Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058

RE- EXAMINATION

Jan. 2017

Program: B.Tech. Electrical

Date:

Duration: Three Hour

Course code: BTE327

Maximum Marks: 100

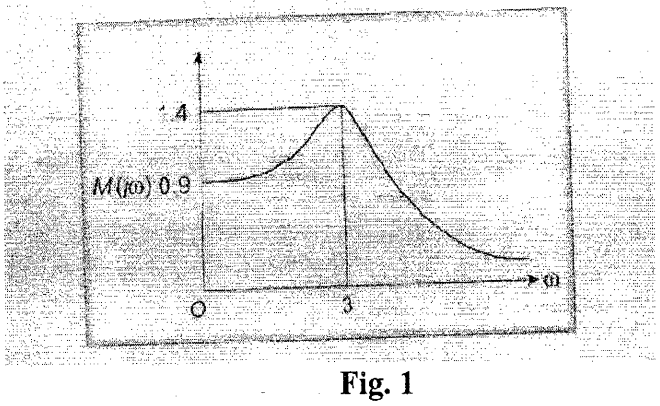
Name of the Course: Control System II

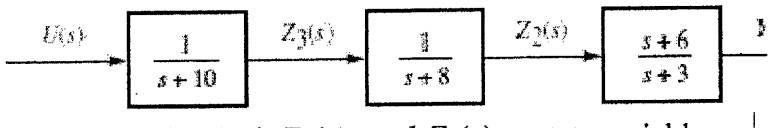
Semester: VI

Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Question No.	Questions	Maximum Marks	Course Outcome Number	Module No.
Q1.				
A	The closed loop frequency response |M(jw)| versus requency of a second order prototype system is shown in **Fig. 1.** Find out the peak time, percentage overshoot, settling time and steady- state error for unit step .  **Fig. 1**	**10**	**1,2,3**	**1**
B	Describe Eigen Values and Eigen Vector in brief.	**04**	**2**	**3**
C	Derive the expression for modal matrix for diagonalizing any square matrix with distinct eigen values.	**06**	**3**	**3**

Q2.				
A	Explain the importance of observer in state space design. Define Controllability and Observability. Derive $K_z = K_x P^{-1}$ where K_z is feedback gain vector of the system which is not represented in phase variable form, K_x is feedback gain vector of the system which is represented in phase variable form and P is a transformation matrix between these two state space representations of same physical system.	**(04)** **(04)** **(06)**	**4,5**	**4**
B	Sketch the polar Nyquist plot for the open loop transfer function given below. $G(s) = \frac{10}{s(s+1)(1+0.5s)}$	**06**	**3**	**1**
Q3.				
A	A control system is described by the differential equation $\frac{d^3 y(t)}{dt^3} = u(t)$ where y(t) is the observed output and u(t) is the input. 1. Describe the system in state space form 2. Is the system controllable? 3. Is the system Observable?	**10**	**6,7**	**5**
B	Explain with mathematical justification why **"s"** is replaced with **"jw"** in frequency domain analysis of the control system.	**10**	**2,4,5**	**1**
Q4.				
	Consider the following transfer function: $G(s) = \frac{(s+6)}{(s+3)(s+8)(s+10)}$ If the system is represented in cascade form as shown in figure below  Consider $Z_1(s) = Y(s), Z_2(s)$ *and* $Z_3(s)$ as state variables for designing the controller. Design a controller to yield a closed loop response of **10% overshoot** with a **settling time of 1 second**. Design the controller by first transforming the plant to phase variable.	**20**	**4.5.6**	

Q5.				
	Consider the plant **(13)** $$G(s) = \frac{1}{s(s+3)(s+7)}$$ whose state variables are not available. Design an observer for the observer canonical variables to yield a transient response described by **damping ration of 0.4** and **natural frequency of oscillations is 75**. Place the third pole 10 times farther from the imaginary axis than the dominant poles.	**20**	**2,3,4,5,6**	**2**
Q6.	Consider the unity feedback system with G(s) as forward path transfer function with $$G(s) = \frac{K}{s(s+5)(s+20)}$$ The uncompensated system has about 55% overshoot and a peak time of 0.5 second when Kv= 10. Use frequency response methods to design a lead compensator to reduce the percent overshoot to 10%, while keeping the peak time and steady state error about the same or less.	**20**	**3,4,5,6,7**	**7**
Q7.	An electrie ventricular assist device (EVAD) that helps pump blood concurrently to a effective natural heart in sick patients can be shown to have a transfer function. $$G(s) = \frac{P_{ao}(s)}{E_m(s)} = \frac{1361}{s^2 + 69s + 70.85}$$ 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 loop with G(s) as 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	**20**	**3,4,5,6,7**	**2**

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SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

SGP KT (OLD) Jan.2017

(2)

Total Marks: 100 Duration: 3 Hour

CLASS/SEM : TE/VI (ELECTRICAL) SUBJECT : PROTECTION & SWITCHGEAR ENGG.

Master file.

- Attempt any FIVE question out of SEVEN questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks

Q1)		Explain protection provided for generator in case of i) Failure of prime mover ii) Motoring operation of generator	20
Q2)	a)	Using following key points write short note on air circuit breaker (i)Ratings: (ii) Arc quenching :(iii)utilization categories (iv)applications: (v)advantages:	10
	b)	Write short note on lightning arrester.	10
Q3)	a)	What are different zones of protection? What is meant by primary and back up protection? Explain various types of back up protections	10
	b)	Describe the protection scheme which restrains the operation of relay during inrush magnetizing current of a transformer.	10
Q4)	1.	A three phase, 11KV/33KV, Y-Δ connected power transformer is protected by differential protection. The C.T.s on the LV side have a current ratio of 400/5. What must be the ratio of CTs on HV side? With the help of neat drawing show CTs on both sides.	20

Q5)	a)	Explain construction and working of Induction cup or disc type relay.	10
	b)	Differentiate between a fuse and a circuit breaker.	10
Q6)		Write short notes	20
		1.Reverse power or directional relay (electromechanical type):	
		2.Static relays	
Q7)		Write note on any two	
		a. Protection for transmission line using distance relays. b. Numerical relay c. Construction, working and application of Vacuum circuit breaker. d. Buchholz relay	20