

BTS (C) - VI - (S) - 05 - 074 (I)

### B. Tech Degree VI Semester (Supplementary) Examination, November 2005

**ME 603 INSTRUMENTATION THEORY AND CONTROL ENGINEERING**  
(2002 Admissions)

Time : 3 Hours

Maximum Marks:100

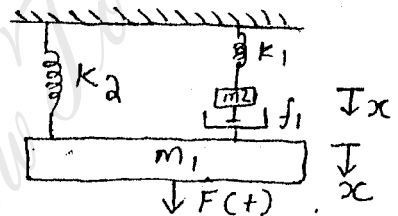
- I. (a) Which are the three categories of error in measuring systems? A 600 V voltmeter is specified to be accurate within  $\pm 2\%$  of full scale. Calculate the limiting error when the instrument is used to measure 250V. (12)
- (b) What do you mean by order of an instrument in the mathematical modeling? Define time constant and static sensitivity of a first order instrument. (8)

**OR**

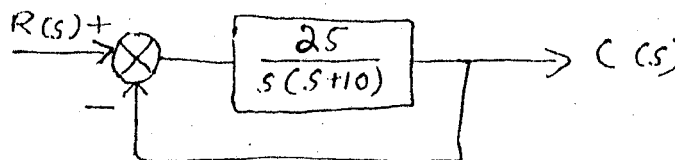
- II. (a) Differentiate between accuracy and precision. (6)
- (b) Develop the mathematical model for a second order system and discuss on its step response with the help of relevant plots and equations. (14)
- III. (a) Mention the advantages of semiconductor strain gauges over the others. (6)
- (b) A resistance strain gauge with a gauge factor 2 is cemented to a steel member, which is subjected to a strain  $1 \times 10^{-6}$ . If the original resistance value of the gauge is  $130 \Omega$ , calculate the change in resistance. (6)
- (c) Explain the working principle and application of a scintillation counter. (8)

**OR**

- IV. (a) Explain the working principle of a sound level meter. (6)
- (b) Explain any one type of torque measuring technique. (6)
- (c) Derive the transfer function of the mechanical system shown below. (8)



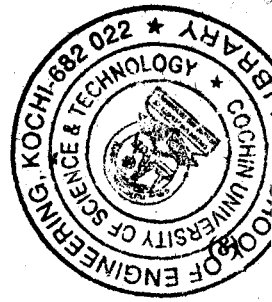
- V. (a) Derive the transfer function of the closed loop system given below. (8)



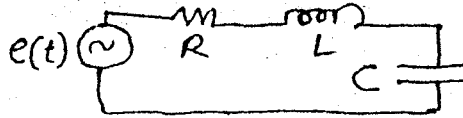
- (b) Write short note on ORSAT apparatus. (6)
- (c) Explain robot arm system with the aid of a suitable diagram. (6)

**OR**

(Turn Over)



VI. (a) Obtain the state space representation of the RLC network shown below.



(b) The closed loop transfer function of a system is given by  $\frac{C(s)}{R(s)} = \frac{7}{s^2 + 4s + 5}$

Determine

- (i) the damping ration
- (ii) natural frequency
- (iii) step response and
- (iv) error response

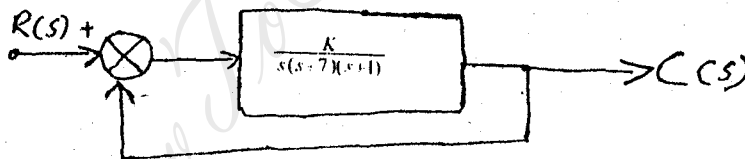
(12)

VII. (a) Using Hurwitz approach, verify the stability of  $s^4 + 4s^3 + 9s^2 + 8s + 2 = 0$

(8)

(b) Determine the value of K for the below system to be stable

(12)



OR

VIII (a) By sketching Bode plot, discuss the stability of the unity feed back

system,  $G(s) = \frac{50}{s(s+2)(s+5)}$

(12)

(b) What is a Liapunove function? How it is being developed? Explain how it can be used in stability analysis of systems.

(8)

IX. (a) Write short notes on,

- (i) Pneumatic controllers
- (ii) Servo motors
- (iii) Synchronos
- (iv) Integral control action

(5x4=20)

OR

X. (a) What are the advantages and limitations of derivative control action compared to others? (8)

(b) Derive the transfer function of an armature controlled DC servomotor and explain. (12)

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