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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 DEGREE EXAMINATION(S), MAY 2019 |
| **Course Code: AE301** |
| **Course Name: CONTROL SYSTEM** |
| Max. Marks: 100 |  | Duration: 3 Hours |
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| **PART A**  |
|  |  | ***Answer any two full questions, each carries 15 marks.*** | Marks |
| 1 | a) | Comparison with any three points (1x3); block schematic is desirable. | ( 3) |
|  | b) | Differential equations formation (6), force voltage analogous circuit (2) | (8 ) |
|  | c) | Static error coefficient (1), steady state error (3) | ( 4) |
| 2 | a) | Two features for both ( 4x0.5) | (2 ) |
|  | b) | Masons gain formula (1), forward path (3), loop gains including non- touching combinations (4), value of delta (1), final answer (1). | (10) |
|  | c) | Definition for both (2), any one transfer function example (1) | (3) |
| 3 | a) | Elimination of 3 inner loops to get final answer (5), signal flow graph (2) | (7) |
|  | b) | Closed loop transfer function (2), equation of maximum overshoot (1), derivation of relation between K and delta (2), damping ratio values (2), Final answer (1) | (8) |
| **PART B**  |
| ***Answer any two full questions, each carries 15 marks.*** |
| 4 | a) | Any three significant points (3) | (3 ) |
|  | b) | R.H criteria statement or concept (1), Routh array construction (3), location of roots (1), Comment on the stability (1). | (6) |
|  | c) | Magnitude and angle evaluation of G(jω) for ω =0 and infinity (3), crossing point on axis(1.5), final rough sketch (1.5) | (6 ) |
| 5 | a) | Definition with expression (1x2), value of GM for critically stable system (1) | (3) |
|  | b) | Poles and zeros (1), Angle of asymptotes (2), centroid(1), existence of root locus on real axis (1), break away points (2), value of K and ω (2), Final sketch on *graph sheet*(3). | (12) |
| 6 | a) | Definition (2), example(1) | (3) |
|  | b) | Sinusoidal transfer function and corner frequencies (1), initial gain in dB and initial slope (1), magnitude plot calculation (2), phase angle plot calculation (2), plots on *semi log sheet* (3), Gain and phase margin (2), comment on stability (1) | (12) |
| **PART C**  |
| ***Answer any two full questions, each carries20 marks.*** |
| 7 | a) | Definition (2), four distinct advantages (4x1) | (6) |
|  | b) | Differential equations governing the electrical network(2), state equations (2), state model (2). | (6) |
|  | c) | Transfer function equation(1), determination of [sI-A]-1(3), Transfer function (4) | (8) |
| 8 | a) | Four properties (4x1), no need for derivation. | (4) |
|  | b) | Characteristic equation formula (1), finding characteristic polynomial equation (4), solving C.E for getting poles (2), comment on stability (1). | (8) |
|  | c) | Advantages (1), Methods for diagonalization (3), determination of eigen values (3), Diagonalization using property of eigen values of [A](1). | (8) |
| 9 | a) | Definition (2x1): statement only needed. | (2) |
|  | b) | Re-arrangement of transfer function to the form of Masons gain formula (1), state variable assumption and signal flow graph representation (4), sate equations (3)State model of the system (2). | (10) |
|  | c) | Formula of Qc (1), Determination of Qc (2), comment on controllability with reason (1).Formula of Qo (1), Determination of Qo (2), Comment on observability with reason (1)… Total (4+4). | (8) |
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