



The Open University of Sri Lanka
Faculty of Engineering Technology
Technology (Engineering) Program

Final Examination- 2007

AEX5230 Power and Machinery in Agriculture

Date : 22-04-2008
Time : 0930-1230 hours

SECTION 2: Answer only four (04) questions

1. A two wheel drive tractor is used to pull a disc harrow on a level ground with a wheel slip of 20%.
 - (a) Draw the free body diagram of the tractor with different forces acting on it.
 - (b) Find out the maximum thrust possible (Hm)
 - (c) Find out the thrust per tire at 20% wheel slip
 - (d) What is the total draft force?
 - (e) Find the travel speed (V) if the loading of the engine is 80%.

Use the following data in answering question 1

Mass of the tractor: 3500kg

Weight distribution (when the tractor is in motion): front- 40%, rear – 60%

Contact patch area on the rear tire: 0.15m^2 per tire

Contact patch length on the rear tire: 0.4m per tire

Soil Cohesion (C): 10kN/m^2

Angle of internal friction of soil (ϕ) : 25°

Soil deformation modulus (k) : 20mm

Total rolling resistance: 120N

2.
 - (a) With the aid of Coulomb relationship and the Mohr's stress circle explain how soil fails when subjected to principal stresses.
 - (b) Explain the two modes in which soil could reach the failure state depending upon the relative magnitude of the two principal stresses.
3.
 - (a) Explain a laboratory method that can be used to determine the soil cohesion and the angle of internal friction.
 - (b) It was found that a sample of soil having an angle of internal friction of 30° reached failure state when subjected to principal stresses of 20MN/m^2 and 60MN/m^2 . Find out by sketching the Mohr's stress circle, the cohesion of the soil.
4.
 - (a) Explain why cleaning of seeds is necessary.
 - (b) Describe the cleaning principles used in screening machines for basic cleaning of seeds.
5. Discuss the barriers to using animal power in the agricultural sector in Sri Lanka. You may focus on social, economic and technological aspects.

6. (a) A sample of soil is subjected to principal stress 40 MN/m^2 and 80 MN/m^2 .
- (i) Draw Mohr's circle and mark major principal stress, Minor principal stress and the maximum shear stress.
 - (ii) What is the magnitude of maximum shear stress?
- (b) If the soil in (a) has cohesion of 15 MN/m^2 and angle of internal friction 30° , would the soil sample fail under given stress conditions? Find out principal stress when the Coulomb line is tangent to the Mohr's circle?