Subject Description Form

Subject Code	EE539
Subject Title	Aerospace Power Electronics and Actuation Systems
Credit Value	3
Level	5
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To provide engineers with in depth knowledge of the use of power electronics and actuation systems in the aerospace industry. 2. To provide latest development and applications in power conversion, electric actuator, fly-by-wire, fly-by-light and space will be covered.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Have the ability to acquire a good understanding of aircraft actuation systems. Be able to present the understanding of the basic requirements of aircraft actuation systems. b. Understand and analyse power system needed for the aerospace applications. Be able to present the understanding of power systems for aircrafts. c. Understand the power electronics needs to military devices and space applications. Be able to present the understanding of the basic requirements of power electronics to aerospace environment.
Subject Synopsis/ Indicative Syllabus	1. ***More electric aircraft*:** Basic concept of more electric aircraft, review of electric systems of aircraft, wiring and cabling, cabin lighting and utilities. 2. ***Aircraft power electronics*:** Soft power system, rectifier units, distribution systems, and power supplies. 3. ***Actuation systems*:** Review of hydraulic and electro-hydraulic control systems, hydraulic servo valve, fuel pump, secondary flight control system, flux-reverser. 4. ***Aerospace standards*:** Military standards, British standards on aerospace, and NASA standards. 5. ***Aerospace and aeronautic control:*** Reliability, fly-by-wire, fly-by-light, unmanned air vehicles, propulsion, aeronautic computing system and gyroscope. 6. ***Military power electronics and actuation*:** Packaging for Military-standard, missile control and guidance system, E-bomb. 7. ***Space power engineering*:** Ion-thrusters, rocket power electronics and system, power conversion and energy storage in space, space transportation, and photovoltaic system. **Laboratory Class:** Each student is required to conduct a laboratory test or attend a demonstration to understand the aerospace devices and components. **Assignment and mini-project:** Each student is required to work on a mini-project which covers the above selected areas. Written report and presentation are needed.

Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on design and practical applications are given through a practical case study, in which the students are expected to understand design problems with real-life constraints and to attain pragmatic solutions.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lectures	√	√	√
Tutorials	√	√	√
Assignment/Presentation	√	√	√

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Examination	60%	√	√	√
2. Tests	24%	√	√	√
3. Report/Presentation	16%	√	√	√
Total	100%			

One end-of-semester written examination; test(s); a laboratory report; a power point presentation and report for the particular topic.

Student Study Effort Expected		
	Class contact:	
	▪ Lecture/Tutorial	30 Hrs.
	▪ Laboratory	6 Hrs.
	▪ Test/Presentation	3 Hrs.
	Other student study effort:	
	▪ Case Study	18 Hrs.
	▪ Self-study	48 Hrs.
	Total student study effort	105 Hrs.

Reading List and References

Reference books:

1. Selected articles from Military and Aerospace Electronics, PennWell Publishing Company
2. Selected articles from Defense & Aerospace Electronics, Pasha Publications, Inc.
3. A.M. Cruise, J.A. Bowles, T.J. Patrick, C.V. Goodall, Principles of Space Instrument Design, Cambridge University Press, 2006
4. Noah D. Manring, Fluid Power Pumps and Motors: Analysis, Design and Control McGraw-Hill Education, 2013
5. M. Jelali, A. Kroll, Hydraulic Servo-systems: Modelling, Identification and Control, Springer, 2013
6. R.P.G. Collinson, Introduction to Avionics Systems, Kluwer Academic, 2011.
7. I. Moir, A. Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Wiley, 2012.