2071 Chaitra

1. List the main types of drag on an aircraft and explain their source. What is area rule and why is it important? (8)
2. For a flight velocity of 300 m/s of a 20-ton elliptical-winged aircraft cruising at an altitude where the density ratio is 0.3, calculate the required lift and drag coefficients. Assume zero-lift drag is 0.01, reference area of 160 m2 and aspect ration of 8. What is the lift-to-drag rati0, and explain how aspect ratio affects this ratio? (8)
3. What are the three main design parameters for an airfoil? Explain how they matter in the design of an airfoil. (8)
4. What are the main types of leading and trailing edge devices? Explain their features with the help of schematics and state the benefits they hold. (8)
5. Define the following terms for an aircraft in brief. (2\*8)
6. Aspect Ratio
7. Cruise speed
8. Zero-lift angle of attack
9. Stall speed
10. Empennage
11. Induced drag
12. Mean aerodynamic chord (MAC)
13. Drag divergence
14. What is a thick box-beam wing structure? List its advantages and explain in detail the components of the structure, their placements and what roles they play structurally. Draw schematic where necessary. (8)
15. What are the advantages of integrally stiffened cover panels over conventional skin stringer panels? Explain in detail important design considerations for the wing compression surface. (8)
16. Describe the following techniques in sufficient details. (8)
17. Wing-rib alignment techniques and their feature.
18. High and low winged aircrafts, with their design features.
19. What are the main components of a landing gear assembly? Explain the purpose of landing gear and their important design considerations. (8)

2072 Chaitra

1. List the main components of an airfoil. How does a finite wing differ from an airfoil? Explain in brief. (10)
2. What are the three main types of wing box structure? Explain the design principles of each type in necessary details. (10)
3. What are the main sections of an airplane fuselage? Explain the methods of wing-fuselage arrangement configurations with advantages and disadvantages of each. (10)
4. What are the main types of drag acting on an airplane? For an MA60 airplane wing with reference area of 75 sq. meters flying at a cruise speed of 120 m/s and airplane weight of 21 tons, calculate the required lift coefficient. Given a drag coefficient of 0.021, calculate the drag on the airplane. (10)
5. Describe the structural elements of a high aspect ratio wing, with details of principle of load bearing and transfer. (10)
6. What are the main components of an airplane landing gear? Describe their arrangements and design requirements in brief. (10)
7. Write short note on the following: (4\*5)
8. Hot and high take-off condition.
9. Downwash and induced drag.
10. Effect of camber and Reynolds number on lift coefficient.
11. Types of wing leading and trailing edge devices.
12. Types of clouds and their classifications.

2073 Shrawn

1. a. What is monocoque and semi-monocoque construction? (4)

b. What are various types of structural stresses acting on an aircraft? (4)

c. Explain in brief construction of wing with suitable diagram. (8)

1. a. How are landing gear aligned and supported to fuselage? (4)

b. What is the indication of Underinflation and Overinflection in the aircraft tires? (4)

c. Explain landing gear indication system with diagram. (4)

1. a. What are the functions of Auxiliary group of fight controls? (4)

b. What are the components associated with hydraulic system? (4)

c. Explain in brief Primary Control Surfaces with suitable diagram. (8)

1. a. What is Passenger service Unit? (4)

b. What are the different types of fuel tanks? (4)

c. Briefly explain light aircraft fuel system. (8)

1. a. Why is an aircraft cabin pressurized? (4)

b. Name different types of Ice protection system. (4)

c. Briefly explain Diluter Demand Type Oxygen System (8)

2074 Chaitra

1. With neat illustrations, explain in detail the salient features of airplane with biplane and monoplane design from aerodynamics and structural point of view. Bring out the advantages and limitations of each type. (4+4)
2. Briefly describe the modern development in aircraft design with respect to the following:

New airfoil profiles, new fuselage design, noise reduction, windows and windshields. (2+2+2+2)

1. With neat sketch, explain the construction of typical aircraft wing. Show all the structural components of wing construction and mention the types of load/stresses experienced by the structural members. (8+4)
2. Explain how pressure, temperature and air density are related in mathematical representation of atmospheric property variations with altitude. (8)
3. With neat illustration, describe how lift and drag are produced when an airfoil is placed in a uniform air flow. (8)
4. What kinds of landing gears are used in aircrafts? What are the main functions of main wheel and nose wheel? (4+4)
5. Show how the value of lift coefficient varies with angle of attack for symmetric and cambered airfoil and hence explain stalling of an airfoil. Explain by Ct-alpha curve. (4+4)
6. Name any four components of hydraulic system with brief explanation. What are the sources of hydraulic pressure and pneumatic power in an aircraft? (8+4)
7. What are three purposes for the boost pumps in an aircraft fuel system? What causes a vapor lock in an aircraft fuel system? What is done in most aircraft to prevent vapor lock? (3+3+2)

2075 Aswin

1. With schematic diagram explain how the aircraft control surfaces (aileron, rudder and elevator) are used to control flight direction of an aircraft. [Hint: Assume deflection angle of the control surface and its effect on the motion using suitable view] (4+4+4)
2. Aircraft fuselage is subjected to number of loads. First explain the source of these structural loads and then explain how the structural components of fuselage withstand such loads. Use appropriate figures where necessary. (10)
3. Aircraft wing and fuselage have number of cutouts for various purposes. Give five names of such cutouts in an aircraft body. Then give five points to stress the importance of design consideration of such cutouts. Also explain the significance of crack-arrestors in aircraft structures (i.e. which design criteria does it address in aircraft design process, use appropriate figure). (5+5+4)
4. What is the significance of retractable landing gear? Explain preliminary and general design consideration for landing gears. Explain with two major points why aircraft wings are twisted? (2+8+4)
5. Current world of civil aviation hasn’t seen drastic change in aircraft configuration (i.e. the B707 configuration is not much different with latest B787). List out twelve areas where the improvements have been made in current aircrafts from the past (i.e. at the starting of jet age). [Hint: explain in respect to reliability, efficiency and passenger comfort]. (12)
6. An A380 intended for long haul 14 hrs flight take off from certain airport. Because of passenger’s health issues, this aircraft has to make an emergency landing after 1 hrs of flight. What would be the procedure of landing with respect to fully filled fuel tank in the aircraft? Explain the fuel systems in modern commercial aircrafts. (4+6)
7. What do you understand by aircraft maintenance? What are the types of maintenance techniques? State the major cause of aircraft accidents. (2+4+2)