|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 mark  Bode plot-4 marks  Compensator Transfer function  Gc(s)=10(1+20S) / (1+200S) ( may not same)-5 marks  Note: 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 mark  Dominant poles=7.2±j9.6- 1 mark  Gain,K=150- 2 marks  Pole-zero plot-2 marks  Transfer function of compensator  Gc(s)=(s+9.1) / (s+16.25) [may not be same]-4 marks  Note: 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 marks  Controllability determination from Qc matrix-1 mark | | | (6) |
|  | b) | 2 necessary conditions are satisfied-1 mark  3 sufficient conditions are satisfied-2 marks  Stable-1 mark | | | (4) |
| 13 |  | Pulse transfer function  C(z)= Z[Go(s)G(s)]R(z)/[1+Z(Go(s)G(s))]- 4 marks  Output  C(k)=0.5-0.5(-0.264)k- 6 marks | | | (10) |
| 14 | a) | Equations & State variables – 1 mark  State equation-1 mark  Output equation-1 mark | | | (3) |
|  | b) | State equation – 1 mark  Controllability – 2 marks  Characteristic polynomial – 1 mark  State 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 marks  Output equation – 1 mark  Describing function derivation - 6 marks  Note: if the student derives saturation and dead zone separately full marks should be given. | | | (10) |
| 16 |  | Plot of G(jw)-3 marks  Plot of -1/KN –3 marks  maximum value of K=2.25-2 marks  Frequency of limit cycle=0.707 rad/sec- 2 marks | | | (10) |
| 17 |  | Singular point  Singular point is the origin-2 marks  Construction of phase trajectory-6 marks  Nature of singular point and stability  Singular point is stable focus-2 marks | | | (10) |
| \*\*\*\* | | | | | |