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)

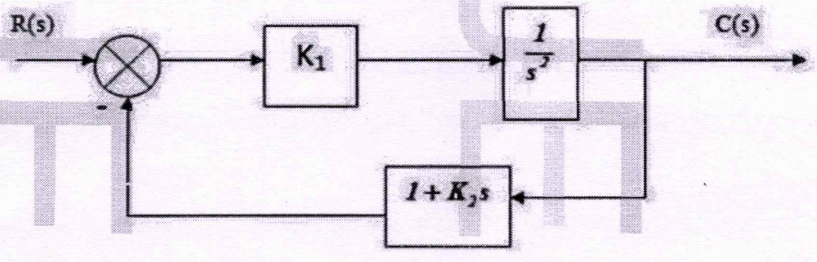
PART B

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 K1 and K2 so that Mp=25% and tp=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 $\omega_n = 8rad/sec$ of above system. (4)

OR

16 a) Sketch the complete root locus of given system with $G(s)H(s) = \frac{K(s+4)}{s(s+5)(s^2+s+8)}$. Comment on stability. (10)

b) Design a Lag compensator of above system with velocity error constant $K_v = 45sec^{-1}$ and dominant pole as -5.6+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 ζ=0.5, ωn=2 rad/s steady state error$\leq$ 0.125 for unity ramp input.

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