Total No. of Questions : 8]

SEAT No. :

PA-1531

[Total No. of Pages : 4

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## T.E. (Mechanical/Mechanical- Sandwich)

## MECHATRONICS

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

*Time : 2½ Hours]* *[Max. Marks : 70*

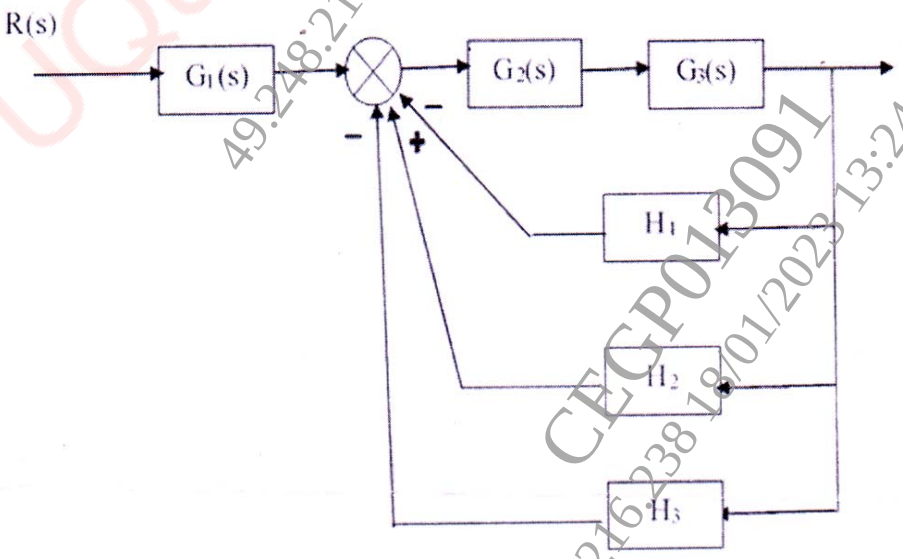
***Instructions to the candidates:***

1) ***Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 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 application of mechatronics: Anti-lock Breaking System (ABS). **[5]**

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

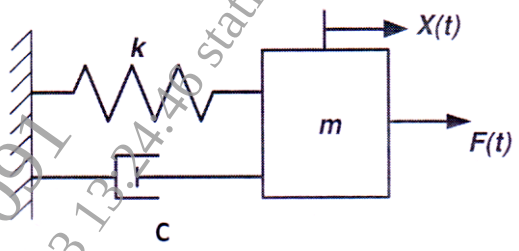
c) Reduce the block diagram and find the transfer function of the following Figure. **[8]**




OR

***P.T.O.***

***Q2)*** a) Find the transfer function of the given system for F(t) input and X(t) output from the following Figure. **[5]**




b) Explain washing machine as an application of mechatronics system. **[5]**

c) By using Routh Herwitz criterion, determine the range of K that would confirm closed loop stability of system given by Transfer Function $\frac{1}{S^4+3S^3+3S^2+2S+K}$. **[8]**

***Q3)*** a) Explain transient response specification and define delay time, rise time, peak time. **[5]**

b) Explain Bode plot with magnitude plot and phase plot. **[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 frequency response specifications such as resonant peak, resonant frequency, band width. **[5]**

b) Compare time response and frequency response analysis. **[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 : **[7]**

i) location of poles and zeros

ii) damping factor

iii) comment of stability.

*Q5)* a) Distinguish between P1 controller and PID controller. **[5]**

b) Explain Proportional-Derivative controller with a block diagram. **[5]**

c) An integral controller is used for speed control with a set point of 15 rpm within a range of 10 to 20 rpm. The controller output is 23% initially. The constant $K_i$ = –0.15 % controller output per second per percentage error. If the speed jumps to 12.5 rpm, calculate the controller output after 3 sec for constant $e_p$. **[8]**

OR

*Q6)* a) State the advantages and application of PID controller. **[5]**

b) Explain ON-OFF controller action with block diagram along with neutral zone. Also state the suitable application of ON-OFF controller. **[5]**

c) 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 : **[8]**

i) 61°C

ii) 122°C and

iii) A ramping temperature of (82 + 5t) °C.

*Q7)* a) What is the Internal Architecture in any PLC? **[5]**

b) Explain the selection criteria of 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. **[7]**

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

OR

*Q8)* a) Explain counters in PLC with a neat sketch and explain UP and DOWN counters. **[5]**

b) Explain Input module and output module in PLC. **[5]**

c) Write ladder logic for a simple traffic light controller for the following sequence of operations : **[7]**

i) Turn Green ON for 45 seconds

ii) Turn Yellow ON for 5 seconds

iii) Turn Red ON for 50 seconds

iv) Repeat the sequence

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