B.E. Mechanical Engineering (Model Curriculum) Semester - IV

PCCME206 - Instrumentation and Control

P. Pages : 3 **GUG/S/23/14065**

Time : Four Hours * 2 8 0 2 * Max. Marks : 80

Notes :
1. All questions carry equal marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.
7. Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.

1. a) Draw and explain the response of the 1st order system to the step input. Explain steady state error and transient error. **8**

b) Define the term Error. Describe in detail systematic, random and random types of errors. **8**

2. a) Explain generalized measurement system with block diagram. **8**

b) Discuss following dynamic characteristics of the instruments. **8**
Peak overshoot
Dead time and dead zone
Dynamic error and
Settling time

3. a) Define steady state error. Derive an expression for the steady state error. **8**

b) A system has **8**

$$G(S)H(s) = \frac{k(S+4)}{S\left(S^3+5S^2+6S\right)}$$

Find
i) Type of system
ii) All static errors

4. a) Find steady state error and error constant for the system whose. **8**

$$G(S) = \frac{49}{S^2(S+7)}$$

And H(S) = 1

b) Discuss briefly PID Controller. **8**

5. a) Sketch and explain hydraulic load cell. **8**

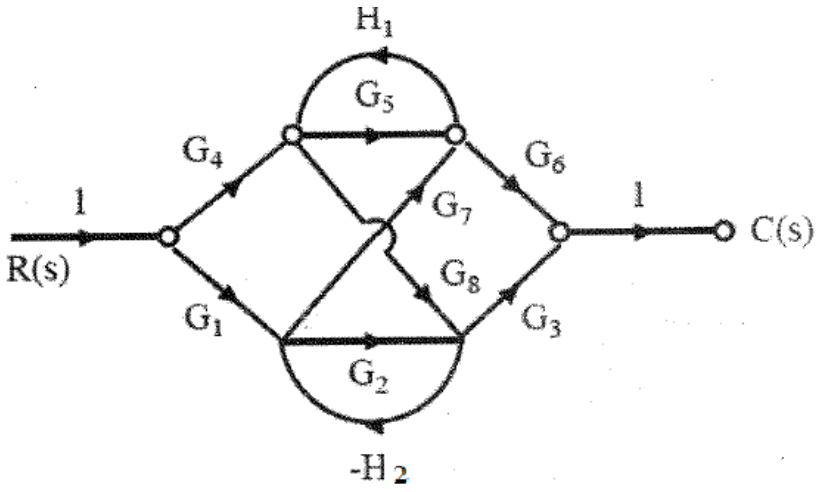
b) Explain construction and working of LVDT with its advantages. **8**

6. a) Enlist the various transducers used in speed measurement and explain photoelectric transducer. **8**

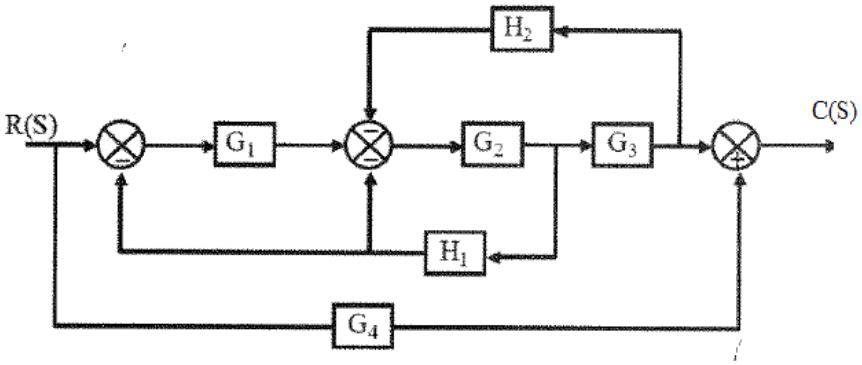
b) Following data refers to the test on an engine with rope brake dynamometer. **8**
Mass attached to rope = 75kg,
Spring balance reading = 1N
Flywheel radius = 0.2 meter
rope diameter = 2cm,
speed = 480 RPM. Obtain the power of the engine.

7. a) Differentiate between open loop and closed loop system. **8**

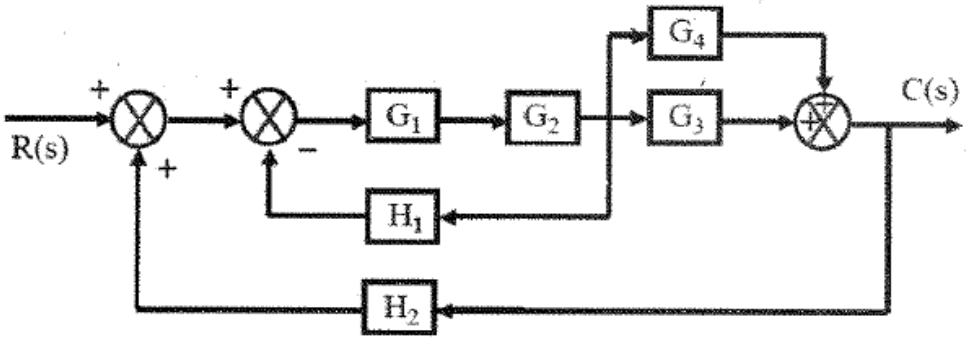
b) Find out Transfer function using Mason gain formula. **8**



8. a) Obtain C(S)|R(S) by using block diagram reduction technique. **8**



b) Find out transfer function- **8**
C(s)/R(s)



9. a) Explain- **10**

i) Significance of Root locus.

ii) Routh's criterion for stability A unity feedback system has the open loop transfer function G(s)

b) A unity feedback system has the open loop transfer function **6**

$$G(s) = \frac{k}{s(s+1)(s+3)(s+4)}$$

Plot the Root locus

10. For unity feedback system, **16**

$$G(s) = \frac{100}{s(s+2)(s+20)}$$

sketch the Bode plot. Find PM and GM of the system and comment upon the stability of system.

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