(b) For each motor, calculate the theoretical speed based on the available flow.

(c) Check whether each motor can meet both the starting torque and continuous operation requirements.

(d) Recommend the suitable motor with justification.

[3+3+3+5]=14

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M.Tech Even Semester Examination, May, 2025

Agricultural Engineering

(2nd Semester)

Course No: 2AG-154A

(Hydraulic System and Control)

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 is a pneumatic vacuum system? 6

   (b) With neat sketch explain the operations of a pressure-reducing valve. Sketch its graphical symbol. [6+2]

2. (a) With neat sketch explain power steering of tractor. 8

   (b) What is accumulator in hydraulic system? Explain its construction. [2+4]=6

UNIT-II

3. (a) Explain automatic draft and depth control system of tractor. 7

Turn Over

(b) A double acting cylinder is hooked up in the regenerative circuit.The relief valve setting is 68.94 bar and the Piston area is 6.35 x 10^{-3}m^2 & the rod area is 1.778 x 10^{-3} m^2. If the pumpflow is 75.706 lpm find the cylinder speed for retracting stroke 7

4. (a) With a neat circuit diagram explain open centre and closed centre hydraulic control system. 6

(b) Explain different types of pumps used in hydraulic systems. 8

UNIT-III

5. With the help of circuits, explain how synchronizing of two linear actuators are achieved by connecting them in series and in parallel. [4+6+4]

6. (a) Explain different directional control valves used in hydraulic system with sketch. 8

(b) List out the most widely used types of seal configurations. 6

UNIT-IV

7. Draw and explain constructional features of a 5/3-directioncontrol valve of linear type along with its graphical symbol. [4+6+4]

8. Construct a double pump hydraulic circuit employedin a punching press and explain how it functions. [8+6]

UNIT-V

9. A hydraulic motor is required to deliver a torque of 250 Nm at a speed of 400 rpm for a continuous industrial application.The available hydraulic supply is 16 MPa pressure and 50 L/min flow rate.Design and analyze the motor by answering the following:

(a) Calculate the theoretical displacement (in cm^3/rev) required for the motor.

(b) Determine the actual flow rate required considering a volumetric efficiency of 90%.

(c) Calculate the theoretical power output (in kW) and compare it with the actual output considering a mechanical efficiency of 88%.

(d) Comment whether the available supply is sufficient for continuous operation.

[3+3+4+4]=14

10. An agricultural machine requires a hydraulic motor to operate a rotating arm. The arm needs:

Starting torque: 500 Nm,

Continuous torque: 350 Nm at 600 rpm,

Maximum available system pressure: 20 MPa,

Available flow rate: 60 L/min.

Two motor types are available:

Motor A: Low-speed, high-torque motor, displacement = 150 cm^3/rev, volumetric efficiency = 91%, mechanical efficiency = 87%.

Motor B: High-speed, low-torque motor, displacement = 75 cm^3/rev, volumetric efficiency = 95%, mechanical efficiency = 89%.

Answer the following:

(a) For each motor, calculate the theoretical torque at 20 MPa.