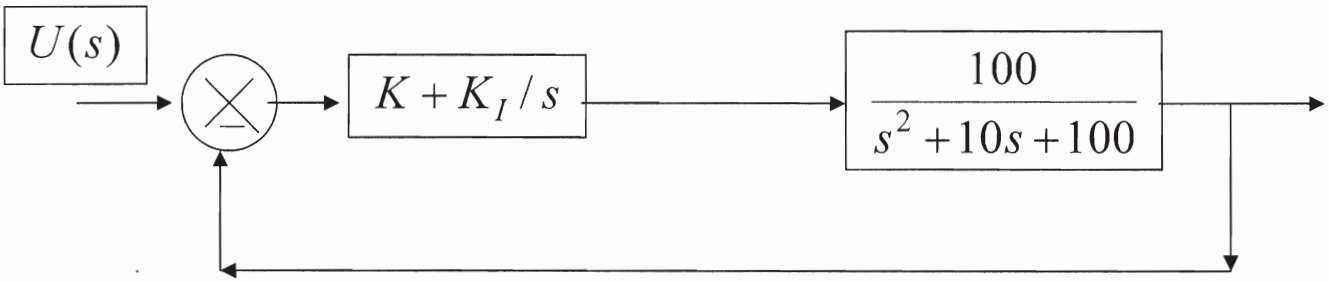
Major Test MEL 312 : Max Marks 40: Time 2 hours minus Quiz Time

Part B

1. The unity feedback system shown by the block diagram below consists of a proportional plus integral controller and a plant modeled by a second order type zero transfer function.



(a) Find the value of K_I so that the steady state error due to a unit ramp input is not more than 10%. (5)

(b) Plot the root locus pattern for a system whose forward path function is

$$\frac{K(s+1)}{s(s+2)(s^2+2s+5)}$$

From the root locus find what values of K make the system unstable.

(5)

2 (a) The open loop transfer function of a system is given as

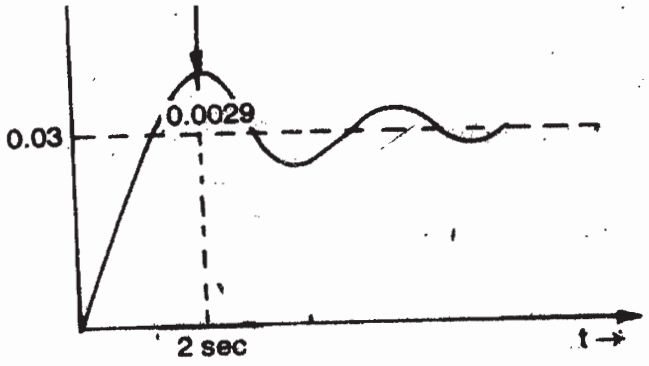
$$G(s) = 100/s\,(s+10)$$

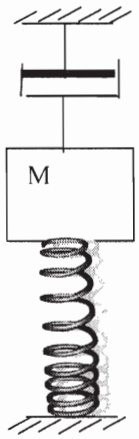
Find the dynamic error as a function of time when the closed loop is subject to an input of the form

$$r(t) = a_0 + a_1 t + a_2 t^2$$

(5)

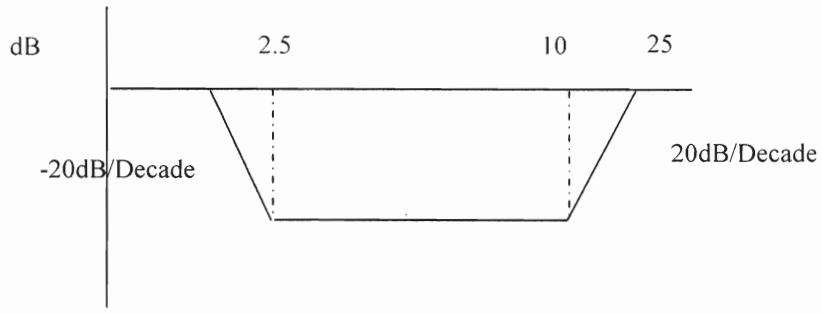
(b) F igure below shows the response of a mechanical system when a 10N of sudden force is applied to it . Find the values of M, K and C (5)





(5)

3. (b) For a lag lead system whose transfer function is plotted as shown in figure below, give the transfer function.



(5)

(b) Sketch the Bode plot for the following OLTF

$$\frac{Ks^2}{(1+0.2s)(1+0.02s)}$$

Determine the system gain for the gain cross over frequency of 5 rad/s. (5)

4. (a) In a potato chip making assembly line, at one inspection stage the, weight and label on the packet is checked. If the packet is underweight, a plunger type of actuator A1 pushes such packets on another conveyor line where they would go for repacking. If the label is not there, then another actuator A2 pushes such packets to another line L2 where they would be relabeled. However, such packets must be of appropriate weight. Make the logic diagram and write suitable logic equations (5)

(b) Water level in a tank is controlled by 2 limit switches. When the water level falls below "low" limit the limit switch LS2 state, the relay is activated and the solenoid valve opens giving a constant flow. The moment levels rises beyond "High" a limit switch LS1 changes state, the relay disconnects and the solenoid valve flow stops. The whole control system can be started by a push button P1. Any time while running the system can be stopped by an emergency stop button and the flow would stop. Make the ladder diagram of the situation using the suitable elements.. (5)