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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 MarksDerivation – 2 MarksAssumptions - 1 Mark | ( 5) |
| 2 |  | Diagram – 1 MarkSpecifications – 4 x 1 Mark | (5 ) |
| 3 |  | Error coefficients Co= 0.1, C1= 9/10, C2 = -9/500 : 3 Markse(t) = 1/10 (1.234 + 2.27t + 1.5t2 ) : 2 MarksNote: 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 MarksRoot 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 MarksExplanation: 3 Marks | (5) |
| 8 |  | Example: 2 MarksRepresentation: 3 Marks | (5) |
| **PART B** |
| ***Answer any twofull questions, each carries10 marks.*** |
| 9 | a) | signal flow graph : 3 Marksoverall transfer function: 3 Marks$$\frac{G\_{1}G\_{2}+G\_{1}G\_{3}}{1- G\_{1}G\_{2}}$$ | (6 ) |
|  | b) | Block Diagram Reduction : 4Marks | ( 4) |
| 10 | a) | constructional features: 3 Marks principle of operation: 3 Marks | (6) |
|  | b) | Advantages: 2 MarksApplications: 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 MarksExplanation of force current analogy :1marks | (4) |
| **PART C** |
| ***Answer any twofull questions, each carries10 marks.*** |
| 12 | a) | Error constants : 2 MarksErrors: 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 Marksclosed 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: 4MarksGain crossover frequency 2 Marks | (6) |
|  | b) | Angle at w=0: 4 Mark | ( 4) |
| 16 | a) | Magnitude Plot (Gain Cross over=0.9 ) : 4 MarksPhase plot (phase cross over=3.2) : 2 MarksNote: 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 MarksBeing graphical method minor variation in the value of the answers should be ignored. | (4) |
| 17 | a) | polar plot : 2 MarksComplete Nyquist plot: 4 marksAns: Nyquist plot does not encircle -1+j0 twice, Hence stable : 2 MarksAns K<3: 4 Marks | (10) |
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