

**B.Tech Odd Semester (CBCS) Exam.,
December—2017**

AGRICULTURAL ENGINEERING

(7th Semester)

Course No. : AE-706 (C)

(Advanced Farm Power)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

- Note :
1. Answer **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) Two double-acting cylinders are to be synchronized connecting them in series as shown in Fig. 1. The load acting on each cylinder is 4000 N.

Cylinder 1 has the piston diameter 50 mm and rod diameter 20 mm. If the cylinder extends 200 mm in 0.05 s, then find the following :

- (i) The diameter of the second cylinder
- (ii) The pressure requirement of the pump
- (iii) The capacity of the pump assuming the efficiency of the pump to be 85% and overall efficiency of the system as 90%.

9

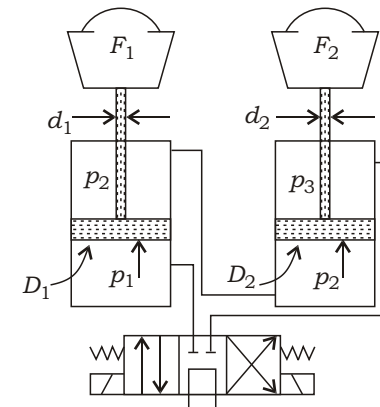


Fig. 1

- (b) Explain different types of gear pumps with sketch.

6

2. (a) A double-acting cylinder is used in a regenerative circuit as shown in Fig. 2. The relief valves are set at 7.5 N/mm^2 ,

(3)

the piston area is 150 cm^2 , the rod area is 40 cm^2 and the flow is 75 LPM. Find the cylinder speed and load-carrying capacities for various DCV :

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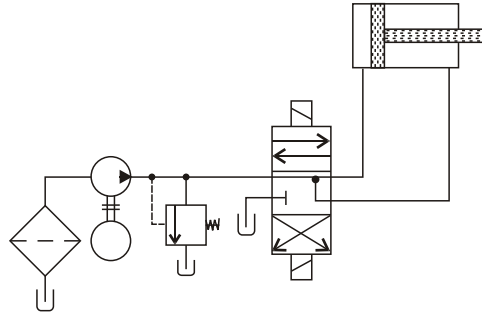


Fig. 2

- (b) Explain different types of directional control valves according to no. of switching positions with sketch.

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UNIT—2

3. (a) What is gear envelope? Why in a tractor more no. of gears are provided?
- (b) A rubber wheel carrying a load W of 5.4 kN has an effective ground contact area A of 0.09 m^2 over which the pressure may be assumed to be uniform. The soil and rubber/soil strength characteristics are shown in Fig. 3. What is the maximum pull

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(4)

which can be generated by the wheel if—

- (i) the wheel has lugs which engage the soil;
- (ii) the lugs are removed?

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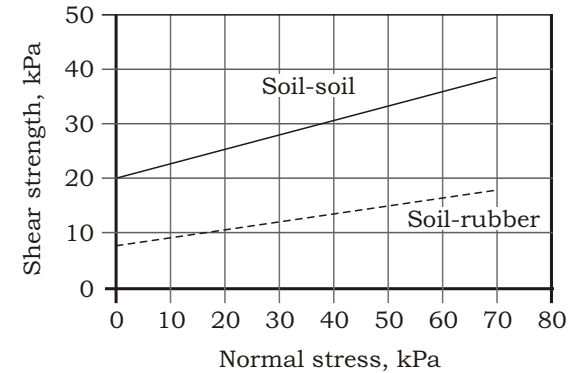


Fig. 3

- (c) How many times the power of an engine increases or decreases if the diameter of the piston is increased by 20% and stroke length is reduced by 20%, all factors remain the same?

4

4. (a) Consider the Farmland tractor with a spray tank mounted on the three-point linkage at the rear. The following data are applied :

Weight of spray tank when empty = 60 kg

Centre of gravity of the tank and water = 1.5 m from the rear axle = 1.0 m from the ground

(5)

- (i) If there is 210 kg of water in the tank, then what is the weight on the front wheels for the unit moving on horizontal ground?
- (ii) What weight of water can be carried and what will be the tractive coefficient (based on the total tractive force) if the unit is moving up a 10° slope and the weight on the front wheels is to not be less than 4 kN?
- (iii) What will be the maximum weight on the front wheels and the tractive coefficient as the tractor empties the spray tank while travelling down a 10° slope? 8
- (b) Determine an expression for the CG of a tractor by lifting method. 7

UNIT—3

5. (a) An engine developing 45 kW at 1000 rpm, is fitted with a cone clutch built inside the flywheel. The cone has a face angle of 12.5° and a maximum mean diameter of 500 mm. The coefficient of friction is 0.2. The normal pressure on the clutch face is not to exceed 0.1 N/mm^2 . Determine (i) the axial spring force necessary to engage the clutch and (ii) the face width required. 8

(6)

- (b) Explain the mechanical steering system of tractor with sketch. 7
6. (a) Explain different equations for prediction of drawbar pull, rolling resistance and tractive coefficient. 8
- (b) Explain with neat sketch camber, caster, toe-in and toe-out and kingpin angle with significance in steering system. 7

UNIT—4

7. (a) A 2 WD tractor has an engine speed of 2200 rpm and power output of 25 kW. If the overall transmission ratio is 45 and transmission efficiency is 90%, find out (i) power and torque developed at each rear wheel, when the differential lock is engaged, (ii) power and torque at each wheel when the speed of the left rear wheel is reduced by 50% during turning. 10
- (b) A tractor has a weight of 2000 kg and 40% weight is distributed on front axle. If the tractor has a drawbar pull of 600 kg, find out the tractive coefficient. 5

8. Write short notes on the following : 3×5=15
- (a) Tractive efficiency
 - (b) Gear envelope
 - (c) Final drive
 - (d) Hydraulic brake
 - (e) Mobility number

UNIT—5

9. (a) Discuss different ergonomic considerations for the driver's seat design of a tractor. 5
- (b) If the sound pressure level at 90 dB is increased by 6 times, then what will be the sound level in dB? 4
- (c) Define transmissibility of the tractor seat with formula and graph. 6
10. (a) Discuss different aspects of safety and comforts of agricultural tractors. 5
- (b) A tractor seat and operator of combined weight of 85 kg has a transmissibility of 0.325 at a tractor chassis frequency of 4 Hz and static spring deflection of seat and operator is 10 cm. Determine undamped natural frequency of the seat, spring and shock absorber value. 10

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