Sanjay Ghodawat University, Kolhapur 2019-20

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017 EXM/P/09/01

Year and Program: 2019-20 and TY	**School of Technology**	**Department of Aeronautical Engineering**
Course Code: AET301	**Course Title: Aerodynamics II**	**Semester – V**
Day and Date Tuesday 19/11/19	**End Semester Examination (ESE)**	**Time:** 10.30 am to 1.30 pm. **Max Marks: 100**

Instructions:
1) All questions are compulsory.
2) Assume suitable data wherever necessary.
3) Figures to the right indicate full marks.
4) Gas tables are allowed.

			Marks	Bloom's Level	CO
Q.1		**Attempt the Following**			
	a)	State the significance of second law of thermodynamics in terms of entropy and derive the relation for s_2-s_1	07	L_2	CO1
		OR			
	a)	Define the total stagnation conditions. At a point in an airflow the pressure, temperature and velocity are 1atm, 320K and 1000m/s. Calculate the total temperature and total pressure at this point.	07	L_2	CO1
	b)	Consider a point in an airflow where the local Mach number, static pressure and static temperature are 3.5, 0.3atm and 180K respectively. Calculate local values of P_0, T_0, T^*, a^* and M^* at this point.	08	L_3	CO2
		OR			
	b)	Define Mach number in terms of speed of sound. Derive the relation for speed of sound in terms of density and pressure.	08	L_2	CO2
Q.2		**Attempt the Following**			
	a)	Explain in detail about Shock expansion theory.	07	L_2	CO3
		OR			
	a)	Derive the oblique shock relations in terms of Θ, β and M.	07	L_3	CO3
	b)	Derive an expression for Area-velocity relation for a supersonic flow through nozzle.	08	L_2	CO3
		OR			

ESE

	b)	Write short notes on supersonic flow through diffusers for ideal case.	08	L_2	CO3
Q.3		**Solve any Two**			
	a)	What is Isentropic process? Derive the relation for temperature, pressure and density in terms of Isentropic relation.	08	L_2	CO1
	b)	Consider a streamline with a point in an airflow over an airfoil where the local Mach number, static pressure and static temperature are 3.5, 0.3atm and 180K respectively. Calculate local values of P_0, T_0, T^*, $á^*$ and M^* at this point.	08	L_3	CO2
	c)	A uniform supersonic flow at $M_1 = 2, p_1 = 0.8X10^5$ N/m^2 and temperature 270K expands through two convex corners of 10° each. Determine the downstream Mach number M_3 ,p_3 and T_3 for the Expansion shock wave.	08	L_3	CO3
	d)	State the significance of High speed tunnels. With a neat sketch write about the working of supersonic wind tunnel.	08	L_2	CO3
Q.4		**Solve any Two**			
	a)	What is lift slope and mention the effect of lift slope due to the effect of C_L and C_P. Calculate the pressure coefficient(C_P) at a point on the airfoil surface if pressure coefficient is -0.4 at very low speeds for free stream mach number 0.7. Also Calculate the lift coefficient(C_L) for M_∞=0.8.	09	L_3	CO4
	b)	Write about Transonic Area rule and swept back wings in reducing the drag of an aircraft with a schematic diagram.	09	L_2	CO4
	c)	Explain in detail the Drag divergence Mach number and Critical Mach number with a neat sketch.	09	L_2	CO4
Q.5		**Solve any Two**			
	a)	What do you mean by viscous flow? Write about the compressible laminar and turbulent flow.	09	L_2	CO4
	b)	The F-104 supersonic fighter flying at Mach 2 at 11km altitude with the air density and temperature given by $\rho_\infty = 0.3648$ kg/m^3 and T_∞ = 216.78K. Calculate the angle of attack of the wing with aircraft weight of 9400kgf. The Area of wing is 18.21m^2	09	L_2	CO4

ESE

	c)	What do you mean by Linear Theory? Derive the linearized supersonic pressure coefficient formula.	09	L_2	CO4
Q.6		**Solve any Three**			
	a)	Explain the supercritical airfoil with a neat sketch.	06	L_2	CO4
	b)	Comment on the location of minimum pressure with respect to Critical Mach number.	06	L_2	CO4
	c)	Calculate the lift and drag coefficients for an infinitely thin flat plate in a Mach 2.6 freestream at angles of attack of $\alpha = 8^0$ and $\alpha = 12°$	06	L_3	CO4
	d)	Derive the wave drag coefficient for the supersonic flow over a flat plate.	06	L_3	CO4

****

ESE