Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2018

EE2CO09 Control Systems

Programme: Diploma Branch/Specialisation: EE

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. In a signal flow graph, nodes are represented by small _____ **1**

(a) Circles (b) Squares (c) Arrows (d) Pointers

ii. Which among the following is not an advantage of an open loop system? **1**

(a) Simplicity in construction & design

(b) Easy maintenance

(c) Rare problems of stability

(d) Requirement of system recalibration from time to time

iii. By equating the denominator of transfer function to zero, which among the following will be obtained? **1**

(a) Poles (b) Zeros

(c) Both (a) and (b) (d) None of these

iv. Which point on root locus specifies the meeting or collision of two poles? **1**

(a) Centroid (b) Break away point

(c) Stability point (d) Anti-break point

v. Root locus specifies the movement of closed loop poles especially when the gain of system _____ **1**

(a) Remains constant (b) Exhibit variations

(c) Gives zero feedback (d) Gives infinite poles

vi. The characteristics equation of a closed loop control system is given as **1**

(a) 1±GH=0 (b) GH (c) G/1±GH (d) None of these

P.T.O.

	vii.	State space analysis is applicable even if the initial conditions are _____ (a) Zero (b) Non-zero (c) Equal (d) Not equal	**1**
	viii.	What is the value of steady state error in closed loop control systems? (a) Zero (b) Unity (c) Infinity (d) Unpredictable	**1**
	ix.	With regard to the filtering capacity the lead compensator and lag compensator are respectively: (a) Low pass and high pass filter (b) High pass and low pass filter (c) Both high pass filter (d) Both low pass filters	**1**
	x.	A lag compensator is basically a (a) High pass filter (b) Band pass filter (c) Low pass filter (d) Band elimination filter	**1**
Q.2	i.	Define signal flow graph.	**2**
	ii.	Compare and contrast open loop and closed loop control systems.	**3**
	iii.	Derive the expression for closed loop transfer function.	**5**
OR	iv.	Discuss the working of a stepper model and derive a suitable mathematical model for it.	**5**
Q.3	i.	What is steady-state error?	**2**
	ii.	Define delay time, rise time and peak time.	**3**
	iii.	Explain the second order time domain specifications of a control System.	**5**
OR	iv.	Find the time domain specifications for the system given as: C(s)/ R(s) = (s^2 +2s+3) / (s^2 + 5s+9)	**5**
Q.4	i.	Check the stability of the system whose characteristic equation is given by $s^4+2s^3+6s^2+4s+1=0$	**3**
	ii.	Explain the Routh Hurwitz criteria for determining the stability of a system.	**7**
OR	iii.	Consider a unity feedback control system with the following transfer function $G(s) = \frac{K}{s(s^2+4s+8)}$ plot the root loci for the system.	**7**

Q.5	i.	Define state variable, state vector and state space.	**3**
	ii.	Define Eigen values and Eigen vectors.	**7**
OR	iii.	Explain controllability and observability with the help of block diagram.	**7**
Q.6	i.	Write short notes on different type compensations.	**3**
	ii.	Write the effect of phase lead network. Explain limitations of phase lead network.	**7**
OR	iii.	Write short note on phase lag network. Draw the bode plot for phase lag network.	**7**

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Marking Scheme

Q.1	i	In a signal flow graph, nodes are represented by small _____ (a) Circles	**1**
	ii	Which among the following is not an advantage of an open loop system? (d) Requirement of system recalibration from time to time	**1**
	iii	By equating the denominator of transfer function to zero, which among the following will be obtained? (a) Poles	**1**
	iv	Which point on root locus specifies the meeting or collision of two poles? (b) Break away point	**1**
	v	Root locus specifies the movement of closed loop poles especially when the gain of system _____ (b) Exhibit variations	**1**
	vi	The characteristics equation of a closed loop control system is given as (a) 1±GH=0	**1**
	vii	State space analysis is applicable even if the initial conditions are _____ (b) Non-zero	**1**
	viii	What is the value of steady state error in closed loop control systems? (a) Zero	**1**
	ix	With regard to the filtering capacity the lead compensator and lag compensator are respectively: (b) High pass and low pass filter	**1**
	x	A lag compensator is basically a (c) Low pass filter	**1**
Q.2	i.	Definition of signal flow graph.	**2**
	ii.	Compare open loop and closed loop control systems. Each point of 0.5 mark (0.5 mark * 6)	**3**
	iii.	Expression for closed loop transfer function. 3 marks Block diagram 2 marks	**5**
OR	iv.	Working of a stepper model 2 marks Mathematical model for it. 3 marks	**5**
Q.3	i.	Steady-state error	**2**
	ii.	Delay time, rise time and peak time. Each point of 1 mark (1 mark * 3)	**3**
	iii.	Second order time domain specifications of a control System	**5**
OR	iv.	Find the time domain specifications for the system given as: C(s)/ R(s) = (s^2 +2s+3) / (s^2 + 5s+9) Each specification point of 1 mark (1 mark * 5)	**5**
Q.4	i.	Stability of the system 1 mark Characteristic equation is given by $s^4+2s^3+6s^2+4s+1=0$ 2 marks	**3**
	ii.	Routh Hurwitz criteria for determining the stability of a system.	**7**
OR	iii.	Consider a unity feedback control system with the following transfer function $G(s) = \frac{K}{s(s^2+4s+8)}$ 3 marks Plot the root loci for the system 4 marks	**7**
Q.5	i.	Define state variable, state vector and state space. Each point of 1 mark (1 mark * 3)	**3**
	ii.	Define eigen values 3 marks Eigen vectors. 4 marks	**7**
OR	iii.	Controllability 2 marks Observability 2 marks Block diagram. 3 marks	**7**
Q.6	i.	Write short notes on different type compensations. Each point of 1 mark (1 mark * 3)	**3**
	ii.	Effect 3 marks Phase lead network. 2 marks Limitations of phase lead network 2 marks	**7**
OR	iii.	Phase lag network. 4 marks Bode plot for phase lag network. 3 marks	**7**

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