Total No. of Questions : 8]

SEAT No. :

P2318

[Total No. of Pages : 4

[5870]-1023

T.E. (Mechanical/Mechatronics Sandwich)

MECHATRONICS

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

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to Candidates:

1) ***Answer Q.No.1 or Q.No. 2, Q.No. 3 or Q.No. 4, Q.No.5 or Q.No. 6, Q.No. or Q.No.8.***
2) ***Figures to the right indicate full marks.***
3) ***Use Graph paper for Graphical solution.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Using suitable diagram explain the application of Automotive Engine Management System. **[6]**

b) Reduce the block diagram in Fig. (a) And determine the transfer function: Y(s)/X(s). **[6]**

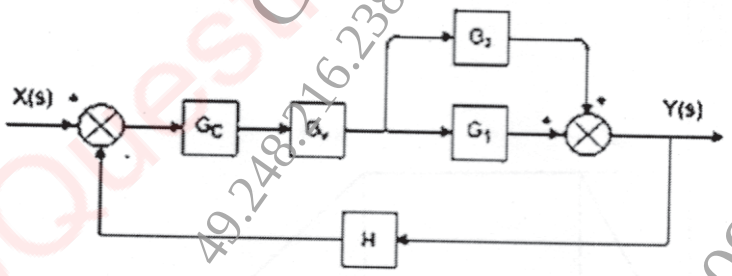

Fig. (a)

c) Find the poles and zeros of the transfer function $G(S)=\frac{s^2+3s+2}{(s+4)(s^2+6s+25)}$ and sketch pole-zero plot. **[6]**

OR

P.T.O.

Q2) a) Compare open loop and closed loop control system. **[6]**

b) By using Routh-Hurwitz stability criterion determine the stability of the system represented by the characteristic equation $9S^5 - 20S^4 + 10S^3 - S^2 - 9S - 10 = 0$. Comment on the location of roots of characteristics equation. **[6]**

c) Define "Transfer Function" and discuss its importance in the context of control of a mechatronic system. **[6]**

Q3) a) Define the following terms:

i) % Overshoot ii) Steady state errors

iii) Damping Frequency iv) Natural Frequency **[8]**

b) Determine the values of delay time, rise time, peak time, settling time and % overshoot when the control system shown in Fig. (b) is subject to a unit step input. **[9]**

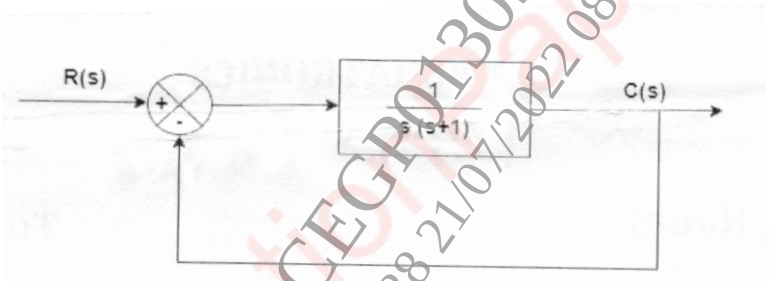

Fig. (b)

OR

Q4) a) Compare tome domain and frequency domain techniques for analysis of systems. **[8]**

b) Write a short note on the following point: **[9]**

i) Gain Margin

ii) Phase Margin

iii) Bode Plot

Q5) a) Using a suitable block diagram explain the working of PID control in parallel form. **[8]**

b) Draw the controller response for given error graph as shown in Fig. (c) $K_P = 5$, $K_D = 0.5$ s and $P_O = 20\%$.

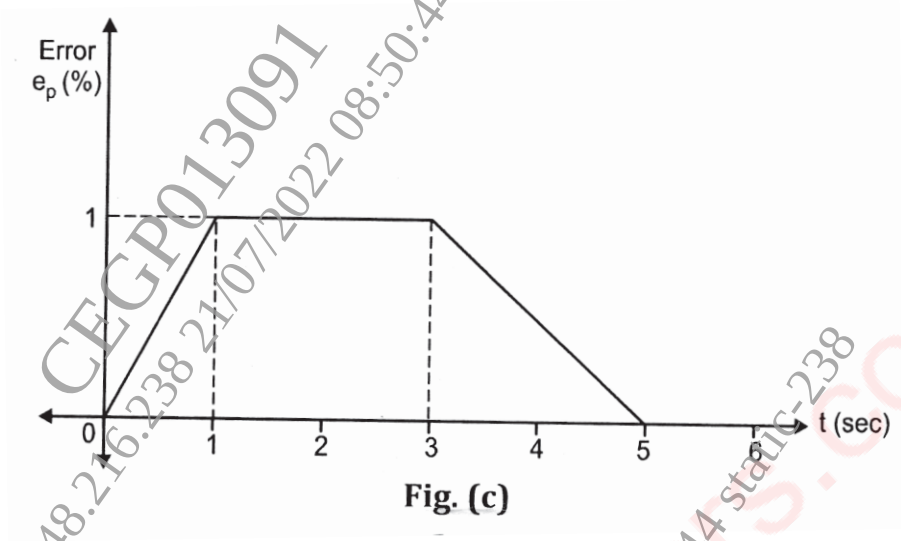

Fig. (c)

[10]

OR

Q6) a) Explain Derivation control with a neat diagram and equation. Why derivative controller cannot be used alone? **[8]**

b) For a proportional controller, the controller variable is a process temperature with a range of 50°C to 130°C and a set point of 73.5°C. Under nominal conditions, the set point is maintained with an output of 50%. Find the controller output having proportional gain of 2, if the temperature is:

i) 61°C

ii) 122°C and

iii) A ramping temperature of (82 + 5t) °C. **[10]**

Q7) a) List the criterion for the selection of a PLC and explain any two criterions in details. **[8]**

b) In a certain bank each of three bank officers has a unique key to the vault. The bank rules requires that two out of the three officers be present when the vault is opened. Draw the ladder diagram for a relay logic circuit that will unlatch the door and turn on the light when the three keys are inserted. **[9]**

OR

Q8) a) Using a suitable example, draw a ladder diagram and explain how timer is implemented. **[8]**

b) A circuit involves four NO type switches P1, P2, S1 and S2 and a DC motor (M). Draw a ladder diagram such that the said circuit satisfies following objectives:

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. **[9]**