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| **Name:**<br>**Enrolment No:** | UPES<br>UNIVERSITY WITH A PURPOSE |

**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, May 2019**

**Course:Instrumantation & Control** **Semester:IV**
**Program:Mechatronics** **Time : 03 hrs.**
**Course Code: ECEG2004** **Max. Marks: 100**

**Instructions:**

**SECTION A**

| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | List the desirable characteristics of transducer elements. | **5** | **CO1** |
| Q 2 | Classify the different type of instrumentation. | **5** | **CO1** |
| Q 3 | List the static and dynamic characteristic of the instrumentation. | **5** | **CO2** |
| Q 4 | List the selection parameters of instrumentation. | **5** | **CO2** |

**SECTION B**

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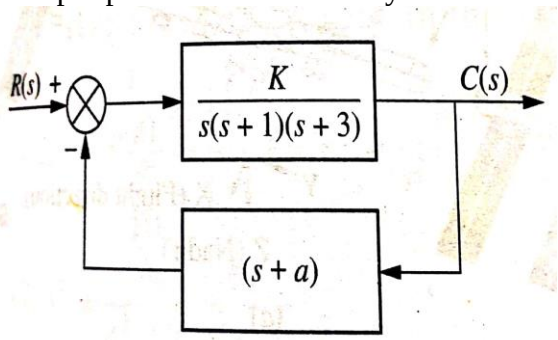
| Q 5 | Given the system shown in figure 1, find the sensitivity of the steady -state error to parameter a. Assume a step input. Plot the sensitivity as a function of parameter a.<br>  <br><br>Figure 1 | **10** | **CO2** |
| Q 6 | A dynamic voltage resistor (DVR) is a device that is connected in series to a power supply. It continuously monitors the voltage delivered to the load, and compensates voltage sags by applying the necessary extra voltage to maintain the load voltage constant. In the model shown in figure 2, $u_r$ represents the desired reference voltage,$u_o$ is the output voltage, and $Z_L$is the load impedance. All other parameters are internal to the DVR<br>(a) assuming $Z_L = \frac{1}{sC_L}$, and β≠1, find the system's type<br>(b) find the steady-state error to a unit step input as a function of β | **10** | **CO3** |

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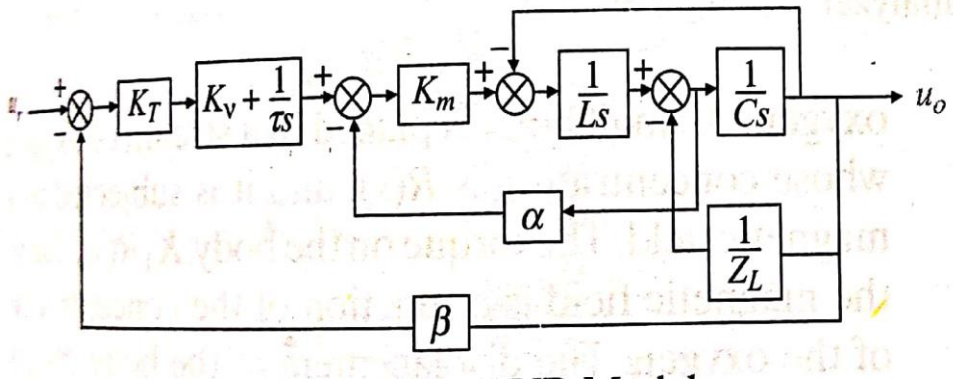
| |  <br>Figure 2 | | |
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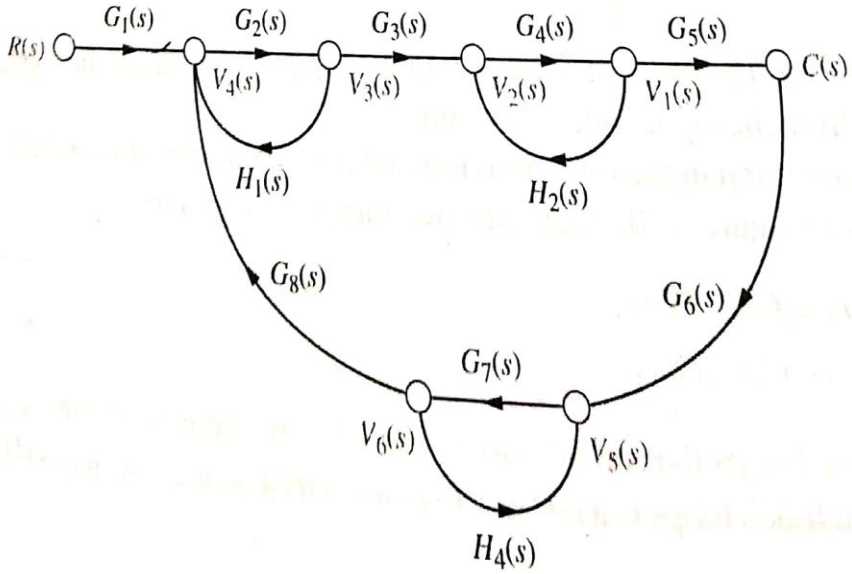
| Q 7 | Describe the effect of damping factor for the second order system. | **10** | **CO3** |
| Q 8 | Describe the signal flow graph for demonstrating Mason's rule.<br>OR<br>Find the transfer function C(s)/R(s), for the signal-flow graph in figure 3.<br>  <br>Figure 3 | **10** | **CO3** |
| **SECTION-C** | | | |
| Q 9 | Given a unity feedback system that has the forward transfer function<br>$$G(s) = \frac{K(s+2)}{(s^2 - 4s + 13)}$$<br>Evaluate the following<br>(a). Sketch the root locus<br>(b)Find the imaginary -axis crossing<br>(c)Find the gain, K, at the $jw$-axis crossing<br>(d)Find the break-in point | **20** | **CO4** |

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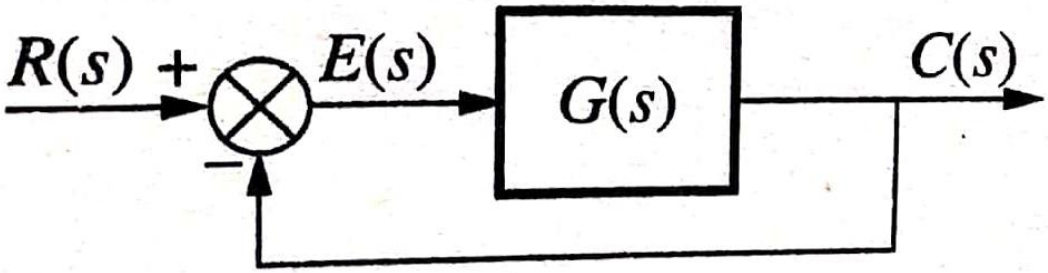
| | (e)Find the angle of departure from the complex poles | | |
| Q 10 | Sketch the Bode plots for the system shown in figure4, where $G(s) = \frac{K(s+3)}{s(s+1)(s+2)}$. Comment the stability of the system and determine the range of gain $K$.<br>  <br><br>OR<br>For the unity feedback system of figure 4, where $G(s) = \frac{K}{s(s+3)(s+5)}$, find the range of gain, $K$ . for stability, instability, and the value of gain for the marginal stability . For marginal stability also find the frequency of oscillation. Use the Nyquist criterion. | **20** | **CO4** |
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