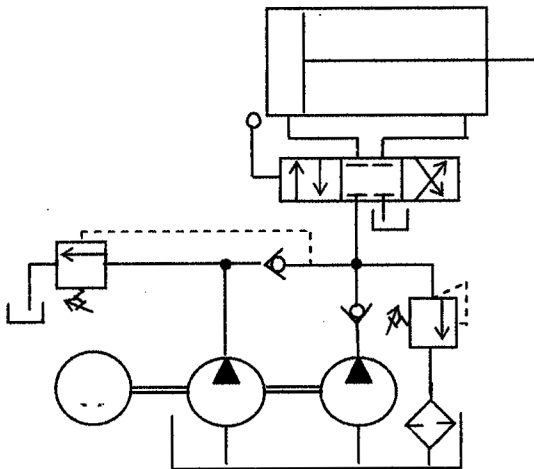


Bachelor of Engineering (Mechanical Engineering) - Fourth Year - Second Semester, 2023

Subject: Electrohydraulic Control Systems

Time : Three hours**Full Marks: 100***Answer any **five** questions*

1. (a) Why positive displacements pumps are preferred over rotodynamic pumps in case of fluid power applications?
 (b) What is a tandem-centered Direction Control Valve?
 (c) Explain the operation of a fixed displacement type vane pump.
 (d) Can a regenerative circuit be constructed with a symmetric actuator? Explain. [5×4]
2. (a) Briefly describe the operation of an *intensifier* circuit, as used in a fluid power system, with the help of a neat sketch.
 (b) Explain the operation of a dual stage Pressure relief valve with neat sketch. [10+10]
3. (a) Explain explicitly every symbol of the circuit shown in the figure. Identify the circuit and explain its working principal.



- (b) Justify the statement: 'Meter out circuits are hydraulically more efficient than meter in circuits'. [14+6]
4. (a) Explain the function of a pressure-compensated flow control valve with a neat sketch and explain its advantage over a simple flow control valve.
 (b) With a neat sketch, describe the operation of a sequencing circuit. [10+10]

[Turn over

5. (a) For the system with transfer function $G(s) = C(s)/R(s) = 2(s^2+9s+19)/(s^2+17s+30)$, what are the poles and zeroes. Indicate them in the Argand diagram and comment on the stability of the system.

(b) Using *Routh's Criteria*, comment on stability of the system with characteristic equation

$$s^4 + s^3 + 2s^2 + 2s + 5 = 0. \quad [08+12]$$

6. (a) Consider a tank of cross-sectional area A being filled with a liquid. The liquid flows out of the tank through a pipe of equivalent hydraulic resistance R_h . For a step input of inflow q_i , obtain the differential equation relating instantaneous water level $h(t)$ and q_i . Draw the block diagram and obtain the system transfer function. Hence obtain the response $h(t)$ as a function of time for a step input $q_i(t) = q_o$. Comment on the stability of the plant.

(b) In the previous problem, suggest how a Proportional controller can be implemented. Comment how stability and speed of response can be affected by tuning the controller parameter (s). [10+10]

7. (a) What is the main drawback of a P controller? State how a PI controller can overcome the this drawback.

(b) Explain how a tandem-centred 4-way DCV can be used for multi cylinder actuation.

[8+12]