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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**SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019 |
| **Course Code: EE304** |
| **Course Name: ADVANCED CONTROL THEORY** |
| Max. Marks: 100 |  | Duration: 3 Hours |
| **PART A** |
|  |  | ***Answer all questions, each carries5 marks.*** | Marks |
| 1 |  | Comparison –Any five points- 5x1 =5 marks | (5) |
| 2 |  | Effect of Lag compensator….2.5 marksEffect of Lag lead compensator-2.5 marks  | (5) |
| 3 |  |  definitions- 5x 1 = 5 marks | (5) |
| 4 |  | Definition-3 marks, Derivation / writing transfer function - 2 marks | (5) |
| 5 |  | Five characteristics- 5 x 1=5 marks | (5) |
| 6 |  | Definition- 2 marks, Use of DFon stability analysis- 3 marks | (5) |
| 7 |  | Singular point-2.5 marks, Eigen values offivetypes of singular points- 2.5 marks | (5) |
| 8 |  | Liapunov stability statements …. 2 marks stable at origin, asymptotically stable, asymptotically stable in the large- 1 mark each (3 x 1=3) marks | (5) |
| **PART B** |
| ***Answer any twofull questions, each carries10 marks.*** |
| 9 |  | K=5-1 markBode plot-4 marksCompensator Transfer functionGc(s)=10(1+20S) / (1+200S) ( may not same)-5 marksNote: Note: The position of compensator zero can be one octave to one decade below the gain cross over frequency. So according to this choice position of zero may change and pole will be at (zero/β). Proper marks should be given considering the choice of zero. | (10) |
| 10 |  | Damping ratio=0.6-1 markDominant poles=7.2±j9.6- 1 markGain,K=150- 2 marksPole-zero plot-2 marksTransfer function of compensatorGc(s)=(s+9.1) / (s+16.25) [may not be same]-4 marksNote: Note: Lead compensator zero may be placed just below the dominant pole on the real axis. So according to the choice of the zero, pole location also change to satisfy the | (10) |
| 11 | a) | Two methodswith necessary curves and table of parameters 3 marks each | (6) |
|  | b) | Series and feedback compensation-2 marks each | (4) |
| **PART C** |
| ***Answer any twofull questions, each carries10 marks.*** |
| 12 | a) | Definitions of controllability and observability- (2x1) - 2 marks Determination of Qc matrix – 3 marksControllability determination from Qc matrix-1 mark | (6) |
|  | b) | 2 necessary conditions are satisfied-1 mark3 sufficient conditions are satisfied-2 marksStable-1 mark | (4) |
| 13 |  | Pulse transfer functionC(z)= Z[Go(s)G(s)]R(z)/[1+Z(Go(s)G(s))]- 4 marksOutputC(k)=0.5-0.5(-0.264)k- 6 marks | (10) |
| 14 | a) | Equations & State variables – 1 markState equation-1 markOutput equation-1 mark | (3) |
|  | b) | State equation – 1 markControllability – 2 marksCharacteristic polynomial – 1 markState feedback gain matrix, K=[0.4 0.4 0.1]- 3 marks | (7) |
| **PART D** |
| ***Answer any twofull questions, each carries 10 marks.*** |
| 15 |  | saturation or dead zone non-linearity.Sinusoidal response – 3 marksOutput equation – 1 markDescribing function derivation - 6 marksNote: if the student derives saturation and dead zone separately full marks should be given. | (10) |
| 16 |  | Plot of G(jw)-3 marksPlot of -1/KN –3 marksmaximum value of K=2.25-2 marksFrequency of limit cycle=0.707 rad/sec- 2 marks | (10) |
| 17 |  | Singular pointSingular point is the origin-2 marksConstruction of phase trajectory-6 marksNature of singular point and stabilitySingular point is stable focus-2 marks | (10) |
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