Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIFTH SEMESTER B.TECH. (E & C) DEGREE END SEMESTER EXAMINATION
DECEMBER 2018/JANUARY 2019
SUBJECT: LINEAR AND DIGITAL CONTROL SYSTEMS (ECE - 3101)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. For the mechanical system shown in Figure 1A, write the differential equations governing the mechanical behaviour of the system. Draw the force-current analogous circuit.

1B. For a type-2 system, find the steady state error for step, ramp and parabolic inputs.

(5+5)

2A. Plot the root locus for a unity feedback system, given $G(S) = \frac{K(S+2)}{S^2+2S+3}$

2B. Show, how the gain and phase margins of a system can be improved by using lag compensation. Derive the phase gain characteristic of such a compensator. Indicate an electrical circuit that can produce such a compensating circuit. Derive the transfer function.

(5+5)

3A. Check the stability of a digital system with characteristic equation P(z)= $0.8+3z+3.3z^2+z^3$ using Bilinear transformation and RH criterion.

3B. Using Block diagram reduction find the transfer function of the system shown in Figure 3B.

(5+5)

4A. The open loop transfer function of a unity feedback system is given by:

$$G(S) = \frac{K}{(S+2)(S+4)(S^2+6S+25)}$$

By applying Routh-Herwitz's criterion find the value of K which will cause oscillations in the closed loop system. Find the corresponding oscillating frequencies.

4B. A unity feedback system is characterized by a open loop transfer function, $G(s) = \frac{K}{s(s+10)}$.

Determine the gain K so that the system will have a damping ration of 0.5. For this value of K, determine settling time, peak overshoot and time to peak overshoot for a unit step input.

(6+4)

5A. With help of Bode plot ascertain the stability of a system whose open loop transfer function is given by $G(s) = \frac{10}{s(s+1)(s+0.1)}$

5B. For the control system shown in Figure 5B, evaluate the following:

1. Damping ratio
2. Instant at which peak overshoot occurs
3. Steady state error for unit step excitation

(4+6)

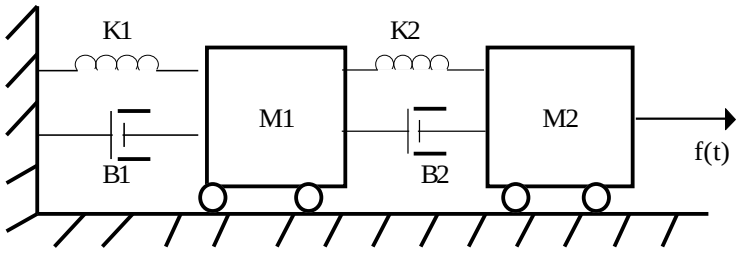

Figure 1A

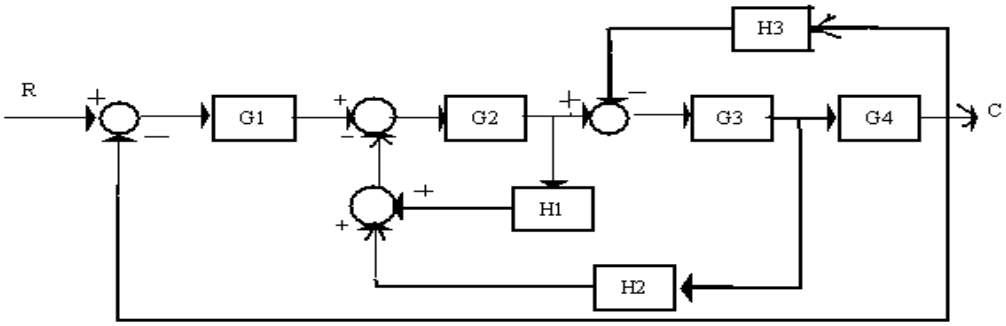

Figure 3B

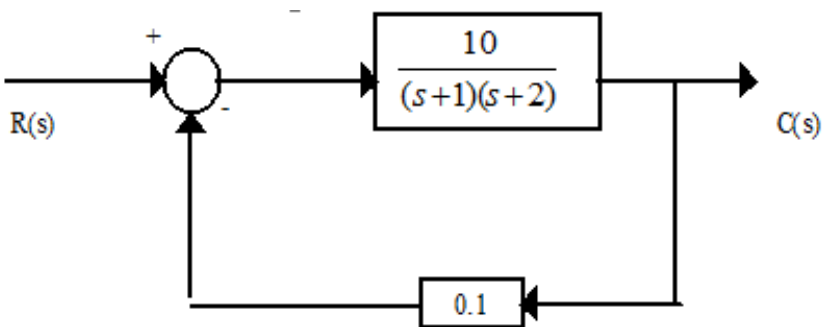

Figure 5B