Total No. of Questions : 8]

SEAT No. :

P-342

[Total No. of Pages : 4

[6003]-423

T.E. (Mechanical/Mechanical Sandwich)

MECHATRONICS

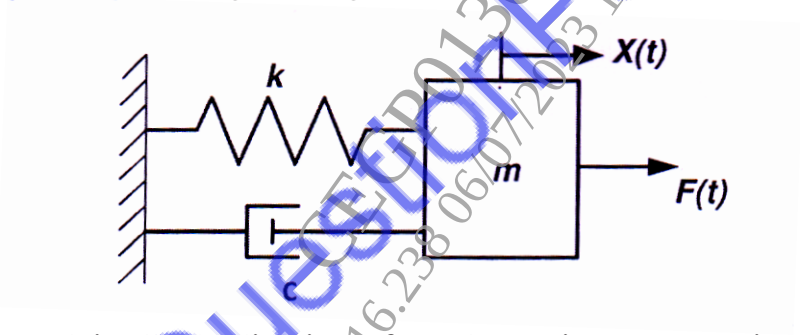
(2019 Pattern) (Semester - I) (302044)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

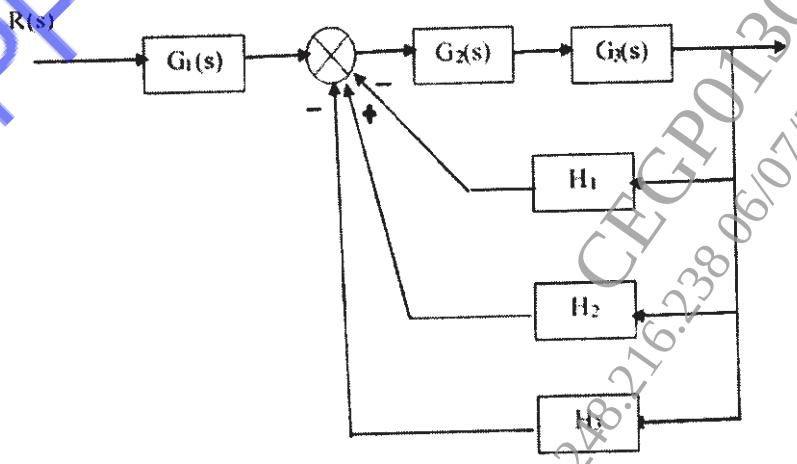
1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.*
2) *Use of drawing instruments, electronic pocket calculators are allowed.*
3) *Figures to the right indicates full marks.*
4) *Assume Suitable data if necessary.*

Q1) a) Find the transfer function of the given system for F(t) input and X(t) output for the given figure below. **[5]**



b) Explain the application of mechatronics : automatic assembly machine **[5]**

c) Reduce the block diagram and find the transfer function of the following Figure. **[8]**



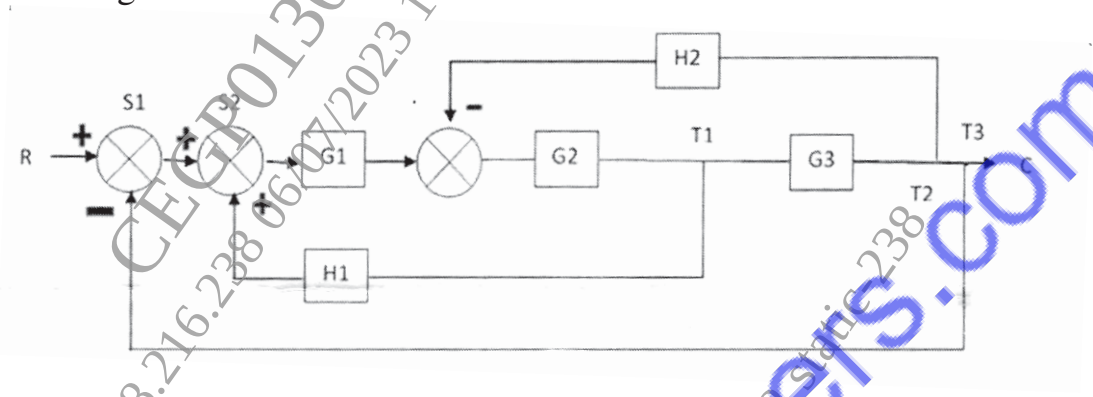
P.T.O.

OR

Q2) a) Compare open loop and close loop control system with block diagram and applications. **[5]**

b) Explain the concept of poles of zeros for stability analysis. **[5]**

c) Reduce the block diagram and find the transfer function of the following Figure. **[8]**



Q3) a) Explain natural frequency, damped frequency and damping ratio in detail. **[5]**

b) Compare time response and frequency response analysis **[5]**

c) For the system with transfer function $\frac{1}{(S+5+5j)(S+5-5j)}$. Draw the pole and zero plot and find damping ratio, natural frequency, peak time, maximum overshoot **[7]**

OR

Q4) a) Explain Bode plot with magnitude plot and phase plot. **[5]**

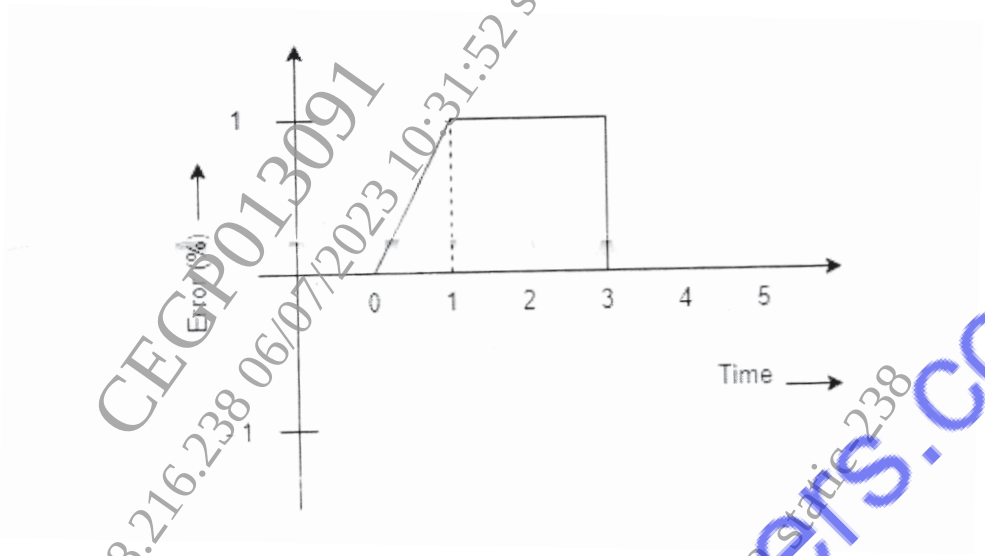
b) Explain frequency response specifications such as resonant peak, resonant frequency, band width **[5]**

c) $\frac{C(s)}{R(s)} = \frac{4s+6}{s^2+4s+6}$ For the transfer function of second order system presented by above equation, determine: i) location of poles and zeros ii) damping factor iii) comment of stability. **[7]**

Q5) a) Using a suitable block diagram explain the working of PID controller in series form. **[5]**

b) Distinguish between Proportional and Derivative controller. **[5]**

c) The Figure given below shows an error time graph. Sketch PID controller (Parallel form) output with respect to time. Assume Kp = 10. K_I= 2. K_D = 0.5 and Po = 0 i.e. the controller output is zero when the error is zero. **[8]**



OR

Q6) a) Explain manual tuning method used for PID controller **[5]**

b) State the advantages and application of PID controller. **[5]**

c) An integral controller is used for speed control with a set point of 13 rpm within a range of 10 to 20 rpm. The controller output is 22% initially. The constant K_I = – 0.15 % controller output per second per percentage error. If the speed jumps to 11 .5 rpm, calculate the controller output after 2 sec for constant e_p. **[8]**

Q7) a) Explain the concept of Latching with ladder in PLC. **[5]**

b) What is the Internal Architecture in any PLC? **[5]**

c) Draw a ladder diagram for the following operation. Two push buttons PB_1 and PB_2 are used to operate Red and Yellow light

i) When PB_1 is pushed Red lamp should be ON and it will continue to be ON till PB_2 is pushed.

ii) When PB_2 is pushed, Yellow light should be ON and it will continue to be ON till PB_1 is pushed.

iii) If PB_1 and PB_2 is pushed simultaneously, no lamp should be ON **[7]**

OR

Q8) a) Draw the block diagram of PLC and explain. **[5]**

b) Explain counters in PLC with a neat sketch and explain UP and DOWN counters. **[5]**

c) A circuit involves four NO type switches. P1, P2, S1 and S2 and a DC motor(M).Draw a ladder diagram such that following conditions are satisfied. **[7]**

i) When P1 is pushed the circuit shall turn ON and shall continue to remain ON until P2 is pushed

ii) When S1 is pushed and S2 is not pushed then motor is ON in clockwise direction

iii) When S2 is pushed and S1 is not pushed then motor is ON in anti-clockwise direction

iv) When P2 is pushed the circuit turns OFF