Library
11/05/16

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
Test – I / Test – II / End Semester Exam
November 2015 / May 2016

Q. P. Code:
Duration:
Program: Electrical
Course Code : EE352

Max. Marks: 100
Class: T.E. Semester: VI
Name of the Course: Control System II

Instructions:

1. **Question No. 1 is compulsory.**
2. Answer any four questions from remaining six.
3. Keep answers to the point.
4. Make suitable assumptions if required and justify the same.

Master file.

Question No		Maximum Marks	Course Outcome Number
Q1a	Explain in brief the concept of Eigen Values and Eigen Vectors.	**04**	1
Q1b	Prove that any square matrix with distinct Eigen values can be transformed to equivalent diagonal matrix with the help of Modal Matrix, as a transformation matrix, constructed using Eigen vectors.	**06**	1,2,3,
Q1c	Define Principal of Argument and explain in brief how Nyquist has applied it to define the Nyquist stability criterion for minimum phase system.	**03+05**	1,,2
Q1d	Define the gain margin and phase margin in a typical Bode Plot. **Note:** Just draw the typical bode blot and indicate gain and phase margin on it do not write any description to answer the question.	**02**	1,2,3

Q2a	Define Controllability and Observability.	**04**	1
Q2b	**Fig. 1** indicates Bode magnitude plot. Find the transfer function from the plot. Also draw the corresponding Bode phase plot.	**06**	2,3
Q2c	Derive the transfer function from state space model for single input single output system and explain in brief how stability of the system can be confirmed from the Eigen values of System Matrix A.	**03+02**	2,3
Q2d	Draw the bode plot for transfer function shown below. Assume **K=100**. $$G(s)=\frac{K}{s(s+2)(s+10)}$$	**05**	1,2
Q3a	Justify with proper mathematical analysis that **"s"** can be replaced with **"jω"** while analyzing the system using frequency domain approach.	**10**	1
Q3b	List out the frequency domain specifications. Derive the relationship for them for a typical prototype second order system. Write down the restriction on their validity if any exists. If some specifications cannot be derived easily write down their equations.	**02+06+02**	1,2,3
Q4	An electric ventricular assist device (EVAD) that helps pump blood concurrently to a defective natural heart in sick patients can be shown to have a transfer function **(Continued On Next Page)**	**20** (5 Marks for Bode plot of uncompensated	1,2,3

	$$G(s) = \frac{P_{ao}(s)}{E_m(s)} = \frac{1361}{s^2 + 69s + 70.85}$$ The input, Em(s), is the motor's armature voltage, and the output is Pao(s), the aortic blood pressure (Tasch, 1990). **The EVAD will be controlled in the closed-loop configuration with unity feedback and G(s) as a forward path transfer function.** Design a phase lag compensator to achieve a tenfold improvement in the steady-state error to step inputs without appreciably affecting the transient response of the uncompensated system.	system 3- Marks for transforming specifications into frequency domain 12 – Marks for Compensator design (include step marking)	
Q5	An aircraft roll control system is shown in **Fig. 2**. The torque on the aileron generates a roll rate. The resulting roll angle is then controlled through a feedback system as shown. Design a lead compensator for a **60 degree phase margin and Kv = 5**.	**20** (5 Marks for Bode plot of uncompensated system 3- Marks for transforming specifications into frequency domain 12 – Marks for Compensator design (include step marking)	1,2,3
Q6	The model for patients treated under a regimen of a single day of Glargine insulin. The model to find the response for a specific patient to medication can be expressed in phase-variable form with **(Continued On Next Page).**	**20** (3 Marks for Finding Eigen Values 3- Marks for transforming specifications into desired characteristic	1,2,3

	$A=\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -501.6\times10^{-6} & -128.8\times10^{-3} & -854\times10^{-3} \end{bmatrix}$ $B=\begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ $C=\begin{bmatrix} 0.78\times10^{-4} & 41.4\times10^{-4} & 0.01 \end{bmatrix}$ $D=[0]$ The state variables will take on a different significance in this expression, but the input and the output remain the same. Recall that **u = external insulin** flow, and **y = plasma insulin concentration.** Obtain a state-feedback gain matrix so that the closed-loop system will have **two of its poles** placed at **-1/15** and **the third pole** at **-1/2.**	equation 14 – Marks for Compensator design (include step marking)	
Q7	Design an observer for the plant $G(s)=\dfrac{1}{(s+7)(s+8)(s+9)}$ whose estimated plant is represented in state space in cascade form as $\dot{\hat{\mathbf{z}}}=\mathbf{A}\hat{\mathbf{z}}+\mathbf{B}u=\begin{bmatrix} -7 & 1 & 0 \\ 0 & -8 & 1 \\ 0 & 0 & -9 \end{bmatrix}\hat{\mathbf{z}}+\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}u$ $y=\mathbf{C}\hat{\mathbf{x}}=[1 \quad 0 \quad 0]\hat{\mathbf{z}}$ The closed-loop step response of the observer is to have 10% overshoot with a 0.1 second settling time.	**20** (2 Marks for Representing System in Observable Canonical form. 3- Marks for transforming specifications into desired characteristic equation 14 – Marks for Compensator design (include step marking)	1,2,3

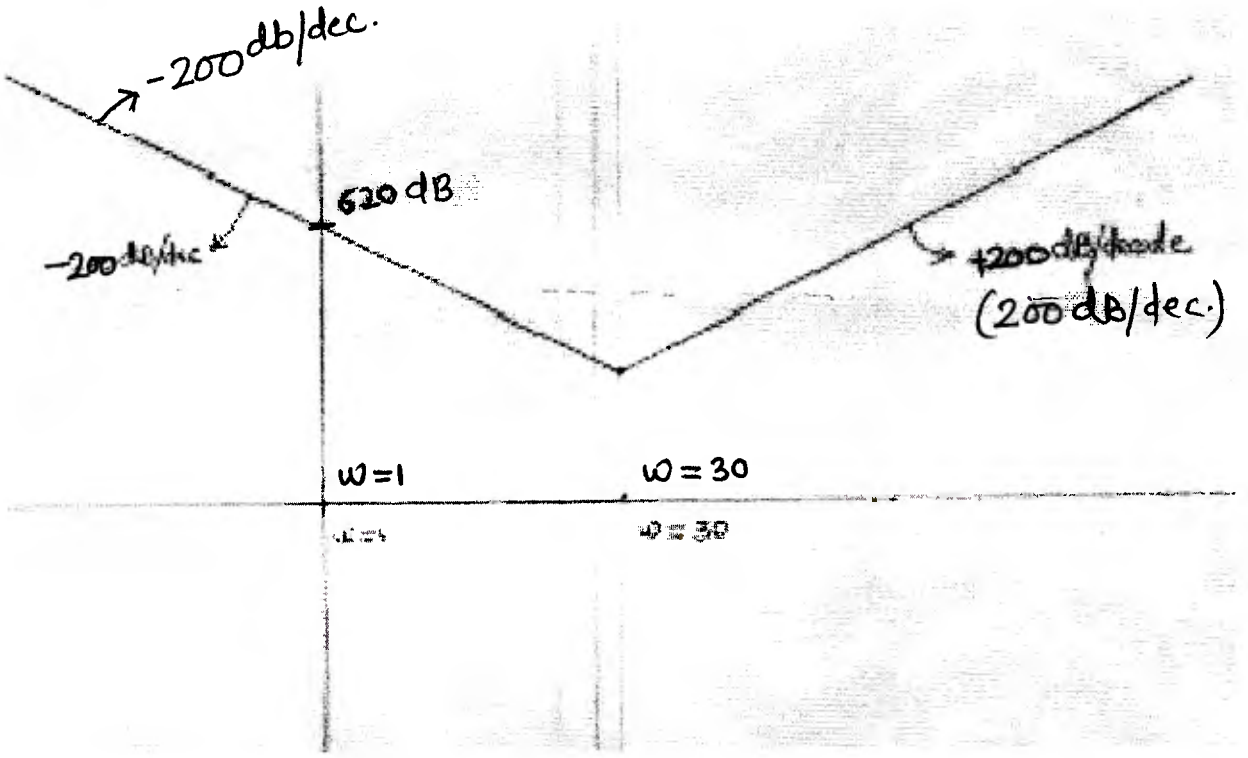
-200 db/dec.
620 dB
-200 db/dec
+200 db/dec
(200 dB/dec.)
w=1
w = 30

Fig. 1

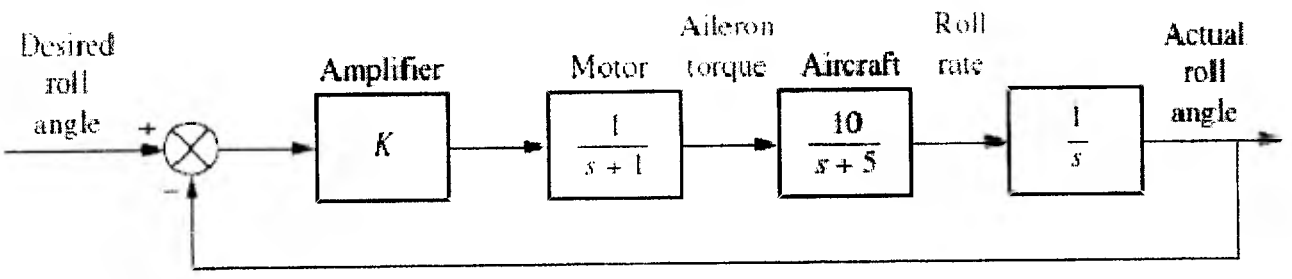
Desired roll angle
+
−
Amplifier
K
Motor
1/(s+1)
Aileron torque
Aircraft
10/(s+5)
Roll rate
1/s
Actual roll angle

Fig. 2

Qip Seln
9/5/2016

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam

May 2016

E

Max. Marks: 100
Class: TE
Semester: VI
Name of the Course: PSOC

Q. P. Code:
Duration: 3 hrs
Program: B.Tech
Course Code : EE351

Master file.

Instructions:

Kindly attempt only five question out of the given question including sub-parts if any
All question carries equal marks
Draw need and well labeled diagram where ever necessary

Question No		Maximum Marks	Course Outcome Number
Q1a	Define generator constraint. And draw its capability curve? What are the stability issues in power system? State any 2 issues with explanation A 50 Hz, 4 pole turbo generator rated 100 MVA,11Kv has an inertia constant of 8.0 MJ/MVA. Find the stored energy in the rotor at synchronous speed. If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find rotor acceleration , neglecting mechanical and electrical losses OR Describe power system voltage stability what are the factors effecting its stability when subject to disturbance. Also define the various operating state of power system in the security its loading capabilities.	20	1
Q2	Describe the reasons for limitation on system frequency variation? Write a short note on load frequency problem for a simple single machine? Two turbo alternators rated for 110 MW and 210 MW have governor drop characteristics of 5 percent from no load to full load. They are connected in parallel to share a load of 250 MW. Determine the load shared by each machine assuming free governor action.	20	2

Q3a	What do you understand by reactive power production and how it is been absorbed? derive an expression for reactive power flow for a simplified model of system?	10	3
Q3b	Why does converter needs reactive power supply? Explain with waveform OR Describe the methods through which voltage profile of a generator can be controlled?	10	3
Q4a	Give various reactive power characteristics for static var compensators with its diagram	10	4
Q4b	Write a short notes on FACTS devices and explain various FACTS controllers available in industry OR Write a short note on STATCOM, SVC, FACTS, SSSC	10	4
Q5a	Give chief objectives of power system operation and what are the objective of compensated line which had to be taken into mind while erecting a transmission line. OR Describe in brief about TCSC controller	10	5
Q5b	Give difference between series and shunt compensator in terms of transmission network. Describe the impact of series compensator on voltage profile. Why compensators are been used in a transmission line? OR Derive an expression for transmission line compensation as well as creat a static load model	10	5
Q6a	What are the system operational constraint which should be considered while creating the model for power system OR The fuel input per hour of plant 1 and 2 are given below $F_1 = 0.2P_1^2 + 40P_1 + 120$ Rs. Per hr $F_2 = 0.25P_2^2 + 30P_2 + 150$ Rs. Per hr Determine the economic operating schedule and the corresponding cost of generation if the maximum and minimum loading on each unit is 100 MW and 25 MW, the demand is 180 MW and the transmission losses are neglected. If the load is equally shared by both the units. Determine the saving obtained by loading the unit as per equal incremental production cost.	10	6

Q6b	Write a short note on economic dispatch theory with example? Write and explain in brief about merit order scheduling? OR What do you understand by load forecasting why its been done, what are the factors to be consider while preparing load forecasting report for creating proper load management system	10	6
Q7a	What do you understand by deregulation industry? Why is it necessary? What are the reason behind creating deregulation industry OR Describe the power system structure as well give the traditional vertically integrated electric industry chart? Write about the various entities involved in deregulation industry?	10	7
Q7b	Write in brief about the Indian power scenario and its current updates with facts and profile? OR What do you understand by ancillary service management system	10	7

Library 2410611 6

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(Govt. Aided Autonomous Institute under University of Mumbai)

Re – Examination June 2016

Program: B. Tech. Electrical
Course: Digital Signal Processing
Total Marks: 100

Class: T. Y. Sem. VI
Course Code: EE355
Date: 24th June 2016

Note: Solve any **FIVE** questions of the following. All questions carry equal marks. Master file.

		Question	CO No. / Mod. No.	
1	*a*	Design a Butterworth digital IIR highpass filter using bilinear transformation by taking T = 0.5 sec, to satisfy following specifications: $0.707 \le \lvert H(e^{j\omega}) \rvert \le 1.0 \quad ; 0.65\pi \le \omega \le \pi$ $\lvert H(e^{j\omega}) \rvert \le 0.2 \quad ; 0 \le \omega \le 0.45\pi$	3/6	(20)
	b	Design a Chebyshev digital IIR lowpass filter using bilinear transformation by taking T = 1 sec, to satisfy following specifications: $0.8 \le \lvert H(e^{j\omega}) \rvert \le 1.0 \quad ; 0 \le \omega \le 0.2\pi$ $\lvert H(e^{j\omega}) \rvert \le 0.2 \quad ; 0.32\pi \le \omega \le \pi$	3/6	
2	*a*	Determine 8-point DFT of the sequence $x(n) = \{1,2,4,8,16,32,64,128\}$ using radix-2 DIT FFT algorithm.	2/4	(10)
	b	Determine IDFT of the following sequence using radix-2 DIF FFT alrorithm: $X(k) = \{20, -5.828 - j2.414, 0, -0.172 - j0.414, 0, -0.172 + j0.414, 0, -5.828 + j2.414\}$	2/4	(10)
3	*a*	Using Hanning Window Function, design a sixth order linear phase FIR lowpass filter having cutoff frequency of $\frac{\pi}{4}$ rad.	3/5	(10)
	b	Using frequency sampling method determine the coefficients and draw realization diagram of a linear-phase FIR filter of length 15 which has a symmetric unit sample response and a frequency response that satisfies the condition, $H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0,1,2,3 \\ 0.4, & k = 4 \\ 0, & k = 5,6,7 \end{cases}$	3/5	(10)

4	*a*	Justify: *Impulse invariant mapping preserves the stability but is prone to aliasing.* Explain the *frequency warping effect* in bilinear z-transformation method.	**3/6**	**(10)**
	b	An analog circuit has following normalized, s-plane transfer function: $$H(s)=\frac{5s+1}{s^2+0.4s+1}$$ Determine the transfer function of an equivalent digital circuit using bilinear transformation with resonant frequency of 10 Hz and sampling frequency of 60 Hz.	**3/6**	**(10)**
5	*a*	The sequence $x(n)=4\delta(n)+3\delta(n-1)+2\delta(n-2)+\delta(n-3)$ has 8 – point DFT $X(k)$. Determine the sequence $y(n)$ that has 8 – point DFT $Y(K)=W_8^{4k}X(K)$ and sequence $w(n)$ that has 8 – point DFT $W(K)=0.5\left[X(K)+X(-K)\right]$.	**2/3**	**(10)**
	b	Determine linear convolution of the following signals using convolution property of DTFT. $x_1(n)=nu(n)$ and $x_2(n)=(2)^n u(n-1)$.	**1/2**	**(10)**
6	*a*	Determine and sketch the magnitude and phase response of the system given below: $y(n)=x(n)+0.9x(n-2)-0.4y(n-2)$. [**Note:** Plot the magnitude and phase response on a graph paper only.]	**1/ 1, 2**	**(10)**
	b	A linear phase FIR filter has transfer function $H(z)=1+2z^{-1}+3z^{-2}+2z^{-3}+z^{-4}$. Determine response of this filter to the input, $x(n)=\delta(n)+\delta(n-1)-\delta(n-3)-\delta(n-4)$ using circular convolution approach.	**2/3**	**(10)**
7	*a*	(*i*) State and prove symmetry properties of DFT for a real valued sequence. (*ii*) The first 8 samples of a 14-point DFT $X(k)$ of a real valued sequence $x(n)$ are: $X(0)=12,\quad X(1)=-1+j3,\quad X(2)=3+j4,\quad X(3)=1-j5,$ $X(4)=-2+j2,\quad X(5)=6+j3,\quad X(6)=-2-j3,\quad X(7)=10,$ Determine remaining samples of DFT $X(k)$	**2/3**	**(10)**
	b	Given that $x_1(n)=\{1,2,2,1\}$ and $x_2(n)=\{1,2,3,1\}$. Find $x_3(n)$ such that $X_3(k)=X_1(k).X_2(k)$.	**2/3**	**(10)**

* * * * *