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Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Aerospace Engg.) (Sem.– 8)

APPLIED GAS DYNAMICS

Subject Code : ASPE-410

M.Code : 72573

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.
4. Use of calculator and gas tables is permitted.

SECTION-A**Q1. Explain briefly :**

- a) Shock induced flow separation
- b) Detached shocks
- c) Friction constant
- d) De Laval Nozzle
- e) Drag divergence
- f) Prandtl - Meyer expansion fan
- g) Small perturbation theory
- h) Similarity rules
- i) Real fluids
- j) Mach reflection

SECTION-B

- Q2 Derive expression for ' θ - β -M relation'. (5)
- Q3 Explain shock polar diagram. Also explain dimensionless shock polar. (3,2)
- Q4 What is Prandtl – Glauert (P-G) rule? 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 $\alpha = 3^\circ$ and $C_L = -0.1$ at $\alpha = -2^\circ$. (2,3)
- Q5 What do you mean by 'potential equation and its linearization'? (5)
- Q6 Explain briefly the optical methods of flow visualization. (5)

SECTION-C

- Q7 A flat plate is kept at 20° angle of attack to a supersonic stream at Mach 2.4. Solve the flow field around the plate and determine the inclination of slipstream to the freestream direction using shock-expansion theory. (10)
- Q8 A De Laval nozzle has to be designed for an exit Mach Number of 1.5 with exit diameter of 20 cm. Find the necessary ratio of throat area to exit area. The reservoir conditions are given as $p_0 = 1$ atm and 20°C . Also, find the maximum mass flow rate through the nozzle. What will be the exit pressure and temperature? (3,3,2,2)
- Q9 Explain the following with the help of neat and labelled diagrams : (5,5)
- a) Shock tube
 - b) Rayleigh Flow

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.