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

AGRICULTURAL ENGINEERING

(8th Semester)

Course No. : AE–803 (C)

(Testing and Evaluation of Tractors and Machineries)

Full Marks : 75
Pass Marks : 30

Time : 3 hours

Note : 1. Attempt **one** question from each Unit.
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.

UNIT—1

1. *(a)* What is field capacity? Distinguish between theoretical field capacity and actual field capacity. Actual field capacity is always less than theoretical field capacity. Give reasons. 6

(b) Explain the procedure to determine the following during testing a farm machinery : 9

(i) Actual field capacity

(ii) Theoretical field capacity

(iii) Forward speed

(iv) Slip of tractor drive wheels

(v) Fuel consumption

(vi) Field performance index

2. *(a)* A tractor disc harrow system has an effective field capacity of 0·8 ha/h. Operating costs of the tractor and disc harrow are ₹ 50/h and ₹ 10/h, respectively. Annual fixed costs of the tractor and the disc harrow are ₹ 2,000 and ₹ 800, respectively. The annual use of tractor is 1000 hours and of the harrow is 200 hours. Calculate the total cost of tillage per hectare. 6

(b) What is field efficiency? A2 × 30 cm mb plow is tested for its performance in a field size 60 m × 30 m. The forward speed of the tractor was found to be 4 km/h. There was an overlap of 5 cm in each run. The average time loss during turning was found to be 10 s/turn. The time lost in the field adjustment and preparation of tractor

for the field operation was 5 minutes for this field. The driver is habituated to take rest for 5 minutes for every one hour of operation. Determine the field efficiency if the tractor is operated along the length of the field. 9

UNIT—2

3. *(a)* What are inversion and pulverization? How do you measure them? Explain. 6

(b) Distinguish between a seed drill and a planter along with their applications. Calculate the diameter of cell plate and peripheral distance between two consecutive cells to get 20 cm seed spacing by a seed drill having speed ratio of 4:3 between cell plate and ground wheel. The diameter of the ground wheel is 70 cm. The speed of cell plate is 27 m/min. The forward travel speed of the machine is 3·2 km/h. 9

4. *(a)* What is draft? Explain the procedure for the measurement of draft of the following : 6

(i) Bullock drawn implement

(ii) Tractor drawn implement

(b) A power sprayer having 3 plungers each of 20 mm diameter and 20 mm stroke length is operating at a speed of 1000

rpm. The suction volume is 24·4 L/min and the pump efficiency is 64%. The sprayer is operating at a speed of 8 km/h. In a working day of 8 h, the time lost in filling the tank and turning is 30%. The boom length is 7 m. Find the *(i)* theoretical suction capacity of the pump, *(ii)* shaft power in kW when the pressure is 3000 kPa and *(iii)* area covered by the sprayer in one day. 9

UNIT—3

5. *(a)* What is puddling? How do you evaluate quality of puddling? 6

(b) Write the complete observation details of testing a bullock drawn plow. 9

6. *(a)* Distinguish between trailed, semimounted and mounted type of tractor drawn implements. 6

(b) Distinguish between position control and draft control. List the operations performed in these two control modes. What is mixed control mode? 9

UNIT—4

7. *(a)* Write the importance of application of chemical by spraying. Write the relationship between the following : 6

(i) Size of droplets and number of droplets produced by atomization

(ii) Size of droplets and area covered by the droplets after atomization

(iii) Size of droplets and pressure applied while using one particular nozzle

(iv) Size of droplets and nozzle diameter when pressure applied is maintained constant

(v) Nozzle flow rate and pressure applied

(b) What is calibration? Explain the procedure for the calibration of a manually-operated sprayer and a tractor-operated sprayer. 9

8. *(a)* A field sprayer is equipped with nozzles having a rated delivery of 0·42 L/min of water at 275 kPa. The nozzle spacing on the boom is 51 cm. Each kilogram of active ingredient (2, 4-D) is mixed with 80 L of water and the desired application rate is 0·95 kg of chemical per hectare. What is the correct forward speed for a nozzle pressure of 200 kPa? 6

(b) What are the various types of nozzles available for spraying operation? Explain with neat sketches their salient features and applications. 9

UNIT—5

9. *(a)* Distinguish between a reaper and a mower. What are the functions of a combine harvester? 6

(b) What is air blast sprayer? Explain its applications. An air blast sprayer is to be operated at 4 km/h and the desired application rate is 19 L per tree. The tree spacing is 9 × 9 m and each nozzle delivers 4·0 L/min at the operating pressure of 451 kPa.

(i) If one-half row is sprayed from each side of the machine, how many nozzles will be needed?

(ii) How many hectares can be covered with a 2-m^3 tank full of spray? 9

10. *(a)* Explain design and purpose of various types of threshing cylinders used in a power thresher. 6

(b) Draw a neat sketch of the cutter bar assembly of a reaper. Explain the function of each component of the assembly. What is meant by registration of cutter bar? 9

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