



APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2019

Course Code:AE405

Course Name: ADVANCED CONTROL THEORY

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) 5 Marks ()
- b) Solution expression derivation 10 marks ()

- 2 a) 1.25 marks each ()
- b) 6 singularities , total 10 marks ()

- 3 a) 1 mark for each ()
- b) Stable focus (5 marks) ()
- c) Adv 2.5 marks, dis adv 2 .5 marks ()

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) **Solution:** The describing function for saturation, for the given set of parameters, is given by (10)

$$k_{eq} = \begin{cases} 1, & |X| < 1 \\ \frac{2}{\pi} \left[\sin^{-1} \left(\frac{1}{X} \right) + \frac{1}{X} \sqrt{1 - \frac{1}{X^2}} \right], & |X| > 1 \end{cases}$$

The describing function is real; therefore, $-(1/k_{eq})$ plot will be on the negative side of the real axis. It will start from $(-1, j0)$ and move towards negative infinity as X assumes large values.

Now,

$$-\frac{1}{k_{eq}} = -\frac{1}{\frac{20}{\pi} \left[\sin^{-1} \left(\frac{0.1}{X} \right) + \frac{0.1}{X} \sqrt{1 - \frac{0.01}{X^2}} \right]} = -\frac{1}{6}$$

or

$$\left[\sin^{-1} \left(\frac{0.1}{X} \right) + \frac{0.1}{X} \sqrt{1 - \frac{0.01}{X^2}} \right] = \frac{6\pi}{2} = 0.942$$

The value of X is to be calculated by trial and error method.

- b) Merits-(2.5)mark ,demerits-.5 mark ()



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Pages 2

- 5 a) 10 marks 0
b) Concept- 3 marks, method-2 marks 0
- 6 a) P matrix-5 mark, $v(x)$ - marks 0
b) 5 Mark 0

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Z transform-8 marks 0
b) Inverse z transform-12 marks 0
- 8 a) 10 marks 0
b) Controllability-5 mark, Observability- 5 mark 0
- 9 a) 10 marks 0
b) Loose of controllability and observability(10 marks) 0

