

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S,FE) (FT/WP/PT) Examination December 2025 (2019 Scheme)

Course Code: EET302**Course Name: LINEAR CONTROL SYSTEMS**

Max. Marks: 100

Duration: 3 Hours

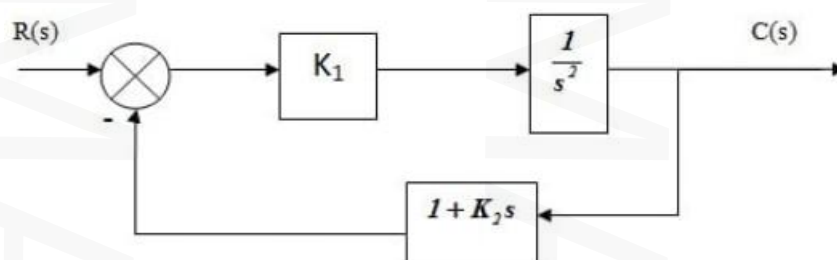
PART A*Answer all questions, each carries 3 marks.*

Marks

- 1 Describe the working and control application of Stepper motor. (3)
- 2 Explain how the feedback of the system effects on sensitivity and stability (3)
- 3 Obtain the static error coefficients and steady state error of open loop transfer function $G(s)H(s) = \frac{5}{s(s+4)(s+9)}$. (3)
- 4 Derive the impulse response of transfer function $\frac{25}{12s+6}$. (3)
- 5 Test a point $(-2+j4)$ for its existence on Root locus with $G(s)H(s) = \frac{20}{s(s+4)}$. (3)
- 6 Derive the expression of resonant peak in frequency domain specification. (3)
- 7 Find the resonant frequency and resonant peak of unity feedback system with $G(s)H(s) = \frac{625}{s(s+6)}$. (3)
- 8 Find the centroid and angle of asymptotes of $G(s)H(s) = \frac{K(s+4)}{s(s^2+2s+2)}$. (3)
- 9 Explain about Nyquist stability criterion. (3)
- 10 Find the open loop poles and closed loop poles of $G(s)H(s) = \frac{(s+1)(s+2)}{s(s+3)}$. (3)

PART B*Answer one full question from each module, each carries 14 marks.***Module I**

- 11 a) Derive the transfer function of Lag and Lead compensator with suitable circuit. (8)
- b) For the control system shown in figure, find the values of K_1 and K_2 so that $M_p=25\%$ and $t_p=4$ sec. Assume unit step input (6)



OR

- 12 a) Derive transfer function of armature controlled DC servomotor and draw pole zero plot. (8)
 b) Derive Impulse response of Second order system. (6)

Module II

- 13 a) Derive the step response of second order under damped system and derive its time domain specifications. (14)

OR

- 14 a) Evaluate the generalized coefficients and steady state error of $G(s)H(s) = \frac{2}{s(s+7)}$ if the input of the system is $\frac{3}{s} + \frac{8}{s^2}$. (10)
 b) Check the stability of characteristic equation $s^4 + 4s^3 + 12s^2 + 8s + 16$ using Routh Hurwitz criterion. (4)

Module III

- 15 a) Sketch the complete root locus for the system $G(s)H(s) = \frac{K(s+4)(s+7)}{s(s+2)}$. (10)
 b) Design a lead compensator with $\xi = 0.3$ and $\omega_n = 8 \text{ rad/sec}$ of above system. (4)

OR

- 16 a) Sketch the complete root locus of given system with $G(s)H(s) = \frac{K(s+4)}{s(s+5)(s^2+s+8)}$. (10)
 Comment on stability.
 b) Design a Lag compensator of above system with velocity error constant $K_v = 45 \text{ sec}^{-1}$ and dominant pole as $-5.6 \pm j12$. (4)

Module IV

- 17 a) Sketch the Bode plot of $G(s)H(s) = \frac{10(s+3)}{s(s+2)(s^2+4s+100)}$ Find $\omega_{gc}, \omega_{pc}, GM, PM$ and comment on stability. (14)

OR

- 18 a) Determine the value of gain K for $G(s)H(s) = \frac{500K}{s(s+10)(s+50)}$ using Bode plot when GM= 12 dB. (14)

Module V

- 19 a) Construct Nyquist plot of the open loop transfer function is given by $G(s)H(s) = \frac{1+4s}{s^2(1+s)(1+2s)}$. Comment on Stability (14)

OR

- 20 a) The forward path transfer function of a unity feedback control system is given by (14)

$$G(s)H(s) = \frac{K}{s(s+2)(s+8)}$$

Design a suitable lag compensator so that system meets following specification as $\zeta=0.5$, $\omega_n=2$ rad/s steady state error ≤ 0.125 for unity ramp input.
