CBCS SCHEME

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15AE61

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Aerodynamics - II

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Gas Tables by S.M. Yahya is permitted.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Derive Momentum equation and write the application of momentum equation. **(08 Marks)**

b. Consider the flow property at a point in a flow where the temperature is 320 K and velocity is 1000 m/s. Find the Mach number at that point. **(02 Marks)**

c. Derive the Relation for velocity of sound for a Calorifically perfect gas. **(06 Marks)**

OR

2 a. Write the steady flow energy equation for a flow process. **(03 Marks)**

b. What is the criteria for obtaining supersonic flow in a nozzle? Draw the performance for various back pressure and explain nozzle operation. **(07 Marks)**

c. A subsonic diffuser operating under isentropic conditions has an inlet area of $0.15m^2$. Conditions at inlet are $V_1 = 240$ m/s , $T_1 = 300K$, $P_1 = 0.7$ bar. Velocity leaving the diffuser is 120 m/s. Calculate i) Mass flow rate ii) Stagnation pressure and Temperature at exit iii) Static pressure at exit iv) Exit area. **(06 Marks)**

Module-2

3 a. Write the equations of Motion for Normal shock and derive Prandtl relation. **(08 Marks)**

b. The properties of normal shock upstream in air is given as $M_1 = 2.5$, $P_1 = 1$ atm , $\rho_1 = 1.225$ kg/m^3. Find P_2, ρ_2 , T_2 , M_2 , V_2 , Po_2 and To_2 in the downstream. **(04 Marks)**

c. Draw the Hugonoit curve and explain the uses with required equations. **(04 Marks)**

OR

4 a. Derive Hugonoit equation for normal shock wave and write its advantages. **(06 Marks)**

b. What is meant by moving normal shock and explain where it occurs? **(02 Marks)**

c. Air from a reservoir at 200 KPa and 350 K is expanded through a C – D nozzle of throat area $0.2m^2$ and exit area $0.8m^2$. Normal shock is positioned at C.S area of $0.6m^2$. Calculate i) Static and stagnation pressure on either side of shock.
ii) Static and stagnation temperature at nozzle exit.
iii) Static and stagnation pressure at nozzle exit. **(08 Marks)**

Module-3

5 a. Derive Rankine – Hugonoit equation for oblique shock wave. **(08 Marks)**

b. What is Shock Polar? Explain the advantages with graphical representation. **(04 Marks)**

c. Explain about supersonic flow over a wedge, with neat sketch. **(04 Marks)**

OR

6 a. What is Expansion Wave and How it is formed in the flow? Derive relation for Prandtil – Meyer function. **(08 Marks)**

b. Explain with neat sketch about intersection of shocks of same family and opposite families with different and equal strength. **(08 Marks)**

Module-4

7 a. Derive Small Perturbation theory using linearized velocity potential equation. Also write the conclusion. **(10 Marks)**

b. Derive the expression for pressure co-efficient for linearized flow. **(06 Marks)**

OR

8 a. Derive Prandtl – Glavert rule compressibility correction from Small Perturbation theory for supersonic flow. **(08 Marks)**

b. Write about uses of Karman rule and obtain an expression for lift and drag co-efficient using Von – Karman rule. **(08 Marks)**

Module-5

9 a. Write about the types of Subsonic and Supersonic wind tunnels, with sketch. **(06 Marks)**

b. Write the pressure measuring instruments used in wind tunnel. Explain any two with neat sketch. **(06 Marks)**

c. Write about the flow visualization techniques used for subsonic flow. **(04 Marks)**

OR

10 a. Explain about shock tube with neat sketch and write its applications. **(06 Marks)**

b. Explain about schlieren technique and shadow graph technique and write its advantages and disadvantages. **(10 Marks)**

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