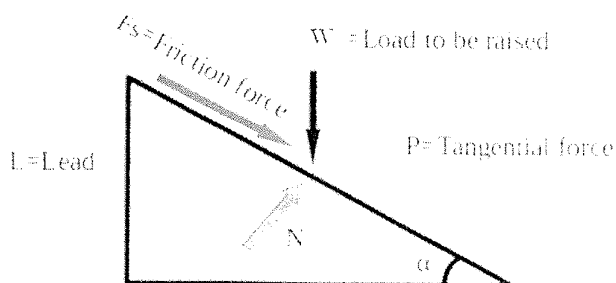
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SECTION 2: Answer any four (04) questions.

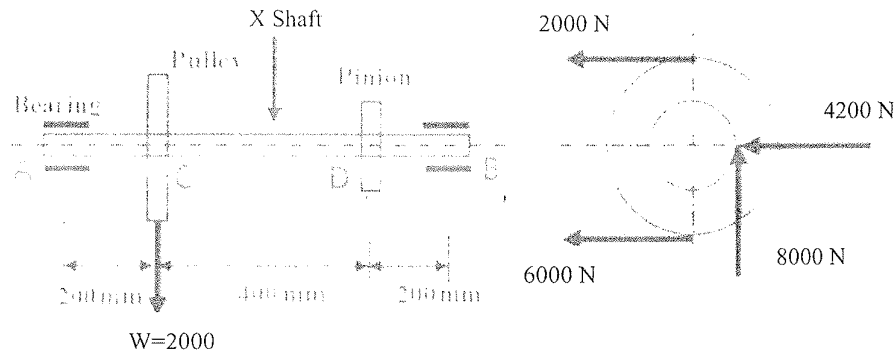
- Imagine you are an agricultural engineer tasked with designing a key component for an agricultural machinery application. To ensure the component functions effectively and safely, a structured design approach must be followed. Describe the step-by-step procedure you would undertake to design this component.
(25 marks)

- a) By using the diagram below, prove the equation
$$P = W (\mu \cos \alpha + \sin \alpha) / (\cos \alpha - \mu \sin \alpha)$$

(10 marks)



- b) A belt drive system transmits power from a motor to a gearbox using a X shaft. The motor drives a pulley, which in turn drives a gear connected to the gearbox. The diameters of the pulley and gear are 500 mm and 250 mm, respectively.



- i) Determine the reaction forces at the A & B bearings

(10 marks)

- ii) In designing the X shaft to withstand minor to heavy shock, what would be the next step in determining the appropriate shaft diameter?

(5 marks)

3. (a) Explain the relationship between bolt force, joint compression, and applied external force in a bolted joint.
 (b) Discuss how these forces interact under different loading conditions, and
 (c) Describe their impact on the integrity of the joint. Support your explanation with relevant diagrams.

(25 marks)

4. a) What is a clutch, and what is its primary function?

(5 marks)

- b) List three types of friction clutches.

(5 marks)

- c) List main components of selecting one type of clutch, and explain its operating mechanism

(10 marks)

- d) What are the four requirements that should be considered in clutch design?

(5 marks)

5. a) A caliper brake is required for the front wheels of a sport's car with a braking capacity of 820 Nm for each brake. Preliminary design estimates have a set the brake geometry as inner radius ($r_i = 100\text{mm}$), Outer radius ($r_o = 160\text{mm}$), and $\Theta = 45^\circ$. A pad with a coefficient of friction of 0.35 has been selected.
- i) Calculate mean effective radius (R_m) for constant pressure
 - ii) Determine the required actuating force
 - iii) Determine the average and maximum contact pressures.
(15 marks)
- b) What are the three primary methods of power transmission between shafts, and how do they differ in terms of functionality and application?
(10 marks)
6. Write short notes on following **three (3)** topics.
(25 marks)
- i) Classifications of Machine Design
 - ii) Factors consider in shaft designing
 - iii) Fits
 - iv) Stress Concentration
 - v) Clutches