Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (BME)/SEM-7/BME-703/2009-10

2009
POWER AND CONTROL SYSTEM

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

   i) The transfer function is defined for

      a) linear and time variant system

      b) linear and time invariant system

      c) non-linear and time variant system

      d) non-linear and time invariant system.

   ii) An error detector is a control system that

      a) detects one error and signals out an alarm

      b) detects the error of the system only

      c) produces an error signal of difference between the actual output and the desired value of the output

      d) none of these.

http://qpaper.wbut.ac.in

iii) In Thyristor (SCR) permanent damage can arise due to high

a) di/dt b) dv/dt

c) none of these d) all of these.

iv) A power chopper converts

a) AC to DC b) DC to DC

c) DC to AC d) AC to AC.

v) Cycloconverter is a device that converts

a) AC to DC b) DC to AC

c) AC to AC d) none of these.

vi) In Thyristor anode current is made up from

a) electrons only

b) electrons and holes

c) holes only

d) none of these.

vii) A system will show undamped output when

a) $\xi = 0$ b) $\xi > -1$

c) $0 < \xi < 1$ d) $\xi > 1$.

http://qpaper.wbut.ac.in

viii) A phase controlled converter supplies a highly inductive load. It behaves as naturally commutated inverter when firing angle (α) is

a) $\alpha > 90^\circ$ b) $\alpha < 90^\circ$

c) $\alpha = 90^\circ$ d) $\alpha = 45^\circ$.

ix) A single phase full converter with free wheeling diode, supplies a high inductive load. The free wheeling diode conducts for (assuming continuous load current)

a) α b) $\pi - \alpha$

c) β d) $\pi + \alpha$.

x) The overall gain of the system show below is given by

a) $G_1G_2G_3 + G_4$

b) $G_1G_2 + G_3 + G_4$

c) $G_1G_2G_3G_4$

d) $G_1G_2G_4 + G_3$.

http://qpaper.wbut.ac.in

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What are the main functions of a freewheeling diode ?

3. What is inverter ? Write down the classification of different types of inverters.

4. Find the overall T.F. using Manson's gain formula for the signal flow graph shown below :

5. Find the time response of 1st order control system subjected to unit ramp input function.

6. The characteristic equation for certain feedback control system is given below. Determine the range of values of K ($K > 0$) for which the system is stable.

   $S^4 + S^3 + S^2 + S + K = 0.$

7. a) What are the conditions for successful switching (turn-on) of an SCR ?

   b) What is the turn-off time of thyristors ? 3 + 2

http://qpaper.wbut.ac.in

GROUP – C
(Long Answer Type Questions)
Answer any *three* of the following. 3 × 15 = 45

8. Sketch the nature of root locus of the system with loop transfer function $G(s)H(s)=\frac{k(s+2)}{s(s+5)(s+7)}$ as k varied from zero to infinity.

9. a) Define the terms 'gain margin' & 'phase margin'.

   b) A unit feedback control system has open loop transfer function $G(s)=\frac{200(s+5)}{s(s+5)(s+20)}$. Sketch the Bode plot & show gain margin, phase margin, gain crossover frequency & phase crossover frequency. 4 + 7 + 4

10. a) Find the system equation of the mechanical system shown below. Also find the force-voltage (f-v) and force-current (f-i) analogy.

http://qpaper.wbut.ac.in

b) Find the overall transfer function shown below using block diagram reduction technique.

10 + 5

11. a) Why are snubber circuits used ? Explain the circuit diagram.

b) Why an RC triggering circuit cannot be used for an SCR for α close to 180°.

c) What are the drawbacks of a resistance-triggering circuit ?

d) What are the advantages of a sharp gate signal for an SCR ? 6 + 5 + 2 + 2

12. a) What are the merits of *d.c-d.c* converters ?

b) What is a first and second quadrant converter ? Explain with circuit diagram.

c) What is the principle of operation of a step-up converter ? Explain with circuit diagram. 2 + 7 + 6

http://qpaper.wbut.ac.in

13. Write short notes on any *three* of the following : 3 × 5

a) MOSFET

b) Thyristor inverter

c) AC regulator

d) Tachometer

e) PID controller

f) Servo motor.

http://qpaper.wbut.ac.in