



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

AERONAUTICAL ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	CONTROL THEORY – APPLICATION TO FLIGHT CONTROL SYSTEMS
Course Code	:	R15-A72119
Class	:	IV B Tech I Semester
Branch	:	AERONAUTICAL ENGINEERING
Year	:	2018 – 2019
Course Coordinator	:	Ms. D. Anitha, Assistant Professor, Dept of AE.
Course Faculty	:	Ms. D. Anitha, Assistant Professor, Dept of AE.

OBJECTIVES

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S No	QUESTION	Blooms Taxonomy level	Course Outcomes
ASSIGNMENT-I UNIT - I CONTROLSYSTEMS-MODELING, FEEDBACK CONTROL			
1	a. Discuss the purpose and functioning of various filters used in control systems. b. How is overall system stability determined?	Remember	1
2	Describe a SISO (Single input single output) system and a MIMO (Multiple input and multiple output) system and explain how they are analyzed.	Understand	1
3	Describe non linear system and discuss how they are linearized?	Understand	1
4	Explain the role of feedback in stability augmentation, control augmentation and automatic control with example.	Remember	1
5	Discuss use of transducer, sensor and filter in control system.	Understand	1
6	a. With example explain the method of modeling dynamical systems using differential equations. b. Discuss modeling and transfer function of servomotor and actuators.	Remember	1
7	a. Discuss merits of feedback control. b. Discuss modeling and transfer function of different filters used in aircraft control	Understand	1
8	a. Discuss deterministic and stochastic control system. b. Discuss application of feedback in stability augmentation system.	Understand	1
9	Functionally, how do closed-loop systems differ from open-loop system? Also give three examples of open loop systems.	Remember	1
10	a. Discuss the procedure for analyzing SISO and MIMO system. b. Discuss linear and non-linear systems with examples.	Understand	1

UNIT - II			
PERFORMANCE- TIME, FREQUENCY AND S-DOMAIN DESCRIPTION			
1	For the given transfer function ,Plot pole-zero in complex s-plane $G(s) = \frac{(s^2 + 4)(s-1)(s+2)}{(s^4 + 1)(s^3 + 27)(s^5 - 32)}$	Remember	3
2	<p>Reduce the block diagram shown in the figure to a single transfer function, $G(s) = C(s)/R(s)$.</p>	Understand	2
3	a. Discuss the following: i. Poles and zeros ii. Dominant pole. b. Discuss the following i. Resonant frequency ii. Peak Gain	Understand	2
4	a. Discuss the significance of corner frequencies, resonant frequencies and peak gain of a second order system. b. Explain the experimental method of determining system transfer function by frequency response measurements.	Remember	2
5	a. Find the poles and zeros of a control system whose transfer function is given by $G(s) = \frac{(s+3)}{(s^2 + 7s + 12)}$ b. With example explain the significance of gain and phase margin.	Understand	3
6	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 $t = 0$. $\frac{d^2y(t)}{dt^2} + 7 \frac{dy(t)}{dt} + 12y(t) = u(t)$ where $u(t)$ is unit step unit.	Remember	2
7	a. Discuss the significance of band width, resonant frequencies, peak gain in relation to second order system. b. With example discuss the time domain specifications of second order control system	Understand	3
8	a. Discuss second order system specifications in time domain. b. Transfer function of a control system is $s/((s+1)(s+2))$. Find the response for the unit step input.	Understand	2
9	a. Discuss frequency response method of control system design. b. Discuss Bode and Polar plots.	Remember	2
10	a. Discuss the procedure of experimental determination of system transfer functions by frequency response measurements. b. Discuss the significance of resonant frequency and bandwidth.	Understand	2
UNIT-III			
SPECIFICATION OF CONTROL SYSTEM PERFORMANCE REQUIREMENTS- SYSTEM SYNTHESIS- CONTROLLERS- COMPENSATION TECHNIQUES			
1	Discuss and differentiate between Time and frequency response in control systems.	Remember	2
2	With the suitable examples Differentiate the first order system from second order system?	Remember	2
3	List the specifications in a. Time b. Frequency c. S domain	Understand	5
4	How the desired input varies to output relation between them and Explain steady state systems with specifications	Understand	5
5	Write a short note on a. Accuracy b. Steady state error c. Robustness	Understand	5

ASSIGNMENT-II UNIT-III SPECIFICATION OF CONTROL SYSTEM PERFORMANCE REQUIREMENTS- SYSTEM SYNTHESIS- CONTROLLERS- COMPENSATION TECHNIQUES			
1	Discuss following type of controllers: a. Series controller b. Feedback controller	Remember	5
2	a. Discuss frequency response method of analysis and compensation in control system. b. Discuss implementation, application of adaptive control.	Remember	5
3	Explain briefly about a. Gain scheduling b. Adaptive control	Remember	5
4	a. Discuss merits and constraints of non linear control. b. List the advantages of gain and phase margin with suitable examples.	Understand	5
5	a. Discuss the significance and interpretation of gain margin, phase margin. b. List the advantages and disadvantages of Block diagram Reduction technique	Remember	5
UNIT-IV AIRCRAFT RESPONSE TO CONTROLS-FLYING QUALITIES-STABILITY AND CONTROL AUGMENTATION-AUTO PILOT			
1	a. Discuss the flying qualities requirement of an aircraft. What is pilot's opinion rating? b. Explain the purpose and functioning of pitch, yaw and bank hold auto pilot.	Understand	6
2	a. Briefly explain the role of displacement and rate feedback in the design of stability augmentation system. b. Discuss the role and purpose of displacement auto-pilot.	Remember	8
3	a. List the steps to determine the transfer function of an aircraft. b. Discuss Zeigler and Nichols method in design of controllers.	Understand	6
4	a. Explain the role of auto-pilot as stability augments. b. Discuss briefly functioning of fly-by-wire control.	Understand	10
5	a. Write short notes on reversible and irreversible flight control system. b. Differentiate between stability control system and control augmentation system.	Remember	6
6	a. Discuss the response of an aircraft to pilot's control input and atmosphere. b. Discuss pole-zero and time-response specifications of flying quality requirements.	Understand	8
7	a. With help of block diagram explain the functioning and components of a displacement autopilot. b. Discuss the functioning of normal acceleration command maneuvering autopilot.	Remember	6
8	a. Explain how approximate aircraft transfer function is obtained from control systems. b. Discuss the role of rate feedback in stability augmentation system.	Understand	8
9	a. Discuss the purpose and functioning of fly-by-wire system. b. Discuss the need for automatic control.	Understand	6
10	Briefly explain about the controls that control the Pitching moment and rolling moment in aircraft stability.	Remember	6
UNIT-V MODERN CONTROL THEORY-STATE SPACE MODELING, ANALYSIS			
1	a. Discuss the method of modeling dynamical system using state space equations. b. Discuss general form of time invariant linear system.	Understand	9
2	What is controllability? How do you test the controllability of a system in the modern control systems?	Remember	7
3	a. Define the state variable and state equations with examples. b. Discuss the properties of state transition matrix.	Understand	7
4	Discuss limitation of classical control theory when applied to multiple input multiple output systems.	Understand	9

5	List the advantages and disadvantages of digital control systems with suitable examples.	Remember	7
6	Discuss the advantages of digital control system over analog control system and its usage.	Understand	7
7	Explain the multiple input multiple output systems with the block diagram and its applications.	Remember	9
8	a. Discuss state space modeling of dynamical system. b. Discuss the properties of state –transition matrix.	Understand	7
9	List the significance of a. Controllability b. Observability.	Understand	9
10	Discuss the significance of Canonical transformation of state equations to solve problems in modern control theory.	Remember	7

Prepared By: Ms. D. Anitha, Assistant Professor.

HOD, AE