AMITY UNIVERSITY
UTTAR PRADESH

Course Title : Automatic Flight Control Systems **Credit Units** : 04
Course Level : PG
Course Code : SPAC605

L	T	P/S	SW/FW	TOTAL CREDIT UNITS
3	1	0	0	04

Course Objectives :

This course seeks to impart basic understanding of automatic flight control of an aircraft.

Pre-requisites:

- Differential Calculus
- Linear Algebra and
- Laplace Transform

Course Contents/Syllabus:

	Weightage (%)
Module I : Input / Output Relationship	**20**
1. Introduction to open loop and closed loop control systems, 2. Mathematical modeling and representation of physical systems (Electrical, Mechanical and Thermal), 3. Derivation of transfer function of different types of systems 4. Block diagram and signal flow graph 5. Block Diagram reduction techniques 6. Mason's Gain Formula.	
Module II: Time – Domain Analysis	**20**
1. Time domain performance criteria 2. Transient response of first, second & higher order systems 3. Steady state errors and static error constants in unity feedback control systems 4. Error criteria and generalized error constants 5. Performance indices 6. Response with P, PI and PID controllers.	

Module III: Frequency Domain Analysis	**25**
1. Polar and inverse polar plots 2. Frequency domain specifications 3. Logarithmic plots (Bode Plots) 4. Gain and phase margins 5. Relative stability 6. Correlation with time domain 7. Constant close loop frequency responses from open loop response 8. Nyquist Plot.	
Module IV: Auto Pilots	**25**
1. Asymptotic stability and conditional stability 2. Routh–Hurwitz criterion 3. Root Locus plots and their applications. 4. Compensation Techniques: Concept of compensation, Lag, Lead and Lag-Lead networks 5. Design of closed loop systems using compensation techniques 6. Introduction to state variables 7. Controllability and observability	
Module V: Miscelleneous	**10**
1. Fly-By-Wire control system 2. Longitudinal Auto Pilot: Brief description through Block diagrams and Root Locus of Displacement 3. Auto Pilot 4. Pitch Orientation Control System 5. Acceleration control system	

Student Learning Outcomes (SLO):

On completion of the course the student will be able to:

- Understand concept of auto pilot and
- Design and develop a fly-by- wire control system for an aircraft.

Pedagogy for Course Delivery: The course pedagogy will include lectures, numerical practice, case studies. It also includes discussion on problems and challenges faced by design engineers.

Assessment/ Examination Scheme:

Theory L/T (%)	Lab/Practical/Studio (%)	Total
100	**Nil**	**100**

Theory Assessment (L&T):

	Continuous Assessment/Internal Assessment				End Term Examination
Components (Drop down	**CT**	**S/V/Q**	**HA**	**Att**	**EE**
Weightage (%)	10	8	7	5	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

Texts:

- Pallet H.J., "Automatic Flight Control", B.S. Professionals Books, Oxford, 3rd Ed, 1987.
- Benjamin C. Kuo, "Automatic Control Systems," Prentice Hall of India, 1992
- Dr. N.K Jain, 2005, "Automatic Control System Engineering", Dhanpat Rai Publication.
- J. Nagrath & M. Gopal, 2000, "Control System Engineering", New Age International.

References:

- John H. Blackelock, "Automatic Control of aircraft and Missiles", John Wiley and Sons, 2nd Ed.1990
- Perkins C.D. and Hage R.E., "Airplane Performance Stability and Control", John Wiley and Sons.
- Bernard Etkins, "Dynamics of Flight Stability and Control", John Wiley & Sons, 2/Ed 1989
- Robert C. Nelson, 'Flight Stability and Automatic Control", McGraw Hill Co, 1989.
- M, K. Ogata, 2002, "Modern Control Engineering, PHI.