Hall Ticket No. | | | | | | | | | | | Question Paper Code: AAE018

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech VIII Semester End Examinations, April - 2020

Regulations: R16

FLIGHT CONTROL THEORY

(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer **ONE** Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. a) List the merits of open loop system and Discuss the need for a stable System. [7M]
   b) Describe a SISO Single input single output) system and a MIMO (Multiple input and multiple output) system and explain how they are analyzed. [7M]

2. a) Discuss the rules and conventions of reducing the block diagram of complex systems? [7M]
   b) Explain the role of feedback in stability augmentation, control Augmentation and automatic control with example. [7M]

UNIT – II

3. a) Explain the difference between system parameters and characteristic Parameters of control systems. [7M]
   b) Discuss the relationship between impulse response and transfer function with the suitable example. [7M]

4. a) A control system is defined by the following differential equation. Find the output response y (t) using Laplace transform method. Assuming y(t) and dy(t)/dt are zero at t = 0. [7M]
   $$\frac{d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 12y(t) = u(t)$$
   where u (t) is unit step unit.
   b) Discuss the procedure of experimental determination of system transfer functions by frequency response measurements. [7M]

UNIT – III

5. a) Differentiate between transient state and steady state with suitable examples and its necessity. [7M]
   b) List the examples of second order system with the help of transient state equation and explain it. [7M]

6. a) Discuss and differentiate between Time and frequency response and explain them with the neat sketch. [7M]
   b) How does the PD controller affect the bandwidth of a control system and which errors will occur? [7M]

UNIT – IV

7.	a)	What is the purpose of stability augmentation system and its importance in the control systems?	[7M]
	b)	Explain how a modern design technique helps in designing SAS (Stability Augmentation System) as well as autopilots	[7M]
8.	a)	Briefly explain about the controls that control the Pitching moment and rolling moment in aircraft stability.	[7M]
	b)	Differentiate between stability control system and control augmentation system.	[7M]

UNIT – V

9.	a)	Write the advantages and disadvantages of digital control system over analog control system.	[7M]
	b)	State the concept of Digital control in the modern control theory with help of neat sketch.	[7M]
10.	a)	Explain the multiple input multiple output systems with the block diagram and its applications.	[7M]
	b)	Discuss the significance of Canonical transformation of state equations to solve problems in modern control theory.	[7M]

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COURSE OBJECTIVES:

The course should enable the students to:

I	Apply stability criteria to determine the stability of an aircraft, and specify the aircraft time-domain and frequency-domain response specifications.
II	Understand Classical control theory in the frequency domain and modern control theory in the state- space are effectively mixed to provide the student with a modern view of systems theory.
III	Design control techniques for aircraft control systems, and study some feedback control applications.
IV	Study the controllability and observability of aerospace systems, and apply the modern control techniques to design enhanced flight control systems.

COURSE OUTCOMES (COs):

CO 1	Describe the analysis techniques for classical control theory to nonlinear system
CO 2	To describe and analyze the physical system with inherent non-linearity for stability and performance.
CO 3	Provide knowledge on various adaptive schemes, with a basic understanding on closed loop system stability and implementation issues
CO 4	Describe the principle of approximations to aircraft transfer functions, control surface actuators-review. response of aircraft to elevator input, response of aircraft to rudder input and response of aircraft to aileron input to atmosphere
CO 5	Define reversible and irreversible flight control systems. flying qualities of aircraft-relation to airframe transfer function. pilot's opinion ratings. flying quality requirements- pole-zero, frequency response and time- response specifications

COURSE LEARNING OUTCOMES (CLOs):

AAE018.01	Define the basic concepts associated with Control Theory and its application.
AAE018.02	Review Fourier Transform with mathematical operations and its applications.
AAE018.03	Review Laplace Transform and some other important mathematical operations.
AAE018.04	Understand about the concepts of Transfer function, its merits and applications.
AAE018.05	Understand the control system performance with the time domain description.
AAE018.06	Analyze the steady state response and application of feedback in augmentation controls.
AAE018.07	Understand the control system performance with the frequency domain description.
AAE018.08	Analyze an aircraft’s performance to controls and related aspects.
AAE018.09	Evaluate an aircraft’s performance from the control point of view as a system.
AAE018.10	Determine the Approximations to aircraft transfer functions.
AAE018.11	Understand about stability augmentation systems for an aircraft with autopilot system.
AAE018.12	Determine the Flying qualities of aircraft and requirements.

AAE018.13	Understand about the concepts of feedback control its merits and applications.
AAE018.14	Understand the concept of control surface actuators and its usage in aircraft applications.
AAE018.15	Determine the Displacement and rate feedback determination of gains conflict with pilot inputs resolution

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Bloom's Taxonomy Level
1	a	AAE018.01	Define the basic concepts associated with Control Theory and its application.	CO1	Understand
	b	AAE018.01	Define the basic concepts associated with Control Theory and its application.	CO1	Remember
2	a	AAE018.02	Review Fourier Transform with mathematical operations and its applications.	CO1	Understand
	b	AAE018.03	Review Laplace Transform and some other important mathematical operations.	CO1	Remember
3	a	AAE018.04	Understand about the concepts of Transfer function, its merits and applications.	CO2	Understand
	b	AAE018.05	Understand the control system performance with the time domain description.	CO2	Understand
4	a	AAE018.06	Analyze the steady state response and application of feedback in augmentation controls.	CO2	Remember
	b	AAE018.06	Analyze the steady state response and application of feedback in augmentation controls.	CO2	Understand
5	a	AAE018.07	Understand the control system performance with the frequency domain description.	CO3	Remember
	b	AAE018.07	Understand the control system performance with the frequency domain description.	CO3	Understand
6	a	AAE018.08	Analyze an aircraft's performance to controls and related aspects.	CO3	Remember
	b	AAE018.09	Evaluate an aircraft's performance from the control point of view as a system.	CO3	Understand
7	a	AAE018.10	Determine the Approximations to aircraft transfer functions.	CO4	Remember
	b	AAE018.11	Understand about stability augmentation systems for an aircraft with autopilot system.	CO4	Understand
8	a	AAE018.11	Understand about stability augmentation systems for an aircraft with autopilot system.	CO4	Remember
	b	AAE018.12	Determine the Flying qualities of aircraft and requirements.	CO4	Understand
9	a	AAE018.13	Understand about the concepts of feedback control its merits and applications.	CO5	Understand
	b	AAE018.14	Understand the concept of control surface actuators and its usage in aircraft applications.	CO5	Remember
10	a	AAE018.15	Determine the Displacement and rate feedback determination of gains conflict with pilot inputs resolution	CO5	Understand
	b	AAE018.15	Determine the Displacement and rate feedback determination of gains conflict with pilot inputs resolution	CO5	Remember

Signature of Course Coordinator **HOD, AE**