

**GUJARAT TECHNOLOGICAL UNIVERSITY****B. E. Sem-VI Examination May 2011****Subject code: 160404****Subject Name: Instrumentation and process control****Date: 21/05/2011****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) A thermometer having a time constant of 10 second is placed in a temperature bath. After the thermometer reaches steady state temperature of 30°C it is suddenly placed into a hot fluid at 60°C. Sketch the response of the thermometer. **07**
- (b) Explain servo and regulatory problems with suitable examples. **07**

- Q.2** (a) Obtain the transfer function for N-identical non-interacting system in series. **07**
- (b) A step change of magnitude 6 is introduced into a system having transfer function, **07**

$$G(S) = 16 / (1.5s^2 + 2.4s + 6)$$

Determine the following,

- (i) Overshoot
- (ii) Period of oscillation
- (iii) Rise time

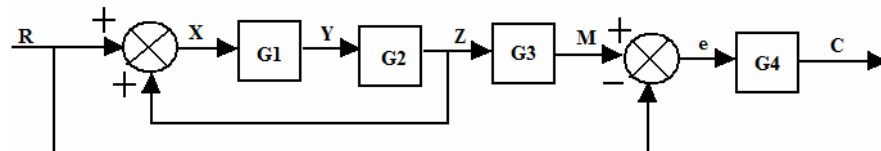
**OR**

- (b) Derive the relationship between output pressure and error for **07**
- (i) PI Controller
  - (ii) PD Controller

- Q.3** (a) Derive the Transfer Function of U-tube manometer with its basic assumptions and limitations. **07**
- (b) Describe the principle, construction and working of thermocouple for temperature measurement. **07**

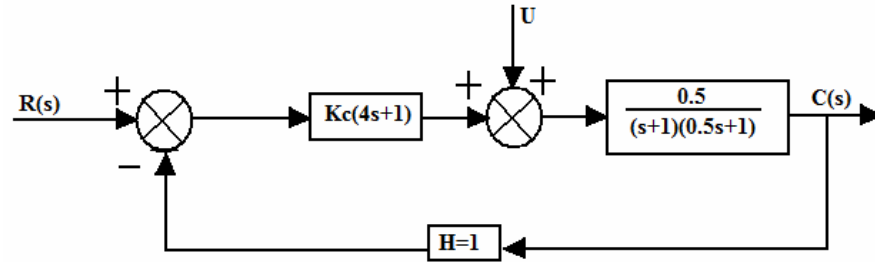
**OR**

- Q.3** (a) Determine the overall transfer function  $C(s)/R(s)$  for the following system **07**



- (b) What are the static characteristics of an instrument? **07**
- Define,
- (i) Accuracy
  - (ii) Reproducibility
  - (iii) Sensitivity

- Q.4** (a) Define the term stability. Determine the stability of the following control system for  $k_c=4$  by routh test. Assume unity feedback control system. **07**



- (b) When will you employ differential pressure method for level measurement? Describe its construction and working with neat sketch. **07**

**OR**

- Q. 4** (a) Sketch the root locus diagram for the system having open loop transfer function. **07**

$$G(s) = \frac{k_c}{s(s+1)(s+2)}$$

Indicate all poles, zero, centre of gravity, breakaway point, asymptotic lines, the direction in which loci travel. Determine the value of  $k_c$  for which system become just unstable.

- (b) Explain principle, construction and working of venturimeter. **07**

- Q.5** (a) Define the concept of cascade control and give the applications and advantages of cascade control. **07**

- (b) Define- **07**

- (i) Absolute humidity      (ii) Relative Humidity
- (iii) Dry bulb temperature      (iv) wet bulb temperature
- (v) Dew point temperature

**OR**

- Q.5** (a) A unit step change is given to a PI controller. If the proportional sensitivity or gain  $K_c$  is 4, the integral time  $\tau_I$  is 2, Obtain the response of the PI controller. **07**

- (b) How pH can be measured using calomel reference electrode. **07**

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