



Name :
Roll No. :
Invigilator's Signature :

CS/B.TECH(BME)/SEM-7/BME-703/2011-12

2011

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 : $10 \times 1 = 10$
 - i) In Thyristor (SCR) permanent damage can arise due to high
 - a) di / dt
 - b) dv / dt
 - c) none of these
 - d) all of these.
 - ii) A power chopper converts
 - a) AC to DC
 - b) AC to AC
 - c) DC to AC
 - d) DC to DC.
 - iii) In Thyristor the anode current is made up of
 - a) electrons only
 - b) electrons and holes
 - c) holes only
 - d) none of these.
 - iv) 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) $\pi + \alpha$.



- v) Two blocks $G_1(s)$ and $G_2(s)$ can be cascaded to get resultant transfer function as
- a) $G_1(s) + G_2(s)$ b) $G_1(s) G_2(s)$
 c) $G_1(s) / G_2(s)$ d) $1+G_1(s) G_2(s)$.
- vi) To reduce steady state error
- a) decrease natural frequency
 b) decrease damping
 c) increase damped frequency
 d) increase gain constant of the system.
- vii) If the gain margin is positive and the phase margin is negative, the system is
- a) stable b) unstable
 c) indeterminist d) none of these.
- viii) When a human being tries to approach an object, his brain acts as
- a) an error measuring device
 b) a controller
 c) an actuator
 d) an amplifier.
- ix) The settling time of a feedback system with the closed loop transfer function $\frac{C(s)}{R(s)} = \frac{W_n^2}{s^2 + 2\xi W_n s + W_n^2}$ is
- a) $t_s = 2 / \xi W_n$ b) $t_s = \frac{\xi W_n}{2}$
 c) $t_s = 4 / \xi W_n$ d) $t_s = 4\xi W_n$.
- x) A TRIAC can be triggered by making
- a) gate positive with respect to MT_1
 b) gate negative with respect to MT_1
 c) MT_2 positive with respect to MT_1
 d) under all these conditions mentioned.

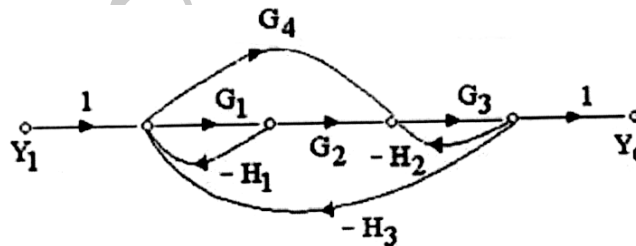


GROUP - B

(Short Answer Type Questions)

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

2. Explain the anode-cathode characteristics of SCR with a neat sketch.
3. What is Inverter ? Explain the single phase half bridge inverter and its disadvantages. 1 + 4
4. Calculate the transfer function of the signal flow graph given below :



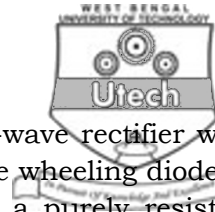
5. A first order system is excited with 60 volt D.C. signal and produces 50 volt output after 30 second later. How much time the system will spend to reach 90% of input as the output of the system ?
6. Examine the characteristic equation $D(s) = s^4 + 2s^3 + s^2 + 4s + 2 = 0$ for stability using Routh-Hurwitz stability criterion.
7. Explain the construction and V-I characteristics of UJT.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. Depict the two-transistor analogy of SCR with a neat sketch. What are the conditions for successful switching (turn-on) of an SCR ? What is the turn-off time of thyristor ? How an SCR can be used as a signal shaping circuit ? 7 + 3 + 2 + 3



9. Explain the circuit of a single phase half-wave rectifier with all the waveforms. What is the effect of free wheeling diode in it ? If the half-wave control rectifier has a purely resistive load of R and the delay angle is $\alpha = \pi/3$, then determine
 (a) Rectification efficiency, (b) Form factor, (c) Ripple factor, (d) Transformer utilization factor, (e) Peak inverse voltage of SCR T_1 .
10. What are the merits of DC to DC converters ? What is the principle of operation of a step-up converter ? Explain with circuit diagram. Briefly state the principle of three-phase AC regulator with star-delta connection. 2 + 7 + 6
11. Sketch the asymptotic Bode plot for the transfer function given below :

$$G(s)H(s) = 2(s + 0.25) / s(s + 1)(s + 0.5)$$
 i) Calculate gain cross-over frequency
 ii) Phase cross-over frequency
 iii) Gain margin
 iv) Phase margin. 7 + (4 × 2)
12. a) Obtain the unit step response of a unity feedback system whose open loop transfer function is

$$G(s) = 4 / s(s + 5)$$
 b) The forward path transfer function of a unity feedback system is given by $G(s) = K / s(s + 4)(s + 5)$. Find out the breakaway point and sketch the root locus as K varies from 0 to ∞ . 5 + 10
13. Write notes on any *three* of the following : 3 × 5
- Polar plot
 - Servo motors
 - TRIAC
 - Series inverter
 - PID controller.

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