

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E SEM-VII Examination-Nov/Dec.-2011****Subject code: 170101****Date: 19/11/2011****Subject Name: Aircraft design-I****Time: 10.30 am-01.00 pm****Total marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) What do you understand by conceptual design? What are requirements to prepare conceptual design? **07**
- (b) Determine all main wing geometrical parameters like Wing Area S, Wing span b, Tip Chord Ct, Root Chord Cr, Leading edge angle (Sweep back) α_{LE} . **07**
- Speed = 0.85 Mach
Weight of aircraft = 187000 Kg
Wing Aspect Ratio = 7.5:1
Taper ratio = 0.2
 $Cl = 0.0373$
Service Ceiling = 45000 feet above mean sea level.
Assume density at 45000 feet = 0.6 kg/m^3
Temperature at 45000 feet = -56°C
- Q.2** (a) Determine approximate fuselage length required to carry 135 passengers with 2 pilots and 3 cabin crews. **07**
- Seat Pitch = 1 m
Seat width = 0.5m
Aisle Width = 0.7 m
Door width = 1m
Wall thickness = 0.15 m
Note: Don't let the ratio of Fuselage length to Fuselage diameter exceeds than 11:1.
- (b) 1. Determine approximate payload of 135 passengers with appropriate assumptions. **03**
2. Only draw a sketch which can explain how Lht and Lvt are decided. **04**
- OR**
- (b) Draw a neat sketch explaining how to find MAC of main wing? Just draw a sketch which can show how will you match C.G with main wing plan view? **07**
- Q.3** (a) With neat sketches and necessary graphs explain importance of Super critical airfoils over reflex airfoils for aircrafts flying above the speed of 0.7 Mach. **07**
- (b) What are the needs of multi element aerofoil in aircraft design? **07**
- OR**
- Q.3** (a) With neat sketches explain wing structure members which can withstand against bending, shear and aerodynamic twisting forces. **07**
- (b) Briefly explain how good maneuverability characteristics are achieved in multi role combat aircrafts? **07**

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- Q.4 (a)** With necessary equations explain how wing loading effects take off and landing performance. **07**
- (b)** Briefly explain structure of main rotor of conventional helicopter. **07**
- OR**
- Q.4 (a)** With neat sketch explain advantages and disadvantages of different tail plane configurations. **07**
- Q.4 (b)** Differentiate between Deicing and Anti icing. Why bleed air supply is shut off at the time of take off in aircraft? **07**
- Q.5 (a)** Differentiate between Turbofan engine and Turbo shaft engine with respect to performance and applications. **07**
- (b)** Briefly explain Cyclic and Collective pitch operations in helicopters for maneuvering purpose. **07**
- OR**
- Q.5 (a)** Compare between Aircraft rudder operation and Helicopter tail rotor operations with neat sketch. **07**
- (b)** How will you determine “Total take off weight” of aircraft? **07**
