**B.E. (ME) Part-II 4th Semester Examination, 2010**

# Measurement and Control
# (ME-404)

Time : 3 hours Full Marks : 70

***Use separate answerscript for each half.***

FIRST HALF

***[Answer O.No.l and any TWO from the rest)***

1. Answer any three of the following questions : I3$_x$5|

(a) Find the equivalent transfer function ***T\s)*** = $\frac{C(s)}{}$ of the system shown in Fig

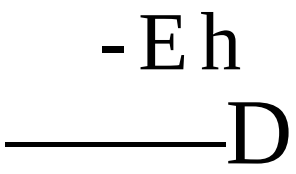


Fig.-1

(b) For the system shown in Fig. **-2,** find the peak time, percent overshoot and the settling time when ***R(s) = j.***

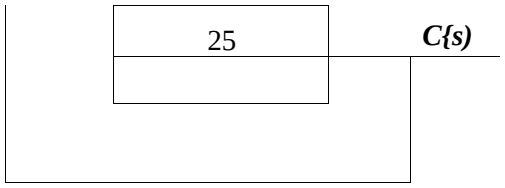


Fig.-2

(c) For a unity feedback control system with the forward path transfer function ***G(s) = ,(l+,}*** . find the value of ***a*** such that the unit step response has 5% overshoot.

(d) Find the analytical expressions for the gain and phase of the system ***G{s)*** = —~ as functions of the operating frequency Plot the asymptotic Bode plot (both gain and phase) for the system and show the bandwidth.

2. The closed loop transfer function of a system is as given below. Determine the number of poles on the right half-plane, left half-plane and on the imaginary axis of the s-plane. (101

$$T(s) = \frac{20}{s^* + s^7 + \backslash 2s^6 + 22s^5 + 39s^4 + 59s^3 + 48s^2 + 38s + 20\ *}$$

3. For the system shown in Fig.-3,

(a) Obtain the three static error constants.

(b) Hence find the steady state errors for unit step, ramp and parabolic inputs.

(c) Comment on the type of the system. (4+4+2]

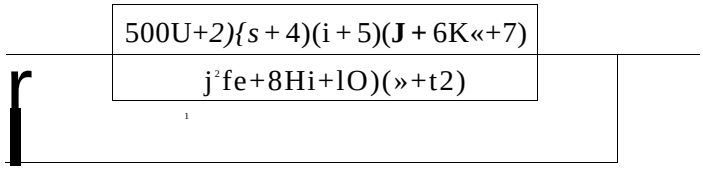


Fig.-3

4. A model for an airplane's pitch control loop is shown in Fig.-4.

(a) Find the range of gain K that will keep the system stable. Can the system ever be unstable for positive values of K?

(b) Estimate the steady state error of the system under unit step input for $K = 10$. [6+4]

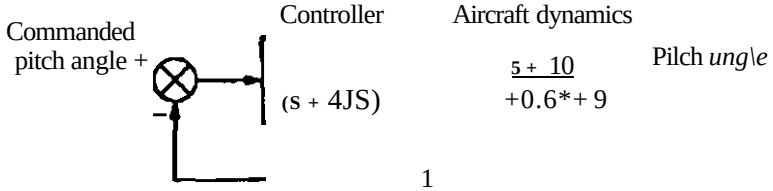


Fig.-4

SECOND HALF

***{Answer anu THREE questions from the rest.***

***The questions are of equal value.)***

5. a) With neat sketch show the different parts of a McLeod gauge and explain the method of low pressure measurement by it. What are the disadvantages of this gauge?

b) Discuss about the advantages of cistern manometer.

6. a) Classify the different types of temperature measuring instruments on the basis of the changes in temperature related properties.

b) Explain the method of measurement of temperature by means of a resistance thermometer. What are the advantages and disadvantages of this thermometer?

7. a) Define : (i) Damping, (ii) Critical damping and (iii) Time constant.

b) Deduce an expression for the completion of a process assuming a step-forced first order system.

c) Explain the significance of the time constant.

8. a) State the various means of measurement of forces.

b) With a labelled sketch explain the method of measurement of force by means of a hydraulic load cell.

c) What is the difference between Roughness and Waviness?

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**9.** Write short notes on any three of the following :

a) Simple two liquid manometer.

b) Bourdon tube pressure gauge.

c) Metal bellows.

d) Calibration of strain gauge.

e) Standard of temperature.