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

CLASS: BE **SEMESTER : VII**
BRANCH: EEE **SESSION : MO/18**

SUBJECT: MEE1119 CONTROL SYSTEM DESIGN

TIME: 3 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) Give an example of the application of feedback closed loop system in the real world. [2]
Q.1(b) What are the guidelines for designing in the time and frequency domain? [4]
Q.1(c) Mathematical Modeling and the derivation of transfer function plays a vital role in analyzing a system. Explain it in context to an armature controlled dc motor. [6]

Q.2(a) Placing a zero close to the origin is avoided. Give reasons. [2]
Q.2(b) How can Ziegler Nichols method be applied to find tuning parameters? [4]
Q.2(c) Analyze the effect of a PD controller on the transient response of a system. [6]

Q.3(a) How are controllers classified from filtering standpoint? [2]
Q.3(b) The open loop transfer function of a type 1 unity feedback system is given by [10]

$$G(s) = K / s(s+1)$$

It is desired to have a velocity error constant $K_v = 10$ and a phase margin of atleast 45^0. Sketch the bode plot and design a lag compensator.

Q.4(a) What do you understand by the term robustness? [2]
Q.4(b) State the difference between forward and feed forward configuration with the help of block diagrams. [4]
Q.4(c) Exact cancellation of poles and zeroes are rarely possible. Discuss. [6]

Q.5(a) What is the function of a state observer? [2]
Q.5(b) A Plant represented by [10]

$\dot{X} = AX + Bu$ where

$$A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{pmatrix}; \quad B = \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

Find the desired feedback gain matrix K where desired closed loop poles are at S=- 2 ±j4, S= -10

Q.6(a) What is the role of a sampler and a hold circuit? [2]
Q.6(b) Solve the difference equation given as, [10]
$C(k + 2) - 5C(k + 1) + 6\,C(k) = u(k)$, given that $C(0) = 0$ and $C(1) = 1$

Q.7(a) Write the transfer function of a PID controller and state its order and type. [2]
Q.7(b) Draw a circuit to physically realize a lead controller. [4]
Q.7(c) What is the significance of inserting a PID controller and tuning of its parameters? [6]

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