BACHELOR OF ENGINEERING (MECHANICAL ENGINEERING)
4TH YEAR 2ND SEMESTER EXAM 2022
Subject: **ELECTROHYDRAULIC CONTROL SYSTEMS**

Time : Three hours **Full Marks: 100**

Question No.* 1 *is compulsory *and Answer* ***two*** *questions from each of groups A and B.*

1. (a) Why positive displacements pumps are preferred over rotodynamic pumps in case of fluid power applications?

(b) Discuss the role of an *Accumulator* in a fluid power circuit.

(c) Explain the operation of a *Swash Plate type Axial Piston Pump*.

(d) Can a regenerative circuit be constructed with a symmetric actuator? Explain.

(e) Write short note on: *Double Stage Pressure Relief Valve*? **[5x4]**

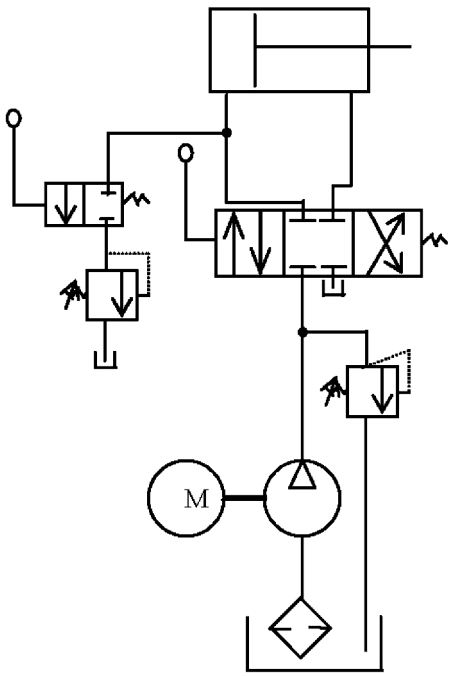
Group A

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 working principle of a *counterbalance valve* with neat sketch. **[10+10]**

3. (a) Can *Tandem centred DCVs* be used for multi cylinder actuation? Explain.

(b)



Explain all the symbols used in the above hydraulic circuit. **[10+10]**

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]**

Group B

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. Which one is the dominant pole? Explain why it is so called.

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

$s^4 + s^3 + 2s^2 + 2s + 5 = 0$

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) Draw the Bode plot for amplitude for the following transfer function:

$$G(s) = \frac{(s+3)(s+1)}{(s+79)(s+2)(s+18)}$$

[10+10]

7. (a) State the main drawback of a P-controller and explain how the same can be overcome.

(b) The block diagram shown in the Fig.P7 below, consists of an inner loop with feedback gain K_T & an outer loop with forward path gain K_B. Find the gain K_T which makes the inner loop critically damped.

Using this value of K_T, determine the range of gain K_B for which the closed loop system is stable.

[08+12]