Total No. of Questions : 8]

SEAT No. :

P3913

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M.E. (Mechanical - Design Engg.)

MECHANICAL MEASUREMENT OF CONTROL

(2013 Course) (Semester -III) (602214)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer any five questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Explain Classification of measuring instruments. **[5]**

b) Explain any five static characteristics of instruments. **[5]**

Q2) a) Calculate standard deviation (σ) and variance (V) for following measurement sets 398 420 394 416 404 408 400 420 396 413 430 410 411 416 401 400 407 403 399 406 401. **[6]**

b) How Systematic Errors can be removed? **[4]**

Q3) a) By using following data find lines of regression & Compute Karl Pearson coefficient of correlation. **[6]**

$\sum x = 15000 \quad \sum y = 6800 \quad \sum xy = 1022250 \quad \sum x^2 = 2272500$

$\sum y^2 = 463025$

$n = 100$

b) Explain different types of correlation. **[4]**

Q4) a) Explain construction & working of Foil type heat flux gage. **[5]**

b) Explain any hygrometer used for humidity measurement. **[5]**

P.T.O.

Q5) a) Explain any one dynamometer used for torque measurement. **[5]**

b) Write note on Phase-Angle Measurement. **[5]**

Q6) a) Represent a generic state space model using the block diagram approach and define the elements of the block diagram. **[5]**

b) Differentiate between the Time Domain and the Frequency Domain based modelling approach. **[5]**

Q7) a) Using Routh-Hurwitz criterion find closed loop stability of system given below. **[5]**

$$\frac{C(s)}{R(s)} = \frac{2_s + 1}{S^3 + 3s^2 + 3_s + 1}$$

b) Derive the transfer function between output y and input F for the single DOF translational mechanical system shown in Figure Q7 (b) **[5]**

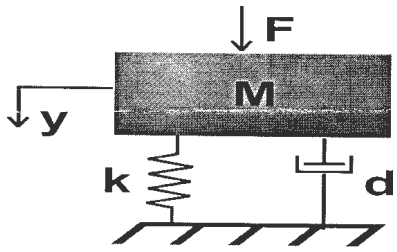

Figure Q7 (B)

Q8) a) Explain Proportional + Derivative control action. **[5]**

b) The equation of error is $e = 0.5t + 0.03t^2$. With $K_p = 5\%/\%$, $K_D = 0.5\ \%/s$ and $m(0) = 50\%$. Sketch the graph of controller output vs time or P+D controller (in series form) from t = 0 to t = 2sec. **[5]**

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