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| **Scheme of Valuation/Answer Key**  (Scheme of evaluation (marks in brackets) and answers of problems/key) | | | | | |
| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  FIFTH SEMESTER B.TECH(S) DEGREE EXAMINATION, MAY 2019 | | | | | |
| **Course Code: EE303** | | | | | |
| **Course Name: LINEAR CONTROL SYSTEMS** | | | | | |
| Max. Marks: 100 | | |  | Duration: 3 Hours | |
| **PART A** | | | | | |
|  |  | ***Answer all questions, each carries5 marks.*** | | | Marks |
| 1 |  | Definition -2 Marks  Derivation – 2 Marks  Assumptions - 1 Mark | | | ( 5) |
| 2 |  | Diagram – 1 Mark  Specifications – 4 x 1 Mark | | | (5 ) |
| 3 |  | Error coefficients Co= 0.1, C1= 9/10, C2 = -9/500 : 3 Marks  e(t) = 1/10 (1.234 + 2.27t + 1.5t2 ) : 2 Marks  Note: It is not necessary that the answer should be give in the above simplified form | | | (5) |
| 4 |  | Mark closed loop poles on s-plane for all values of K : 3 Marks  Root Locus: 2 Marks | | | (5) |
| 5 |  | If the student has marked gain and phase cross over frequency and explained GM and PM give 5 Marks | | | (5) |
| 6 |  | Figure with markings : 2marks explanation of frequency domain specifications :3 Marks | | | (5) |
| 7 |  | Examples: 2 Marks  Explanation: 3 Marks | | | (5) |
| 8 |  | Example: 2 Marks  Representation: 3 Marks | | | (5) |
| **PART B** | | | | | |
| ***Answer any twofull questions, each carries10 marks.*** | | | | | |
| 9 | a) | signal flow graph : 3 Marks  overall transfer function: 3 Marks | | | (6 ) |
|  | b) | Block Diagram Reduction : 4Marks | | | ( 4) |
| 10 | a) | constructional features: 3 Marks  principle of operation: 3 Marks | | | (6) |
|  | b) | Advantages: 2 Marks  Applications: 2 Marks | | | (4) |
| 11 | a) | Step Response b=4: 1- 2te-t –e-2t  b=5: 1 + 1/3 e-4t – 4/3 e-t  2 x 4 Marks | | | (6) |
|  | b) | Circuit diagrams :2 marks(1+1)  Explanation of Force voltage analogy: 1 Marks  Explanation of force current analogy :1marks | | | (4) |
| **PART C** | | | | | |
| ***Answer any twofull questions, each carries10 marks.*** | | | | | |
| 12 | a) | Error constants : 2 Marks  Errors: 4 Marks | | | ( 6) |
|  | b) | Steady state error to ramp input decreases, Other errors remains the same: 4 Marks | | | ( 4) |
| 13 | a) | open loop poles: 2 Marks  closed loop poles: 2 Marks  roots of the characteristic equation: 1 Marks | | | (5) |
|  | b) | a1a2> a0a3 | | | (5) |
| 14 | a) | open loop poles: 2 Marks | | | (2) |
|  | b) | root locus: 5 Marks  range of values of K= 0 to 0.4: 1 Mark  closed loop poles corresponding to a damping ratio of 0.7 : 2 Marks | | | (8) |
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| **PART D** | | | | | |
| ***Answer any twofull questions, each carries 10 marks.*** | | | | | |
| 15 | a) | Bode plot magnitude and phase angle plot: 4Marks  Gain crossover frequency 2 Marks | | | (6) |
|  | b) | Angle at w=0: 4 Mark | | | ( 4) |
| 16 | a) | Magnitude Plot (Gain Cross over=0.9 ) : 4 Marks  Phase plot (phase cross over=3.2) : 2 Marks  Note: There are different methods for drawing Bode plot. Students may draw individual plots and add them or draw the net plot. In either case if the answer is correct, full credit needs to be given. Being graphical method minor variation in the value of the answers should be ignored.  Gain margin :2 marks phase margin :2 marks | | | (10) |
|  | b) | Gain margin (17dB) and phase margin (56 degree): 2x 2 Marks  Being graphical method minor variation in the value of the answers should be ignored. | | | (4) |
| 17 | a) | polar plot : 2 Marks  Complete Nyquist plot: 4 marks  Ans: Nyquist plot does not encircle -1+j0 twice, Hence stable : 2 Marks  Ans K<3: 4 Marks | | | (10) |
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