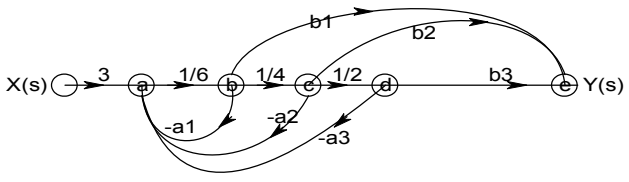
**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, April/May 2018**

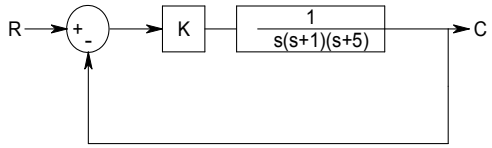
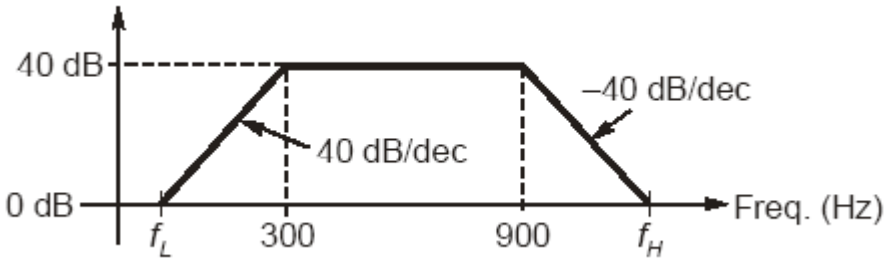
**Course: Control system Engineering** **Semester: VI**
**Program: B.TECH EE**
**Time: 03 hrs.** **Max. Marks: 100**

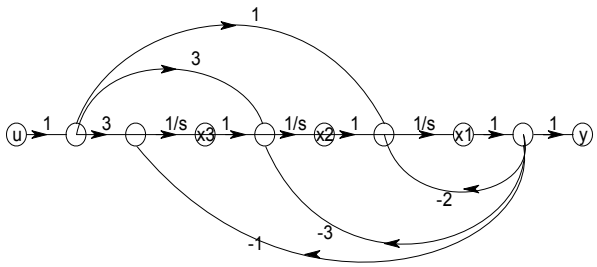
**Instructions: All questions are compulsory**

## SECTION A

| S. No. | | Marks | CO |
|---|---|---|---|
| Q1. | Comment on the stability and location of poles of the given characteristic equation, 1+G(s)H(s)= $\mathbf{s^6+3s^5+4s^4+6s^3+5s^2+3s+2.}$ | **5** | **CO2** |
| Q2. | The open loop transfer function of a unity feedback system is given by G(s) = K/s(s+3)($s^2$+s+1). Determine the value of K that will cause sustained oscillations in the closed loop system. Also, find the natural frequency of oscillation? | **5** | **CO3** |
| Q3. | Evaluate the Transfer Function T (s) from the given bode plot and define the term Crossover frequency. | **5** | **CO3** |
| Q4. | Evaluate the open loop transfer function G(s) of the signal flow graph given below using mason's gain formula. Assume unity gain feed back   | **5** | **CO1** |

## SECTION B

| | | | |
|---|---|---|---|
| Q 5 | (a)Evaluate the break-away points of the root locus defined for G(s)H(s)= K/s(s+2)(s+3)?<br>(b).What will be the value of K so that the closed loop system shown in figure becomes marginally stable?<br>  | **10** | **CO2,CO1** |
| Q6 | A first order closed loop control system is defined by T(s) = K/(s+a).If a unit step input is applied, the system response reaches 50 % of its steady state value in 20 sec. How much time will it take the response to reach 99% of the steady state value? Plot the curve also? | **10** | **CO2** |
| Q7. | A feed-back control system is given by G(s) = 10/s(1+0.2s)(1+0.01s), H(s)=1, Determine the followings:<br>(a)Gain crossover and phase crossover frequencies.<br>(b)Gain margin and phase margin<br>(c)The stability of the closed loop system | **10** | **CO4** |
| Q8. | Evaluate the bandwidth of the bode plot given in the figure below?<br>  | **10** | **CO4** |
| | **SECTION-C** | | |
| Q9. | Design a closed loop Second order system for an analog voltmeter such that:<br>(a). The pointer of the analog meter will final settles at 10 V after some time.<br>(b). For second cycle the peak overshoot measured as 10%.<br>(c). Time duration between first peak time and 3rd peak time noticed as 20s.<br><br>Also determine the output response equations and draw the output and input on same scale. | **20** | **CO2,CO4** |
| Q10. | Evaluate the Transfer Function of the control system from the signal flow graph given below and calculate the following? | **20** | **CO4,CO3** |




(a) Find state transition matrix
(b) Comment on the controllability and observability
(c) Comment on the stability of the control system.