MECH/CBGS/V/MM&C / 28-11-2016

Mechanical Measurement & Control

K. G. C. E. EXAM KARJAT, RAIGAD

Q.P. Code : 600600

(3 Hours) **[Total Marks : 80**

N. B. : (1) Question **1 compulsory**.
(2) Attempt any **three** questions from the remaining **five** questions.
(3) Assume suitable data, if necessary.
(4) Figures/sketches. carry weightage.

1. (a) Draw and label a Stethoscope used by medical practitioners. Identify and represent its measurement system elements in a block diagram form with respect to a generalized measurement system. Enlist its varied application's in modem world. **10**
   (b) What are Encoders? With a neat sketch explain the working of an Incremental and Absolute optical encoder. Give examples of their use. **10**

2. (a) Define Resolution, Precision and Accuracy of a measuring instrument. A moving coil voltmeter has a uniform scale with 100 divisions, the full scale reading is 200v and 1/10th of a scale division can be estimated with a fair degree of certainty. Determine the resolution of the instrument in volt. **7**
   (b) What is a Stroboscope? A stroboscope projects 6000 flashes per minute on a disc with 10 patterns mounted on the shaft of a machine. Find the speed of machine if the disc appears stationary and has a single point image. What will be the two possible shaft speeds if 10 points appear to be revolving once in 15 second? Draw your solution. **7**
   (c) Illustrate the working principle of "L.V.D.T." for displacement measurement. **6**

3. (a) What are Bi-metallic Thermometers? State the principle of operation and explain with neat diagram the deflection measured in industrial type bi-metallic thermometers. **8**
   (b) The output power of a rotating shaft is measured by a dynamometer. The relationship for output power is - **12**

$$P = \frac{2\pi \times 9.81 FLT}{t \times 10^6} KW$$

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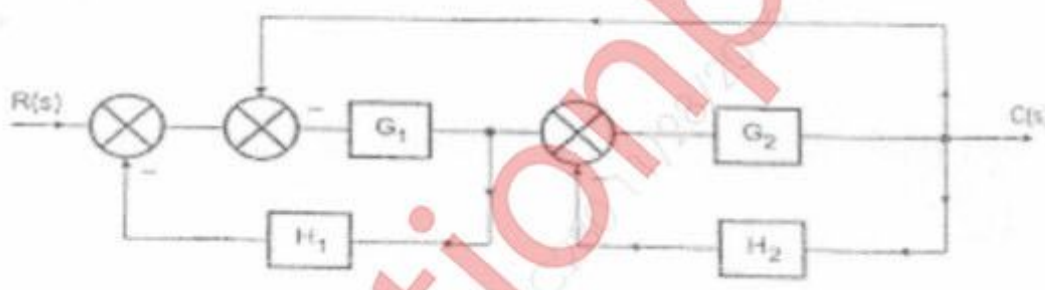
Where;
F = Force at the end of torque arm, kg ;
L = Length of torque arm, mm ;
R = Number of revolutions during time t,
t = Time for test run, S.

The test data are -

F = 4.58 ± 0.02 kg
L = 397 ± 1.3 mm
R = 1202 ± 1.0 revolutions
t = 60 ± 0.50 second

The errors are limiting (absolute) errors. Determine the magnitude of power and magnitude of the limiting error in the computed power.

4. (a) Obtain the Transfer function for the Block diagram using Standard Block reduction rules. **10**



(b) Enumeratethe types of pressure measurement devices w.r.t. to pressure levels to be measured. State the working principle of any one transducer for each pressure level. **10**

5. (a) A second order system has unit feedback and open loop T.F. G (s)=500/s(s+15). **10**
   (a) Draw the block diagram for closed loop system and write the characteristic equation.
   (b) Calculate the Damping ratio and natural frequency, peak time, peak overshoot and setting time for the system output when excited by step input.
   (c) Sketch the transient response for unit setup input
   (d) If the input is ramp of 0.5rad/sec, calculate steady state error.

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(b) Sketch the Root Locus for the given system having G (s). H (s) = K(s + 0.5) /s (s^2 + 2s+ 2). Comment on its stability. **10**

6. (a) What do you understand by a State-space modeling of a system? What is its significance for theory and practical applications? Comment. **5**

(b) Write a short note on PID controller. **5**

(c) A feedback system has G(s) H(s) = 100 (s+4) / s (s + 0.5) (s + 10). Draw Bode plot and comment on its stability. **10**

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