

Total No. of Pages :02

Total No. of Questions : 09

B.Tech.(ANE) (Sem.-5)
AIRCRAFT PERFORMANCE
Subject Code : ANE-315
M.Code : 60524

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTIONS 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

Q.1 Distinguish between the following :

- (a) 'Low Wing loading' and 'High wing loading'.
- (b) 'Range' and 'Endurance'.
- (c) 'Aerodynamic Center' and 'Center of Gravity'.
- (d) 'Geometric altitude' and 'Geopotential altitude'.
- (e) 'Troposphere' and 'Stratosphere'.
- (f) 'Washin' and 'Washout'.
- (g) 'Camber' and 'Camber line'.
- (h) 'Dihedral angle' and 'Anhedral angle'.
- (i) 'Mach Number' and 'Critical Mach number'.
- (j) 'Skin friction drag' and 'Pressure drag'.

SECTION-B

- Q.2 Calculate the standard atmospheric values of T , p and ρ at a geo-potential altitude of 30 km. The values of T , p and ρ at 12 km altitude are 216.66K, 19399Nm⁻² and 0.31194 kg-m³ respectively. Assume Lapse rate of + 2.8 K/km above 25km altitude.
- Q.3 Explain 'Delta Wing Aerodynamics' at Low Speed with the help of labelled illustration/plots.
- Q.4 Derive the expression for lift coefficient, drag coefficient and speed for minimum drag condition.
- Q.5 Define and explain various high lift devices. Show their effect on lift curve slopes.
- Q.6 Explain the nomenclature of '4-digit' and '5-digit' NACA series airfoils.

SECTION-C

- Q.7 Gulfstream-IV twin turbofan executive transport with weight of 200000N, planform area of 80 m² and drag polar as $C_D = 0.015 + 0.08C_L^2$ is flying at an altitude of 10 km ($\rho = 0.413 \text{ kg/m}^3$). Calculate :
- Lift coefficient corresponding to $(C_L^{3/2}/C_D)_{\max}$, $(C_L/C_D)_{\max}$, and $(C_L^{1/2}/C_D)_{\max}$ conditions. (3)
 - $(C_L^{3/2}/C_D)_{\max}$, $(C_L/C_D)_{\max}$ and $(C_L^{1/2}/C_D)_{\max}$ values and their ratio. (4)
 - Velocities at which $(C_L^{3/2}/C_D)_{\max}$, $(C_L/C_D)_{\max}$, and $(C_L^{1/2}/C_D)_{\max}$ occur. (3)
- Q.8 Write notes on the following :
- Drag, Drag polar, Drag bucket (6)
 - V/STOL vehicles (4)
- Q.9 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)
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|---------------------------|-------------------|-------------------------------|-----------------------|
| $C_D = 0.014 + 0.07C_L^2$ | $k_1 = 0.02$ | $K_{uc} = 4.5 \times 10^{-5}$ | $b = 20\text{m}$ |
| $T = 65000\text{N}$ | $h = 2.5\text{m}$ | $S = 90\text{m}^2$ | $\mu_r = 0.035$ |
| $C_{L\max} = 1.5$ | $N = 3$ | $e = 0.9$ | $h_{OB} = 12\text{m}$ |

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.