Code No: NR322101 **NR**

III B.Tech II Semester Supplementary Examinations,
November/December 2005
AERODYNAMICS-II
(Aeronautical Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. The axis system associated with an airplane may be described with a sketch. Now explain the equilibrium of forces and moments acting on the airplane, illustrated with sketches and plots. How are these forces and moments controlled? [16]

2. Illustrate the effect of the C.G. travel on the static longitudinal stability criterion $\left(\frac{dC_m}{dC_L}\right)_{fixed}$. Explain from the magnitude of $\left(\frac{dC_m}{dC_L}\right)_{fixed}$,the restrictions placed on the shift of C.G. Hence define Neutral point stick fixed and static margin stick fixed. [16]

3. Show with the help of sketches pressure distribution on 'leading and lagging' tabs on a control surface. Hence define the terms 'floating tendency and restoring tendency'. Describe ways and means to alleviate or control these hinge moments. [16]

4. Derive the expression for stick force in unaccelerated flight given by $F_s = K\frac{1}{2}\rho V^2\left[A + C_{h\delta t}\delta_t - C_L\left(\frac{dC_m}{dC_L}\right)_{free}\frac{C_{h\delta}}{C_{m\delta}}\right]$ .Plot the stick force v/s velocity curve and show that an unstable airplane demands a nose-down tab to trim out the stick force F_s for a given trim speed. [16]

5. Show that an airplane with swept back wing produces left rolling moments when it meets right side-slip i.e. it produces positive dihedral effect i.e $-C_{l'\beta}$. Make use of sketches and plots in this respect. [16]

6. Describe from basic considerations that the directional stability of an airplane can be obtained from the summation of various factors as follows ; $(C_{n\psi})_{airplane} = (C_{n\psi})_w + (C_{n\psi})_{Fus,nac} + (C_{n\psi})_{\mathrm{Pr}op} + (C_{n\psi})_v + \Delta_1 C_{n\psi} + \Delta_2 C_{n\psi}$. Hence explain the contribution of all the terms involved. [16]

7. The characteristic equation of dynamic longitudinal stability of an airplane was obtained as below; $A\lambda^4 + B\lambda^3 + C\lambda^2 + D\lambda + E = 0$, where A = 1 ,B = 5.102 ,C = 14.35 ,D =0.363 , E = 0.637 . Work out the period, $N_{1/2}$ and $t_{1/2}$of the phugoid oscillations.Provide the basis of your recognizing the oscillation to be as such. [16]

8. The two real roots of the lateral-directional stability quartic are $\lambda_1 = 0.1815 and \lambda_2 = -10.61$. Explain the motions represented thereby. Provide the characteristics and simple analysis along with. [16]

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