C.M.R. INSTITUTE OF TECHNOLOGY
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CBCS SCHEME

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18ME71

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Control Engineering

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. With a block diagram, explain automobile speed closed control system. **(10 Marks)**

b. List and explain requirements of an ideal control system. **(10 Marks)**

OR

2 a. Explain: (i) Proportional controller (ii) Derivative controller **(10 Marks)**

b. Obtain transfer function for armature controlled D-C motor. **(10 Marks)**

Module-2

3 a. Explain typical test signals in control system. **(10 Marks)**

b. Determine order and type for open and closed loop control system as shown in Fig.Q3(b).

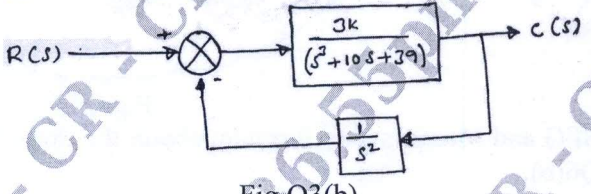

Fig.Q3(b) **(10 Marks)**

OR

4 a. Define:
(i) Delay time (ii) Rise time (iii) Peak time
(iv) Maximum overshoot (v) Setting time **(10 Marks)**

b. A unity feedback system is characterized by open loop transfer function $G(s) = \frac{16}{s^2 + 2s + 16}$.
Determine the following when the system subjected to unit step input :
(i) Undamped not usual frequency (ii) Damping ratio (iii) Peak overshoot
(iv) Peak time (iv) Settling time **(10 Marks)**

Module-3

5 a. Reduce the block diagram as shown in Fig.Q5(a) to simple form and find transfer function:

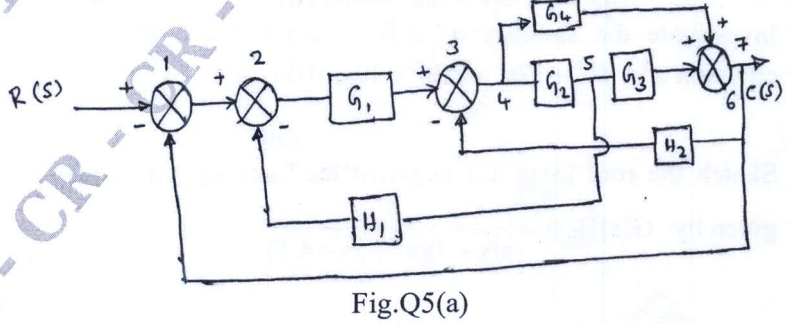

Fig.Q5(a) **(10 Marks)**

b. Obtain transfer function of block diagram shown in Fig.Q5(b) by reduction technique.

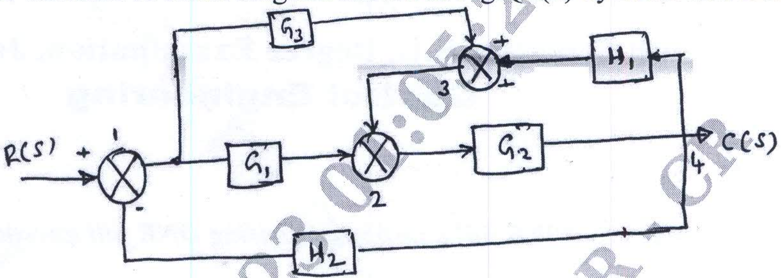

Fig.Q5(b) **(10 Marks)**

OR

6 a. For the system shown in Fig.Q6(a), determine $\frac{C(s)}{R(s)}$ using Mason's gain formula.

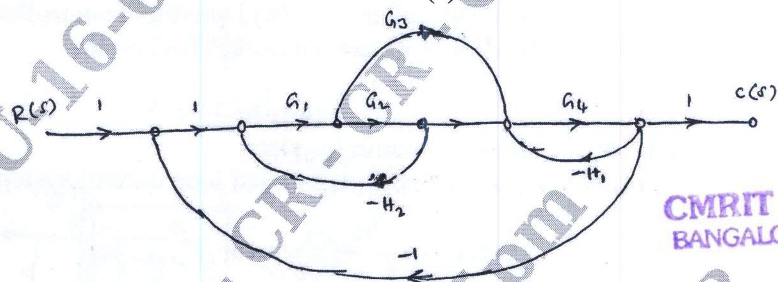

Fig.Q6(a) **(10 Marks)**

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b. Using SFG and Mason's gain formula, obtain the overall transfer function of system shown in Fig.Q6(b).

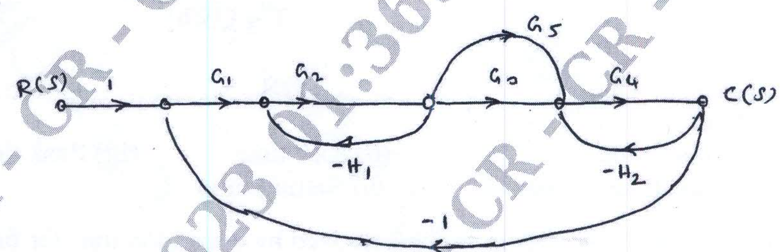

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. Applying Routh criterion, discuss the stability of closed loop system as function for open loop transfer function:

$$G(s)H(s) = \frac{K(s+1)}{s(s-1)(s^2+4s+16)}$$ **(10 Marks)**

b. Investigate the stability of system using Routh Hurwitz criterion having characteristic equation $s^5 + 4s^4 + 12s^3 + 20s^2 + 30s + 100 = 0$ **(10 Marks)**

OR

8 Sketch the root locus for negative feedback system whose open loop transfer function is given by $G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+4.5)}$ **(20 Marks)**

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Module-5

9 a. Sketch polar plot for transfer function $G(s) = \frac{10}{s(s+1)(s+2)}$. **(10 Marks)**

b. Open loop function control system $G(s)H(s) = \frac{1}{s^2(s+2)}$, sketch Nyquist plot and ascertain stability. **(10 Marks)**

OR

10 A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the Bode plot if phase cross over occur at $\omega = 6.35$ rad/sec, find the corresponding gain margin. **(20 Marks)**

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