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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M.Tech ASE + UAV | **Semester –I**
Subject (Course): Airplane Performance and Design | **Max. Marks : 100**
Course Code : ASEG 7010 | **Duration : 3 Hrs**
No. of page/s: 2

NOTE:. Make use of *sketches/plots* to elaborate your answer. Brief and to the point answers are expected.

Section A (4X5M=20M)

Q1. What do you understand by high lift devices? explain how these devices contributes in further increase in lift?

Q2. Define the following: a) Trailing vortex drag b) Skin friction drag

Q3. If the thrust Vector is inclined upward by an angle θ_T to Flight direction. Prove that angle of climb θc is given by

$$\theta_c = \tan^{-1}\frac{T\cos\theta_T - D}{L + TSin\theta_T}$$

Q4. Define Aerodynamic center and Center of Pressure ?

Section B (4X10M=40M)

Q5. Explain with a neat sketch the working principle of Pitot-Static Tube ?

Q6. Draw the V-n diagram for a conventional aircraft and explain the critical points. Explain the effect of gust velocity on the V-n diagram.

Q7. Explain in detail the different types of drags and how are they Caused and methods to reduce them.

Q8 Show that the minimum time required to turn through a give angle is given by

$$t = \frac{\propto}{g}\sqrt{\frac{w}{\frac{1}{2}\rho s c_l}}\frac{\sqrt{n}}{\sqrt{n^2-1}}$$

Section C (2X20M=40M)

Q9. A sail plane weighs 4500 N and has a wing loading of 600 N m^{-2} . Its drag equation is

$$C_D = 0.010 + 0.022\, C_L^2$$

After completing launch at 350 m in still air, what is the greatest distance the sailplane can cover, and what is the greatest duration of flight possible, assuming in both cases flight over level ground? Find also the corresponding speeds of flight. Ignore changes of density of the atmosphere.

Or

Prove that the condition of the maximum Rage in case of a Propeller aircraft is the condition of maximum endurance of a Jet engine aircraft.

Q10. Describe Aircraft *Take-off* and *Landing* procedures. Derive the relations for runway distance required for any one of the cases.