

Roll No.....

Total No. of Printed Pages: [01]

Total No. of Questions: [09]

B. Tech. (Aerospace Engineering (Semester – 6th))

AEROSPACE VEHICLE DESIGN

Subject Code: BASES1-602

Paper ID: [19113024]

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a. Phases of aircraft design
- b. Uses of composites in modern aircraft
- c. Range and endurance
- d. Gust loads
- e. Catapult take-off
- f. Lofting
- g. Sustained Turn rate
- h. Reference area and Wetted area
- i. Longitudinal static stability
- j. Wing loading and thrust loading

Section – B

(5 marks each)

- Q2. Explain V-n diagram and Gust envelope. (3,2)
- Q3. Explain payload – range diagram. Also, explain its importance. (4,1)
- Q4. Explain spread sheet for turbojet engine sizing.
- Q5. Explain passive and active devices used for enhanced lift design.
- Q6. Explain ‘Pressurization and Air-conditioning system’ of a typical aircraft.

Section – C

(10 marks each)

Q7. Estimate gross take-off weight of 150 seater high bypass ratio turbojet aircraft using following data at 10 km altitude using simple cruise mission profile.

$$\begin{array}{llll} M_{\text{cruise}} = 0.75 \text{ Mach} & M_{\text{loiter}} = 0.5 \text{ Mach} & \text{Cruise} = 4000 \text{ km} & \text{Loiter} = 45 \text{ minutes} \\ (L/D)_{\text{max}} = 16 & C_{\text{cruise}} = 14.1 \text{ mg/Ns} & C_{\text{loiter}} = 11.3 \text{ mg/Ns} & \rho = 0.413 \text{ kg/m}^3 \\ p = 26000 \text{ N/m}^2 & W_e/W_0 = 0.97 W_0^{-0.06} & W_{\text{Payload}} = 100 \text{ kg} & W_{\text{Passenger}} = 65 \text{ kg/passenger} \\ W_{\text{Luggage}} = 20 \text{ kg/passenger} & & \text{Wing taper ratio} = 0.5 & \text{Wing Aspect Ratio} = 8 \end{array}$$

- Q8. (a) Estimate Mean aerodynamic chord (MAC) of wing, Location of MAC, Span & chord of aileron for the aircraft in Q.7. Use suitable value of assumed parameter, if required. (5)
(b) Define seat pitch, seat width, aisle, galley and head room in case of fuselage of a commercial aircraft with the help of neat sketch. (5)
- Q9. Write notes on the following: (6,4)
 - a. Flying qualities & Cooper Harper scale
 - b. Factors affecting material selection for aircraft structure