CBCS SCHEME

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21AE72

# Seventh Semester B.E./B.Tech. Degree Examination, June/July 2025
## Control Engineering

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***



### Module-1

1 a. Define control system. List out the differences between open loop and closed loop control system with example. **(10 Marks)**

b. Explain the various requirement of ideal control system. **(10 Marks)**

**OR**

2 a. Derive the transfer function of an armature controlled DC motor with neat sketch. **(10 Marks)**

b. Determine the transfer function, $\frac{X_1(s)}{F(s)}$ and $\frac{X_2(s)}{F(s)}$ for the system shown in Fig Q2(b).

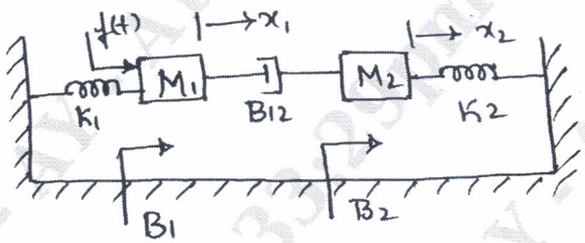


Fig Q2(b) **(10 Marks)**

### Module-2

3 a. List out the rules of Block diagram reduction algebra with example. **(10 Marks)**

b. Determine the closed loop transfer function C(s)/R(s) shown in Fig Q3(b).

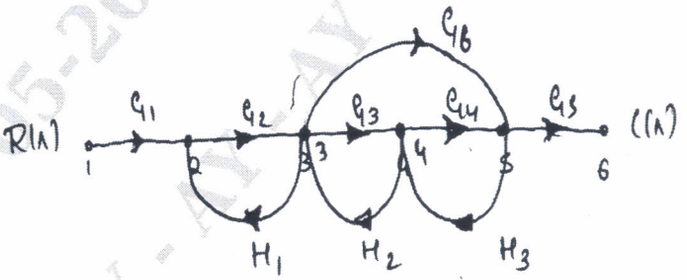


Fig Q3(b) **(10 Marks)**

**OR**

4 a. Obtain the response of underdamped second order system for unit step input with nature of graph. **(10 Marks)**

b. Obtain the response of first order system for unit step input. **(10 Marks)**

## Module-3

5 Sketch the root locus of the system whose open loop transfer function is, $G(s)=\frac{K}{s(s+2)(s+4)}$ find the value of K so that the damping ratio of the closed loop system is 0.5. **(20 Marks)**

**OR**

6 Sketch Bode plot for the following transfer function and determine the system gain K for the gain cross over frequency to be 5 rad/sec. $G(s)=\frac{Ks^2}{(1+0.2s)(1+0.02s)}$. **(20 Marks)**

## Module-4

7 a. Write a short note on M and N circle with neat sketch. **(16 Marks)**

b. Define the following :
i) Gain Margin ii) Phone margin iii) Bandwidth iv) Resonant peak. **(04 Marks)**

**OR**

8 a. Consider a unity feedback system having an open loop transfer function $G(s)=\frac{K}{s(1+0.2s)(1+0.05s)}$ Sketch the polar plot and determine the value of 'K', so that
(i) Gain margin is 18 db (ii) Phase frequency 60°. **(16 Marks)**

b. Derive the expression for bandwidth ($W_b$) frequency domain specification of second order system. **(04 Marks)**

## Module-5

9 a. Explain the following controller with their transfer function
i) PI controller
ii) PD controller
iii) PID controller **(10 Marks)**

b. Enumerate series and feedback compensation with block diagram. **(10 Marks)**

**OR**

10 a. Define the following :
i) State
ii) State variables
iii) State vector
iv) State space
v) State equation **(10 Marks)**

b. Write short note on controllability and observability. **(10 Marks)**

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