**M.Tech Even Semester (CBCS) Exam., April—2017**

AGRICULTURAL ENGINEERING

**( 2nd Semester )**

Course No. : MAE–CC—06

Full Marks : 50

Pass Marks : 15

Time : 2 hours

[ Water Resources Development and Management
Students will answer MAE1-CC–06
Food Processing Engineering Students will
answer MAE2-CC–06
Farm Machinery and Power Engineering
Students will answer MAE3-CC–06 ]

Note : 1. Attempt *any* **five** questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the margin indicate full marks for the questions.

Course No. : MAE1-CC–06

**( WATER WELL AND PUMP ENGINEERING )**

1. Briefly describe the geological formation of the following :　　　　　2×5=10
   (a) Alluvial deposit
   (b) Limestone

**( 2 )**

   (c) Volcanic rock
   (d) Sandstone
   (e) Igneous and metamorphic rock, clay

2. Briefly describe about the construction of cavity-type, strainer-type and gravel pack-type tube wells.　　　10

3. Briefly describe about gravel pack design with the following points :　　　10
   (a) Uniformity coefficient
   (b) Pack aquifer ratio
   (c) Gravel pack thickness

4. (a) Write the groundwater quality standard classification and designated uses.　　5

   (b) How does groundwater become contaminated? Define common ground-water contaminants.　　5

5. (a) Describe the vadose zone flow in regional scale hydrology. How is water in vadose zone monitored with the steps involved?　　2+3

   (b) Explain how the sea level rises and saltwater intrusion impacts on groundwater, and mention why these changes would be concerning.　　5

6. (a) Write Ghyben-Herzberg relation between freshwater and saline water.　　5

(b) In an unconfined coastal aquifer, the lower true interface is 95 m below the water table. If the densities of the freshwater and saltwater are 1 g/cc and 1·03 g/cc, respectively, find the water table elevation above sea level at the apex of the saltwater wedge using the Ghyben-Herzberg principle. 5

7. (a) A confined horizontal aquifer of thickness 15 m and permeability K 20 m/day connects two reservoirs M and N situated 1·5 km apart. The elevations of the water surface in reservoir M and N measured from the top of aquifer are 30·0 m and 10·0 m respectively. If the reservoir M is polluted by a contaminant suddenly, calculate the time required for the contaminant to reach the reservoir N assuming porosity of the aquifer is 0·3. 5

(b) Describe the difference between the infiltration and percolation and then, explain how climate change leads to change in infiltration rate which influences groundwater. 5

8. (a) What is a groundwater model? List the assumptions that constitute a conceptual model. 2+3

(b) List and explain the common misuses and mistakes related to modeling. 5

Course No. : MAE2-CC–06

**( FOOD PROCESSING AND PRODUCT TECHNOLOGY–II )**

1. (a) Write down the difference between pasteurization and sterilization. 5

(b) Write short notes on the following : 5
   (i) Reverse osmosis
   (ii) Blanching
   (iii) Thermal death rate
   (iv) Ultrafiltration
   (v) Pickling

2. (a) Write down the major preservatives used in food processing. What is the function of salt in pickling? 5

(b) What is the difference between jam and jelly? Explain different steps involved in the manufacture of jams. 5

3. (a) What are the unit operations of spice processing? Mention important uses of spices with their classification. 5

(b) Explain the role of pectin while preparing the jam. 5

**( 5 )**

4. *(a)* What is the function of 'aspirator' in processing of spices?      3

*(b)* What do you understand by cryogenic grinding? Define in brief the advantages of cryogenic grinding of spices over conventional one.      7

5. *(a)* Define by-products. What are the by-products of milling industry? Mention their utilization.      6

*(b)* What do you mean by agro-industrial by-products?      4

6. What do you mean by preservatives? Name any two chemical preservatives permitted to beverages according to FPO (1955) and explain the working principle of them.      10

7. *(a)* Write down the principles of food preservation.      6

*(b)* Draw the neat sketch of continuous-type pasteurizer.      4

8. Explain in detail about the rice by-products utilization as waste management.      10

**( 6 )**

Course No. : MAE3-CC–06

**( DESIGN AND TESTING OF FIRM MACHINERY SYSTEMS–II )**

1. *(a)* Distinguish among a reaper, a mower and a binder.      3

*(b)* Explain the steps involved in the design of a rasp-bar thresher.      7

2. *(a)* Energy required in threshing is about 2·5 hp-h per tonne of crop. Calculate the power needed by a thresher in a combine of 1·2 m width harvesting rice at 5·4 km/h forward speed. Yield of rice is 4·6 tonnes/ha. Grain to straw ratio is 0·54.      3

*(b)* Draw a typical curve of threshing efficiency and grain damage versus cylinder speed of a grain thresher. Explain how you can select a suitable cylinder speed based on the above.      7

3. *(a)* Explain the working of a chaff cutter. Write the expression for its output capacity.      7

*(b)* A chaff cutter having 2 knives cuts dry hay at 60 r.p.m. with output capacity of 480 kg/h. If the throat size is 18 cm×6 cm, find the effective density of dry hay for a length of cut of 2·2 cm. How do you increase the length of cut in a chaff cutter?      3

**4.** Write short notes on the following : 10

(a) Vegetable transplanter

(b) Sugarcane cutter planter

**5.** (a) Explain the working of a grain combine with the help of a neat diagram. 3

(b) A 4·5 m grain combine was used in the field over distance of 10 m. Five samples taken in the field before using the combine for pre-harvest losses weighed 1·0 g, 1·2 g, 0·8 g, 0·6 g and 1·4 g when using 1 m$^2$ frame. Grain collected in the tank was 20·5 kg. When the grain was separated from the straw and chaff, the grains in the unthreshed heads weighed 50 g and free grains weighed 80 g. In the test area after the combine has passed, five samples collected from area 1 m$^2$ weighed 5·0 g, 6·5 g, 7·2 g, 5·6 g and 6·2 g. Calculate the shattering loss, threshing loss, rack loss, cutter bar loss and total loss. 7

**6.** (a) Draw a neat sketch of the cutter bar assembly of a reaper. Explain the functions of each component of the assembly. 3

(b) Derive the expression for the inertia force at each end of the stroke of a cutter bar. A mower operating at a crank speed of 1000 r.p.m. has S 240 mm, L 1·06 m, R 38 mm, knife mass = 4·4 kg, pitman mass = 3·4 kg with its centre of gravity at 0·48 m from the crank end, and crank pin mass = 0·36 kg. Calculate the inertia force at each end of the stroke. 7

**7.** (a) What do you mean by production with regard to land reclamation machinery? Explain the procedure to determine the production of dozer. 3

(b) What is land reclamation? Distinguish among dozer, excavator and loader. 7

**8.** Explain the complete procedure for the testing of a threshing machine along with the terminologies used for the evaluation of the performance of a thresher. 10

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