SEMESTER 4

FLIGHT MECHANICS

Course Code	PCAOT402	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. Understanding the performance of airplanes under different operating conditions.
2. Examine the aircraft's response to intentional and unintentional changes in flying circumstances statically and dynamically.

SYLLABUS

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Module No.	Syllabus Description	Contact Hours
1	**Steady level performance:** True, indicated and equivalent airspeed. Mach number, Drag polar equation and curves. Straight and level flight, thrust required and available. Power required and available, Effect of altitude on thrust and power. Conditions for minimum drag and minimum power required.	9
2	**Accelerated Performance:** Range and Endurance. Gliding and Climbing flight. Take-off and landing performance, Turning performance, horizontal and vertical turn. Pull up and pull down, maximum turn rate, V-n diagram.	11
3	**Static Stability:** Degree of freedom, Static and dynamic stability, static longitudinal stability conditions. Static longitudinal stability - Stick fixed and Stick free (Contribution of individual components, neutral point, static margin, Hinge moment, Elevator control effectiveness). Directional Stability- Weather cock stability, dorsal fin, directional control. Lateral Stability- Dihedral effect ,side slip	13

4	**Dynamics:** Aircraft equations of motion - Routh's criterion, Stability derivatives. Longitudinal Dynamics-Equation of Longitudinal motion., Phugoid motion: long period and short period. Lateral Dynamics-Spiral and directional divergence, Dutch roll, Autorotation and spin.	**11**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

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End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the aircraft performance in steady level flight.	**K2**
CO2	Summarize the performance of aircraft under accelerated flight conditions.	**K2**
CO3	Apply the basic principle of motions to derive the static stability requirements of an aircraft .	**K3**
CO4	Utilize the equation of motions of an aircraft to assess the different maneuvers of an aircraft.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

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CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	3	-	-	-	-	-	-	-	-	-	2
CO4	3	3	-	-	-	-	-	-	-	-	-	2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Aircraft Performance and design	John D Anderson Jr.	McGraw-Hill Education	2017
2	Airplane Performance Stability and Control	Courtland D Perkins, Robert E Hage	John Wiley & Sons	
3	Flight stability and automatic control	Nelson R C	McGraw-Hill book Co	2004
4	Advanced Aircraft Flight performance	Filippone,Antonio	Cambridge university	2012

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Steady Aircraft flight and performance	N.Harris, McClamroch	Princeton University	2011
2	Theory and Practice of aircraft performance	Ajoy Kumar Kundu, Mark A Price,David Riordan	Wiley	2016
3	Dynamics of flight stability and control	Bernard Etkin, Lloyd Duff Reid	Wiley	3rd Edition,1996
4	Aircraft performance: An Engineering Approach	Mohammed H Sadraey	CRC Press	2023
5	Introduction to Flight	John D Anderson Jr	McGraw-Hill Education	Eighth Edition,2016

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