Sem IV (R-2019) "ECS" + Control Instrumentation May 2022

University of Mumbai

Examinations Summer 2022

93467

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Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	A control system is said to be open loop, if -
Option A:	The output is independent of input
Option B:	Control action is independent of the input
Option C:	Control action is independent of the output
Option D:	The transfer function of the system is unity
2.	Which of the following is true in the case of an AC servomotor?
Option A:	The fixed winding and control windings are excited by voltages with 180 degrees phase shift
Option B:	The fixed winding and control windings are placed 180 degrees apart in space
Option C:	The fixed winding and control windings are placed 120 degrees apart in space
Option D:	The fixed winding and control windings are placed 90 degrees apart in space
3.	The identical first order system have been cascaded non-interactively. The unit step response of the systems will be:-
Option A:	Under damped
Option B:	Over damped
Option C:	Critically damped
Option D:	Un-damped
4.	The open loop TF of a system is given by: K/(s - 1). The system will be ---
Option A:	Absolutely stable
Option B:	Oscillatory
Option C:	Conditionally Stable
Option D:	Unstable
5.	Which of the following is a time domain specification of a system?
Option A:	Maximum peak overshoot
Option B:	Phase margin
Option C:	Bandwidth
Option D:	Resonant peak
6.	At lower frequencies, the initial slope of the Bode magnitude plot of a type 0 system will be :-
Option A:	-40 dB/decade
Option B:	-20 dB/decade
Option C:	20 dB/decade
Option D:	0 dB/decade
7.	Polar plot of $1/s^2$ will be :-
Option A:	Positive real axis
Option B:	Negative real axis

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Option C:	Positive imaginary axis
Option D:	Negative imaginary axis
8.	Which of the following is a displacement transducer?
Option A:	Strain gauge
Option B:	LVDT
Option C:	Orifice
Option D:	RTD
9.	An FM wave represented by $e = 12 \sin (6 \times 10^8 t + 5 \sin 1250 t)$ V. The carrier and modulating frequencies are –
Option A:	6 KHz and 1.25 Khz
Option B:	95.5 KHz and 19.9 KHz
Option C:	95.5 MHz and 199 Hz
Option D:	95.5 MHz and 19.9 MHz
10.	Which of the following is similar to a data logger
Option A:	Chart Recorders
Option B:	Flip Flop
Option C:	Memory
Option D:	Counter

Q2	**Solve any Four** **5 marks each**
A	Explain Mason's gain formula. Construct signal flow graph for the following set of equations, by taking x_1 as input and x_4 as output $x_2 = A_{21}x_1 + A_{23}x_3$ $x_3 = A_{31}x_1 + A_{32}x_2 - A_{34}x_4$ $x_4 = A_{42}x_2 + A_{43}x_3$
B	Explain the variations in time domain specifications with changes in ξ and ω_n
C	Determine stability of the system having characteristic equation $s^6 + 5s^5 + 10s^4 + 24s^3 + 20s^2 + 15s + 10 = 0$
D	What are Data loggers? State its types and applications?
E	Explain the principle of RTD
F	Explain HART communication protocol
Q3.	**Solve any Two Questions** **10 marks each**
A	Explain, with a neat diagram, the working of an armature controlled DC servomotor. Derive its transfer function
B	TF of a second order system is given by : $\frac{C(s)}{R(s)} = \frac{1}{s^2 + 0.6s + 1}$ If tolerance is 2%, calculate all time domain specifications.