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V SEM. B.Tech. (MECHANICAL ENGINEERING.) DEGREE END SEM EXAMINATIONS
NOVEMBER/DECEMBER - 2015

SUBJECT: AUTOMATIC CONTROL ENGINEERING (MME-343)
REVISED CREDIT SYSTEM

Time: 3 Hours. **(07/12/2015)** MAX.MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVEFULL** questions.

1A) Explain with suitable example the working of a regulatory type control system **(05)**

1B) Simplify the block diagram shown in Fig Q1B, and determine the closed loop transfer function. **(05)**

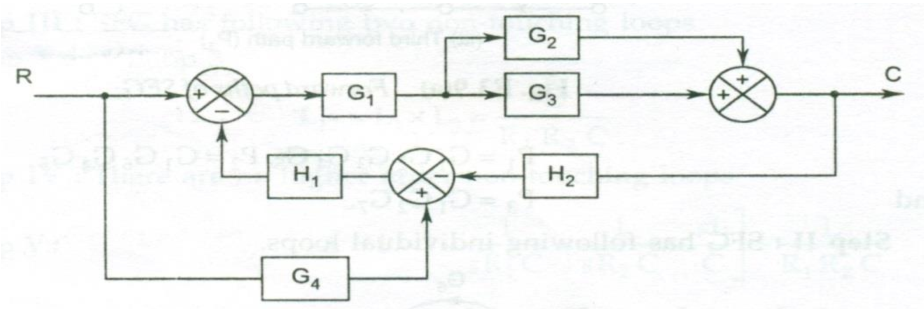

Fig Q1B

2A) The feed forward transfer function of a unity feedback control system is given by G(s) $=\frac{4}{s^2+s}$. Calculate the following for unit step input applied on the system , **(05)**

a) Rise time b) peak time and c) peak overshoot.

2B) With usual notations, derive the expression for the transfer function of a first order thermal system (furnace) . List the assumptions made. **(05)**

3A) Draw the root locus for a closed loop system with unity feedback for which G(s) $=\frac{K}{s(s+4)(s+8)}$. Determine the marginal value of K to ensure stability. **(05)**

3B) Obtain the transfer function from the state space matrices shown below, **(05)**

$A = \begin{bmatrix} -2 & 1 \\ 0 & -3 \end{bmatrix}$ $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 1 \end{bmatrix}$

4A) A unity feedback system has $G(s) = \frac{K}{s(s+1)(s+2)(s+4).}$ Using Routh's criteria , find the marginal value of K for stability. **(03)**

4B) Find the transfer function of a system with the Bode plot shown in Fig Q4B. **(03)**

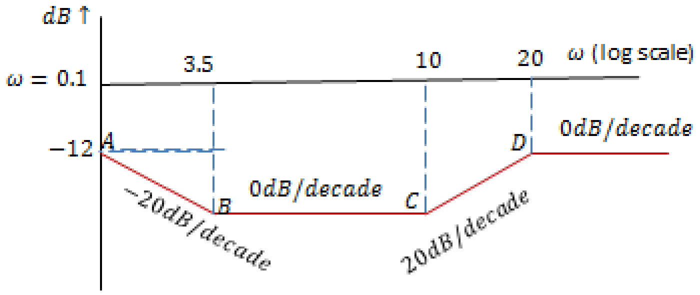

Fig Q4B

4C) With the help of block diagram for a proportional controlled speed governor for a gas turbine with load, derive the expression for the steady state error due to **reset value** (with unit step input) and show the influence of damping coefficient in controlling steady state error. **(04)**

5A) Draw the Nyquist plot for the system with open loop transfer function $G(s)H(s)=\frac{12}{s(s+1)(s+2)}$ and ascertain stability. Also find the gain margin. **(05)**

5B) Distinguish between regulatory and follow up closed loop control system **(02)**

5C) A **unity feedback** system has $G(s) = \frac{K}{s(s+5)(1+0.3s)}$. Determine steady state error for an input signal r(t)= 7t (Ramp input) and K = 10. **(03)**

6A) Write a computer algorithm for digital PID controller **(03)**

6B) For a system with open loop transfer function $G(s)H(s) = \frac{4}{s(s+2)}$, has a undamped natural frequency of 4 rad/s and the damping factor $\xi = 0.5$. In the root locus plot, the dominant closed loop poles are $s_d = -2 \pm 3.46j$. Determine the location of pole and zero of the compensator using root locus method . What is the gain of the compensator? **(05)**

6C) Write note on M circles and N circles. **(02)**