Model Question Paper-1 with effect from 2022-23 (CBCS Scheme)

USN

Fourth Semester B.E. Degree Examination

Subject Title: Aerodynamics

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Use of **Gas Tables** is permitted

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	Show that the stream function is depends on half of the source strength for the combination of Uniform, Source and Sink flows.	L4	10
	b	With a neat sketch and notations, Illustrate the Non-lifting flow over a circular cylinder.	L2	10
		OR		
Q.02	a	Derive an expression for Lifting Curve Slop for Cambers airfoil by using classical thin airfoil theory.	L4	10
	b	A source flow having 0.620 m²/s. the pressure at radius of flow is 5mm is 200 KN/ m². Find i)pressure at radius of 550mm ii) Plot stream line and potential line.	L3	6
	c	Write a short note on Kutta-Condition for Lifting over an airfoil.	L2	4
		Module-2		
Q. 03	a	Derive an expression for Prandtl's Classical lifting line theory.	L4	10
	b	Explain the effect of Downwash & Induced Drag.	L2	6
	c	Write a importance of Biot-Savart Theorem for Finite Wing.	L2	4
		OR		
Q.04	a	Consider finite wing with an Aspect Ratio of 10 & Tapered ratio 0.5 Airfoil section thin & Symmetrical. Calculate lift & Induced drag coefficient for wing when it has an angle of attack 10°. Assume $\delta=\tau$ and δ is 0.055.	L3	10
	b	Derive an equation for Elliptical & Modified lift distribution.	L3	10
		Module-3		
Q. 05	a	Illustrate the importance of Sweep wing and its effect in Configuration of an airfoil.	L2	10
	b	Summarize about Subsonic & Supersonic Leading Edge.	L2	5
	c	Describe Horshoe-Vortex Model with a suitable sketch.	L2	5
		OR		
Q. 06	a	Discuss about High Lift Devices.	L2	10
	b	Write a note on Transonic area rule.	L2	4
	c	Paraphrase the Source panel & Vortex lattice method.	L2	6
		Module-4		
Q. 07	a	Draw a neat sketch & explain variation of pressure along Convergent-Divergent duct for various back pressure.	L2	10
	b	The pressure, temperature & mach number at entry of a flow passage are 2.45 bar, 26.5°& 1.4 respectively. If extend mach number is 2.5, Calculate for adiabatic flow of a perfect gas having $\gamma=1.3$ & R=0.469 KJ/KgK.	L3	10
		OR		

Q. 08	a	Derive an expression of Adiabatic state energy equation.	L4	10
	b	A flow in a duct has a velocity 300 m/s , pressure 1 bar & temperature 290K. Taking γ=1.4 & R=287KJ /KgK. Determine i) Stagnation temperature ii) Velocity of Sound in dynamic & stagnation condition.	L3	10
		Module-5		
Q. 09	a	Derive an equation for Mach number downstream of Normal Shock Wave.	L4	10
	b	Air approach symmetrical wedge δ=15° at mach number 2.0. Analyze the strong & weak wave for a)Wave angle b) Pressure ration c) Density d) Temperature ration e) Downstream Mach number.	L3	7
	c	With a neat sketch explain about Supersonic flow over a wedge of an airfoil.	L2	3
		OR		
Q. 10	a	Starting from the general energy equation for flow through an Oblique shock wave, Obtain the Prandtl's equation.	L4	10
	b	Explain the following a)Shock polar b)Hodograph Plane c) Intersection of waves.	L2	10

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.

Model Question Paper-2 with effect from 2022-23 (CBCS Scheme)

USN

Fourth Semester B.E. Degree Examination
AERODYNAMICS

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Use of gas tables is allowed

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	With a neat sketch, derive an expression of velocity potential and stream function of doublet flow	L2	10
	b	Briefly explain about Non-lifting flow over a circular cylinder	L4	10
		OR		
Q.02	a	State kelvin's circulation theorem	L2	4
	b	What is kutta condition? Derive an expression for kutta-joukowski theorem	L3	8
	c	Derive an expression for symmetrical thin airfoil theory	L3	8
		Module-2		
Q. 03	a	Derive the expression for the velocity induced by infinite vortex filament using the Biot-savart law.	L4	6
	b	Derive an expression for lift coefficient and induced drag coefficient in terms of circulation strength Γ(y) for a finite wing through Prandtl's classical lifting line theory	L4	14
		OR		
Q.04	a	Derive the expression for the induced angle of attack and induced drag coefficient using elliptical lift distribution	L4	12
	b	Discuss lifting surface theory and vortex lattice method for wing	L2	4
	c	Explain the limitations of Prandtl's lifting line theory	L2	4
		Module-3		
Q. 05	a	Discuss the advantages of swept wing in model airplane with a neat sketch	L3	8
	b	Write a note on influence of Downwash on tail plane	L2	8
	c	write short notes on simplified horse shoe vortex model	L2	4
		OR		
Q. 06	a	Explain in detail about the high lifting devices helps for lift enhancement.	L3	8
	b	Briefly explain the transonic area rule	L2	8
	c	What is critical mach number	L1	4
		Module-4		
Q. 07	a	Derive the energy equation for flow and non-flow process	L3	8
	b	An aircraft flies at 800 km/hr at an altitude of 10,000 meters (T=223.15K, p=0.264 bar). The air is reversibly compressed in an inlet diffuser. If the mach number at the exit of the diffuser is 0.36. Determine i) entry mach number ii) velocity, pressure and temperature of air at the diffuser exit.	L3	8
	c	Write the bernoulli's equation for isentropic compressible flow	L3	4
		OR		

Q. 08	a	Derive the area ratio as a function of mach number	L4	8
	b	Derive the impulse function	L3	8
	c	Derive the mass flow rate in terms of pressure ratio	L3	4
Module-5				
Q. 09	a	Derive the Prandtl-Meyer equations for normal shock wave in perfect gas	L4	8
	b	Derive the expression for Rankine-Hugoniot equations of a normal shock wave	L4	8
	c	Derive the governing normal shock wave equations	L2	4
OR				
Q. 10	a	Obtain the expression for $\emptyset - \beta - M$ relation for oblique shock	L4	15
	b	With a neat sketch explain the shock polar	L1	5

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