BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII/ADD**
BRANCH: EEE **SESSION : MO/19**

SUBJECT: MEE1119 CONTROL SYSTEM DESIGN

TIME: 3:00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) What do you mean by the type of a system and how does it affect the stability of a system? [2]
Q.1(b) What do you mean by offset voltage in context of a sensor? [4]
Q.1(c) What design specifications are used in time domain and frequency domain? [6]

Q.2(a) What are the advantages of a PI controller? [2]
Q.2(b) How is Zeigler Nichols method applied to tune a controller? [4]
Q.2(c) Discuss time domain interpretation of a PD controller. [6]

Q.3(a) Draw the bode plot of a phase lead controller. [2]
Q.3(b) The unity feedback system is given by [10]

$$G(s) = K / s(s+2)$$

It is desired to have a velocity error constant $K_v \geq 10$ and a phase margin $\geq 60^0$. Design a lead compensator.

Q.4(a) What is the advantage of placing a controller in the minor loop? [2]
Q.4(b) What is the advantage of using an additional controller in a 2-DOF configuration? [4]
Q.4(c) Derive the closed loop transfer function of a feedforward compensation with series compensation configuration. [6]

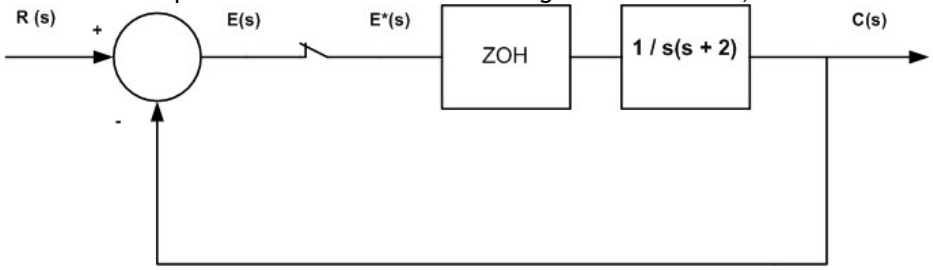
Q.5(a) What do you understand by controllability and observability of a system? [2]
Q.5(b) A Plant represented by [10]

$\dot{X} = Ax + Bu$ and $y = Cx$ where

$$A = \begin{pmatrix} 0 & 20.6 \\ 1 & 0 \end{pmatrix}; \quad B = \begin{pmatrix} 0 \\ 1 \end{pmatrix}; \quad C = \begin{pmatrix} 0 & 1 \end{pmatrix}$$

Design a full order state observer for the desired eigen values as $\mu_1 = -10$, $\mu_2 = -10$

Q.6(a) What is the difference between *difference equation* and *differential equation*? [2]
Q.6(b) Determine the pulse transfer function for the figure shown below, [10]



Q.7(a) What is the effect of derivative action on the response of a system? [2]
Q.7(b) Draw a circuit to physically realize a PID controller. [4]
Q.7(c) Discuss the role played by the necessary components of a digital control system? [6]

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