PRN:		Course Code :	PAS104

First Year **M. Tech** End Semester Examination Winter 2024

Flight Performance

000461

Day and Date: Wed - 4 DEC 2024 Max Marks: **100**

Time : 10:30AM To 01:30PM Duration: **03** hrs

Instructions: All questions are compulsory.

			Marks	Bloom's Level	CO
Q.1		**Attempt the following**			
	a)	Derive Equations of motion of a rigid flight vehicle.	08	1	1
	b)	Explain detail about calculation of airspeed by using pitot static tube.	08	2	1
		OR			
	b)	Expression the relation between true airspeed and equivalent airspeed.	08	2	1
Q.2		**Attempt the following**			
	a)	Discuss the Drag reduction techniques.	08	2	1
	b)	Explain Airfoil nomenclature with wing characteristics.	08	2	2
		OR			
	b)	What is NACA Aerofoil's? Explain NACA 4 digit and 5 digits with suitable examples.	08	3	2
Q.3		**Attempt any two from the following**			
	a)	An aircraft weights 250000 N has wing area of $80m^2$ and its drag equation is $Cd = 0.016 + 0.04\ Cl^2$. Calculate minimum thrust required for S/L flight i. At sea level ii. At 1000m altitude	08	1	2
	b)	Discuss the drag estimation and also drive the equation for velocity corresponding to minimum drag.	08	2	3
	c)	Derive the equation for power required minimum condition.	08	2	3
Q.4		**Attempt any two from the following**			
	a)	An aircraft weight 20000kg, its wing loading is 2850 N/m^2 and its wing span is 24m, i. Calculate velocity required to maintain (L/D)max ii. Calculate $P/Pmin$ at 180 m/s $CDo = 0.018$ iii. Calculate power required to maintain 180m/s	08	1	3

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	b)	Drive the equation for steady state climb flight condition.	08	2	4
	c)	Estimate angle of climb maximum for a jet engine aircraft which produces thrust $T = 27000\,N$ which is independent of forward Velocity. The flight weights 160000 N and wing area 42m^2. Its drag polar equation is $CD = 0.014 + 0.05CL^2$.Also calculate rate of climb (R/C)max and Corresponding Velocity.	08	3	4
Q.5		**Attempt any Two of the following**			
	a)	A sailplane weight $4500N$ has a wing loading of $600N/m^2$. Its drag polar equation is $Cd = 0.01 + 0.022\,CL^2$ after completing a launch of $350m$ in still air, i. What is the greatest distance the sailplane can cover ii. What is the greatest duration of the flight possible? Assume in both cases flight over the level ground	09	3	4
	b)	A Sail plane weights 4500 N, has wing loading of 600 N/m^2. It's dang polar equation is CD = 0.7+ 0.022 CL^2. Estimate the gliding angle when,during with airbrakes at a speed of 30m/s at Sea level.	09	2	4
	c)	An aircraft weights $4300N$ has a wing loading of $600\,N/m^2$ and which drag polar equation is $CD = 0.01 + 0.02CL^2$. The $CLmax = 2.5$ when approaching to landing the aircraft is found at a speed of 15% greater than Stalling in glide and it is required to have an approach glide angle of 20°. Estimate the rising in zero lift Cohesion necessary to attain this glide angle. And also Calculate approach gliding speed.	09	3	5
Q.6		**Attempt any Two of the following**			
	a)	Drive the range and endurance equation for Jet engine Aircraft.	09	2	5
	b)	An aircraft has the following characteristics: Wing span $20m$. Wing area 44m^2 . Total mass 15 $tones$, Fuel mass 4.5 tones. Specific fuel consumption 0.6, Zero lift drag coefficient 0.018. Oswald efficiency factor 0.85. Calculate a Maximum L/D b Ratio Maximum range and endurance speed Assume sea level density as $1.2256\,kg/m^3$	09	2	5
	c)	Discuss the importance of the V-n diagram in detail.	09	3	5

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