

**Bachelor of Engineering (Mechanical Engineering) - Fourth Year - Second Semester**

**Electrohydraulic Control Systems**

Time : 3 hours

Full Marks: 100

Answer any four [4] questions

1a) Indicate the stability of the characteristic equations using *Routh's Criterion*:

$$3s^5 + s^4 + 2s^3 + s^2 + 2s + 1 = 0.$$

10

b) Explain the working principle of a regenerative circuit with neat sketch.

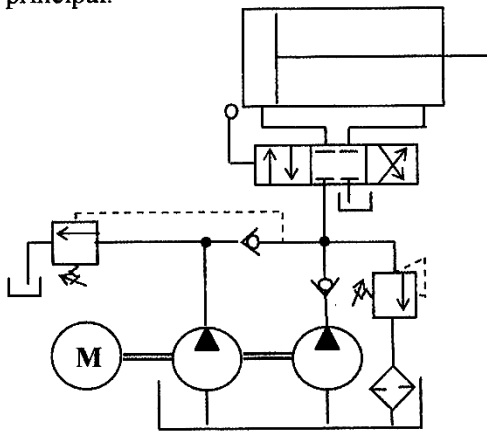
10

c) What is meant by an underlapped valve?

5

2. Explain explicitly every symbol of the circuit shown in the figure. Identify the circuit and explain its working principal.

8+8



b) Explain the working principle of a 2 stage pressure relief valve with neat sketch.

9

3a) Why intensifier and accumulators are used in hydraulic circuits.

8

b) How can Tandem center DCVs be used for multi cylinder actuation? Explain with neat sketch.

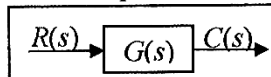
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c) Why is a displacement pump preferred over a rotodynamic pump for control applications?

7

4. If the transfer function of the system shown can be expressed as

$$G(s) = \frac{C(s)}{R(s)} = \frac{(s+3)}{(s+1)(s-2)},$$



find the response  $c(t)$  for unit step input  $r(t)$ . Comment on the stability of the plant and draw a Bode plot. 10+15

5a) With neat sketch explain the working principal of a counterbalance valve.

10

b) For the system with transfer function  $G(s) = \frac{5(s+0.5)}{s^2+11s+18}$ , what are the characteristic equation, poles and zeroes?

5

c) Consider 40 mm bore diameter and 15 mm rod diameter for the cylinder with 0.2 lps supply at 10.0 MPa pressure to find all possible normal and regenerative speeds in both directions along with the normal and regenerative thrusts available at the actuator during the extension stroke.

10