

(Please write your Exam Roll No.)

Exam Roll No. ....

# END-TERM EXAMINATION

FIFTH SEMESTER [B.TECH.] - DECEMBER-2007

Paper Code: ETME-307

Subject: Measurement and Controls

Paper ID: 36307

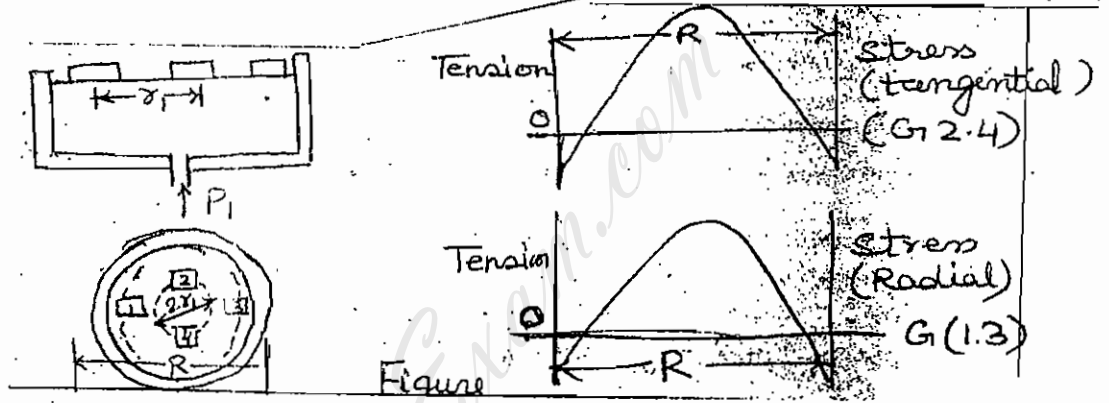
(Batch: 2004-2005)

Time: 3 Hours

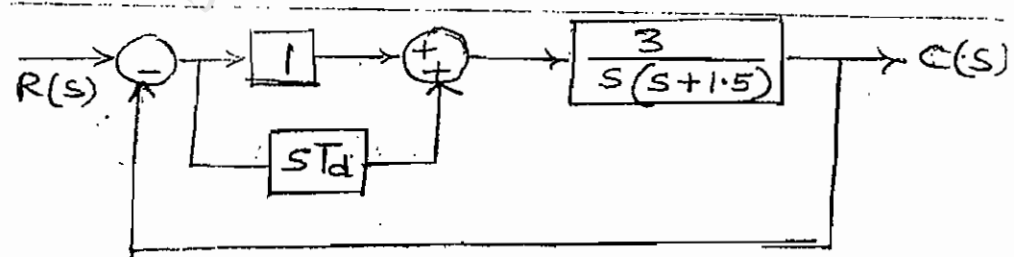
Maximum Marks: 75

Note: Attempt any five questions.

- Q.1 (a) How strain gauges are used in diaphragms for measuring differential pressure? If the radius of a 1.5mm thick metal diaphragm is 5cm and its Young's Modulus is  $10^6 \text{ kg/cm}^2$  and its Poisson's ratio is 0.3 and it has 4 resistance strain gauges of gauge factor 2 and resistance 120 ohms each bonded to its surface as per the scheme shown below. Derive the values of tangential and radial stresses at a distance of 1 cm from the centre. (7.5)



- (b) The open loop transfer function of a unity feedback system is  $G(S) = K/S(ST+1)$ , where  $K$  and  $T$  are positive constants. How many times the gain should be increased to increase the overshoot from 40% to 60%? (7.5)
- Q.2 (a) Why is a cold junction compensation necessary in temperature measuring schemes using thermocouples? What is the recent trend in making such compensation? (7.5)
- (b) Given below is the figure shows PD controller used for controlling the system performance. Determine  $T_d$  to make the system critically damped. Calculate settling time. (7.5)



- Q.3 (a) What is Reynold's number? How does it come in for flow calculations? How laminar and non-laminar flows are related to Reynold's number? (7.5)
- (b) Draw the root locus of the system whose open loop transfer function is  $G(S)H(S) = \frac{K}{S(S+3)(S^2+3S+11.25)}$ . Comment on the stability. Write all the steps to get the plot. (7.5)

**[-2-]**

- Q.4 (a) Distinguish between sensitivity and precision. Discuss installation errors and equipment errors. How can they be eliminated or minimised? (7.5)
- (b) Determine phase margin for a unity feedback standard second order system? (7.5)
- Q.5 (a) Draw the Bode plot for a unity feedback system with  $G(S) = \frac{K(S+0.3)}{(S+4)(S^2+30S+20)}$  where  $K = 2000$ . Determine Gain margin, Phase margin, Gain cross over frequency, Phase cross over frequency, Stability. (7.5)
- (b) What is tachogenerator? What is the difference between AC and CD tachogenerator with the help of diagram? (7.5)
- Q.6 (a) Draw the Nyquist plot and discuss the stability of the closed loop system.  $G(S)H(S) = \frac{K}{S(S+1)(S+5)}$ . (7.5)
- (b) What are compensators? Discuss all the compensators, by comparing their features. (7.5)
- Q.7 (a) Write and explain different classification of transducers. (7.5)
- (b) Discuss the application of strain gauges for torsion measurement. (7.5)
- Q.8 Write short notes on: - (15)
- (a) Ultrasonic Flowmeter
- (b) PI and PID Controllers
- (c) Application of Thermistors

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