Roll No. | | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(Aeronautical Engineering) (Sem.–8)

HIGH SPEED AERODYNAMICS

Subject Code : ANE-411

M.Code : 70493

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

1. Explain the following briefly :

(a) Define 'Friction Parameter'.

(b) What is De Laval Nozzle and where is it used?

(c) How detached shocks are created?

(d) Distinguish between oblique and normal shock wave.

(e) Distinguish between compression and expansion wave.

(f) Explain the importance of 'Rayleigh Supersonic Pitot Formula'.

(g) Explain the phenomenon of choking briefly.

(h) Explain the phenomenon of 'Drag Divergence'.

(i) What do you mean by compressible flow?

(j) What do you mean by boundary conditions?

SECTION-B

2. Explain 'method of characteristics'.

3. What do you mean by shock polar? Draw dimensionless shock polar.

4. Calculate lift curve slope of a profile at $M_\infty = 0.32$ using P-G rule for the following given data :

   $C_L = 0.2$ at $\alpha = 3°$ and $C_L = -0.1$ at $\alpha = -2°$.

5. What do you mean by 'Aero-Ballistic Ranges' and 'Terminal Ballistic Range'?

6. Explain the working principle of 'Shock Tunnel'.

SECTION-C

7. A flat plate is kept at 20° angle of attack to a supersonic stream at Mach 2.5. Solve the flow field around the plate and determine the inclination of slipstream to the freestream direction using shock-expansion theory.

8. Explain flow through De Laval Nozzle under various back pressure conditions with the help of sketches. Explain over-expanded, under-expanded and fully expanded nozzle with the help of sketches.

9. Write notes on the following :

   (a) θ-β-M relation

   (b) Crocco's theorem

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.