Ref. No: EX/IEBT/T/126/2018

B.Tech (IEE) 1st Year Examination, 2018

(2nd Semester)

SUBJECT: LINEAR CONTROL SYSTEMS

Time: Three hours

Full Marks 100

No. of questions	Answer any four	Marks
1.	The following differential equation represents a linear time invariant system with an input of u(t) and an output of y(t): $d^2y(t)/dt^2 + 6dy(t)/dt + 8y(t) = du(t)/dt + 3u(t)$ (a) Assuming zero initial condition, obtain the transfer function $Y(s)/U(s)$. (b) From the transfer function as obtained in part (a), draw the signal flow graph of the system. (c) From the signal flow graph as obtained in part (b), obtain a state space model of the system.	3 7 15
2.	Open loop transfer function of a system is given as: $G(s)H(s) = 5/(s(s+1)(s+6))$ (a) Write down the sinusoidal transfer function and the corner frequencies. (b) Draw the bode plot of $G(jw)H(jw)$ with proper corrections at corner frequencies. (c) From the graph obtain the gain and phase margins and the phase and gain cross-over frequencies.	5 15 5
3.	A control system with unity feedback is characterized by an open-loop transfer function of $G(s) = 16 / (s(s+6))$ (a) Compute the closed loop pole locations, the undamped natural frequency and damping ratio. (b) Calculate the steady state errors to unit step, unit ramp and unit parabolic inputs. (c) Compute the rise time, peak time, peak overshoot and 2% settling time of the system when excited by a unit ramp.	8 9 8

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4.	The characteristic equation of a closed loop system is given as: $1 + G(s)H(s) = 1 + K(s+3) / (s(s+1)(s+8)) = 0$ (a) Find the range of values of K for which the system remains closed loop stable. (b) Draw the root locus of the closed loop system for $0 \leq K \leq \infty$.	5 20
5.	The open-loop sinusoidal transfer function of a system is given as: $G(jw)H(jw) = 10/ (jw(jw+2)(jw+5))$ (a) Draw the Nyquist contour and the corresponding Γ_{GH} contour. (b) Using Nyquist Stability Criterion, comment on the closed loop stability of the system.	5 + 15 5
6.	Write short notes on any two: (a) Effect of feedback on system dynamics (b) Routh Stability Criterion (c) Lead Compensation (d) Lag Compensation	12½ x 2