Roll No. | | | | | | | | | | | | |

Total No. of Pages :02

Total No. of Questions : 09

B.Tech.(ANE) (Sem.–5)

AIRCRAFT PERFORMANCE

Subject Code : ANE-315

Paper ID : [A1039]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1 Define the following :

a) 'Wing Loading' and 'Thrust Loading'.

b) 'Range' and 'Endurance'.

c) 'Aerodynamic Center' and 'Center of Pressure'.

d) 'Geometric Altitude' and 'Absolute Altitude'.

e) 'Troposphere' and 'Stratosphere'.

f) 'Washin' and 'Washout'.

g) 'Chord Line' and 'Camber Line'.

h) 'Pressure Altitude' and 'Temperature Altitude'.

i) 'Critical Mach Number' and 'Drag Divergence Mach number'.

j) 'Zero-lift Drag' and 'Induced drag'.

SECTION-B

Q2 Calculate the standard atmospheric values of T, p and ρ at a geo-potential altitude of 20 km. Assume Lapse rate of -6.5 K/km in the gradient region. (1,2,2)

Q3 Explain 'Delta Wing Aerodynamics' at Low Speed with the help of labeled illustration/plots. (5)

Q4 Derive the expression for lift coefficient and drag coefficient for minimum drag condition. (5)

Q5 Define and explain various high lift devices. Show their effect on lift curve slopes. (5)

Q6 Explain the nomenclature of '4-digit' and '6-digit' NACA series airfoils. (5)

SECTION-C

Q7 Gulfstream-IV twin turbofan executive transport with weight of 200000N, planform area of 80 m^2 and drag polar as $C_D = 0.015 + 0.08C_L^2$ is flying at an altitude of 10 km ($\rho = 0.413$ kg/m^3). Calculate :

a) $(C_L^{3/2}/C_D)_{max}$, $(C_L/C_D)_{max}$ and $(C_L^{1/2}/C_D)_{max}$ values. (5)

b) Velocities at which $(C_L^{3/2}/C_D)_{max}$, $(C_L/C_D)_{max}$ and $(C_L^{1/2}/C_D)_{max}$ occur. (5)

Q8 Write notes on the following :

a) Drag and its categorization with explanation. (6)

b) V/STOL vehicles. (4)

Q9 Calculate the total take-off distance at sea level of an aircraft weighing 200000N and also compare it with the value obtained from approximate relation with the help of following data (Use calculations at $V_\infty = 0.7V_{LO}$) : (Assume $C_L = 0.1$ during ground roll) (10)

$C_D = 0.014+0.07C_L^2$	$k_1 = 0.02$	$K_{uc} = 4.5\times10^{-5}$	b = 20m
T = 65000N	h = 2.5m	S = 90m^2	$\mu_r = 0.035$
C_{Lmax}=1.5	N = 3	e = 0.9	h_{OB}=12m