CBCS SCHEME

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15EC43

Eighth Semester B.E. Degree Examination, Jan./Feb. 2021
Control System

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Compare open loop and closed loop control system and give one practical example of each. **(04 Marks)**

b. Draw the electrical network based on Torque-current analogy give all the performance equations for the Fig.Q.1(b). **(08 Marks)**

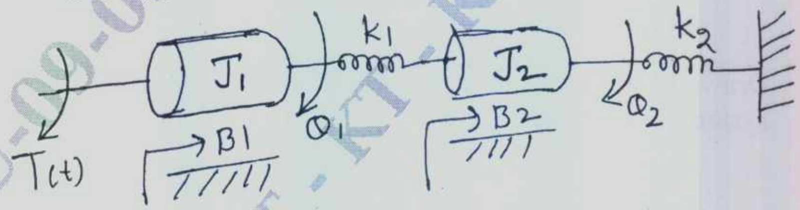

Fig.Q.1(b)

c. Write block diagram reduction rules. **(04 Marks)**

OR

2 a. Using the block diagram reduction rules find $\frac{C(s)}{R(s)}$ for the Fig.Q.2(a). **(08 Marks)**

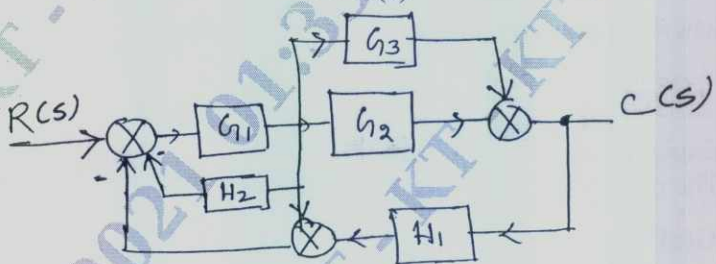

Fig.Q.2(a)

b. Obtain the T.F by using Mason's gain formula for the Fig.Q.2(b). **(08 Marks)**

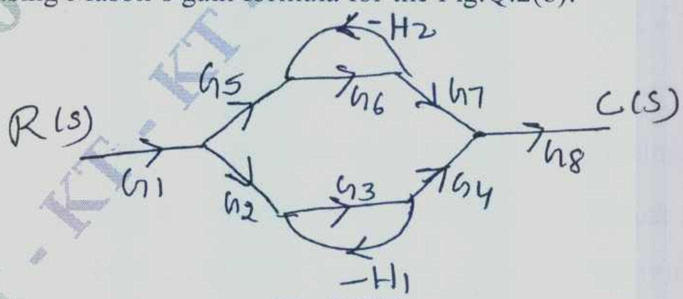

Fig.Q.2(b)

Module-2

3 a. Find K_1 so that $\in = 0.35$. Find the corresponding time domain specifications for the Fig.Q.3(a). **(05 Marks)**

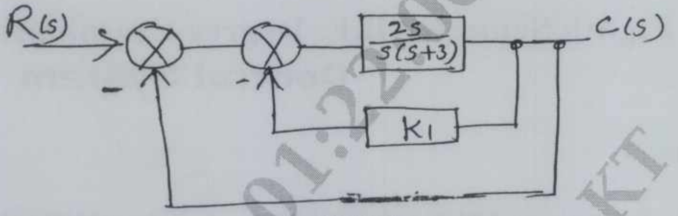

Fig.Q.3(a)

b. For unity feed back control system with $G(S) = \frac{10(s+2)}{s^2(s+1)}$. Find:

i) The static error coefficients

ii) Steady state error when the input

$$R(s) = \frac{3}{s} + \frac{2}{s^2} + \frac{1}{3s^3}$$ **(06 Marks)**

c. Draw the time response curve and define time domain specifications, for second order system for unit step input. **(05 Marks)**

OR

4 a. Explain the effect of ξ on second order system performance. **(04 Marks)**

b. Explain the effects of PI and PD controllers on the performance of second order system. **(08 Marks)**

c. Find K_P and K_V for the system with open loop transfer function as

$$G(s)H(s) = \frac{10(s+2)(s+3)}{s(s+1)(s+4)(s+5)}$$

where input is $r(t) = 3 + t$. **(04 Marks)**

Module-3

5 a. Explain basic concept of Root locus. **(03 Marks)**

b. The open loop T.F of unity feedback system is given by

$$G(s) = \frac{K(s+3)}{s(s^2+2s+3)(s+5)(s+6)}$$

Find the value of K of which closed loop system is stable. **(07 Marks)**

c. A unity feedback control system is described by the characteristic equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Find its stability using R-H criterion. **(06 Marks)**

OR

6 a. Explain R-H criterion for determining the stability of a system and mention its limitations. **(04 Marks)**

b. A feedback control system has an open loop transfer function,

$$G(s)H(s) = \frac{K}{s(s+3)(s^2+2s+2)}$$. Draw the root locus as K varies from 0 to ∞. **(12 Marks)**

Module-4

7 a. List the limitations of lead and lag compensations. **(04 Marks)**

b. Sketch the Bode plot for the $T.F = \frac{300(s^2+2s+4)}{s(s+10)(s+20)}$ Find, phase margin and gain margin. **(08 Marks)**

c. Write a note about gain margin in brief. **(04 Marks)**

OR

8 a. Draw the polar plot of $G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}$. **(08 Marks)**

b. Sketch the Nyquist plot for a system with $G(s)H(s) = \frac{10(s+3)}{s(s-1)}$ comment on closed loop stability. **(08 Marks)**

Module-5

9 a. Explain the sampling process with the help of unit impulse train. **(06 Marks)**

b. What is diagonalization of a matrix explain with suitable example? **(05 Marks)**

c. Obtain the state model of the system represented by the differential equation.

$$\frac{d^3y(t)}{dt^3} + 6\frac{d^2y(t)}{dt^2} + 11\frac{dy(t)}{dt} + 10y(t) = 3u(t)$$ **(05 Marks)**

OR

10 a. Define the following terms:
   i) State variable
   ii) State space
   iii) State trajectory. **(06 Marks)**

b. Obtain the state model of the given electrical system for the Fig.Q.10(b) **(06 Marks)**

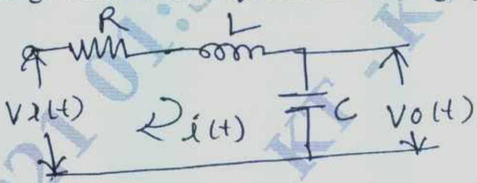

Fig.Q.10(b)

c. State the advantages and disadvantages of digital control system. **(04 Marks)**

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CBCS SCHEME

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Eighth Semester B.E. Degree Examination, November 2020
RADAR Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions irrespective of modules.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain maximum unambiguous range of a radar with equation and graph. **(06 Marks)**

b. Starting from the basic principles, derive simple form of radar range equation. Deduce the equation to other forms also. **(06 Marks)**

c. A radar transmitter operates at 10GHz and transmits 250KW of peak pulse power. If the antenna has a gain of 4000 and power received from a target at 50KM is 10^{-11} watts, find the radar cross section area of the target. **(04 Marks)**

2 a. Explain a conventional pulse radar with a superheterodyne receiver with a neat block diagram. **(06 Marks)**

b. Draw a typical radar pulse waveform and explain PRF, PRI, duty cycle, peak transmitter power, average transmitter power neatly. **(06 Marks)**

c. Explain the applications of radar. **(04 Marks)**

Module-2

3 a. Briefly discuss on the prediction of radar range performance and the detection of signals in noise. **(06 Marks)**

b. Explain on the radar cross section of sphere and cone-sphere targets. **(08 Marks)**

c. An S – Band 3GHz radar is found to have a total two-way microwave plumbing loss of 4.8dB. The 100ft of RG – 113/U aluminum waveguide line loss is 1.0dB, duplexer and related devices loss is 2.0dB, rotary joint loss is 0.8B, connectors and bends loss is 0.3dB. Estimate the loss due to other RF devices. **(02 Marks)**

4 a. Explain the modified radar range equation with all details. **(06 Marks)**

b. Discuss with equation and graphs the probability of false alarm and the probability of detection using a envelope detector. Draw the block diagram. **(08 Marks)**

c. Briefly discuss on transmitter power, PRF and range ambiguities. If the noise figure of a receiver is 2.5dB, what reduction (measured in dB) occurs in the signal–to–noise ratio at the output compared to the signal–to–noise ratio at the input. **(02 Marks)**

Module-3

5 a. With necessary equations and graphs, explain a CW Doppler radar and pulse Doppler radar with neat block diagrams. **(08 Marks)**

b. Explain a N-pulse delay line canceler with neat block diagram, equations, waveforms and graphs. **(06 Marks)**

c. A VHF radar at 220MHz has a maximum unambiguous range of 180nmi.

i) What is its first blend speed (in knots)?

ii) Repeat, but for an L – band radar at 1250MHz

iii) Repeat, but for an X – band radar at 9375MHz. **(02 Marks)**

6 a. Explain the original moving target detector signal processor with neat block diagram and illustration diagram. **(05 Marks)**
b. With neat block diagram explain a MTI radar with power amplifier transmitter. **(05 Marks)**
c. Starting form basic principles, derive the equations for clutter attenuation and MIT improvement factor. **(06 Marks)**

Module-4

7 a. What are the different types of tracking radar systems? Explain with diagrams, how Angle – Tracking is done? **(08 Marks)**
b. Explain with neat block diagram and waveforms, a conical scan tracking radar. **(04 Marks)**
c. Compare and contrast the two major tracking systems. **(04 Marks)**

8 a. Explain a two coordinate (Azimuth and elevation) amplitude comparison monopulse tracking radar with neat block diagram. **(06 Marks)**
b. Discuss on tracking in range of a tracking radar. **(06 Marks)**
c. What do you mean by sequential Lobing and Conical scan? **(04 Marks)**

Module-5

9 a. List the functions of the radar antenna. **(05 Marks)**
b. Explain receiver noise figure and derive the expression for noise figure of networks in cascade. **(06 Marks)**
c. With all necessary details, explain a superheterodyne receiver. **(05 Marks)**

10 a. Explain directive gain, power gain, antenna radiation pattern, effective aperture and polarization of radar antennas with necessary equation and graphs. **(05 Marks)**
b. Discuss on electronically steered phased array antennas. **(05 Marks)**
c. Compare and contrast different types of display presentations in radar. **(06 Marks)**

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