(Please write your Exam Roll No.) Exam Roll No. 60225602614

END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] DECEMBER 2016 – JANUARY 2017

Paper Code: ETEL-307 **Subject: Control Systems**

Time: 3 Hours **Maximum Marks: 75**

Note: Attempt any five questions including Q.no.1 which is compulsory. Select one question from each Unit. Assume suitable missing data if any.

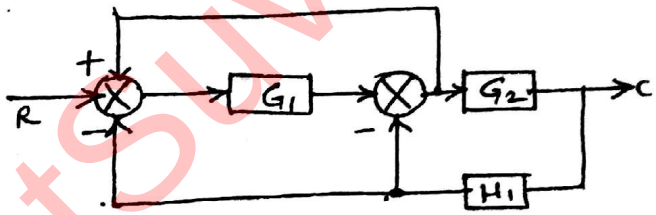
Q1 Write short notes on: **(5x5=25)**

(a) Signal flow graph
(b) PI-Controller
(c) Minimum phase systems
(d) Nyquist stability criterion
(e) Magnetic amplifier

Unit-I

Q2 (a) Find the transfer function $V_0(s)/Vi(s)$ for the operational amplifier shown. Given R1 = R2 = 100K ohm and $C_1 = C_2 = 1\ \mu F$. **(6.5)**

(b) Determine C/R for the system shown by Block diagram reduction method. **(6)**



Q3 (a) Determine transfer function for a dc servo motor. **(8.5)**

(b) A tacho-generator has a gain of 0.05v/rad./sec. Find (i) Output voltage when the shaft speed is 40 deg./sec., (ii) The output voltage when shaft speed is 20 rad./sec. (iii) Shaft speed in rad/sec. and deg./sec when output voltage is 1.8v. **(4)**

Unit-II

Q4 (a) Make a neat diagram and mark on its various transient-response parameters of a typical under damped second order system. **(8.5)**

(b) An UNFB system has $G(s) = 8/[s(s+6)]$. Find the outputs c(t) when the system is subjected to a step input of 2 units. **(4)**

Q5 (a) An UNFB system has $C(s)/R(s) = (Ks+b)/(s^2+as+b)$. Determine open loop transfer function, G(s). Show that e_{ss} in unit ramp response is given by (a-k)/b. **(4)**

(b) For a second order, UNFB system determine peak overshoot and time to reach peak overshoot (i) without controller block and (ii) with controller block connected in the system. Comment upon the effect of controller block. **(8.5)**

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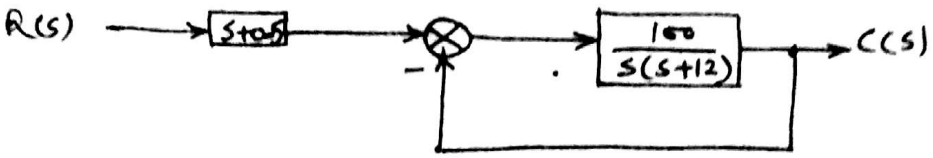

Unit-III

Q6 (a) Given $G(s) = \omega_n^2/(s^2 + 2\zeta\omega_n s + \omega_n^2)$. Show that $|G(j\omega_n)| = 1/2\zeta$. **(4)**

(b) The closed loop frequency response of a prototype second order system gives Mr = 1.4, $\omega_r = 3rad/sec$ and |M(j0)| = 0.9. Sketch corresponding unit step-time response showing values of maximum overshoot, peak time and steady state error. **(8.5)**

Q7 (a) What are the advantages and limitations of frequency domain approach for the analysis of typical control systems? **(4)**

(b) Discuss co-relation of time-domain and frequency domain informations of standard control systems. **(4)**

(c) Sketch polar plots for (i) $G(s) = (1 + j\omega T)$ and (ii) $G(s) = (1 + 2s + s^2)$. **(4.5)**

Unit-IV

Q8 (a) Find the conditions for the stability of system whose characteristic equation is given by: $s^3+(k+0.5)s^2+4ks+50=0$.
Determine the value of 'k' which will cause sustained oscillations and frequency of such oscillations. **(6.5)**

(b) Comment on the stability of a feedback system having open loop transfer function as : G(s)H(s) = k(1+s)/(1-s). **(6)**

Q9 (a) Draw Bode plots for the system having G(s) = 100/[s(s+1)(s+2)]. Find: **(8)**
(i) Gain margin
(ii) Phase margin
(iii) Gain cross over frequency and
(iv) Phase cross over frequency.

(b) The open loop transfer function of a unity feedback system is $G(s)=k(s+1)/s^2$. Sketch root locus plot for the system. **(4.5)**

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