Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**End Semester Examination – April/May– 2017**

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| **Code :** | **14EI3010** | **Duration :** | **3hrs** |
| **Sub. Name :** | **CONTROL SYSTEM DESIGN** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Consider a unity feedback system with open loop transfer function . Design a PD controller so that the phase margin of the system is 300 at a frequency of 1.2 rad/sec. | CO1 | 15 |
| b. | What is PID controller and what are its effect on system performance? | CO1 | 5 |
| (OR) | | | | |
| 2. | a. | Derive the mathematical model of zero-order hold circuit. | CO2 | 15 |
| b. | Describe the methods of discretization. | CO2 | 5 |
| 3. | a. | An Unity feedback system has an open loop transfer function, . Design a suitable Lag Compensator so that phase margin is 40 ͦ and the steady state error for ramp input is less than or equal to 0.2. | CO1 | 15 |
|  | b. | What are the factors to be considered for choosing series compensation? | CO1 | 5 |
| (OR) | | | | |
| 4. | a. | Demonstrate the procedure for the design of Lag Compensator using Bode Plot. | CO1 | 15 |
|  | b. | What are the practical aspects that should be considered while selecting the sampling rate? | CO1 | 5 |
| 5. | a. | The forward path transfer function of a certain unity feedback control system is given by  design a suitable lag compensator so that he system meet the following specifications. The Percentage overshoot ≤16% for unit step input, steady state error ≤0.125 for unit ramp input. | CO1 | 15 |
|  | b. | Explain how root loci are modified when a zero is added to open loop transfer function? | CO1 | 5 |
| (OR) | | | | |
| 6. | a. | Design a Lag-Lead compensator for a system with open loop transfer function  to satisfy the following specifications. (i) Damping ratio of dominant closed loop poles, ζ=0.5; (ii) Undamped natural frequency of dominant closed loop poles, ωn = 5 rad/sec; (iii) Velocity error constant, Kv=80 sec-1. | CO1 | 15 |
|  | b. | Illustrate the Frequency response of the Lag Compensator. | CO1 | 5 |
| 7. | a. | Investigate the use of H-J-B equation as a means of solving the general form of the continuous linear regulator problem. | CO3 | 15 |
|  | b. | Explain the configuration of digital control scheme. | CO2 | 5 |
| (OR) | | | | |
| 8. | a. | Briefly explain the importance of dynamic programming in optimal control with the example of routing problem. | CO3 | 15 |
|  | b. | Explain principle of optimality. | CO3 | 5 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Consider a linear system described by the transfer function    Design a feedback controller with a state feedback so that the closed loop poles are placed at-2,-1±j1 | CO2 | 15 |
|  | b. | Write the controllable phase variable form of state model. | CO2 | 5 |

ALL THE BEST