College of Engineering, Pune.

Electrical Engineering Department

Class: T.Y.B.Tech-Electrical, Subject: Power Electronics (EE-374),

End-Semester Examination-May- 2012

Maximum Marks: 50, Time: 3 hours;

Instructions: Question 1 is COMPULSORY. Solve any THREE questions from Q2 to Q5.
Question 1 carries 20 mark; questions from Q2 to Q5 carry 10 marks each.
Assume suitable data, if necessary. Neat circuit diagrams, waveforms carry weight-age.

Q1.a) Draw the circuit diagram for a single phase unidirectional AC voltage controller with R-L load. Draw its output voltage and current waveforms. Write the expression for the rms output voltage.

b) Draw the circuit diagrams for a single phase Semiconverter. If the load is a R-L load with R = 10 Ω, L= 20 mH and with the input ac supply of 230 volts, 50 Hz, and firing angle of 60^0, what will be the average and rms output voltage? Draw the waveforms for output voltage and current.

c) Draw the circuit of single phase half bridge inverter with R-L load. Draw the output voltage and current waveforms, write the expression for the instantaneous output voltage for the same. For 200 volts dc input voltage and output frequency of 1000 Hz, how much will be the fundamental rms output voltage?

d) Draw the circuit of a step-down dc to dc converter with R-L load. Draw the waveforms for output voltage, output current, switch current, diode current for a duty factor of 50% for continuous and discontinuous current modes.

e) Differentiate between Semi converters and full converters.

Q2.a) What is a duel converter? How it can work in all the four quadrants. Explain the operation in circulating current mode and non circulating current mode.

Q2.b) A single phase semi converter is operated from 230 v, 50 Hz, supply with purely resistive load of resistance R = 10Ω. If the average output voltage is 75% of the maximum possible average output voltage, calculate a) the delay angle, b) the rms and average output currents.

Q3.a) Differentiate between half bridge and full bridge inverters. Why feedback diodes are used in such inverters?

Q3.b) A single phase full bridge inverter is operated from a 230 volts dc, supply and is feeding load of R = 10 Ω, and L = 10 mH. If the output frequency is 100 Hz, a) express the instantaneous output voltage in Fourier series. Calculate b) rms load current at the fundamental frequency, c) the third harmonic component of load current, d) the fundamental power.

Q4.a) Explain the working of a step up dc to dc converter and derive the output equation for the same.

Q4.b) How a Sinusoidal PWM technique is used for inverter voltage control. What are its advantage over single pulse width modulation technique?.

Q5.a) Explain the operation of a three phase bridge inverter with 120^0 mode of operation with balanced three phase resistive load. Draw the line and phase voltage waveforms and gating waveforms.

Q5.b) A step down dc to dc converter has a resistive load of 10 Ω and the input voltage is 220 V. When the converter switch remains on, its voltage drop is 2 volts and the switching frequency is 1 kHz. If the duty cycle is 60%, determine a) the average output voltage, b) the rms output voltage, c) the converter efficiency, d) the effective input resistance of the converter.

College of Engineering, Pune

(An Autonomous Institute of Govt. of Maharashtra)

End-Semester Examination 2011-12

Third Year B. Tech (Electrical)

Subject: - Control Systems-I (EE 310)

Day & Date: Tuesday, 8th May 2012 Max. Marks: - 50

Time: 02.00 -5.00 PM

Instructions:

1) ALL questions are compulsory.

2) Figures to the **RIGHT** indicate **FULL** marks.

3) Make suitable assumptions, if necessary and state the same.

4) Use of non-programmable pocket calculator is allowed.

5) Answer of ALL questions has to be written in the same sequence as they appear in the question paper.

Que. 1

a) With the help the signal flow graph shown in Fig 1(a), find **transfer function using Mason's gain formula.** -------- (05)

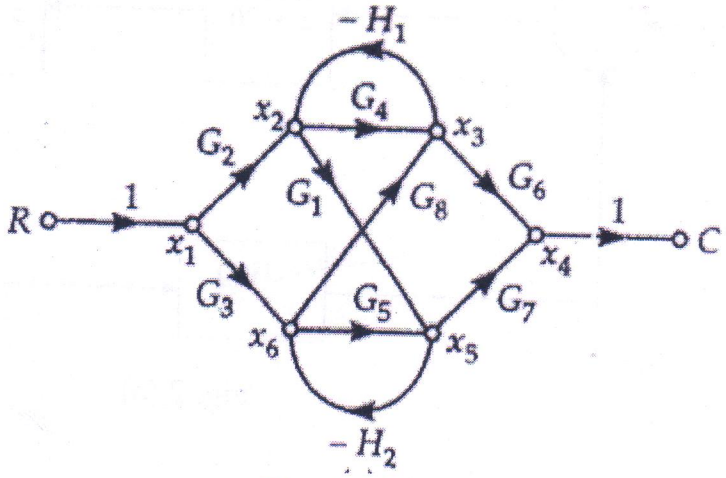

Fig. 1 (a)

b) Draw the free-body diagram and write the force balance equations of the mechanical system shown in Fig 1(b)? ---------- (05)

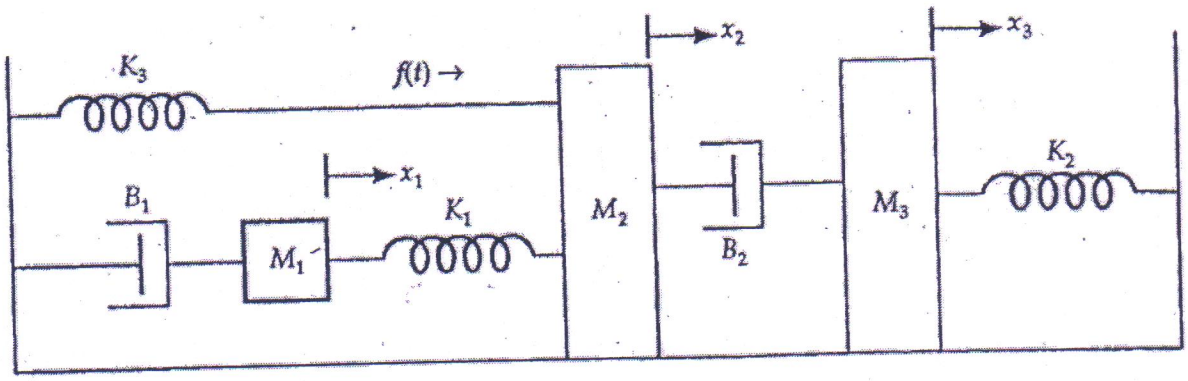

Fig. 1 (b)

Que. 2 a) The block diagram of an electronic pace maker for controlling the rate of heart beat is shown in the Fig. 2(a) below. Assuming unity feedback and K= 400,

Calculate: (a) Output c (t) for unit step input

(b) Steady state error for unit ramp input

(c) Determine K if the error to a ramp is 0.02.

---------- (05)

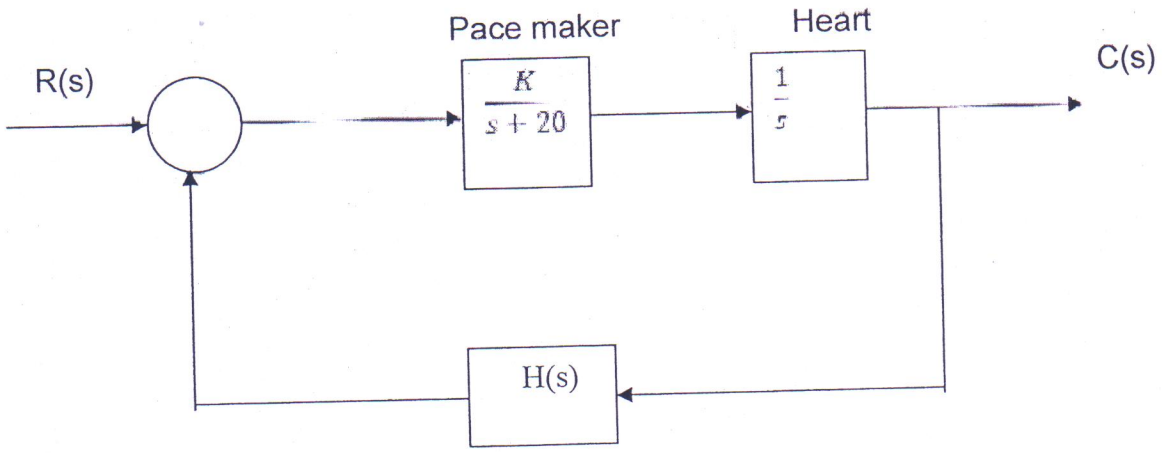

Fig. 2 (a)

b) Using the Routh's criterion, determine the range of values of K for stability of the following system. Also calculate number of roots with zero real parts and comment on the stability of the system.

$$\frac{C(s)}{R(s)} = \frac{K}{s(s^2+s+1)(s+4)+K}$$

---------- (05)

Que. 3 a) For a unity feedback system the open loop transfer function is given by-

$$G(s)H(s) = \frac{K}{s(s+2)(s^2+6s+25)}$$

(a) Sketch the root locus for $0 \leq K \leq \infty$

(b) At what value of K the system becomes unstable?

(c) At this point of instability, determine the frequency of oscillation of the system.

---------- (05)

b) Sketch the root locus for the unity feedback system described by

$$G(s) = \frac{K}{s(s-2)(s+4)}$$

Where K is varied from 0 to ∞. Hence obtain the value of K for which the system is unstable.

---------- (05)

Que. 4 a) Sketch the bode plot for the open loop transfer function given below:

$$G(s)H(s) = \frac{2(s+0.25)}{s^2(s+1)(s+0.5)}$$

---------- (04)

From the bode plot determine:

(a) The phase crossover frequency

(b) The gain crossover frequency

(c) Gain margin

(d) Phase margin

b) Determine the transfer function of the system from Bode plot shown in Fig. 4 (b)

---------- (03)

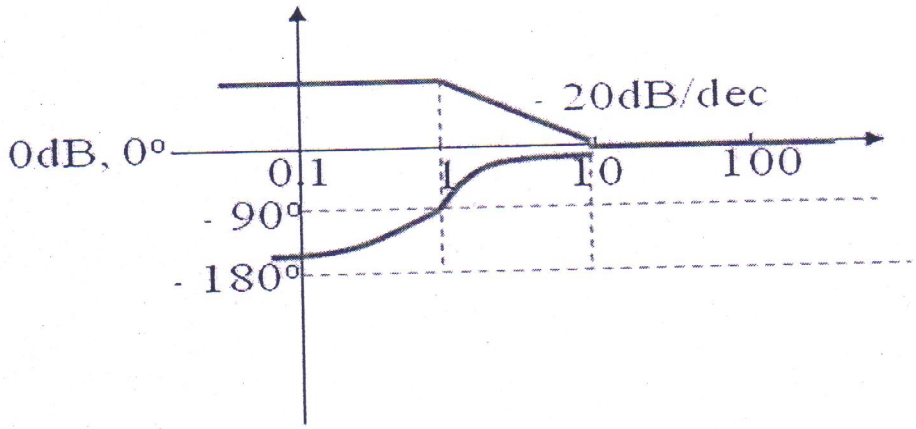

Fig. 4 b)

c) Determine the transfer function of the system from Bode plot shown in Fig. 4 (c)

---------- (03)

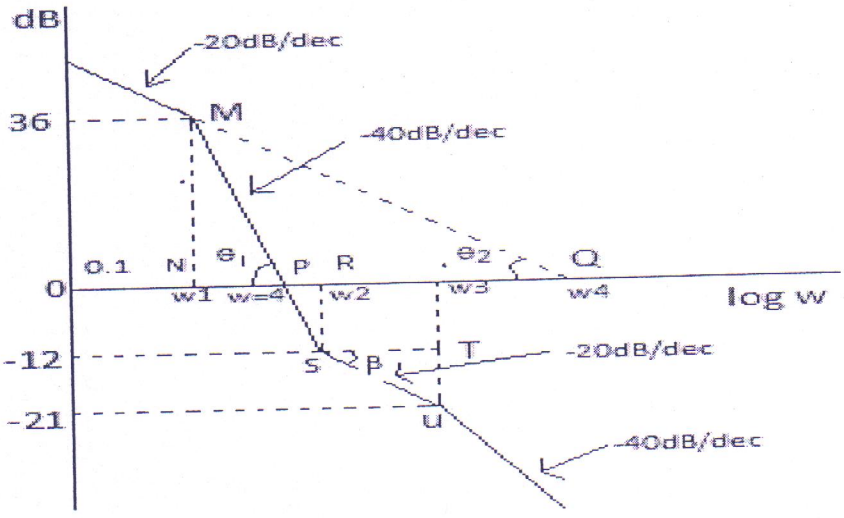

Fig. 4 c)

Q. 5 a) Obtain the state space model for the system shown in Fig. 5 a)

---------- (04)

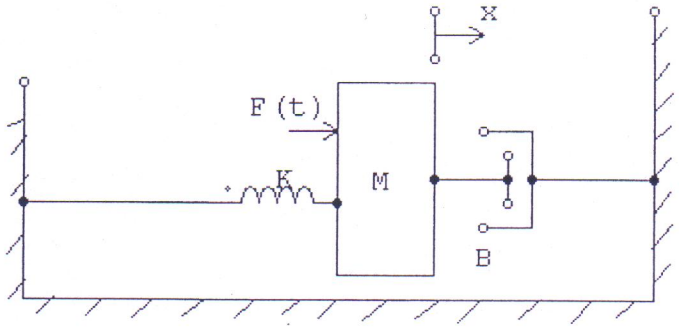

Fig. 5 a)

b) A control system is described by the following differential equation

---------- (03)

$$y''(t) = u(t)$$

Where y(t) is the observed output and u(t) is input. Express the system in state variable form

$$\dot{x} = Ax + Bu \quad \text{and} \quad y = Cx + Du$$

c) A linear time-invariant system is characterized by the state equation

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

Where u is a unit step function. The initial condition is

$$X(0) = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

Using inverse Laplace transform method, obtain the solution of the state equation.

---------- (03)

College of Engineering, Pune 411 005

Electrical Engineering Department T.Y.(B. Tech._Electrical Engg.)

Power Systems_II – ESE_Summer—14May 2012 Time-3.00Hrs --Max. Marks 50

Instructions to the candidates

1. Figures to the right indicate maximum marks.
2. Draw necessary diagrams wherever necessary.
3. Assume suitable data if necessary.

Q.1 Solve any two

a) What are the operating limits for the alternator. Draw suitable diagram and explain. Also prove that the locus field current heating limit is a circle with the centre shifted by V^2/X. 05

b) Compare and contrast "Angular stability" and "Voltage stability". 05

c) Two generators are running in parallel. Their ratings are 400MW and 500MW. The droop characteristics of their governors are 3% and 4% respectively. Assume that the governors operate at 50Hz at no load. Find out the loading of each generator when the total load on the system is 700MW. What will be the system frequency at this load ? Assume free governor action. 05

Q.2a) Compare and contrast "Shunt" and "series" capacitors for the reactive power compensation. 03

b) An express feeder supplies an H. T. Industrial customer having 05

i) Contract demand of 800kVA,
ii) Maximum demand of 750kVA
iii) Average demand of 700kVA
iv) Average power factor of 0.92lag.

The power factor is to be improved to 0.98lag. Calculate the cost of compensating capacitor if the per unit cost is Rs.250/ kVAr. Also calculate the saving in demand charge if the tariff is Rs. 200/ kVAr per month.

c) Draw self explanatory diagrams and explain in 2-4 sentences 04

a) On-load tap changing transformer
b) FC-TCR

Q.3a) With the help of a schematic diagram explain the operation of UPFC. Draw V-I characteristics. 03

OR

a) Explain how Series capacitor helps improve the transmission line loading capability. What are the advantages and disadvantages of Series compensation ? What are the protections provided for the Series capacitor? Draw necessary diagrams. 03

b) The respective incremental costs in Rs. /MWh for two generators, Gen.-1 and Gen.-2, in a plant are as given below. 05

$dC_1/dP_{G1} = 0.25\ P_{G1} + 45.0$

$dC_2/dP_{G2} = 0.30\ P_{G2} + 35.0$

The plant load varies from 50MW to 300Mw. The maximum and minimum load on each generator is 150MW and 25MW.
For the most economical operation of the station, find out how the two generators will share the load for the variation from 50MW to 300MW on the station. Also find out the corresponding IFC and present the results in the tabular form with proper unit. (Minimum 5 different load conditions)

Sr. No.	Plant o/p	P_{G1}	P_{G2}	IFC

Q.4a) What is "State estimation" in Power systems ? What is its significance in the power system operation? 05

b) What is the need of SCADA in Modern power systems? With the help of a block diagram explain the working of SCADA. 05

Q.5 a) What do you understand by Ancillary Service Management in Deregulated power industry? Which entity is responsible for this management? 05

OR

a) With the diagrams of various load shaping objectives, explain the concept and importance of "Demand Side Management (DSM)" in the Modern Power Systems.
Explain how the "Time of the Day (ToD) tariff helps DSM. 05

b) An H.T. industrial customer works in three shifts and has maximum demand of 380kVA and contract demand of 400kVA. The average power factor is 0.98lagging. The average demand is 335kVA. 05

Calculate
i)Energy consumption per month
ii)Monthly charges for energy consumed
iv)Monthly power factor incentive
iii)Total Monthly electricity bill

Assume suitable tariff.