

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, April/May 2018**

**Course: Design of Aerospace Vehicles**  
**Program: B. Tech Aerospace Engineering**  
**Time: 03 hrs.**

**Semester: VIII**  
**Max. Marks: 100**

**Instructions:/Design DATA and formula sheet for shall be provided**

**SECTION A (5x4=20 Marks)**

S. No.		Marks	CO
Q1	Identify the design requirements of a Light Sport Aircraft (LSA).	4	CO1
Q2	What are the design structural limits on <i>load factor</i> and <i>velocity</i> diagram of airplane?	4	CO2
Q3	Describe the steps for conceptual design of aircraft with help of flowchart.	4	CO4
Q4	What do you mean by fuel fraction of the airplane? Explain briefly.	4	CO4
Q5	What do you mean by Mass Ratio (MR) of Rockets? Explain briefly.	4	CO5

**SECTION B (4x10=40 Marks)**

Q 6	A) An airplane has the following features: Weight of the payload+crew=30000 N Estimated fuel fraction ( $W_f/W_0$ )=0.387 Empty Weight fraction ( $W_e/W_0$ )= $0.837(W_0)^{-0.7}$ Estimate Gross Weight ( $W_0$ ) of Airplane.	5	CO1
	B) Derive expression for <i>wing loading</i> ( $W/S$ ) from given load factor ( $n$ ) for <i>turning maneuver(s)</i> of fighter aircraft.	5	CO2
Q7	What are different non-dimensional wing design parameters of a wing? Describe the design process for wing design of an aircraft.	10	CO3
Q8	A) An airplane has the following features: No. of Passengers 450 Range of Flight=12000 Km Draw Mission Profile and Calculate Gross Weight of Airplane	6	CO4
	B) Design fuselage, horizontal and vertical tail for an aircraft with following Data: Gross Weight 3000 kg Maximum level speed at mid cruise 0.3 Mach	4	CO4
Q9	What are the different Mission profiles of launch vehicles? Describe them in detail.	10	CO5

Q10	<b>(Q9 or Q10)</b> What is the design criterion to ensure required stability and control of space launch vehicle? Derive the relation for necessary condition of the same.	<b>10</b>	<b>CO5</b>
<b>SECTION-C(40 Marks)</b>			
Q11	Design a Transport Aircraft for 2000 kg payload carrying capacity with the following performance requirements. Maximum level speed at mid cruise 500 Km/hr Range 4000 km Ceiling 8000 meters Rate of climb at sea level 300 m/min Staling speed 110 Km/hr Landing distance 700 m Take-off distance 800 m	<b>20</b>	<b>CO4</b>
Q 12.	A) Consider a private four seater aircraft with the following characteristics: Cruise Mach number 0.2; cruise altitude=4,000 m, wing loading= $100 \text{ kg}, m^2$ , Take-off weight=5,000 kg. Design the main wing that would be suitable for this aircraft along with the sketch. Justify all of selections	<b>10</b>	<b>CO3</b>
	B) What is the design criterion to ensure required stability and control of space launch vehicle? Derive the relation for necessary condition of the same.	<b>10</b>	<b>CO5</b>