



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	: FLIGHT MECHANICS-1
Course Code	: A42105
Class	: II B. Tech II Semester
Branch	: Aeronautical
Year	: 2016– 2017
Course Coordinator	: Dr.P.K.Dash, Professor
Course Faculty	: Dr.P.K.Dash, Professor

OBJECTIVES

The objectives of the course are to enable the student;

- I. To understand the basic principles of fluid mechanics
- II. To identify various types of flows
- III. To understand boundary layer concepts and flow through pipes
- IV. To evaluate the performance of hydraulic turbines
- V. To understand the functioning and characteristic curves of pumps

S No	QUESTION	Blooms taxonomy level	Course Outcome
UNIT-I			
INTRODUCTION TO AIRCRAFT PERFORMANCE- THE FORCE SYSTEM OF THE AIRCRAFT			
Part –A (Short Answer Questions)			
1	Explain about Atmospheric Flight Mechanics.	UNDERSTAND	1
2	What is Air data measurement? Explain briefly.	UNDERSTAND	1
3	Explain Aircraft performance analysis?	UNDERSTAND	1
4	Explain the aircraft operations safety and economy	UNDERSTAND	1
5	Sketch the military combat aircraft and interceptor aircraft Profile.	UNDERSTAND	1
6	Explain briefly Types of Air Data	UNDERSTAND	1
7	Explain briefly Scheduled performance and operational performance of aircraft.	UNDERSTAND	1
8	Define the following terms a)static Pressure b)Total Pressure	UNDERSTAND	1
9	What are the main purposes of performance measurement?	UNDERSTAND	1
10	What is meant by FAA, ODM and WAT	UNDERSTAND	1
Part-B (Long Answer Questions)			
1	Describe with the help of a diagram the mission profile of a civil transport aircraft. What is involved in performance estimation	EXPLAIN	2
2	Define the following terms i).Static pressure ii).Total pressure iii).Impact pressure	EXPLAIN	2

3	Name two aspects of airplane performance that are significantly affected by the critical Mach number of the wing	APPLY	3
4	Describe with the help of a diagram the mission profiles of different aircrafts.	APPLY	2
5	What are the purposes for which the performance of an aircraft needs to be measured in flight?	DERIVE	3
6	Write a short note on Standard Atmospheric Flight Mechanics.	DERIVE	2
7	What is Air data measurement? Explain briefly	DERIVE	3
8	Explain the aspects of performance planning and fuel planning	DISCUSS	2
Part-C (Critical Answer Type Questions)			
1	With relevant sketches explain the characteristics of atmosphere	UNDERSTAND	3
2	Explain with sketches the vertical development of the atmosphere	UNDERSTAND	5
3	Explain the International standard atmosphere model with relevant sketches	UNDERSTAND	3
4	Derive the pressure-height relation in the stratosphere region	REMEMBER	4
5	Derive the relation for the measurement of equivalent airspeed	REMEMBER	6
6	Discuss the practical considerations of air data measurement.	DISCUSS	3
7	Define the following terms i).Static pressure ii).Total pressure iii).Impact pressure	DISCUSS	4
8	Explain briefly Scheduled performance and operational performance of aircraft.	DISCUSS	5
UNIT-II			
CRUISE PERFORMANCE			
Part –A (Short Answer Questions)			
1	Explain range and endurance with thrust producing engines	UNDERSTAND	7
2	Explain range and endurance with power producing engines	UNDERSTAND	5
3	Define Breguet Range Expression	UNDERSTAND	3
4	Discuss the three Cruise techniques	UNDERSTAND	7
5	Define three fuel flow laws	UNDERSTAND	5
6	Explain the effect of alternative fuel flow laws	UNDERSTAND	3
7	Explain the effect of WAT on Cruise Performance	UNDERSTAND	3
8	Define SAR and SAE	UNDERSTAND	4
9	Compare range and endurance obtained for all cruise techniques	APPLY	6
10	Derive range equation for cruise method I	APPLY	3
Part-B (Long Answer Questions)			
1	Explain minimum drag speed and minimum power speed and describe their Importance in aircraft performance studies.	UNDERSTAND	5
2	Explain the total airplane drag and types, drag reduction methods	UNDERSTAND	3
3	What is EOM?Explain & Derive the EOM.	UNDERSTAND	5
4	Elaborate Cruise Technique - 1 and explain the disadvantages	APPLY	3
5	Compare the cruise techniques 1 & 2	REMEMBER	4
6	Elaborate Cruise Technique - 2 and explain the drawbacks	REMEMBER	6
7	Compare all the cruise techniques and write the relevant results from all the three techniques	REMEMBER	3
8	Elaborate Cruise Technique - 3	APPLY	4
9	Explain the effect of alternative fuel flow laws	APPLY	5
10	Derive the endurance formula for a piston engine aircraft	APPLY	4
11	Derive the range expression for a jet powered aircraft	APPLY	6
12	Derive the range expression for a jet powered aircraft	APPLY	3
Part-C (Critical Answer Type Questions)			
1	Describe the constant altitude, constant mach number cruise method	APPLY	4
2	Explain the constant angle of attack, constant altitude cruise method	APPLY	6
3	With relevant graphs explain the thrust variation with Mach number and bypass ratio	APPLY	3
4	Explain the constant angle of attack, constant Mach no cruise method	APPLY	2

5	Obtain the expression for minimum drag speed and explain with relevant graphs	APPLY	5
6	Discuss the effect of Mach number on lift and drag coefficient with relevant graphs	APPLY	7
7	Explain the following terms i) Gradient of Climb & Rate of climb	UNDERSTAND	5
8	Compare range and endurance obtained for all cruise techniques	REMEMBER	4
UNIT-III			
CLIMB, DESCENT AND MANOEUVRE PERFORMANCE			
Part –A (Short Answer Questions)			
1	Define Maneuver and Turning performance.	APPLY	3
2	Explain in detail, with relevant formulae specific excess power	APPLY	2
3	What is EOM(Equation of Motion)?Explain.	APPLY	3
4	Write notes on Military aircraft maneuver performance	APPLY	2
5	Explain the following term : Aerodynamic forces during climbing Flight (with neat diagram)	APPLY	3
6	Define climb gradient and climb rate.	APPLY	2
7	Show graphically, the effect of minimum drag speed of flight path control.	APPLY	7
8	What are the phases of descending flight?	APPLY	5
9	Give two reasons which limit the aircraft maneuver performance.	APPLY	3
10	What are the different types of maneuver?	APPLY	7
11	What is range of load factor for military and civil transport aircraft?	APPLY	5
12	Define load factor and indicate its significance.	APPLY	
Part-B (Long Answer Questions)			
1	Discuss how each of these aerodynamic characteristics in affect the performance characteristics of the airplane.	REMEMBER	7
2	Describe the equations of motion of an aircraft undergoing lateral maneuver or level turn and derive an expression for radius of turn.	REMEMBER	5
3	Discuss with the help of a diagram the maneuver boundaries for turning performance	UNDERSTAND	3
4	Why climb performance is one of the critical areas in both the design and operation of an aircraft? Derive expressions for climb gradient and climb rate for aircraft with thrust producing engines.	UNDERSTAND	7
5	Discuss the effect of Mach number on lift and drag coefficient with relevant graphs	UNDERSTAND	5
6	Explain the V-n (Maneuver) diagram of an aircraft	UNDERSTAND	4
7	Describe the pull-up maneuvers with neat sketches and also explain the importance of V-n diagram	APPLY	2
Part-C (Critical Answer Type Questions)			
1	Discuss how each of these aerodynamic characteristics in turn affect the performance characteristics of the airplane.	REMEMBER	7
2	Describe the equations of motion of an aircraft undergoing lateral	UNDERSTAND	5
3	maneuver or level turn and derive an expression for radius of turn.	REMEMBER	3
4	Discuss with the help of a diagram the maneuver boundaries for	UNDERSTAND	7
5	Discuss on the aspects of minimum fuel climbs and noise limitations	REMEMBER	5
6	Derive the expression for load factor as a function of Lift, Thrust, a	UNDERSTAND	2
7	Discuss on the effect of wind on climb and descent performance	APPLY	3
8	Explain in detail, with relevant formulae, a)Climb rate b)Climb gradient c)Thrust producing engines d)Minimum fuel climbs	APPLY	3

9	Write notes on a) Instantaneous turns b) Sustained turns c) Military aircraft maneuver performance.	REMEMBER	4
10	Explain about Limit load factor and ultimate load factor with relevant diagram	UNDERSTAND	6
UNIT-IV			
TAKE-OFF AND LANDING-SAFETY REQUIREMENS – FLIGHT PLANNING			
Part –A (Short Answer Questions)			
1	Analyze the performance of the aircraft during takeoff	UNDERSTAND	7
2	Explain the current performance classifications of a Civil Transport aircraft	UNDERSTAND	5
3	Analyze the performance of the aircraft during landing	UNDERSTAND	3
4	Explain how the takeoff distance are classified into	UNDERSTAND	7
5	Derive the ground run distance for take off performance	UNDERSTAND	5
6	Explain take off performance safety factors	REMEMBER	4
7	Discuss the two cases to abandon landing	UNDERSTAND	2
8	Define Flight Planning	REMEMBER	7
9	Explain the terms a)trip fuel b)Diversion fuel	REMEMBER	5
10	Derive the ground run distance for landing performance	REMEMBER	4
11	Discuss the four phases of the flight planning	UNDERSTAND	2
Part-B (Long Answer Questions)			
1	Discuss on the aspects of take-off performance safety factors	APPLY	7
2	Explain the need of 'trip fuel' and 'the diversion fuel'	APPLY	5
3	Explain on the engine failure speed and refusal speed	APPLY	4
4	Explain the landing performance measurement	REMEMBER	2
5	Explain the take-off performance measurement	REMEMBER	3
6	explain Flight Planning and discuss the importance	REMEMBER	4
Part-C (Critical Answer Type Questions)			
1	Draw the fuel planning chart and explain	REMEMBER	6
2	Explain takeoff and landing performances	REMEMBER	5
3	Derive the ground run and airborne distances for the landing performance	UNDERSTAND	2
4	Derive the ground run and airborne distances for the takeoff performance	UNDERSTAND	5
5	Explain the effect of flight variables on the landing performance	APPLY	4
6	Explain the effect of flight variables on the takeoff performance	REMEMBER	4
7	Discuss briefly the space available and space required for take-off of an aircraft	REMEMBER	3
8	Discuss briefly the space available and space required for landing of an aircraft	APPLY	2
9	Explain the four phases of the flight planning briefly	APPLY	2
10	Explain fuel planning and how the weight is categorized depend on the fuel planning	REMEMBER	4
UNIT-V			
AIRCRAFT PERFORMANCE MEASUREMENT AND DATA HANDLING-APPLICATION OF PERFORMANCE DATA			

Part –A (Short Answer Questions)			
1	Explain the purpose of performance measurement	UNDERSTAND	6
2	Explain the terms a) Block fuel b) Block time	UNDERSTAND	5
3	sketch the payload and range diagram with weight boundaries and explain	UNDERSTAND	2
4	Demonstrate the enroute climb performance with neat sketch	UNDERSTAND	5
5	Explain the purpose of the performance measurement	UNDERSTAND	4
6	Explain the effect of the three principle performance variables	UNDERSTAND	4
7	Derive parametric form of the aerodynamic forces	REMEMBER	3
8	Derive the parametric form of the thrust forces	UNDERSTAND	2
9	Derive the parametric form of the climb segment	UNDERSTAND	5
10	Discuss the 3 methods in the data handling	UNDERSTAND	5
Part-B (Long Answer Questions)			
1	Draw the landing performance WAT chart and explain.	REMEMBER	6
2	Explain on the aspect of en-route drift down performance with relevant graphs	UNDERSTAND	5
3	Explain take-off net flight path	UNDERSTAND	2
4	Draw the climb performance WAT chart, for the case of second segment one engine operating and explain	UNDERSTAND	5
5	Explain the determination of failed length available for take-off for the case of all engines operating and one engine operating	APPLY	4
6	Draw the take-off WAT limit chart for a turboprop and explain	APPLY	4
7	Describe the en-route climb and descent performance summary with relevant graphs	APPLY	3
8	Explain payload-range diagram and disposable load	APPLY	2
Part-C (Critical Answer Type Questions)			
T	What is Operational analysis procedure? Explain briefly	REMEMBER	4
2	What are some of the advantages of fleet commonality? Why has there been a trend toward leasing?	UNDERSTAND	1
3	Explain Block performance of an aircraft.	UNDERSTAND	6
4	Explain the current performance classifications	APPLY	5
5	What did you understand about aircraft performance? Explain the aircraft performance requirements.	APPLY	2
6	Explain Payload-range diagrams. Also, explain the definitions of various limits on range, payload and weight of an aircraft	APPLY	5
7	Discuss the importance of the fleet-planning process to both short- term and long-term Management decision making in an airline.	UNDERSTAND	4
8	Write a short note on determination of the maximum takeoff weight	UNDERSTAND	4
9	Describe the flight testing principle variables weight and altitude with suitable examples	UNDERSTAND	3
10	Describe the parametric forms of aerodynamic and thrust forces	UNDERSTAND	1

