cutting force experienced by each rotary disc is 110 N. The peak overall motion resistance is found to be3.6 kN. If the overall power conversion efficiency of the tractor is 82%, What peak engine brake power will be required in kW? [7+7]

10 A tractor weighing 21 kN has 70% static weight on rear axle and its wheel base is 1.8 m. The drawbar hitch is located 25 cm behind the rear axle centre and 35 cm above the ground level. To overcome longitudinal instability, the front-end loading is provided at a distance of 20 cm aheadofthe front axle centre. It is observed that, there is front-end instability in the tractor due to a pull of30 kN inclined at 200 downward from the horizontal. What will be the minimum front-end load required toovercome the instability in N ? [8+6}

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M.Tech Even Semester Examination, May, 2025

Agricultural Engineering

(2nd Semester)

Course No: 2AG-152

(Recent Advances in Farm Machinery and Power Engineering)

Full Marks: 70
Pass Marks: 28
Time: 3 hours

Note:
1. Attempt any five questions taking one 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 figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. (a) What are the different methods used for calculation of centre of gravity of tractor? Discuss in brief. [7]

   (b) Explain different factors which influences dynamic stability of the tractor. [7]

2. The application rate of an 20-nozzle hydraulic sprayer is 1120 L ha^{-1}. The nozzle spacing and forward speed are 400 mm and 3.4 km h^{-1}, respectively. The operating pressure is 2.5 MPa and the pump efficiency is 60%. If 10% of the pump output power is used for agitating the liquid. Calculate the power needed to operate the sprayer in kW [8+6]

UNIT-II

3. A two-wheel drive tractor is taking a turn with a radius of curvature 6.0 m. The minimum horizontal distance between the tipping axis and line of action of the CG is 800 mm. The angle between the line of action of centrifugal force and perpendicular direction to the tipping plane is 15º. If the vertical distance of the CG from the ground level is 900 mm, calculate the limiting speed (in km h^{-1}) of the tractor to prevent overturning. [8+6]

4. While testing a wheat thresher at the recommended throughput, 100 N m torque is recorded at 750rpm 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. [7+7]

UNIT-III

5. A rear-wheel-drive tractor weighing 24 kN has 40 percent of its weight supported by the front wheels. The tractor is pulling a trailed plough with a forward speed of 6 km h^{-1} on flat land. The plough exerts a drawbar pull of 10.0 kN with the line of pull making an angle of 15^0 with the horizonta.in the vertical plane. The drawbar hitch height is 500 mm. Calculate

   (a) The coefficient of traction developed by the tractor for this operation.

   (b) If the wheel slip is 20 percent and the coefficient of rolling resistance is 0.04, what is the tractive efficiency of the tractor? [8+6]

6. (a) What do you mean by precision agriculture? Write the needs of precision agriculture. [2+2]

   (b) Write short notes on:

   a) Strain gauge.

   b) GPS

   c) GIS.

   d) Drawbar power

   e) Draft force [2x5]

UNIT-IV

7. (a) What do you mean by anthropometry? Explain with example about its application in a human- machine-system. [3+3]

   (b) Write the different types of dynamometers? Explain working of Prony type brake dynamometer with neat sketch. [4+4]

8. (a) What are the parameters to be considered when you are designing the tractor cab which is closed and can be purify inlet air 90% of dust when dry tillage operation going on? [7]

   (b) In India, tractor rear wheels couldn't have shock absorber then how can we stop 100% Oscillation of operator, when roadside operations going on? [7]

UNIT-V

9. A tractor PTO operated 5-disc rotary mower is harvesting with a forward speed of 3.5 km h^{-1}. The cutting circle diameter and rpm of each disc are 60 cm and 1400, respectively. The peak