Bachelor of Engineering (Mechanical Engineering), 2019 (Old)
(5ᵗʰ Year 1ˢᵗ Semester)
FLUID POWER AND CONTROL

Time : 3 hours   Full Marks: 100
*Answer any four [4] questions*

1a) Describe the working of a swash plate type axial piston pump.   *10*
 b) Define open centre, close centre and tandem centre in the context of a spool valve. *5*
 c) What are the principal components of a feed back control system? Specify their functions with the help of a block diagram.   *10*

2a) Indicate the stability of the following characteristic equations using *Routh's Criterion*:

$$s^5 + 2s^4 + 3s^3 + 6s^2 + 2s + 1 = 0$$ *13*

 b) For the system $G(s) = \dfrac{54(s^2 + 2s - 3)}{(2s+6)(s^2 + 3s + 9)}$, what is the characteristic equation? Locate the poles and zeros of the system in *S*-plane and comment about its stability.   *12*

3a)
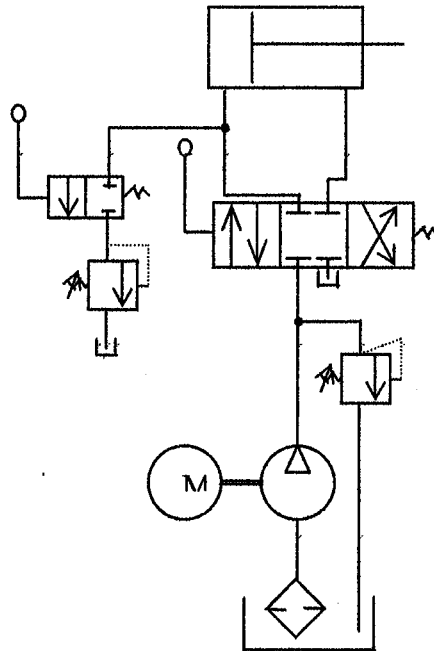
Explain all the symbols used in the above hydraulic circuit.   *13*
b) Explain the working principle of a sequencing circuit with neat sketch.   *12*

4a) With a neat schematic diagram and symbol briefly describe the function of a compound pressure relief valve. *13*

   b) With neat sketch briefly describe how a basic linear hydraulic circuit works. *12*

5. Sketch the schematic of filling a reservoir with inlet and long outlet along with proportional control arrangement for the inlet flow. Write down the governing equations for the system. Construct the block diagram and find the transfer function of the system. Find the steady-state error for a step-input demand. *25*

6a) For a regenerative circuit, consider 40 mm bore diameter and 15 mm rod diameter for the cylinder with 0.2 l/s supply at 10.0 MPa pressure. Find all possible normal and regenerative speeds in both directions, and normal and regenerative thrusts available at the actuator during the extension stroke. *13*

   b) Describe a typical meter-in circuit along with a schematic diagram. *12*