

CBCS SCHEME

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BAE/BAS402

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2026

Aerodynamics

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks, L: Bloom's level, C: Course outcomes.
3. Use of Gas Table data handbook is permitted.*

Module – 1				M	L	C
Q.1	a.	With a relevant sketch, derive an expression of velocity potential and stream function of source flow.	10	L3	CO1	
	b.	Illustrate the classification of flow.	06	L2	CO1	
	c.	Consider the nonlifting flow over a circular cylinder. Calculate the locations on the surface of the cylinder where the surface pressure equals the free stream pressure.	04	L4	CO1	
OR						
Q.2	a.	Derive an expression of Non-Lifting flow over a Circular Cylinder.	10	L3	CO1	
	b.	Explain about the Kutta-conditions of a/F.	06	L2	CO1	
	c.	Consider the lifting flow over a circular cylinder. The lift coefficient is 5. Calculate the peak (negative) pressure coefficient.	04	L4	CO1	
Module – 2						
Q.3	a.	Derive an expression of Prandtl's classical Lifting-line theory.	12	L3	CO2	
	b.	Illustrate the Vortex Lattice Method.	04	L2	CO2	
	c.	Explain the Lift, Drag and Moments of complete Airplane.	04	L2	CO2	
OR						
Q.4	a.	Derive an equation of Elliptical Lift distribution of a wing.	10	L3	CO2	
	b.	Summarize the Biot Savart Law.	05	L2	CO2	
	c.	Write a note on Downwash and Induced drag.	05	L2	CO2	
Module – 3						
Q.5	a.	Define Sweep Angle and explain the types of Swept Wing.	08	L2	CO2	
	b.	Explain about typical Aerodynamics characteristics.	06	L2	CO2	
	c.	Derive an equation of coefficient of pressure.	06	L3	CO2	

OR

Q.6	a.	With a neat sketch, illustrate the Leading Edge and Trailing Edge Highlight devices.	12	L2	CO2
	b.	Explain the formation of Critical Mach Number with a suitable sketch.	04	L2	CO2
	c.	Write a note on Subsonic and Supersonic Leading Edge.	04	L2	CO2

Module – 4

Q.7	a.	The Pressure, Temperature, Mach number at the entry of passage are 2.45 bar, 26.5°C and 1.4 respectively. If the exit Mach number is 2.5, determine for Adiabatic flow of a perfect gas of $\gamma = 1.3$ and $R = 0.45 \text{ KJ/kg.K}$. (i) Stagnation temperature of Inlet (ii) Stagnation temperature of Outlet if same passage (iii) Temperature of Exit (iv) Velocity of Exit (v) Flow rate per square metre of Inlet.	08	L4	CO3
	b.	Write a note on Stagnation temperature, Pressure and Density with a suitable notations.	04	L3	CO3
	c.	Derive an expression of Steady Flow Energy Equation.	08	L3	CO3

OR

Q.8	a.	Air flowing in a duct has a velocity of 300 m/s. Pressure 1.0 bar and temperature 290 K. Assume $\gamma = 1.4$ and $R = 287 \text{ J/kg K}$ of the flow. Determine (i) Stagnation pressure (ii) Stagnation temperature (iii) Velocity of sound in dynamic (iv) Velocity of sound in stagnation (v) Stagnation pressure with constant density	08	L4	CO3
	b.	Derive an equation of Energy for Adiabatic flow.	08	L3	CO3
	c.	State the following of TD: (i) Laws of Thermodynamics (Four Laws) (ii) Internal Energy and Enthalpy	04	L2	CO3

Module – 5

Q.9	a.	Derive an equation of Prandtl – Meyer relation for Normal Shock Wave.	10	L3	CO3
	b.	The state of gas ($\gamma = 1.3$, $e = 0.47$) KJ/kg K upstream of normal shock wave is given by following data: $M_x = 2.5$, $P_x = 2 \text{ bar}$ and $T_x = 275 \text{ K}$. Calculate the Mach number, Pressure, Temperature and Velocity of the downstream of shock.	06	L4	CO3
	c.	Write a note on Expansion of Supersonic flow.	04	L2	CO3

OR

Q.10	a.	Derive an equation of Oblique Shock Wave with a Rankine-Hugoniot relationship.	10	L3	CO3
	b.	A gas having $\gamma = 1.3$ @ $P_1 = 345 \text{ Mbar}$, $T_1 = 350 \text{ K}$ and $M_1 = 1.5$ is to be isentropically expanded to 138 Mbar. Determine (i) Deflection Angle (ii) Final Mach Number (iii) Temperature of the gas	06	L4	CO3
	c.	Explain about Shock Polar Diagram.	04	L2	CO3