Q. P. Code: 21814

Time: 3 Hrs   [Total Marks 80]

N.B.:
(1) **Question No.1 is compulsory**
(2) Attempt any **three** questions out of remaining **five** questions
(3) Figures to right indicate full marks
(4) Assume suitable data if **necessary**.
(5) Notations carry usual meaning.

Q.1 (A)   Differentiate between Deflection type and null type of measuring   8
          instruments.
    (B)   Define the following terms with reference to the state space modelling   06
          of the system.
              (a) State space   (b) State variables
    (C) Explain the following terms with reference to static characteristics of the   06
          measuring instruments.
              (a) Resolution   (b) Precision

Q.2 (A)   Describe the construction and working of diaphragms. Write down the   06
          expression for deflection of diaphragms and natural frequency.
    (B)   Describe the construction and working of a d.c. tachometer generator.   06
          Explain its advantages and dis-advantages.
    (C)   Obtain the state-space equation and output equation for the system   08
          defined by the equation,

$$\frac{Y(s)}{U(s)} = \frac{2s^3 + s^2 + s + 2}{s^3 + 4s^2 + 5s + 2}.$$

Q.3 (A)   With a neat sketch explain the constructional feature and working of   10
          (i) infrared pyrometers. (ii) Electro-magnetic flow meter.

    (B)   For a unity feedback system, the output response is observed as   10

          $c(t) = 1 + 0.504\, e^{-3.07t} - 1.504\, e^{-2.18\,t}$. Determine damping ratio.

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Q.4 (A) Explain the function of Rosettes. Explain the working of   10
        (i)   Rectangular strain gauge rosettes.
        (ii)   Delta type strain gauge rosettes.

(B) For a system having G(s) H(s) $=\dfrac{K(1+s)^2}{s^3}$, find range of values of   10
"K"for system to be stable, using Routh's array.

Q.5(A) For a certain feedback system having,   10
G(s) H(s) $=\dfrac{100\,(s+4)}{s\,(s+0.5)(s+10)}$, Sketch Bode plot and comment on G.M.,
P.M and stability.

(B) A diaphragm gauge is constructed of spring steel to measure differential   10
pressure of 7 MN/m^2. The diameter of diaphragm is 12.5 mm. Calculate
the thickness of diaphragm, if the maximum deflection is 0.33 of
thickness. Also calculate the natural frequency of diaphragm. Given,
Young's modulus = 200 GN/m^2 , poisson's ratio = 0.28 and density of
steel = 7800 Kg/m^3.

Q.6 (A) For a unity feedback system having G(s)$=\dfrac{100(s+1)}{s^2\,(s+2)(s+10)}$, determine   10
(i) Type of system (ii) Error coefficients (iii) Steady state error for
input as $1+4t+\dfrac{t^2}{2}$.

(B) With neat sketches discuss significance of followings aspects of signal   10
conditionings for any one of the sensor: amplification, conversion
filtering, modulation/demodulation, and grounding.