(75) B.E- sem-VII - CBSGS- Electrical - C.S-II 12/12/17

QP CODE : 27293

(3 Hours) **Marks : 80**

NB : (1) Question **No.1** is **Compulsory.**
(2) Attempt any three questions from remainning.
(3) Assume suitable data (mention the same) and use semi log papers wherever necessary.
(4) **Figures** to the **right** indicate full **marks**.

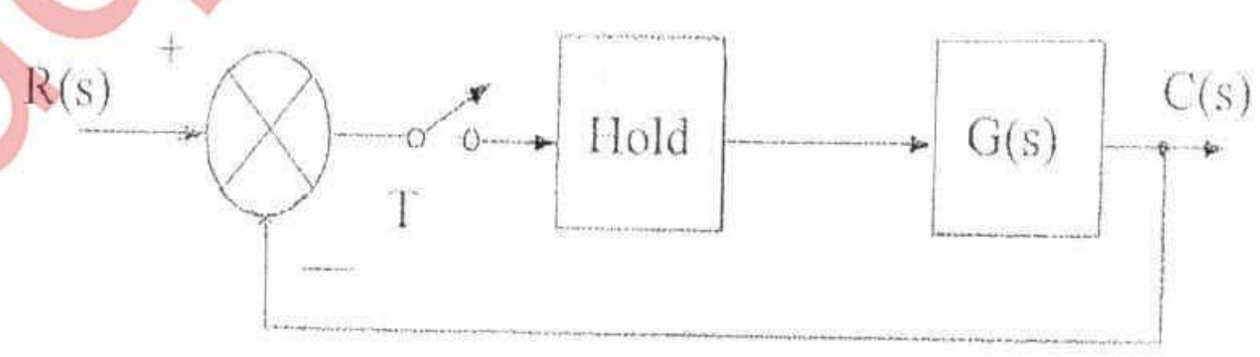
1. Attempt **any four** of the following: **5**
   (a) Explain what you mean by compensator. Explain lag and lead compensator with the help of electrical network and pole - zero plot. **5**
   (b) Explain issues in implementing the industrial PID controller. **5**
   (c) Briefly describe the configuration of an observer. **5**
   (d) Explain PLC Program execution along with steps in processor scan cycle. **5**
   (e) Explain the start and stop interlocking circuit in PLC programming with the help of example.

2. **10**
   (a) Design a lead compensator for the unity feedback system with

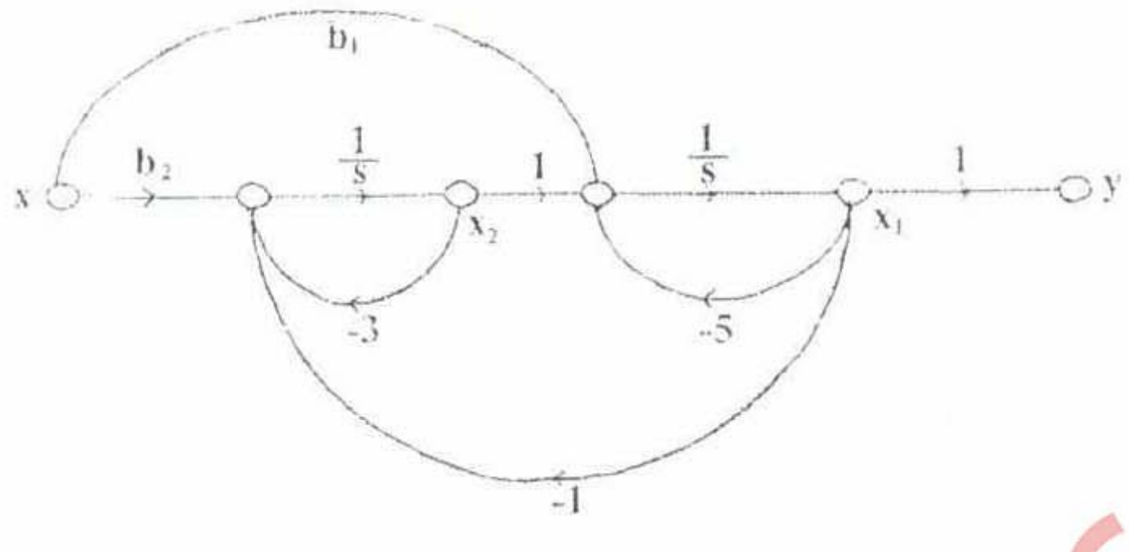
$$G(s) = \frac{100K}{s(s+36)(s+100)}$$ to yield 20% peak overshoot and velocity error constant of 40 with a peak time of 0.1 second.

   (b) For the plant $G(s) = \frac{100(s+10)}{s(s+3)(s+12)}$ design the phase-variable feedback gains to yield dominant pole pairs at $-10 \pm j\ 10.475$ **10**

3. (a) For unit step, ramp and parabolic inputs, find the stedy state error for the digital control system shown below : $G1(s) = \frac{10}{s(s+1)}$ Sampling interval $T = 0.1$ **10**



(b) Given the plant shown in figure, what relationship exists between b1 and b2 to make the system uncontrollable. 5



(c) Explain the proportional band (PB). What is the proportional band setting in a hydraulic process where the controller input variable, *e(t)* was a mechanical displacement of range e_R = 1cm, and the effective controller ouput, *u(t)* was a pressure of range uR = 2 bar. At a given setting of the controller, 0.1 cm of change in *e(t)* caused 0.5 bar change in control output, *u(t)*. 5

4. (a) Design an integral controller for the plant which is represented in phase-variable form $G(s) = \frac{1}{s^2 + 5s + 3}$ to yield a step response with 10% overshoots, a setting time of 0.5 second and zero steady state error. **10**

(b) Find the closed loop digital transfer function of unity feedback system having transfer function $G_1(s) = \frac{27K}{s(s+27)}$ connected in cascade with z.O.H. circuit. Also find whether the system is stable or not for K=20 and K=100 respectively. [T = 0.2] **10**

5. (a) Explain the modeling of digital computer in detail **10**
(b) Explain in detail timer instructions of PLC. **10**

6. (a) Draw and explain the PLC ladder diagram for manufacturing of 5 mH and 10 mH inductor coils. When a 5 mH inductor is produced: the machine makes 400 revolutions to wind the coil. If the 10 mH inductor is produced, the machine makes 800 revolutions before stopping. **10**
(b) Explain AC input module of PLC. 5
(c) Explain AND, OR, NOT, NAND and NOR relay ladder logic circuits operation. 5