Faculty of Engineering
End Semester Examination May 2025
RA3CO31 Automatic Control Systems

Programme	:	B.Tech.	Branch/Specialisation	:	RA
Duration	:	3 hours	Maximum Marks	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

		Marks	CO	BL
Section 1 (Answer all question(s))				

Q1. Which of the following is a characteristic of an open loop control system? — **1 1 1**
- ○ Feedback is present
- ● Feedback is absent
- ○ The system adjusts itself based on the output
- ○ It is complex and costly

Q2. A home thermostat used to control the heating system is an example of: — **1 1 1**
- ○ Open loop control system
- ● Closed loop control system
- ○ Manual control system
- ○ Semi-automatic control system

Q3. What is the purpose of mathematical modeling in system analysis? — **1 2 1**
- ○ To make systems more complex
- ● To provide a physical representation of a system using mathematical equations
- ○ To eliminate the need for simulations
- ○ To make systems less predictable

Q4. In a translational mechanical system, which physical quantity is related to motion? — **1 2 2**
- ● Force
- ○ Torque
- ○ Voltage
- ○ Current

Q5. What defines the natural response of a stable system? — **1 3 1**
- ● The amplitude decreases over time
- ○ The amplitude increases over time
- ○ The amplitude remains constant over time
- ○ None of the above

Q6. How does the Routh-Hurwitz criterion determine the number of poles in the right-half plane? — **1 3 1**
- ○ By inspecting the Nyquist plot
- ● By calculating the determinant of a matrix
- ○ By analyzing the step response
- ○ By plotting the root locus

Q7. What is the primary significance of root locus in control systems? — **1 4 1**
- ○ It defines the frequency response of the system
- ● It indicates the stability of the system
- ○ It predicts the time response of the system
- ○ It determines the root locations of the system's characteristic equation

Q8. Which parameter of controller design influences the location of breakaway and break-in points? — **1 4 1**
- ● Proportional gain (k_p)
- ○ Integral gain (k_i)
- ○ Derivative gain (k_d)
- ○ Phase margin (φ_m)

Q9. In MATLAB, which compensator improves system stability and increases damping ratio? — **1 5 2**
- ○ PD compensator
- ● Lead compensator
- ○ Lag compensator
- ○ PI compensator

Q10. Which MATLAB function is used to plot the root locus of a given transfer function?   **1   5   1**

  ⦿ bode()   ◉ rlocus()

  ⦿ nyquist()   ⦿ pzmap()

Section 2 (Answer all question(s))

Q11. Explain automatic control systems. Write the types of control system based on its application.   **3   1   2**
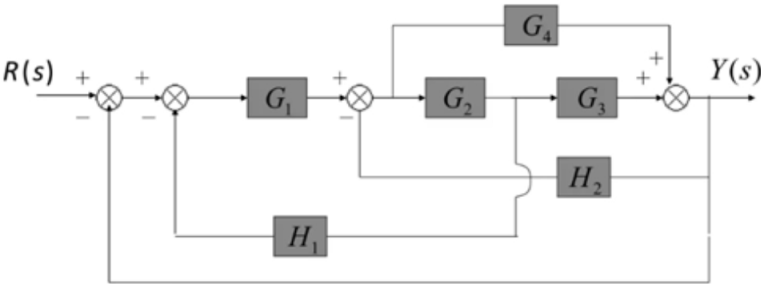
Rubric	Marks
automatic control system definition 1 marks types of control system based on its application 2 marks	3

Q12. (a) Solve the block diagram shown in figure below   **7   1   4**

Rubric	Marks
step wise marking to find Equivalent Forward Transfer Function and Final Transfer Function	7

(OR)

(b) Write the pros and cons of open loop and closed loop system with examples relevant to control system.

Rubric	Marks
pros and cons of open loop and closed loop system 2.5 each with examples relevant to control system. 1 mark each	7

Section 3 (Answer all question(s))

Q13. Explain the concept of impedance and admittance in translational mechanical system.   **4   2   2**

Rubric	Marks
concept of impedance 2 marks concept of admittance 2 marks	4

Q14. (a) Write the differential equations for a rotational mechanical system- two equation of motion and also find a transfer function solving these differential equations.   **6   2   4**

Rubric	Marks
Two equations of motion of 4 marks and transfer function 1 marks each.	6

(OR)

(b) Derive the two equations of motion for a spring-mass system (translational mechanical system) and obtain the corresponding transfer function by solving these differential equation.

Rubric	Marks
Two equations of motion derivation 4 marks transfer function 2 marks	6

Section 4 (Answer any 2 question(s))

Marks CO BL

Q15. Explain the concept of the Routh-Hurwitz criterion in the control system. Discuss the condition that causes zero in the first column and zero in an entire row of the table.   **5   3   3**

Rubric	Marks
concept of Routh-Hurwitz criterion 3 marks conditions 2 marks	5

Q16. What is the relationship between static error constants and steady-state errors for ramp and parabolic input?   **5   3   4**

Rubric	Marks
static error constants 2.5 marks steady state error 2.5 marks	5

Q17. Make the Routh table for the following equations-   **5   3   4**

$$\frac{1000}{s^3 + 10s^2 + 11s + 1030}$$

Rubric	Marks
1 marks for each steps	5

Section 5 (Answer any 2 question(s))

Marks CO BL

Q18. What is root locus? Explain the properties of root locus.   **5   4   2**

Rubric	Marks
root locus 1 marks properties of root locus. 4 marks	5

Q19. Explain the concept of the angle of departure and arrival with a diagram.   **5   4   2**

Rubric	Marks
concept of the angle of departure 2marks and arrival 2 marks with 1 marks of a diagram	5

Q20. Explain the concept of PI controller design, PD controller design, and PID controller design with the help of neat sketch.　　**5　4　2**

Rubric	Marks
concept of PI controller design, 1.5 mark PD controller design, 1.5 marks PID controller design with the help of neat sketch 2 marks	5

Section 6 (Answer all question(s))

Marks CO BL

Q21. Elaborate the key features of MATLAB.　　**4　5　2**

Rubric	Marks
4 Features 1 marks each	4

Q22. (a) Explain the Key Matlab commands.　　**6　5　2**

Rubric	Marks
Atleast 6 commands and their description.	6

(OR)

(b) Describe the advantages and limitations of MATLAB in automatic control system.

Rubric	Marks
advantages 3 marks limitations 3 marks	6

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