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Question Paper Code	12451
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**B.E./B.Tech - DEGREE EXAMINATIONS, NOV/DEC 2023**  
Fourth Semester  
**Mechanical Engineering**  
**20MEPC401 - MEASUREMENTS AND CONTROL SYSTEMS**  
(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

**PART - A (10 × 2 = 20 Marks)**  
Answer ALL Questions

- |  | <i>Marks,<br/>K-Level, CO</i> |
|--|-------------------------------|
| 1. Enumerate the term calibration employed in instruments.   | 2,K1,CO1                      |
| 2. Compare accuracy and precision.   | 2,K1,CO1                      |
| 3. Define open loop and closed loop system.  | 2,K2,CO2                      |
| 4. What are the basic elements of a mechanical system?   | 2,K2,CO2                      |
| 5. Name the test signals used in control system.   | 2,K1,CO3                      |
| 6. What is transient and steady state response?  | 2,K1,CO3                      |
| 7. The damping ratio and natural frequency of oscillation of a second order system is 0.5 and 8rad/sec respectively. Calculate the resonant peak and resonant frequency. | 2,K2,CO4                      |
| 8. Define polar plot.  | 2,K1,CO4                      |
| 9. What are the classifications of tachometer?   | 2,K1,CO5                      |
| 10. Define gauge factor.   | 2,K1,CO5                      |

**PART - B (5 × 13 = 65 Marks)**  
Answer ALL Questions

11. a) Explain the functional blocks of a measurement system with a neat diagram. 13,K2,CO1
- OR**
- b) Eight different students timed in the circuit for resonance and the values of resonant frequency in KHz were recorded as 412, 428, 423, 415, 426, 411, 423 and 416. Calculate arithmetic mean, Average deviation, Standard deviation, median and Variance. 13,K2,CO1
12. a) Compute the differential equations governing the mechanical system shown in Figure 1 and determine the transfer function. 13,K3,CO2

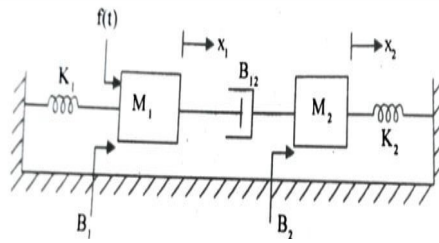


Figure 1

OR

b)

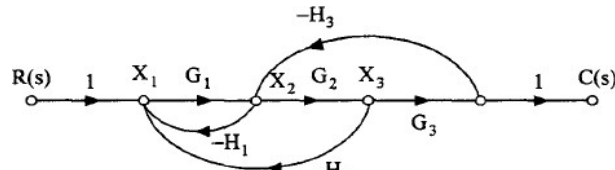


Figure 2

13,K3,CO2

For the signal flow graph in Figure 2, Find  $\frac{C(S)}{R(S)}$  using Masons gain formula.

13. a) Derive the expression and draw the response of second order system for critically damped case with unit step input. 13,K2,CO3

OR

- b) The unity feedback system is characterized by an open loop transfer function  $G(S) = \frac{K}{s(s+10)}$ . Determine the gain K, so that the system will have a damping ratio of 0.5 for this value of K. Determine settling time, peak overshoot and peak time for a unit step input. 13,K2,CO3

14. a) Derive the expressions for frequency domain specifications with unit step input. 13,K2,CO4

OR

- b) Sketch the bode plot for the unity fed back control system with transfer function and determine phase margin and gain margin 13,K3,CO4

$$G(S) = \frac{75(1+0.2s)}{s(s^2 + 16s + 100)}$$

15. a) With a neat diagram explain the principle and construction details of linear and circular potentiometer. 13,K2,CO5

OR

- b) Explain how the torque is measured by strain gauge and relative angular twist. 13,K2,CO5

**PART - C (1 × 15 = 15 Marks)**

16. a) (i) Distinguish between RTD and Thermistor. *5, K2, CO6*  
(ii) State the laws of thermocouples. How are the laws useful in construction of thermocouple thermometers? *10, K2, CO6*

**OR**

- b) Explain how McLeod gauge used for low pressure measurement. Justify this with your answer. *15, K2, CO6*