



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

ASSIGNMENT QUESTIONS

Course Name	:	FLIGHT MECHANICS II
Course Code	:	A52111
Class	:	III B. Tech I Semester
Branch	:	AERO
Year	:	2017 – 2018
Course Coordinator	:	G Swathi, Assistant professor
Course Faculty	:	G Swathi, Assistant professor, A Rathan Babu, Assistant professor

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 Outcome
ASSIGNMENT-I UNIT-I AIRCRAFT IN EQUILIBRIUM FLIGHT- ELEVATOR ANGLE AND STICK FORCES TO TRIM- LONGITUDINAL STATIC AND MANEUVER STABILITY			
1	How many degrees of freedom an aircraft has?	Understand	1
2	Write down the rotational and translational motion of an airplane. .	Apply	1
3	Define what is meant by equilibrium condition for an airplane.	Apply	1
4	Define what is meant by static stability.	Apply	1
5	Define dynamic stability.	Knowledge	1
6	Represent the body axis coordinate system of an airplane and list down the forces, moments and velocity components of an airplane and also show them on the sketch.	Understand	1
7	Explain with relevant figure, the equilibrium conditions of an airplane in a longitudinal symmetric flight.	Understand	1

8	Describe the static stability conditions about the three axis of an airplane.	Understand	1
9	Explain the requirements for static and dynamic stability for an airplane.	Knowledge	1
10	What are the primary and secondary controls and also explain the purpose of each of these controls	Understand	1
UNIT-II			
ESTIMATION OF AERODYNAMIC FORCE AND MOMENT DERIVATIVES OF AIRCRAFT			
1	Write down the expressions for stability derivatives of an airplane in pitch, yaw and roll.	Knowledge	1
2	Write down the expressions for pitch, yaw and roll control derivatives of an airplane.	Knowledge	1
3	What are three types of control with reference to C.G of an airplane?	Knowledge	1
4	Draw a graph of C_M vs α for statically stable, unstable and neutrally stable aircraft configuration.	Knowledge	2
5	What are the four major effects of propeller slipstreams on the longitudinal stability of an aircraft.	Knowledge	2
6	What are the assumptions made in the study to stability and control of an airplane.	Understand	1
7	Derive rigid body equations of motion for F_x , F_y , F_z and L , M , N ,	Knowledge	1
8	Describe the components of gravitational forces and thrust forces acting along the body fitted axis system.	Knowledge	1
9	Discuss the variation of aerodynamic $C_m \alpha C_m$ and C_{m_q} with the Mach number graphically.	Understand	2
10	Explain what is meant by pure pitching motion.	Knowledge	2
UNIT-III			
STICK FREE LONGITUDINAL STABILITY- CONTROL FORCES TO TRIM, LATERAL-DIRECTIONAL STATIC STABILITY AND TRIM			
1	Define hinge moment and write down the expression for hinge moment coefficient.	Knowledge	3
2	Plot the variation of hinge moment with control deflections	Analyze	3
3	Plot hinge moment variation with angle of attack.	Knowledge	3
4	Write down the equation for elevator floating angle.	Knowledge	3
5	Define neutral point	Knowledge	3
ASSIGNMENT – II			
1	Discuss the effects of allowing the controls free to float.	Knowledge	3
2	Show the variation of hinge moment with angle of attack and sketch the pressure distribution over the airfoil with angle of attack.	Knowledge	3
3	Derive the expression for the total hinge moment coefficient due to the contribution of control deflection and angle of attack.	Knowledge	3
4	Explain the control surface floating characteristics.	Knowledge	3
5	Explain the following type of aerodynamic balancing: a) Horn b) Internal Seal & c) Bevelled Trailing edge	Knowledge	3

UNIT-IV AIRCRAFT EQUATIONS OF MOTION- PERTURBED MOTION- LINEARISED, DECOUPLED EQUATIONS OF MOTION OF AIRCRAFT			
1	Bring out the difference between equilibrium condition and trim condition for an airplane.	Knowledge	5
2	Define longitudinal static stability of an airplane	Knowledge	6
3	List down the various components contribution of pitching moments to the total pitching moment of the airplane about the C.G.	Knowledge	6
4	Show graphically the variation of $C_{Mc.g}$ vs C_L for various vertical position of wing with the fuselage.	Knowledge	6
5	Plot the typical variation $C_{Mc.g}$ vs C_L for stable and unstable airplane.	Knowledge	6
6	Represent the forces on the airplanes in accelerated and un-accelerated flight and explain.	Knowledge	5
7	Represent the forces on an airplane in an accelerated level turn flight and derive the expressions for angular velocity and radius of them.	Knowledge	6
8	Draw the schematic diagrams of an airplane in pull-down manoeuvre and obtain the expression for rate of turn and radius of turn.	Apply	6
9	Represent the forces on an airplane in pull-up manoeuvre and derive the expressions for radius of turn and rate of turn.	Knowledge	6
10	An airplane is performing a pull-up manoeuvre at a true airspeed of 350m/sec with a load factor of 4.0 and pull down manoeuvre at a true airspeed of 250m/sec with a load factor of 5.0 calculate the radius of turn and rate of turn in both the manoeuvres.	Apply	6
UNIT-V LONGITUDINAL AND LATERAL-DIRECTIONAL DYNAMIC STABILITY			
1	Define directional static stability of an airplane.	Knowledge	7
2	Write down the expression for yawing moment coefficient.	Knowledge	8
3	Define angle of yaw (ψ) and angle of side slip(β)	Knowledge	8
4	Plot the variation of C_n Vs ψ for directionally stable and unstable airplane.	Knowledge	8
5	Name the control surface applied for directional control.	Knowledge	9
6	Draw the airplane with angle side slip (β) and an angle of yaw (ψ) and represent the angles and velocities.	Knowledge	8
7	Define the criteria for directional stability of an airplane and explain with relevant graphs and equations.	Knowledge	8
8	Derive the expression for yawing moment derivative C_n due to vertical tail.	Evaluate	8
9	Briefly explain the following (a) Adverse Yaw (b) Anti-symmetric power (c) Cross- wind during landing and take-off.	Evaluate	9
10	Explain what is meant by 'Rudder Lock'	Knowledge	10

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