2018/EVEN/12/31/AE–604/290

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B.Tech Even Semester (CBCS) Exam., May—2018

AGRICULTURAL ENGINEERING

(6th Semester)

Course No. : AECC–32

(Testing and Evaluation of Tractors and machines)

Full Marks : 50

Pass Marks : 15

Time : 2 hours

Note :
1. Answer *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 right margin indicate full marks for the questions.

1. *(a)* During testing of a 4-row corn planter at 8 km/h, row spacing maintained at 100 cm and the average turning time at each end is 15 s for either down-the-row speed (assuming the operator throttles down from 8 km/h to turn). The time

required for filling seed hoppers and other miscellaneous interruptions is 4·5 min/ha plus 7% of the effective operating time. Plot curves of field efficiency versus row length from 0·2 km to 1·5 km. 8

(b) What are the MB plough adjustments during field evaluation? 2

2. *(a)* While testing a wheat thresher at the recommended throughput, 80 N-m torque is recorded at 750 r.p.m. at the main shaft of the threshing cylinder, which is operated by a 200 mm diameter V-pulley. The overload factor and unit mass of the V-belt are 1·2 and 0·9 kg m^{1}, respectively. At the condition of maximum power transmission, calculate the maximum tension in the V-belt in N. 6

(b) In a reciprocating type mower, the maximum inertia force of 22 kN along the pitman occurs at 35° crank angle and 25° pitman angle with the horizontal plate. The crank radius is 50 mm and the equivalent mass at the crankpin is 2·5 kg. If the crank rotates at 600 r.p.m., what will be the resultant force passing through the crankpin? 4

3. *(a)* Explain in detail field evaluation of a precision planter. 4

(b) When testing with a tractor-operated single acting trailing type disc harrow has 8 discs on each gang and the gang angle of both the gangs is maintained at 35°. The horizontal component of resultant soil reaction force on each disc is 600 N and it makes an angle of 30° with the gang axis. If the speed of operation is 6 km h ^{1}, find out the required drawbar power in kW to operate the harrow. 6

4. *(a)* The rated nozzle flow rate and volume median diameter (VMD) of droplets of a hydraulic sprayer are 1·0 L min ^{1} and 200 m, respectively at the rated pressure of 500 kPa. If the desired nozzle flow rate is 1 5 L min ^{1}, what will be the droplet diameter in m? 6

(b) During the testing of a spike-tooth type thresher for wheat crop, the throughput and the thresher capacity were found to be 750 kg h ^{1} and 445 kg h ^{1}, respectively. The grain-straw ratio (grain : straw) of the crop is 1·5 : 1. Material other than grain (MoG) collected at the main grain outlet is 0·5%. What is the total grain loss in percentage from all the sources? 4

5. *(a)* What is the drawbar test of tractor? Explain noise level test of a tractor operator's seat. 5

(b) Deduce an expression for calculation of offset of disk harrow. 5

6. Soybean is to be planted with a precision planter that meters 54 seeds per revolution of the metering disc powered from a ground wheel of diameter 490 mm. The desired plant population is 44800/ha with a row-to-row spacing of 0·75 m. The germination percentage is 84. The planter is to be operated at 2·5 km h ^{1} with a 10% skid of ground wheel. What is the angular speed of ground wheel in r.p.m. and the angular speed ratio of metering disc to ground wheel for obtaining the desired plant population? 10

7. A field sprayer having 16 fan type spray nozzles spaced 0·5 m apart is moving at a forward speed of 3·5 km h ^{1} with an application rate of 1 m^3 ha ^{1}. At a deposition level 430 mm below the tip of the nozzle, what is the discharge rate across a 0·2 m width at the centre? 10

8. A two-wheel drive tractor weighing 21 kN has a wheel base of 2·1 m. The CG of the tractor is 0·7 m ahead of rear axle centre. The tractor is pulling a single-axle trailer with gross trailer weight of 50 kN on a levelled concrete road while maintaining the line of pull parallel to the ground surface. The tractor hitch point is 42 cm behind the rear axle centre and 52·5 cm above the ground surface. During operation, 20% of the gross trailer weight is transferred to the tractor hitch point. If the coefficient of rolling resistance for each of the tractor and trailer wheels is taken as 0·04 and their ground reactions are assumed to pass through their respective wheel centres, find out—

(a) the dynamic ground reaction against the tractor rear wheels kN;

(b) the gross traction ratio developed by the tractor. 10

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