



(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 148851**

Roll No.

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## B. Tech.

(SEM. VIII) THEORY EXAMINATION, 2014-15  
AERODYNAMICS DESIGN & TESTING

Time : 3 Hours]

[Total Marks : 100

1 Attempt any two of the following. **10x2=20**

- (a) Making use of sketches briefly explain the contribution of 'Lifting Surface Theory' for predicting lift distribution on a wing with an arbitrary plan form.
- (b) In terms of engines classify the subsonic, supersonic and hypersonic aircrafts and explain how those power plants suits to their configuration.
- (c) Bring out the difference between subsonic and supersonic airplanes. Explain how the aircraft layout is changing according to the Mach number and what is the necessity?

2 Attempt any two of the following : **10x2=20**

- (a) What is parasite drag acting on aircraft?  
Explain the method to estimate it.
- (b) Briefly explain the following.
  - (i) Wing loading
  - (ii) Thrust loading
  - (iii) Absolute ceiling and service ceiling
  - (iv) Climb rate
  - (v) Landing speed
- (c) Explain INDUCED DRAG, AERODYNAMIC TWIST and GEOMETRIC TWIST and explain how they effect the aerodynamic properties of elliptic wing with neat sketches.

3 Attempt any two of the following: **10x2=20**

- (a) What do you understand by the preliminary weight estimation and final weight estimation of an aircraft ? Explain how it is done.
- (b) Bring out the differences between the general features of turbo-prop and turbo-jet and explain them with neat sketches.
- (c) What is meant by pitch of a propeller? What is the difference between fixed pitch propeller and variable pitch propeller? How reverse thrust is generated by propellers ?

4 Attempt any two of the following. **10x2=20**

- (a) Define the term load factor and pull-up maneuver of an aircraft. Show that V-n diagram combines both for describing the whole flight regime of the airplane. Illustrate with examples the V-n diagram.
- (b) Briefly explain
  - (i) Rate of climb
  - (ii) Effect of wind on landing and take off distance
  - (iii) Effect of altitude on engine performance.
  - (iv) Service ceiling
  - (v) Longitudinal stability
- (c) What is hinge moment ? Describe the presence of hinge moments on the horizontal tail from the pressure distribution due to angle of attack  $\alpha$  and the deflections and from  $\delta_e$  and  $\delta_t$  elevator end tab. Hence define the terms 'floating tendency and restoring tendency'. Describe how these hinge moments can be controlled.

5 Attempt any two of the following. **10x2=20**

- (a) With the help of good diagram describe a Blow Down type supersonic wind tunnel and explain its components with their function and necessity to obtain the desired objectives. What makes it superior to a continuous type wind tunnel?

- (b) Explain the term low speed wind tunnel in aerodynamic testing. Describe with brief details through sketches and plots, any one type of low speed wind tunnel.
  - (c) Describe theory and the procedure to be followed in designing and fabricating a new low speed wind tunnel. At which location pressure taps should be fitted for conducting experiments for speed setting of this tunnel?
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