Ref No. Ex/PE/T/316/ /2017(S)

B. POWER ENGINEERING EXAMINATION -2017

(3^{rd} Year - 1^{st} Semester Supplementary)

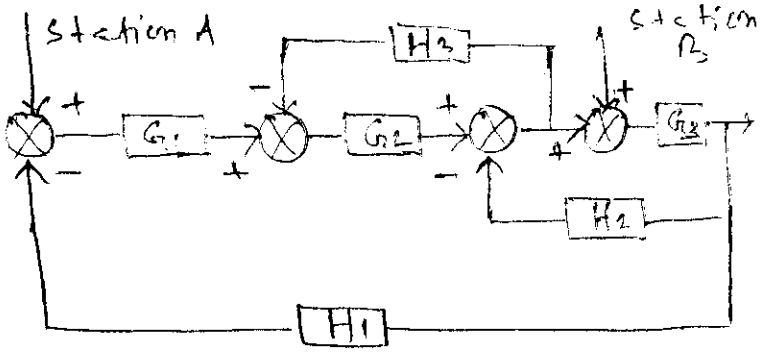
SUBJECT –Control Systems

Time: Three hours | Full Marks: 100

Answer any ***five***

Assume suitable values for missing data, if any

All parts of a question to be answered at one place

No. of Question		Marks
1. (a)	For the system represented by the block diagram shown as fig.1 below, evaluate the closed loop transfer function when the input R is (i) at station A and (ii) at station B  Fig. 1	10+10
2.	Draw the signal flow graph for the system in Q. 1. and verify your answer using Mason's gain formula.	10+10
3. (a)	Derive the expression for unit step response of a standard 2^{nd} order system and hence find the steady state error for this case.	14
(b)	The closed loop transfer functions of certain second order unity feedback control systems are given below. Determine the type of damping (under damped, critically damped etc.) in the systems (i) $\frac{C(s)}{R(s)} = \frac{2}{s^2+2s+1}$ (ii) $\frac{C(s)}{R(s)} = \frac{2}{s^2+4}$	3+3
4. (a)	By means of Routh criterion, determine the stability of the system represented by the following characteristic equation $s^5 + s^4 + 24s^3 + 48s^2 + 25s + 5 = 0$	8

(b)	The characteristic equation of a feedback control system is given by $s^4 + 3Ks^3 + (K+2)s + 4 = 0$ Determine the range of values of K for the system to be stable	12
5.	Sketch the root locus plot for the system given below with K as a variable parameter. $G(s)H(s) = \frac{K}{(s^2 + s + 2)(s^2 + 6s + 4)}$ Is the system stable for all values of K ? If not determine the range of K for stable operation. Find also, the marginal value of K which causes sustained oscillations and the frequency of oscillations.	20
6.	Sketch the bode plots showing the magnitude in dB and phase angle in degrees as a function of log frequency for the transfer function given below. $G(s) = \frac{2000}{s(s+2)(s+100)}$ Determine the gain cross over frequency, phase cross over frequency, gain margin (GM, and phase margin (PM).	12+8
7.	Sketch the Nyquist plot and comment on the stability of closed loop system whose for the open loop transfer function *(K>0)* is given by $G(s)H(s) = \frac{K(s+3)}{s(s-1)}$ Is the system stable for all values of K? If not determine the range of K for which the system is stable.	15+5