Total No. of Questions : 8]

SEAT No. :

PE2635

[Total No. of Pages : 4

[6583]-167

T.E. (Mechanical) (Mechanical Sandwich Engg.)

MECHATRONICS

(2019 Pattern) (Semester - V) (302044)

Time : 2½Hours] *[Max. Marks : 70*

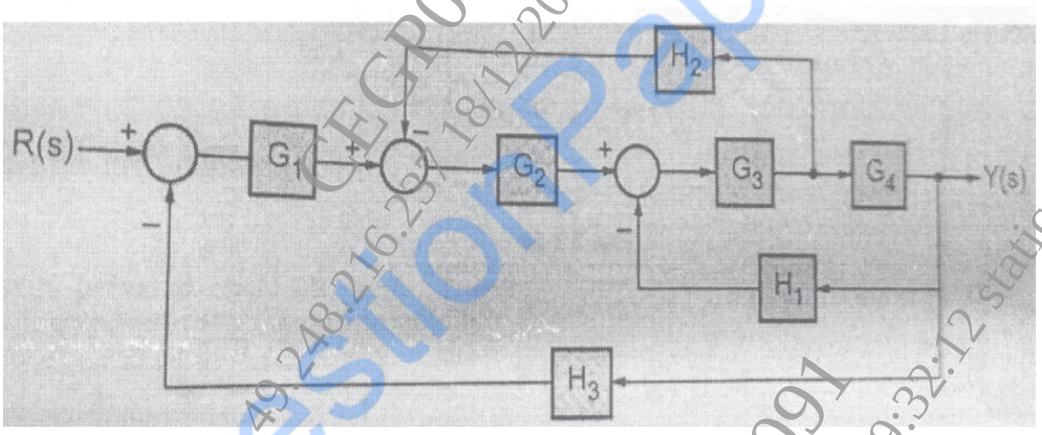
Instructions to the candidates:

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

Q1) a) Explain Open loop control system with a case study/application. **[5]**

b) Explain concept of transfer function and state its properties. **[5]**

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



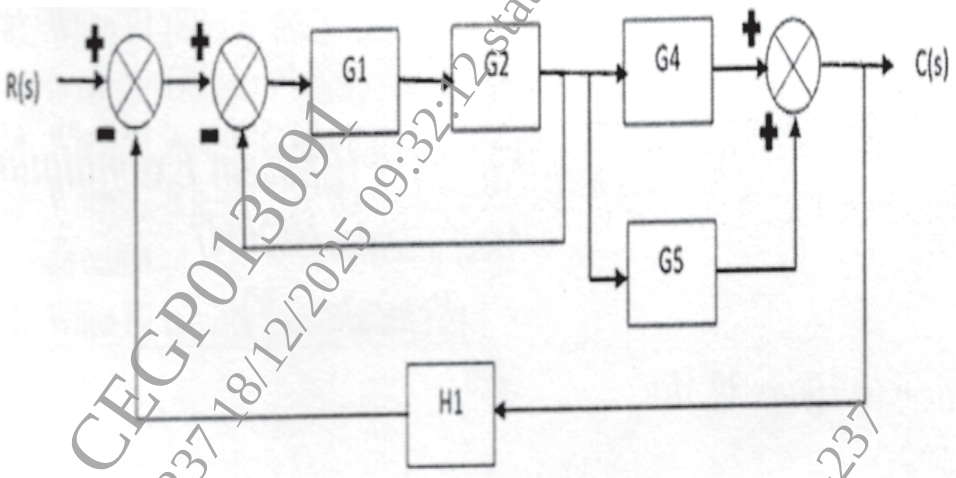
OR

Q2) a) Compare open loop and closed loop control system. **[5]**

b) Explain application of mechatronics: Anti-lock braking system (ABS). **[5]**

P.T.O.

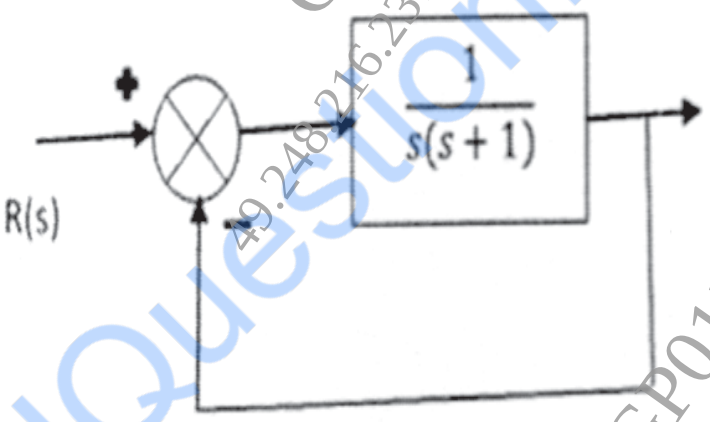
c) Reduce the block diagram and find the transfer function of the following Figure. **[8]**



Q3) a) Explain frequency response specifications and resonant peak, resonant frequency, band width. **[5]**

b) Explain gain margin and phase margin. **[5]**

c) Determine the value of delay time, rise time, peak time, settling time and peak overshoot when control system shown in Figure below is subjected to unit step input. **[7]**



OR

Q4) a) Compare time response and frequency response analysis. **[5]**

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

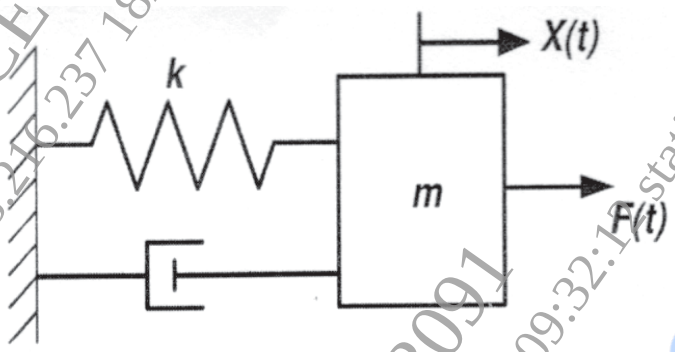
c) For the system in Figure below; assume mass=3kg, stiffness=3.5 N/m and damping coefficient= 0.3 Ns/m. Also, F=Force input in N and x = displacement output in m. **[7]**

Find:

i) Derive the transfer function X(s)/F(s)

ii) Poles and zeros plot

iii) Comment on stability



Q5) a) Why derivative controller is not used in control systems? **[5]**

b) Using a suitable block diagram explain the working of PID control in parallel form. **[5]**

c) A PI controller is reverse acting, PB = 20, 12 repeats per minute. Find **[8]**

i) Proportional gain.

ii) Integral gain

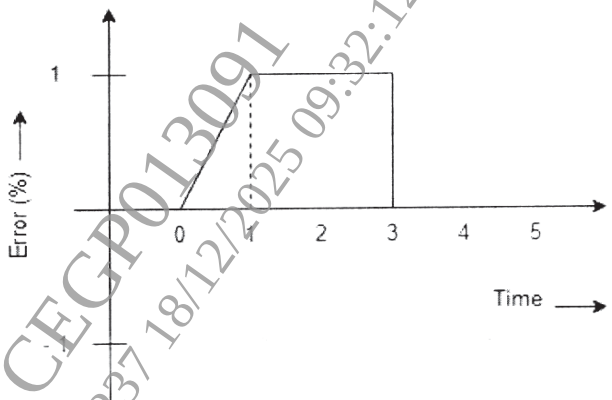
iii) Time that the controller output will reach 0 % after a constant error of 1.5 % starts.
The controller output when the error occurred was 72 %.

OR

Q6) a) Explain the Proportional-Integral controller with a block diagram. **[5]**

b) Explain the manual procedure for PID controller tuning with a suitable example. **[5]**

c) Fig. 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 P_o = 0 i.e. the controller output is zero when the error is zero. **[8]**



Q7) a) Explain the basic components of PLC. **[5]**

b) What is the function of timers in PLC programming? Explain any one of them. **[5]**

c) Given four normally open switches (P1, P2, S1, and S2), with DC motor (M) write a PLC program to satisfy following objectives: **[7]**

i) When P1 (Start Button) is pushed the cycle shall start. The cycle shall continue to remain ON unit P2 (Stop Button) is pushed.

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

iii) When S2 is pushed and S1 is not pushed then motor is ON in counter clockwise direction.

iv) When P2 is pushed the program stops.

OR

Q8) a) List and discuss, in brief, any five specifications of PLC. **[5]**

b) Using a suitable diagram explain the working of the counter in a PLC. **[5]**

c) A conveyor is run by switching ON or OFF a motor. We are positioning parts on the conveyor with an optical detector. When the optical sensor goes on,we want to wait 1.5 seconds, and then stop the conveyor. After a delay of 2 seconds the conveyor will start again. We need to use a start and stop button-a light should be ON when the system is active. **[7]**

✡ ✡ ✡