INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

End-Spring Semester Examination 2022-23

Date of Examination: 21-04-2023 Session: 2:00 to 5:00 PM (AN) Duration: 3 hrs. Full Marks: 50

Subject No.: AG31008 Subject: Post Harvest Engineering

Department/Center/School: Agricultural and Food Engineering

Specific charts, graph paper, log book etc., required

Special Instructions (if any): Answer *any four (4) from 1 to 5* questions and *question 6* compulsory.

1. a) With the help of a diagram explain functioning of air screen cleaner with scalper arrangement. (4)
   b) During the performance evaluation of an air screen grain cleaner with two screens and blower the following information has been obtained:
      i) The impurities present in feed = 8.5%
      ii) The impurities present in the clean grain = 0.8%
      iii) Clean grain carried through outflow of blower = 0.3%
      iv) Clean grain carried through overflow of first screen = 1.2%
      v) Clean grain carried through underflow = 0.6%

      Calculate the cleaning efficiency of air screen grain cleaner. (3)
   c) Explain the functioning of rubber roll dehusker showing major components. (3)

2. a) Justify the statement "Polishing of parboiled rice is difficult compared to raw rice". (2)
   b) Design a paddy parboiling tank matching to a capacity of 24 tons, each milling batch in 8 hours shift. The bulk density and angle of repose of paddy are 720 kg m^{-3} and 32 °, respectively. Consider H/D ratio as 1.8. Also calculate the steam and water requirements for each batch of operation (3+1)
   c) Briefly explain true continuous Jadavpur University method of parboiling. (4)

3. a) What are the different stages of wheat milling? Explain with the help of a schematic diagram. (4)
   b) Explain CFTRI method of pulse milling mentioning critical stages. (3)
   c) A rubber roll dehusker with 200 mm roll diameter operating at 1200 rpm has been used to shell paddy having average size of 4 mm. If the clearance maintained between two rolls is 60% of the grain size, what is the length of husking and period of husking? (3)

4. a) Explain the working principle and construction features of colour sorter. (3)
   b) What is the function of trier cylinder and describe how it works? (3)
   c) In a pulse milling experiment with abrasive mill the following observations were made. Amount of unhulled grains = 3.0%, Recovery of whole split kernel after milling = 75.0%, Amount of crushed kernels = 5.0%, Amount of powder generated = 7.5%, Amount of husk removed = 9.5% out of 12.5%. Calculate both hulling and wholeness efficiency of the system. (4)

5. a) Derive an expression for overall effectiveness of screen in a grain cleaning arrangement. (3)
   b) Explain the lye peeling process of bulgur preparation using a flow chart. (3)
   c) Air stream carrying bran particles of density 960 kg m^{-3} and an average diameter of 48 *microns* enters a cyclone of 500 mm diameter at a linear velocity of 24 m s^{-1}. Calculate the centrifugal force acting radially in the cyclone and the separation factor of the cyclone. (4)

6. a) Draw the typical drying curve of a food system, clearly showing all the phenomenon associated with drying.
   b) What do you understand by constant and falling rate drying period? Explain with appropriate figures.
   c) Obtain the relationship between drying rate constant, drying time, and free moisture content for a falling rate drying period. Consider, single falling rate and the straight passing through origin. [2+3+5]