UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY, CHENNAI 600 025

REGULATIONS - 2013

M.E. AVIONICS

CURRICULUM AND SYLLABUS I TO IV SEMESTERS (FT & PT)

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	AV8101	Avionics System Engineering	3	0	0	3
2.	AV8102 AV8103	**Bridge Course** Aerospace Engineering (For Non-Aero students) (OR) Electronic Systems (For Aero students)	3	0	0	3
3.	AV8104	Digital Avionics	3	0	0	3
4.	AV8105	Electro Optic Systems	3	0	0	3
5.	AV8151	Flight Instrumentation	3	0	0	3
6.	MA8163	Advanced Applied Mathematics	3	1	0	4
PRACTICAL						
7.	AV8111	Avionics Integration Laboratory	0	0	4	2
		TOTAL	**18**	**1**	**4**	**21**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	AV8201	Navigation Systems	3	0	0	3
2.	AV8202	System Modeling and Simulation	3	0	0	3
3.	AL8253	Rocketry and Space Mechanics	3	0	0	3
4.	AV8251	Aerospace Guidance and Control	3	0	0	3
5.		Elective I	3	0	0	3
6.		Elective II	3	0	0	3
PRACTICAL						
7.	AV8211	Automatic Flight Control Systems Laboratory	0	0	4	2
		TOTAL	**18**	**0**	**4**	**20**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1		Elective III	3	0	0	3
2		Elective IV	3	0	0	3
3		Elective V	3	0	0	3
PRACTICAL						
4	AV8311	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	AV8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NO.OF CREDITS: 68

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY, CHENNAI 600 025

REGULATIONS - 2013

M.E. AVIONICS

CURRICULUM I TO VI SEMESTERS (PART - TIME)

SEMESTER – I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA8163	Advanced Applied Mathematics	3	1	0	4
2.	AV8104	Digital Avionics	3	0	0	3
3.	AV8102 AV8103	**Bridge Course** Aerospace Engineering (For Non-Aero students) (OR) Electronic Systems (For Aero students)	3	0	0	3
PRACTICAL						
4.	AV8111	Avionics Integration Laboratory	0	0	4	2
		TOTAL	**9**	**1**	**4**	**12**

SEMESTER – II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	AV8201	Navigation Systems	3	0	0	3
2.	AL8253	Rocketry and Space Mechanics	3	0	0	3
3.		Elective - I	3	0	0	3
PRACTICAL						
4.	AV8211	Automatic Flight Control Systems Laboratory	0	0	4	2
		TOTAL	**9**	**0**	**4**	**11**

SEMESTER – III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	AV8105	Electro-Optic Systems	3	0	0	3
2.	AV8151	Flight Instrumentation	3	0	0	3
3.	AV8101	Avionics System Engineering	3	0	0	3
		TOTAL	**9**	**0**	**0**	**9**

SEMESTER – IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	AV8251	Aerospace Guidance and Control	3	0	0	3
2.	AV8202	System Modeling and Simulation	3	0	0	3
3.		Elective - II	3	0	0	3
		TOTAL	**9**	**0**	**0**	**9**

SEMESTER - V

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1		Elective III	3	0	0	3
2		Elective IV	3	0	0	3
3		Elective V	3	0	0	3
PRACTICAL						
4	AV8311	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER – VI

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AV8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS = 68

LIST OF ELECTIVES

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	AV8001	Active Control Technology	3	0	0	3
2.	AV8002	Airborne Actuators and Sensors	3	0	0	3
3.	AV8003	Airborne Fire Control	3	0	0	3
4.	AV8004	Aircraft Product and System Engineering, Standards and Certification	3	0	0	3
5.	AV8005	Avionics Network Technology	3	0	0	3
6.	AV8006	Display Engineering	3	0	0	3
7.	AV8007	Electronic Warfare	3	0	0	3
8.	AV8008	Fault Tolerant Control	3	0	0	3
9.	AV8009	Flight Dynamics	3	0	0	3
10.	AV8010	Flight Simulation for Combat Aircraft System	3	0	0	3
11.	AV8011	Human Engineering	3	0	0	3
12.	AV8012	Image Processing for Aerospace Applications	3	0	0	3
13.	AV8013	Industrial Avionics	3	0	0	3
14.	AV8014	Instrumentation For Flight Testing	3	0	0	3
15.	AV8015	Missile Technology	3	0	0	3
16.	AV8016	Programming in Ada	3	0	0	3
17.	AV8017	UAV System Design	3	0	0	3
18.	AP8075	Electromagnetic Interference and Compatibility In System Design	3	0	0	3
19.	AS8151	Elements of Satellite Technology	3	0	0	3
20.	AS8251	Missile Guidance and Control	3	0	0	3
21.	AS8252	Spacecraft Communication Systems	3	0	0	3
22.	AV8071	Digital Fly-By Wire Control	3	0	0	3
23.	AV8072	Fault Tolerant Computing	3	0	0	3
24.	AV8073	Soft computing for Avionics Engineers	3	0	0	3
25.	NE8071	Detection and Estimation theory	3	1	0	4
26.	NE8072	Microwaves and Radar	3	0	0	3
27.	NE8073	Real Time Embedded System	3	0	0	3

Any other PG level course can be taken as elective: only with the permission of faculty advisor and HOD.

AV8101 AVIONICS SYSTEM ENGINEERING L T P C
3 0 0 3

OUTCOME:

Upon completion of the course, the students will understand the introduction to the concepts of System Engineering to the engineers and the necessary knowledge that can be significantly introduced to optimize the design and analysis of avionic systems. The students will also have an exposure on various topics such as the System Engineering as a process, System Architecture and integration, Maintainability and reliability and will be able to deploy these skills effectively in the design process of systems in an aircraft.

UNIT I INTRODUCTION TO SYSTEMS ENGINEERING 9

Overview of Systems Engineering- Systems Engineering Concept Map-Systems Definition - The seven steps Systems Engineering-Conceptual System Design- System Engineering Process-Requirements And Management- Trade Studies-;Integrated Product And Process Development-

UNIT II THE AIRCRAFT SYSTEMS AND DESIGN 9

Introduction-Everyday Examples of Systems-Aircraft Systems-Generic Systems-Product Life Cycle-Different Phases-Whole Life Cycle Tasks-Systems Analysis- Design Drivers in the Project, Product, Operating Environment-Interfaces with the Subsystems- Mission analysis

UNIT III SYSTEM ARCHITECTURES AND INTEGRATION 9

Introduction-Systems Architectures-Modelling and Trade-Offs- Evolution of Avionics Architectures-Systems Integration Definition- Examples of Systems Integration-Integration Skills-Management of Systems Integration.

UNIT IV PRACTICAL CONSIDERATIONS AND CONFIGURATION CONTROL 9

Stake holders-Communications-Criticism- Configuration Control Process-Portrayal of a System-Varying Systems Configurations- Compatibility-Factors Affecting Compatibility –Systems Evolution. Considerations and Integration of Aircraft Systems.

UNIT V SYSTEMS RELIABILITY AND MAINTAINABILITY 9

Systems and Components-Analysis-Influence, Economics, Design for Reliability-Fault and Failure Analysis-Case Study-Maintenance Types-Program-Planning and Design

TOTAL: 45 PERIODS

REFERENCES:

1. Systems Approach to Engineering Design by Peter. Sydenham, Artech house, Inc, London, 2003
2. Systems Engineering by Erik Aslaksen and Rod Belcher.
3. Design and Development of an Aircraft Systems by Ian Moir and Allan Seabridge.
4. Aircraft Systems Mechanical, electrical, and avionics subsystems integration by Ian Moir and Allan Seabridge John Wiley & Sons Ltd (2009)
5. Introduction to Systems Engineering by Andrew P.Sage and James E.Armstrong.

AV8102 AEROSPACE ENGINEERING **L T P C**
3 0 0 3

OUTCOME:
Upon completion of the course, the students will understand the available basic concepts of aeronautical engineering to the engineers and the necessary mathematical knowledge that are needed in modeling physical phenomena involved. The students will also have an exposure on various topics such as Lift, Drag, aircraft performance, structure and propulsion and will be able to deploy these skills effectively in the understanding of concepts relating to an aircraft.

UNIT I CONFIGURATION OF AIRPLANE AND BASIC AERODYNAMICS 9
How an Airplane flies - components of an airplane and their functions - Airfoils and streamlines - forces acting on an airplane - lift and drag – types of Drag– speed and power – International Standard Atmosphere.

UNIT II AIRCRAFT PERFORMANCE 9
Straight and level flight– conditions for minimum Drag and minimum power– climbing and gliding – Range and Endurance – Take off and Landing – V-n diagram.

UNIT III STABILITY AND CONTROL 9
Concepts of static and dynamic stability and control– yaw and sideslip – dihedral effect rudder requirements – directional and spiral divergence – Dutch roll– autorotation and spin.

UNIT IV AIRCRAFT STRUCTURES 9
Introduction to Aircraft structures - Loads - Types of construction - Design feature of Aircraft materials.

UNIT V PROPULSION 9
Aircraft propulsion, Rocket propulsion, power plant classification, principles of operation, Areas of their application.

TOTAL: 45 PERIODS

REFERENCES:
1. Kermode, A.C, 'Mechanics of Flight' English Book Store, New Delhi, 1982.
2. Van Sickle Neil, D 'Modern Airmanship' VanNostrand Reinhol, New York, 1985.
3. Megson T.H. 'Aircraft Structures for Engineering Student's II Edition, Edward Arnold, Kent, U.S.A. 1990

AV8103 ELECTRONIC SYSTEMS **L T P C**
3 0 0 3

OUTCOME:
Upon completion of the course, the Students will understand the available basic concepts of Electronic Systems to the engineers and the necessary basic understanding of electronic systems, their design and operation.The students will also have an exposure on various topics such as Operational Amplifiers, Digital Systems, Microprocessor and Microcontroller based systems and will be able to deploy these skills effectively in understanding the systems and analyzing the electronic systems employed in avionics engineering.

UNIT I LINEAR IC's 9
OP-AMP specifications, applications, voltage comparator, A/D and D/A converter, sample and hold circuit, timer, VCO, PLL, interfacing circuits.

UNIT II DIGITAL SYSTEMS 9

Review of TTL, ECL, CMOS- Logic gates, Flip Flops, Shift Register, Counter, Multiplexer, Demultiplexer / Decoder, Encoder, Adder, Arithmetic functions, analysis and design of clocked sequential circuits, Asynchronous sequential circuits.

UNIT III SIGNAL GNERATORS 9

Monostable, Astable and Bistable mutivibrators.Schmitt Trigger. Conditions for oscillation, RC phase shift oscillator, Wien bridge oscillator, Crystal oscillator. LC oscillators. Relaxation oscillators

UNIT IV MICROPROCESSOR BASED SYSTEMS 9

The 8085 microprocessor, interfacing with Alpha numeric displays, LCD panels, Stepper motor controller, Analog interfacing and industrial control.

UNIT V MICROCONTROLLER BASED SYSTEMS 9

8031 / 8051 Micro controllers:– Architecture- Assembly language Programming-Timer and Counter Programming- External Memory interfacing –- D/A and A/D conversions – Multiple Interrupts . Introduction to 16 bit Microcontrollers.

TOTAL: 45 PERIODS

REFERENCES:

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, Millman's, “Electronic Devices and Circuits”, Second Edition, Tata McGraw Hill,New Delhi, 2007.
2. Donald P Leach, Albert Paul Malvino, Goutam Saha, “Digital Principles and Applications”, 6th Edition Tata McGraw Hill, New Delhi,2006..
3. Gayakwad, Ramakant A., “Op-Amps And Linear Integrated Circuits”, Prentice Hall/ Pearson Higher Education, New Delhi, 1999.
4. John Crisp, “Inroduction to Microprocessor and Microcontroller”, Newnes Publication, London. 2004.
5. William Kleitz, “Microprocessor and Microcontroller Fundamentals: The 8085 and 8051 Hardware and Software”, Prentice Hall Inc, New York, 1997

AV8104	DIGITAL AVIONICS	L T P C
		3 0 0 3

OUTCOMES:

Upon completion of the course, the students will understand to impart the basic concepts of Avionics Systems to the engineers and also the necessary knowledge on working of avionics systems in an aircraft. The students will also have an exposure on various topics such as Avionics system architecture, Avionics bus systems, integration , display systems and packaging ; and will be able to deploy these skills effectively in the understanding and analysis of avionics systems.

UNIT I INTRODUCTION TO AVIONICS 4

Role for Avionics in Civil and Military Aircraft systems, Avionics sub-systems and design, defining avionics System/subsystem requirements-importance of ‘ilities’, Avionics system architectures.

UNIT II AVIONICS SYSTEM DATA BUSES, DESIGN AND INTEGRATION 11

MIL-STD-1553B, ARINC-429, ARINC-629, CSDB, AFDX and its Elements, Avionics system design, Development and integration-Use of simulation tools, stand alone and integrated Verification and Validation.

UNIT III AVIONICS SYSTEM ESSENTIALS: DISPLAYS, I/O DEVICES AND POWER 11

Trends in display technology, Alphanumeric displays, character displays etc., Civil and Military aircraft cockpits, MFDs, MFK, HUD, HDD, HMD, DVI, HOTAS, Synthetic and enhanced vision, situation awareness, Panoramic/big picture display, virtual cockpit-Civil and Military Electrical Power requirement standards, comparing the Military and Civil Requirements and Tips for Power System Design.

UNIT IV PACKAGING 4

Modular Avionics Packaging - Trade-off studies - ARINC and DOD types - system cooling - EMI/EMC requirements & standards.

UNIT V SYSTEM ASSESSMENT, VALIDATION AND CERTIFICATION 11

Fault tolerant systems - Hardware and Software, Evaluating system design and Future architecture - Hardware assessment-FARs guide certification requirements-Fault Tree analysis – Failure mode and effects analysis – Criticality, damaging modes and effects analysis - Software development process models - Software Assessment and Validation -Civil and Military standards - Certification of Civil Avionics.

UNIT VI MAINTENANCE and COSTS OF AVIONICS 4

BIT and CFDS, Automatic Test Equipment - Speeds maintenance - ATLAS, Remote diagnostics and maintenance support-Life Cycle Costs for Military and Civil Avionics - Cash flow analysis - Software costs - Establishing spares level.

TOTAL: 45 PERIODS

REFERENCES:

1. Spitzer, C.R. “Digital Avionics Systems”, Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.
2. Cary R .Spitzer, “The Avionics Handbook”, CRC Press, 2000.
3. Collinson R.P.G. “Introduction to Avionics”, Chapman and Hall, 1996.
4. Middleton, D.H. “Avionics Systems”, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
5. Jim Curren, “Trend in Advanced Avionics”, IOWA State University, 1992.

AV8105 ELECTRO OPTIC SYSTEMS L T P C
3 0 0 3

OUTCOME:

Upon completion of the course, the students will understand advanced concepts of Opto-electronics and also the necessary domain knowledge that are needed for avionics applications. The students will also have an exposure on basic of various optical phenomena and their application in avionics domain, working and applications of LASERs and Infrared imaging and tracking devices and concluding with advanced topics relating to use of fiber-optic systems, allowing the avionics engineers to deploy these skills effectively in the design and development of optical systems in avionics engineering.

UNIT I INTRODUCTION 6

Electro Magnetic spectrum, Thermal radiation, Laws of Black body radiation, Emissivity and Kickoff’s law, Black body sources, Atmospheric propagation characteristics: Scattering effect, Transmission through rain, Scintillations.

UNIT II LASER SYSTEMS 9

Theory of Laser operation, Optical resonators, Temporal and spatial coherence, Introduction to gas, solid and semiconductor lasers Modulators: Electro Optic, Magneto optic and Acousto Optic modulators, Q switching, Mode locking, Cavity dumping, Introduction to Holography, Laser gyro. Laser hazards and Safety measures

UNIT III INFRARED SYSTEMS 9

Infrared and thermal detectors, Description and design features of typical passive search and detection, Infrared imaging, Forward looking Infra Red (FLIR) Tracking and Homing systems. Satellite Radiometers.

UNIT IV IMAGING DEVICES AND TRACKING SYSTEMS 12

Imaging tubes: Vidicon, pyroelectric vidicon etc, Image intensifier tubes, CCD, Focal plane arrays (FPA), Optical tracking, Sensor steering and stabilization, Servo Control. Opto mechanical design of camera and systems. Description and design features of laser ranging and guidance system, LIDAR

UNIT V FIBER OPTIC SYSTEMS 9

Types of Fiber optic cables and their characteristics, fiber optic sources and detectors, Avionics fiber optic data busses: IEEE std 1393, MIL STD 1773 etc. Multiplexing schemes for onboard avionics, Fiber optic gyro

TOTAL: 45 PERIODS

REFERENCES:

1. S.C.Gupta, "Optoelectronic devices and Systems", Prentice Hall of India, New Delhi, 2005.
2. Richard.D.Hudson.Jr, "Infrared System Engineering", John Wiley and Sons, Newyork, 2006.
3. Keith Atkins, "Jane's Electro-optic Systems, 2005-06", 11th ed, Janes Information Group Ltd, Surrey, 2005.
4. J.Wilson and J.F.B.Hawkes, "Optoelectronics an Introduction", Prentice Hall of India, New Delhi, 1992.

AV8151 FLIGHT INSTRUMENTATION L T P C

3 0 0 3

OUTCOME:

Upon completion of the course, the students will understand the available basic concepts of Flight instruments to the engineers and the necessary knowledge that are needed in understanding their significance and operation. The students will also have an exposure to various topics such as measurement concepts, air data sensors and measurements, Flight Management Systems, and other instruments pertaining to Gyroscopic measurements and Engine data measurements and will be able to deploy these skills effectively in understanding and analyzing the instrumentation methods in avionics engineering.

UNIT I MEASUREMENT SCIENCE AND DISPLAYS 9

Instrumentation brief review-Concept of measurement-Errors and error estimation- Functional elements of an instrument system –Transducers - classification - Static and dynamic characteristics- calibration - classification of aircraft instruments - Instrument displays panels and cockpit layout.

UNIT II AIR DATA INSTRUMENTS AND SYNCHRO TRANSMISSION SYSTEMS 9

Air data instruments-airspeed, altitude, Vertical speed indicators. Static Air temperature, Angle of attack measurement, Synchronous data transmission system

UNIT III GYROSCOPIC INSTRUMENTS 9

Gyroscope and its properties, gyro system, Gyro horizon, Direction gyro-direction indicator, Rate gyro-rate of turn and slip indicator, Turn coordinator, acceleration and turning errors.

UNIT IV AIRCRAFT COMPASS SYSTEMS &FLIGHT MANAGEMENT SYSTEM 9

Direct reading compass, magnetic heading reference system-detector element, monitored gyroscope system, DGU, RMI, deviation compensator. FMS- Flight planning-flight path optimization-operational modes-4D flight management

UNIT V POWER PLANT INSTRUMENTS **9**

Pressure measurement, temperature measurement, fuel quantity measurement, engine power and control instruments-measurement of RPM, manifold pressure, torque, exhaust gas temperature, EPR, fuel flow, engine vibration, monitoring.

TOTAL: 45 PERIODS

REFERENCES:

1. Pallet, E.H.J. “Aircraft Instruments & Integrated systems”, Longman Scientific and Technical, McGraw-Hill, 1992.
2. Murthy, D.V.S., “Transducers and Measurements”, McGraw-Hill, 1995
3. Doeblin.E.O, “Measurement Systems Application and Design”, McGraw-Hill, New York, 1999.
4. HarryL.Stilz, “Aerospace Telemetry”, Vol I to IV, Prentice-Hall Space Technology Series.

MA8163 ADVANCED APPLIED MATHEMATICS **L T P C**
3 1 0 4

OBJECTIVES:

- To encourage students to develop a working knowledge of the central ideas of linear
- Algebra
- To study and understand the concepts of probability and random variables.
- To understand the notion of a Markov chain, and how simple ideas of conditional
- probability and matrices can be used to give a thorough and effective account of
- discrete-time Markov chains
- To formulate and construct a mathematical model for a linear programming problem
- in real life situation
- Introduce the Fourier Transform as an extension of Fourier techniques on periodic
- functions and to solve partial differential equations

OUTCOMES:

- The course equips students to have knowledge and understanding in the fields of linear algebra, probability, stochastic process, linear programming problem and Fourier transform.

UNIT I LINEAR ALGEBRA **9+3**

Vector spaces – norms – Inner Products – Eigen values using QR transformations – QR factorization - generalized eigenvectors – Canonical forms – singular value decomposition and applications - pseudo inverse – least square approximations --Toeplitz matrices and some applications.

UNIT II ONE DIMENSIONAL RANDOM VARIABLES **9+3**

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT III RANDOM PROCESSES **9+3**

Classification – Auto correlation - Cross correlation - Stationary random process – Markov process –- Markov chain - Poisson process – Gaussian process.

UNIT IV LINEAR PROGRAMMING **9+3**

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT V FOURIER TRANSFORM FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

Fourier transforms: Definitions, properties-Transform of elementary functions, Dirac Delta functions – Convolution theorem – Parseval's identity – Solutions to partial differential equations: Heat equations, Wave equations, Laplace and Poison's equations.

TOTAL: 45+15:60 PERIODS

TEXT BOOKS:

1. Bronson R.,"Matrix Operation, Schaum's outline series", Mc-Graw Hill, New York , 1989.
2. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes", Academic Press, (An imprint of Elsevier), 2010.
3. Taha H.A., "Operations Research: An introduction", Pearson Education, Asia, New Delhi, Ninth Edition, 2012.
4. Sankara Rao K., "Introduction to partial differential equations" Prentice Hall of India Pvt, Ltd, New Delhi, 1997.

REFERENCES:

1. Andrews L.C., and Philips R.L., "Mathematical Techniques for engineering and Scientists", Prentice Hall of India, 2006.
2. O'Neil P.V., "Advanced Engineering Mathematics", (Thomson Asia Pvt Ltd, ingapore), Cengage learning India private limited, 2007

AV8111 AVIONICS INTEGRATION LABORATORY

L	T	P	C
0	0	4	2

OUTCOME:

Upon completion of the course, the students will obtain practical knowledge on the avionic system integration and operation of avionic bus systems. The students will also have an experience of installation, working and testing of various avionic bus systems, and controllers for rotary and fixed wing aircrafts and will be able to deploy these skills effectively in understanding of systems in avionics engineering.

1. Testing of installation of MIL –STD-1553, ARINC-429 and ARINC -629 card (Self test) **9**
2. Configuring MIL –STD-1553, ARINC-429 and ARINC -629 cards in transmitting and receiving mode. **9**
3. Testing of installation and configuring of AFDX card in transmitting and receiving mode.
4. Using the interactive driver to transmit or receive the data **9**
   a) On a single PC by loop back connection.
   b) PC to PC by connecting a shielded pair of wires.
5. Transmit and receive the messages **9**
   a) Using loop back connection with single card.
   b) Using connector (shielded pair of wires).
6. Development of Basic ATmega -8 bit controller for rotary wing and fixed wing

TOTAL: 60 PERIODS

AV8201 **NAVIGATION SYSTEMS** **L T P C**
3 0 0 3

OUTCOME:
Upon completion of the course, students will understand the advanced concepts of Aircraft Navigation to the engineers and to provide the necessary mathematical knowledge that are needed in modeling the navigation process and methods. The students will have an exposure on various Navigation systems such as Inertial Measurement systems, Radio Navigation Systems, Satellite Navigation – GPS ; Landing aids and will be able to deploy these skills effectively in the analysis and understanding of navigation systems in an aircraft.

UNIT I NAVIGATION SYSTEMS & INERTIAL SENSORS 6
Introduction to navigation – Types – Introduction to Inertial Sensors - Mechanical - Ring Laser gyro- Fiber optic gyro – MEMS system

UNIT II INERTIAL NAVIGATION SYSTEMS 9
INS components: transfer function and errors- Earth in inertial space - coriolis effect – INS Mechanization. Platform and Strap down – Navigation algorithms - INS system block diagram, Different co-ordinate systems – Transformation Techniques - Schuler Tuning - compensation errors - Gimbal lock - Initial calibration and Alignment Algorithms

UNIT III RADIO NAVIGATION 12
Different types of radio navigation- ADF, VOR,DME - Doppler – Hyperbolic Navigations -LORAN, DECCA and Omega - TACAN

UNIT IV APPROACH AND LANDING AIDS 6
ILS, MLS, GLS - Ground controlled approach system - surveillance systems-radio altimeter

UNIT V SATELLITE NAVIGATION & HYBRID NAVIGATION 12
Introduction to GPS -system description -basic principles -position and velocity determination-signal structure-DGPS, Introduction to Kalman filtering-Estimation and mixed mode navigation-Integration of GPS and INS-utilization of navigation systems in aircraft.

TOTAL: 45 PERIODS

REFERENCES:
1. Myron Kyton, Walfred Fried, ‘Avionics Navigation Systems’, John Wiley & Sons,2nd edition, 1997
2. Nagaraja, N.S. “Elements of Electronic Navigation”, Tata McGraw-Hill Pub. Co., New Delhi, 2nd edition, 1975.
3. George M Siouris, ‘Aerospace Avionics System; A Modern Synthesis’, Academic Press Inc., 1993**.**
4. Albert Helfrick, ‘Practical Aircraft Electronic Systems’, Prentice Hall Education, Career & Technology, 1995.
5. Albert D. Helfrick, ‘Modern Aviation Electronics’, Second Edition, Prentice Hall Career & Technology, 1994.
6. Sen, A.K. & Bhattacharya, A.B. “Radar System and Radar Aids to Navigation”, Khanna Publishers, 1988.
7. Slater, J.M. Donnel, C.F.O and others, “Inertial Navigation Analysis and Design”, McGraw-Hill Book Company, New York, 1964.

AV8202 SYSTEM MODELLING AND SIMULATION L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Mathematical Modeling and Simulation to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes. The students will have an exposure on various topics such as System Models, probability concepts in simulation and flight simulators and will be able to deploy these skills effectively in the understanding the concepts and working of a flight simulator.

UNIT I SYSTEM MODELS AND SIMULATION 7

Continuous and discrete systems, System modeling, Static models, Dynamic models, Principles used in modeling the techniques of simulation, Numerical computation techniques for models, Distributed lag models, Cobweb models.

UNIT II PROBABILITY, CONCEPTS IN SIMULATION 8

Stochastic Variables, Discrete probability functions, continuous probability function, Measure of probability functions, Continuous uniformly distributed random number, Congestion in systems, Arrival patterns, Various types of distribution.

UNIT III SYSTEM SIMULATION 10

Discrete events, Representation of time, Generation of arrival patterns, Simulation programming tasks, Gathering statistics, Counters and summary statistics, Simulation language. Continuous System models, Differential equation, Analog methods, digital analog simulators, Continuous system simulation language (CSSLs), Hybrid simulation, Simulation of an autopilot, Interactive systems.

UNIT IV SYSTEM DYNAMICS AND MATHEMATICAL MODELS FOR FLIGHT SIMULATION 12

Historical background growth and decay models, System dynamics diagrams, Multi – segment models, Representation of time delays, The Dynamo Language Elements of Mathematical models, Equation of motion, Representation of aerodynamics data, Aircraft systems, Structure and cockpit systems, Motion system, Visual system, Instructor's facilities.

UNIT V FLIGHT SIMULATOR AS A TRAINING DEVICE AND RESEARCH TOOL 8

Introduction, advantage of simulator, the effectiveness of Simulator, The user's role, Simulator Certification, Data sources, Validation, in- flight simulators

TOTAL: 45 PERIODS

REFERENCES:

1. Gordon. G., "System Simulation" , Prentice – Hall Inc., 1992.
2. Stables, K.J. and Rolfe, J.M. "Flight Simulation", Cambridge University Press, 1986.

AL8253 ROCKETRY AND SPACE MECHANICS L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts in Rocketry and Space Mechanics to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the physical processes. The students will have an exposure on various topics such as Orbital Mechanics, Rocket Propulsion and Aerodynamics, Rocket Staging and will be able to deploy these skills effectively in the understanding of Rockets and like spacecraft systems.

UNIT I ORBITAL MECHANICS 9

Description of solar system – Kepler's Laws of planetary motion – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points - Estimation of orbital and escape velocities

UNIT II SATELLITE DYNAMICS 9

Geosynchronous and geostationary satellites- factors determining life time of satellites – satellite perturbations – methods to calculate perturbations- Hohmann orbits – calculation of orbit parameters – Determination of satellite rectangular coordinates from orbital elements

UNIT III ROCKET MOTION 10

Principle of operation of rocket motor - thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories determinations of range and altitude – simple approximations to burnout velocity.

UNIT IV ROCKET AERODYNAMICS 9

Description of various loads experienced by a rocket passing through atmosphere – drag estimation – wave drag, skin friction drag, form drag and base pressure drag – Boat-tailing in missiles – performance at various altitudes – conical and bell shaped nozzles – adapted nozzles – rocket dispersion – launching problems.

UNIT V STAGING AND CONTROL OF ROCKET VEHICLES 8

Need for multistaging of rocket vehicles – multistage vehicle optimization – stage separation dynamics and separation techniques- aerodynamic and jet control methods of rocket vehicles - SITVC.

TOTAL: 45 PERIODS

REFERENCES:

1. G.P. Sutton, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 5th Edition, 1986.
2. J.W. Cornelisse, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd., London, 1982
3. Van de Kamp, "Elements of astromechanics", Pitman Publishing Co., Ltd., London, 1980.
4. E.R. Parker, "Materials for Missiles and Spacecraft", McGraw-Hill Book Co., Inc., 1982.

AV8251 AEROSPACE GUIDANCE AND CONTROL L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Guidance and Control of an aircraft to the engineers and to provide the necessary mathematical knowledge that are needed in modeling the guidance and control methods. The students will have an exposure on various topics such as 6-DOF equations of motion, autopilots and augmentation systems and missile guidance systems and will be able to deploy these skills effectively in the design of control for aerospace systems.

UNIT I INTRODUCTION 4

Introduction to Guidance and control - definition, Historical background

UNIT II AUGMENTATION SYSTEMS 7

Need for automatic flight control systems, Stability augmentation systems, control augmentation systems, Gain scheduling concepts.

UNIT III LONGITUDINAL AUTOPILOT 12

Displacement Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide Slope Coupler and Automatic Flare Control and Flight path stabilization, Longitudinal control law design using back stepping algorithm.

UNIT IV LATERAL AUTOPILOT 10

Damping of the Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system, turn compensation, Automatic lateral Beam Guidance. Introduction to Fly-by-wire flight control systems, Lateral control law design using back stepping algorithm.

UNIT V MISSILE AND LAUNCH VEHICLE GUIDANCE 12

Operating principles and design of guidance laws, homing guidance laws- short range, Medium range and BVR missiles, Launch Vehicle- Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance schemes

TOTAL: 45 PERIODS

REFERENCES:

1. Blake Lock, J.H 'Automatic control of Aircraft and missiles ', John Wiley Sons, New York, 1990.
2. Stevens B.L & Lewis F.L, 'Aircraft control & simulation', John Wiley Sons, New York, 1992.
3. Collinson R.P.G, 'Introduction to Avionics', Chapman and Hall, India, 1996.
4. Garnel.P. & East.D.J, 'Guided Weapon control systems', Pergamon Press, Oxford, 1977.
5. Nelson R.C 'Flight stability & Automatic Control', McGraw Hill, 1989.
6. Bernad Etikin,'Dynamic of flight stability and control', John Wiley, 1972.

AV8211 AUTOMATIC FLIGHT CONTROL SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Flight Control to the engineers and to provide the necessary mathematical knowledge that are needed in modeling the control processes. The students will have an exposure on various topics such as Root locus, analysis of stability through Root locus plots, Bode plot, Lead Lag compensator, PID controller and tuning, controller and autopilot design and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

1. Stability analysis using Root locus, Bode plot, Nyquist plot and Polar plot techniques
2. Design of lead, lag and lead-lag compensator for aircraft dynamics
3. Performance Improvement Of Aircraft Dynamics By pole placement technique
4. Development Of Longitudinal Equations Of Motion
5. Design of displacement longitudinal autopilot
6. Design Of Automatic Glide Slope Control System And Flare Control System
7. Development Of Lateral Equations Of Motion
8. Design of Lateral Autopilot
9. Design of Turn Co-ordination system
10. Design of Automatic Lateral beam guidance system
11. Design of Van-Guard Missile system
12. Design of Kalman filters
13. Basic implementation of ADSP-BF 561 processor for image processing.

TOTAL : 60 PERIODS

NOTE: Implementation using X-plane, Flight-Gear & Aerosim (experiments from 5 to 11) Attested

AV8001 ACTIVE CONTROL TECHNOLOGY L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts in Active Control Technology to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes. The students will have an exposure on various topics such as Automatic configuration management, design considerations, fly-by-wire concepts, flying qualities and control modes of combat aircraft and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I ACTIVE CONTROL FUNCTIONS 12

Introduction-active control technology concepts-control configured vehicle-Design Philosophy, Aerodynamics: Relaxed static stability, Automatic Configuration management, side force control. Structures, Manoeuvre load control, Gust load alleviation, Ride smoothing, fatigue alleviation, Flutter-mode control, Propulsion and Flight Control Integration Technology (PROFIT)

UNIT II ACTIVE CONTROL DESIGN CONSIDERATIONS 5

Stability augmentation, Command augmentation, Control of aircraft center of gravity, Elastic mode stabilization, and Gust load control, Reliability, redundancy

UNIT III FLY-BY-WIRE TECHNOLOGY 8

Fly-By-Wire concepts. Primary and secondary electrical flight control system, Redundancy and architecture trade studies - analog and digital FBW Systems - Typical fly-by-wire flight control system elements - Application of fly-by-wire technology to civil and military aircraft.

UNIT IV FLYING QUALITIES 13

Definition, Cooper - Harper rating scale - flying qualities requirements - Relaxed static stability flying qualities requirements - Lower order equivalent systems criteria Neal - Smith criteria.

UNIT V CONTROL MODES OF COMBAT AIRCRAFT 7

Pitch rate Command - Attitude hold system - Carefree maneuvering - spin-stall prevention and similar limiting concepts - Combat maneuvers.

TOTAL: 45 PERIODS

REFERENCES:

1. AGARD-AG-234, 'Active controls aircraft Design', 1978.
2. AGARD-CP-157, 'Impact of active control technology in aircraft design', 1975.
3. AGARD-CP-260, 'Stability and control', 1978.
4. AGARD-CP-137, 'Advance in Control systems', 1974.
5. AGARD-CP-228, 'Structural aspects of active Controls', 1977.
6. AGARD-IS-89, 'Task oriented flight control Systems', 1977.

AV8002 AIRBORNE ACTUATORS AND SENSORS L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Airborne actuators and sensors to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes. The students will have an exposure on various topics such as aircraft actuation systems, servo-components, inertial sensors, modeling, design and testing of sensors and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I AIRCRAFT ACTUATION SYSTEMS 9

Introduction -Principles of actuation systems, Types of actuation systems.

UNIT II SERVO COMPONENTS 9
Actuators, Valves, Servo amplifiers pick-offs.

UNIT III MODELING, DESIGN, AND TESTING 9
Linear and non-linear actuation system, modeling of actuation systems, Servo-loop analysis actuator design - testing methodologies, Performance testing test equipments for actuation systems.

UNIT IV INERTIAL SENSORS 9
Gyroscope- Principles , Gyro equations, Rate Gyros - Rate integration and free Gyro, Vertical and Directional Gyros, Laser Gyroscopes - Inertial navigation - Basic principles, theory and applications. Accelerometers-- Principles & Theory, Spring mass, force balance and piezo-electric accelerometers, MEMS sensors

UNIT V SENSOR TESTING 9
Test philosophies and methodologies, Test equipment, Performance testing of sensors.

TOTAL: 45 PERIODS

REFERENCES:

1. James Ephraim Johnson, Electrohydraulic Servo Systems, Published by Editors of Hydraulics & pneumatics magazine, 1977.
2. Neal E.Wood et al, 'Electro-mechanical actuation development AFFDL-TR-150' DEC 1978.
3. Pallett, E.H.J. 'Aircraft instruments, principles and applications', Pitman publishing Ltd., London, 1981.

AV8003 AIRBORNE FIRE CONTROL L T P C
3 0 0 3

OUTCOME:
Upon completion of this course, students will understand the advanced concepts in Airborne Fire control to the engineers and to provide the necessary practical knowledge that are needed in handling airborne safety related issues. The students will have an exposure on various topics such as Fire control, problems and it features systems to control fire and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I FIRE CONTROL 6
Introduction -Fire Control problems, Geometrical approach, Coordinate and computing frames, Vectors in fire control.

UNIT II FIRE CONTROL PROBLEM FOR PROJECTILES 7
Statement of the fire control problem, Miss-producing effects, prediction, Time of Flight of the projectile.

UNIT III FEATURES OF FIRE CONTROL SYSTEMS 8
Line of sight and the tracking line, Weapon line, computed weapon line and correct weapon line, Geometrical Interference, Space Integration, Classification of fire control systems, prediction, Pursuit and proportional navigation courses, Hit probability.

UNIT IV ORIENTATION MEASUREMENTS WITH GYROS 8
Gyroscopes, Measurements of direction, Controlled line, Single axis tracking loops

UNIT V FIRE CONTROL COMPUTING SYSTEMS 16
Computing methods and system classification, Prediction computation, Lead computing, Curvature correction, Velocity jump correction and the error corrections, Attack Courses, Bombing computations, Bombsights, Bombing modes.

TOTAL: 45 PERIODS

REFERENCES:

1. Walter Wrigley and John Hovorka, 'Fire Control Principles', McGraw-Hill Book Co., 1959.
2. George W.Masters, 'Integrated Weapon system Test and Evaluation', Airborne systems Course, United States Naval Test Pilot School, 1981, AD A130541.

AV8004	AIRCRAFT PRODUCT AND SYSTEM ENGINEERING, STANDARDS AND CERTIFICATION	L T P C 3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Aircraft product and system engineering, standards and certification to the engineers and to provide the necessary knowledge that are needed in design and development of new aircraft systems. The students will have an exposure on various topics such Avionic system engineering design life cycle, design standards and certification, DO-178B and DO 254 standards and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I AVIONICS SYSTEM ENGINEERING DEVELOPMENT CYCLE 8

Establishing the Avionics System Requirements by Mission Scenario Analysis, Functional Analysis, Physical Partitioning, Avionics Architectural Design, Specification of HW/ SW of Subsystems, Development / Procurement of HW/ SW of Subsystems, SW Integration, HW/SW Integration, Standalone testing of subsystems, Avionics System Integration in Ground based Integration Lab, Integration of Avionics System in Aircraft, Flight Testing, Operational Test and Evaluation by user, Deployment, SW updates, Avionics Upgrades.

UNIT II SYSTEMS ENGINEERING MANAGEMENT AND CERTIFICATION OF AVIONICS SYSTEMS 12

The Systems Engineering Process - Overview, Requirements Analysis, Functional Analysis and Allocation, Design Synthesis, Verification, Systems Engineering Process Outputs System Analysis and Control - Work Breakdown Structure, Configuration Management, Technical Reviews and Audits, Trade Studies, Modeling and Simulation, Metrics, Risk Management Planning, Organizing, And Managing - Systems Engineering Planning, Product Improvement Strategies, Organizing and Integrating, System Development, Contractual Considerations, Management Considerations Certification, Civil Aviation Authorities, Regulatory and Advisory Agencies, Type Certification, Certification Process, Delegation, Product Certification Process Roadmap

UNIT III SOFTWARE CONSIDERATIONS IN AIRBORNE SYSTEMS AND EQUIPMENT CERTIFICATION (DO-178B) 9

System Aspects Relating To Software Development, Software Life Cycle, Software Planning Process, Software Development Processes, Software Verification Process, Software Configuration Management Process, Software Quality Assurance Process, Certification Liaison Process, Overview Of Aircraft And Engine Certification, Software Life Cycle Data, Additional Considerations -Use of Previously Developed Software, Tool Qualification, SW Reliability Models, Formal Methods

UNIT IV DESIGN ASSURANCE GUIDANCE FOR AIRBORNE ELECTRONIC HARDWARE (DO- 254) 8

System Aspects of Hardware Design Assurance, Hardware Design Life Cycle, Planning Process, Hardware Design Processes, Validation and Verification Process, Configuration Management Process, Process Assurance, Certification Liaison Process, Hardware Design Life Cycle Data

UNIT V CERTIFICATION CONSIDERATIONS FOR HIGHLY-INTEGRATED OR COMPLEX AIRCRAFT SYSTEMS (SAE ARP4754) 8

System Development Process Guidelines and Methods, Development Assurance and Safety Directed Development Concept, Certification Process and Coordination, Requirement Determination and Assignment of Development Assurance Level, Safety Assessment Process, Validation of Requirements, Implementation Verification, Configuration Management, Process Assurance.

TOTAL: 45 PERIODS

REFERENCES:

1. IEEE Std 1220-1998, IEEE Standard for Application and Management of the Systems Engineering Process, 2005.
2. Systems Engineering Fundamentals, Supplementary Text Prepared By The Defense Acquisition University Press Fort Belvoir, Virginia 22060-5565, 2001
3. NASA Systems Engineering Handbook, SP-610S, June 1995
4. INCOSE, Systems Engineering Handbook, A "What To" Guide For All SE Practitioners, INCOSE-TP-2003-016-02, Version 2a, 1 June 2004
5. RTCA DO-178B/EUROCAE ED-12B, Software Considerations in Airborne Systems and Equipment Certification, RTCA Inc.,Washington, D.C, 1992.
6. DO-254/EUROCAE ED-80, Design Assurance Guidance For Airborne Electronic Hardware, RTCA Inc.,Washington, D.C, April 19, 2000
7. SAE ARP4754, Certification Considerations for Highly-Integrated or Complex Aircraft Systems, SAE, Warrendale, PA, 1996.
8. SAE ARP4761, Guidelines and Methods for Conducting the Safety Assessment Process on Civil Aircraft Airborne Systems and Equipment, Warrendale, PA, 1996

AV8005 AVIONICS NETWORK TECHNOLOGY

L	T	P	C
3	0	0	3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Avionics Networking Technology to the engineers and to provide the necessary knowledge that are needed in understanding the related processes.The students will have an exposure on various networks in an aircraft ranging from optical, telecommunication, wireless sensor network and military avionics network and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I OPTICAL NETWORKS 9

Fiber channel- WDM LAN- Fiber channel-RF over fiber- Highly integrated photonics (HIP)-Routing in optics- Amplification in optics.

UNIT II ATN (AERONAUTICAL TELECOMMUNICATION NETWORK) 9

ATN Concepts – ATN functionality – ATN Components – End Systems – ATN physical and administrative structures – ATN planning and implementation process – ATN Router.

Military Gigabit type – Ethernet Architecture – Modems - Wideband mobile routers – Smart router – IP Address in cockpit

UNIT III WIRELESS SENSOR NETWORK 9

Introduction-Challenges for wireless sensor networks-Comparison of sensor network with ad hoc network-single node architecture-Hardware components-energy consumption of sensor nodes-Network architecture-sensor network scenarios-types of sources and sinks-single hop versus multi-hop-networks-multiple sinks and sources-Design principles-Development of wireless sensor networks-Application-military-Target detection tracking-Habitat monitoring-Environmental disaster monitoring.

UNIT IV WIDEBAND WIRELESS COMMUNICATION AND NETWORKS FOR MILITARY AVIONICS 9

Communication data link (CDL) - IP based routing in FBW-Smart antenna networking.

UNIT V REAL TIME INTEGRATED AVIONICS NETWORK 9

Inter networking- Multimedia- Pilot vehicles-other defense and aerospace application-Scalable Coherent interface-SCI/RI-Integrated modulator avionics.

TOTAL : 45 PERIODS

REFERENCES:

1. Jian-Guozhang, A.Pervez, A.B.Sharma, "Avionics Data Buses: Overview", IEEE AESS Magazine, Feb 2003.
2. Carry A spitzer, "Avionics Data Buses", Fifty edition 2005.
3. Frank Gross, "Smart Antennas for Wireless Communication" Wisely Publications, second edition 2004.
4. Hamed Al-Raweshidy, Shozo Komaki. "Radio Over Fiber Technology, for Mobile Communication Network", 2002.
5. Clifford Headuey, Govind P Agarwal, "Raman Amplification in Fiber Opical Communication Systems", Tara-McGrall publications, 2002.
6. Feng zhao, Leonidas guibas, "Wiresess Sensor Networks: An Information Processing Approach", Elsevier publication, 2004.
7. C.S.Raghavendra Krishna, M.sivalingam and Tarip znati, "Wireless Sensor Networks", Springer publication, 2004.
8. H.Callaway, "Wireless Sensor Networks: Architecture And Protocol-Edgar", CRS press.2004.
9. Holger Karl, Andrea's willig, "Protocal and Architecture for Wireless Sensor Networks", John willey publication, Jan 2006.
10. "Wireless Sensor Networks", First European workshop, EWSN 2004, Berlion, Germany, January 2004 Proceedings-Hoger Karl, Andreas willig, Adam holisz, Springer publication.2003.
11. http:www.mccallumwhyman.com/downloads/guidance%zomaterial parti.pdf.

AV8006 DISPLAY ENGINEERING L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Display systems to the engineers and to provide the necessary domain knowledge that are needed in understanding display systems. The students will have an exposure on various display systems, cockpit display, display architecture and graphics pertaining to aircraft display systems and will be able to deploy these skills effectively in the design and development of display systems for aircrafts.

UNIT I DISPLAY DEVICES 9

Trends in display technology – Alphanumeric displays, character display etc. Basic components of display systems. CRT displays, Plasma display, LCDs, Solid state displays, etc and their characteristics

UNIT II COCKPIT DISPLAYS 10

Head up displays – Basic principles – Holographic HUDs - HUD electronics – HUD design and display generation. Helmet mounted displays – Helmet design factor – Helmet mounted sights – Head tracking system. Head down displays – Raster overlay display generation – Digitally generated color map displays. Multifunction displays – control and data entry – Multifunction keyboards- voice interactive systems.

UNIT III DISPLAY PROCESSOR REQUIREMENTS & ARCHITECTURE 8

Concepts – Role of display processor – Design steps – Hardware architecture and Building blocks – Software Architecture – Symbol Generator –Display drive circuits – Display management Processor

UNIT IV COCKPIT EVALUATOR 8

Generation of display symbologies with facilities for quick modification and evaluation Cockpit Information and Display Controls Organization and Optimization

UNIT V COMPUTER GRAPHICS 10

2D Graphics: Line, Curve and elipse Algorithms – Attributes – 2D" transformation – viewing, 3D Graphics: 3 D Concepts – Object Representation – Transformation – Viewing – Color models – Animation – Multimedia technologies – Compression and decompression – Data and file format standards – Full motion video – Storage and retrieval technologies.

TOTAL: 45 PERIODS

REFERENCES:

1. Donald Hearn & Pauline Baker, "Computer Graphics", Second edition, 1996
2. Prabath K. Andleigh & Kiran Thakrar, "Multimedia Systems & Design". First Deition, Prentice Hall O India, 1995.
3. Judith Jeffcoate, "Multimedia In Practice Technology And Applications", First Edition, Prentice Hall of India, 1995.
4. Foley, Vandam, Feiner, Huges, "Computer Graphics: Principles and Practice", Second Edition, Pearson Education, 2003.
5. Cooly,"Essence of Computer Graphics", First Edition. Pearson Education, 2004.
6. Goloi W.K. "Interactive Computer Graphics, Data structures, Algorithms, Languages" Prentice –Hall, 1988.
7. Davis, Computer Displays, Prentice – Hall, 1982.
8. R.B.G. Collinson – Introduction to Avionics, Chapman & Hall, 1996.
9. Spitzer, Digital Avionics System, Prentice Hall, New Jersey, 1987.
10. Cary R. Spitzer, The Avionics Handbook, CRC Press, 2000.

AV8007	ELECTRONIC WARFARE	L T P C
		3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Electronic Warfare to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the same. The students will have an exposure on various topics such as principles of electronic warfare system, ESM Receivers and signal processing, Jamming equations and ECCM and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I ELECTRONIC WARFARE (EW) PRINCIPLES AND OVERVIEW 3

Electronic Warfare taxonomy-EW Mission and scenarios

UNIT II ELECTRONIC SUPPORT MEASURE (ESM) RECEIVERS - ELECTRONIC COUNTER MEASURES (ECM) 12

Radar Warning Receivers (RWR) - Passive direction finding and emitter - location - noise jamming - Deception Electronic Counter Measures (DECM) - Modern ECM systems.

UNIT III RADAR AND ECM PERFORMANCE ANALYSIS 9

Radar detection performance low RCS aircraft - ECM - Jamming equations - EW receiver sensitivity

UNIT IV EW SIGNAL PROCESSING 9

Signal environment - EM sensor subsystem - The receiver subsystem - The pre-processor the data servo loop - Mile parameter tracking - Advanced pulley power - Managed Jamming.

UNIT V ELECTRONIC COUNTER - COUNTER MEASURES (ECCM) 12

Radar applications in weapon systems - Radar types and characteristics, EW Technology and Future Trends - Antenna Technology - ECM transmitter power source technology - EW receiver technology - EW at millimeter Wavelength - Low Observability EW technology.

TOTAL: 45 PERIODS

REFERENCES:

1. Curtis Schleher. D. “Introduction to Electronic Warfare’, Artech House Inc., U.S.A., 1986
2. Mario De Archnaelis, “Electronic War from Battle of Osushima to the Falklands and Lebanon Conflicts”, Ritana Books, New Delhi, 1990.
3. Sen, A.K. Bhattacharya, A.B. “Radar Systems & Radar Aids to Navigation”, Khanna Publishers, 1988.

AV8008 FAULT TOLERANT CONTROL L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Fault Tolerant Control to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Multivariate distribution, likelihood distribution, analytical redundancy concept, parity equation and directional residual and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I INTRODUCTION 9

Scope of -Approaches to fault detection and diagnosis:-Model free methods and Model based methods - Introduction to Random variables-Distribution-Bivariatedistribution-Multivariatedistribution-Normaldistribution-Maximum likelihood distribution-Hypothesis testing

UNIT II ANALYTICAL REDUNDANCY CONCEPT 9

Additive faults and disturbance-Multiplicative faults and disturbanceResidualgeneration-Detectionproperty-Isolationproperty-Computationalproperty-Design of Residual generation-Specification and implementation

UNIT III PARITY EQUATION IMPLEMENTATION OF RESIDUAL GENERATOR-PARITY EQUATION FORMULATION 9

Implementation of single residual-Implementation with input output relation-Fault system matrix Design for structure residual-Structural definition-Canonical structures-Handling disturbance-Residual structure for multiple faults

UNIT IV DESIGN FOR DIRECTIONAL RESIDUAL 9

Directional specifications-Parity equation-Linearly dependent columns Residual generation for parametric faults-Representation of parametric fault-Design for parametric fault and model errors-Robustness in residual generation-Perfect decoupling from disturbance

UNIT V ADVANCE TOPICS 9

Fault diagnosis using Kalman filtering-Fault diagnosis using principle component analysis –Fault diagnosis using ANN and Fuzzy clustering

Case study: Aircraft fault detection

TOTAL : 45 PERIODS

REFERENCES:

1. Janos.J.Gertler, “Fault detection and diagnosis in engineering systems”, second edition, Marcel Dekker, 1998.
2. Rami S.Mangoubi, “Robust Estimation and Failure detection”, Springer-Verlag London, 1998.

AV8009	**FLIGHT DYNAMICS**	**L T P C**
		3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Flight Mechanics to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Equations of motion, stability and control, design and orientation and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I FLIGHT DYNAMICS 8

General equation of motion for rigid airplane – concept of equilibrium - Aerodynamic and thrust forces and forward motion – steady state – Perturbed state.

UNIT II STEADY STATE STABILITY AND CONTROL 9

Static – Straight-line flight – Maneuvering, flight design for dynamic stability and response requirements – importance of stability derivatives.

UNIT III STABILITY AND CONTROL OF THE ELASTIC AIRPLANE 8

Frequency response of airplane – atmospheric disturbances and their effects on flight – effect of atmospheric turbulence on flight stability.

UNIT IV DESIGN AND ORIENTATION 10

Mission requirements leading to total configuration selection – role of aerodynamic design in the selection of total configuration- structural constraints on configuration selection- Flight mechanics analysis to support aircraft configuration. - Identification of aircraft parameters.

UNIT V SYSTEM AND MISSION ORIENTATION 10

Automatic flight controls – Formulation of Guidance Laws – Concepts of advanced control technology – Mission requirements – selection of flight modes – Conceptual design of system, Laying down of relevant specifications – Flight planning and flight test data analysis.

TOTAL: 45 PERIODS

REFERENCES:

1. Roskam.J, ‘Airplane flight dynamics and automatic flight controls’, Part I and II,Roskam Aviation and Engg corporation,1975.
2. Bernad Etikin,’Dynamic of flight stability and control’, John Wiley, 1972.
3. Babister, A.W. ‘Aircraft Stability and Response’ I Edition, Pergamon Press, 1980.
4. Nelson R.C ‘Flight stability & Automatic Control’, McGraw Hill, 1989.

AV8010 FLIGHT SIMULATION FOR COMBAT AIRCRAFT SYSTEM **L T P C**
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Flight simulation for combat aircraft system to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Flight simulation, cockpit signals and simulation, environment simulation and avionic system simulation and integration and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I INTRODUCTION TO FLIGHT SIMULATION 9

Introduction to Simulation, basics of modeling and simulation, Combat simulation techniques, System Architecture, simulation Roles, Introduction to real time operating system, Simulation standards, Hardware and software requirements

UNIT II COCKPIT SIGNAL AND SIMULATION SYSTEM AND INTERFACES 9

Cockpit, Displays, Ergonomics, Reachability & Controls, Operating Procedure, Cockpit Lighting, Workload assessment, Data Acquisition, B1553, Rs422, Fiber optics, AFDX, STANAG, Real time networks, Analog and discrete I/Os, LVDTs and RVDTs,

UNIT III AVIONICS SYSTEM SIMULATION 9

Navigation, guidance, Man Machine interface, Controls and display usage, Pilot warning management, Mission Management, Built in test and its types, Data bus management, Sensors, Instrument landing system, Flight dynamics model basics, Under carriage model basics, Utility system model basics

UNIT IV ENVIRONMENTAL SYSTEM SIMULATION AND INSTRUCTOR STATION 8

Terrain map generation, Fly through simulation, Pilot views, Special effects, Seamless image generation, culling and Rendering, Control station, Brief and debrief station, Test station, Data Management system, Mission scenario generation and Target models

UNIT V INTEGRATION & CERTIFICATION 10

Transport Delay and Latency Testing Methods, simulator verification and validation, Integration methods, Configuration management, Types of evaluations Conduct of evaluations, simulator qualification, Certification process-Case studies: F-16A Full Mission Simulator, LCA combat simulator, Air Combat Simulators for various air forces

REFERENCES:

1.Robert E.McShea, National Flight Test School, “TEST AND EVALUATION OF AIRCRAFT AVIONICS AND WEAPON SYSTEM”, Copyright © 2010 by SciTech Publishing, Raleigh, NC.

2.David Allerton, “PRINCIPLES OF FLIGHT SIMULATION”, Department of Automatic Control and Systems Engineering, The University of Sheffield, 2009

3.Brain L.Stevens,Georgia Tech Research Institute and Frank L. Lewis, The University of Texas at Arlington”, AIRCRAFT CONTROL AND SIMULATION”, Copyright © 1992 by John Wiley & Sons, Inc.,

4.Cary R.Spitzer, “THE AVIONICS HANDBOOK”, AvioniCon, Inc., Williamburg, Virginia.

5 .Robert L. Shaw, “Fighter Combat: Tactics and Maneuvering”, Naval Inst Pr; 6th edition (December 1985)

AV8011 HUMAN ENGINEERING L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Human Engineering to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes. The students will have an exposure on various topics such as Man-machine systems, Anthropometry, Human stress management, human system interface and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I INTRODUCTION TO HUMAN ENGINEERING AND MAN MACHINE SYSTEMS 9

Definitions, scope and applications Purpose of man machine system, Types of systems, Operational functions and components, Sensory and motor processes, Human information processes, Human motor activity.

UNIT II INFORMATION DISPLAYS 10

Types of information presented by displays, Design criteria for displays, Selection of sensory modalities for displays, Checklist for good display/indicator selection and arrangements for displays, speech communication.

UNIT III HUMAN CONTROL OF SYSTEMS 10

Principles of control design and related devices, Design of controls in aircraft cockpit, coding of controls.

UNIT IV ANTHROPOMETRY 11

Definition, Importance, Static and dynamic anthropometry, Anthropometry and cockpit Design. Basic principles of seat design, crew seat design - Transport aircraft and helicopters, Passenger - seats. Work space lay out for Fighter, Helicopters and Transport aircraft.

UNIT V HUMAN FACTORS STUDY IN RELATION TO AVIATION-STRESSES 11

Hypoxia, Acceleration, Thermal stress, Noise vibration and fatigue. Life support system in Aircraft-Scope, types of life-support system, human factor considerations.

TOTAL: 45 PERIODS

REFERENCES:

1. William L. Wolfe and George J. Zissis, Infrared Handbook , Office of Naval Research Dept. of the navy Washington DC,1978.
2. Wasten, J. “Optoelectronics”, Van Nostrand Reinheld (UK) co. ltd.. UK. 1988.
3. Robert G. Seippel, “Opto – electronics for technology and engineering” Prentice Hall, New Jersey, 1989.

AV8012 IMAGE PROCESSING FOR AEROSPACE APPLICATIONS L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Image processing for aerospace applications to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Image enhancement, Wavelet transforms, multi-resolution analysis and vision based navigation and control and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING 9

Introduction – Elements of visual perception, Steps in Image Processing Systems – Image Acquisition – Sampling and Quantization – Pixel Relationships – Colour Fundamentals and Models, File Formats Introduction to the Mathematical tools

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – DFT, FFT, DCT, Smoothing and Sharpening filters – Homomorphic Filtering.

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UNIT III IMAGE SEGMENTATION AND FEATURE ANALYSIS 9

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Feature Analysis and Extraction.

UNIT IV MULTI RESOLUTION ANALYSIS 9

Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms, Fast Wavelet transforms, Wavelet Packets.

UNIT V AEROSPACE APPLICATIONS 9

Principles of digital aerial photography- Sensors for aerial photography - Aerial Image Exploration - Photo-interpretation, objective analysis and image quality - Image Recognition - Image Classification – Image Fusion – Colour Image Processing - Video Motion Analysis – Case studies – vision based navigation and control.

TOTAL: 45 PERIODS

REFERENCES:

1. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Processing, Analysis and Machine Vision", Third Edition, Third Edition, Brooks Cole, 2008.
3. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice-Hall India, 2007.
4. Madhuri A. Joshi, 'Digital Image Processing: An Algorithmic Approach", Prentice-Hall India, 2006.
5. Rafael C.Gonzalez , Richard E.Woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", First Edition, Pearson Education, 2004.
6. Ron Graham, Alexander Koh,"Digital Aerial Survey: Theory and Practice", Whittles Publishing; First edition,2002.

AV8013 INDUSTRIAL AVIONICS L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Industrial avionics to the engineers and to provide the necessary knowledge that are needed in understanding relevant processes. The students will have an exposure on various topics such as System Engineering, on-board software, safety of complex systems, FMS, ARINC 424 and Human interface and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I SYSTEM ENGINEERING 9

System engineering overview, system engineering contract process, Technical process, H/w & S/w life cycle, Avionics systems includes FMS, BITE, Air traffic management systems, cockpit display system, Navigation, Mission management system, TCAS

UNIT II ON BOARD SOFTWARE 8

Introduction to FAR, JAR.25-1309 regulations & DO-178 standards. System aspects and software levels. Software development requirements, verification requirements, software configuration management requirements, software quality assurance requirements according to levels- case study.

UNIT III SAFETY OF COMPLEX SYSTEMS 9

Introduction & objectives-Definition of basic concepts, certification regulations, analysis methods, Dependability techniques and tools- FMEA, FTA, combined failures, Reliability of systems, standards, methods of reliability analysis, certificate of Airworthiness, Risk management concepts – case study.

UNIT IV ON BOARD NAVIGATION SYSTEMS 9

Over view of navigational aids, Flight planning, Area navigation, required time of arrival, RNAV architecture , performance aspects, approach and landing challenges, regulatory and safety aspects, GPS and GNSS characteristics, Receiver autonomous integrity monitoring(RAIM)

UNIT V FMS & HUMAN MACHINE INTERFACE 10

Introduction, ARINC 424, Aircraft Performance, Aircraft Guidance, Flight plan, Trajectory and prediction, Position determination, VNAV, Flight Management Computer, control display unit, control display page function, flight management function, Navigation display system, Tactical display, FMS Graphical Flight Planning display, cockpit display system, aircraft display control panel

TOTAL: 45 PERIODS

REFERENCES:

1. Spitzer, C.R. “Digital Avionics Systems”, Prentice Hall, U.S.A
2. Introduction to Systems Engineering by Andrew P.Sage and James E.Armstrong
3. Civil Avionics systems by lan moir and Allan seabridge , Professional Engineering Publishing Limited, London and Bury St Edmunds, UK
4. Introduction to Avionics Systems by R.P.G. Collinson Third Edition, Springer Publishers.

AV8014 INSTRUMENTATION FOR FLIGHT TESTING L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Flight testing instruments to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the process involved. The students will have an exposure on various topics such as Principles and concept sof measurement and instrumentation, Data acquisition, Telemetry and Range instrumentation and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I INTRODUCTION TO FLIGHT TESTING 5

Introduction - Methodology - Planning - Techniques - Instrumentation & Telemetry - Data analysis.

UNIT II DATA ACQUISITION SYSTEMS 12

Basic concepts of measurement - Units - Generalized performance characteristics –Errors, Sensors & Transducers, Types selection - Sampling – System design - System error analysis.

UNIT III TELEMETRY SYSTEM 14

System block diagram, Frequency and Time Division Multiplexing , Frequency Modulation - Pulse amplitude modulation - Pulse code modulation, Radio Link - Airborne and ground antennas, Link parameters - Design and analysis.

Attested

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UNIT IV GROUND TELEMETRY STATION **10**

Introduction - Principles of demultiplexing - FM, PAM and PCM Demultiplexing systems - IRIG Standards - Recorders - Quick look displays - Data compression

UNIT V RANGE INSTRUMENTATION **4**

Introduction - Typical range activities - TSPI Systems.

TOTAL: 45 PERIODS

REFERENCES:

1. Doebelin. O, 'Measurement Systems - Application and Design', McGraw-Hill, 1986.
2. Rangan, C.S. Sharma, G.R. Mani, V.S.V., 'Instrumentation Devices and Systems', McGraw Hill, 1986.
3. HarryL.Stilz, "Aerospace Telemetry", Vol I to IV, Prentice-Hall Space Technology Series.

AV8015 **MISSILE TECHNOLOGY** **L T P C**
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Missile Technology to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes. The students will have an exposure on various topics such as classification, aerodynamics, propulsion, navigation, guidance and control of missile systems, and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I MISSILE SYSTEMS **8**

Introduction - history - classification - missile system elements, missile ground systems - radars – launchers, coordinate frames, basics of trajectory dynamics.

UNIT II AERODYNAMICS **9**

Missile aerodynamics- design methodology, aerodynamic prediction method, aerodynamic loads & performance analysis, wind tunnel and flight testing of missile models and missile prototypes.

UNIT III PROPULSION **8**

Principles of jet propulsion and rocketry, nozzle theory and performance parameters of solid rockets and ramjet and compound jet engines – evaluation of flight performance - forces acting on vehicle - basic relations of motion - multi stage vehicles

UNIT IV NAVIGATION, GUIDANCE & CONTROL **12**

Navigation - types - inertial - GPS - radar based terrain mapping, guidance - explicit - PN –APN - beam riding – CLOS, control – autopilot, and actuation - hydraulic - pneumatic - electromechanical - RCS

UNIT V MISSILE TRAJECTORY CALCULATIONS **8**

Vertical, inclined and gravity turn trajectories – determination of range and altitude- numerical computation of ballistic trajectories.

TOTAL: 45 PERIODS

REFERENCES:

1. G. Merrill, "Dictionary of Guided Missiles and Space Craft", D. Van Nostrand and Company, Inc, 1959.
2. S. S. Chin, "Missile Configuration Design", McGraw Hill, 1961.
3. P. Garnel, "Guided Weapon Control Systems", 2nd Edition, Pergamon Press, 1980.
4. J. Frederick White, "Flight Performance Handbook for Powered Flight Operations", John Wiley & Sons, Inc., 1963.

AV8016 **PROGRAMMING IN ADA** **L T P C**
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of programming using the ADA language to the engineers and to provide the necessary programming knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Object oriented Programming concepts, packages, parallel programming and interfaces to JAVA and other languages and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I OBJECT ORIENTED PROGRAMMING 9

Overview- History of Ada -Inheritance, dynamic dispatching (polymorphism)- Encapsulation.

UNIT II ADA DATA TYPES 9

Basic Ada structures, program units, Ada structures, lexical elements, identifiers, numeric literals, character literals, Basic types- integer , float, Boolean, user defined types & rule types-Enumeration. Array, records, limited and private limited types, control structure- if, case, loop, loop iteration schemes, subprograms-declaration, parameter passing- local and global variables.

UNIT III ADA PACKAGES 9

Declaration and bodies-packages-compilation units, I/O capabilities, Text file I/o, various text file, package command line options, child packages, exceptions - declarations, handling, generics-definitions, formal parameters, visibility rules.

UNIT IV PARALLEL PROGRAMMING 9

Access types-declaration -unbounded types, unchecked deal location-task and protected types-multitasking.

UNIT V INTERFACING WITH OTHER LANGUAGES 9

Interfacing with C, Java vs. Ada, Ada applets, Java interfaces and aliased components- flight safety and Ada, recursion and efficiency, software inspection, debugging, Ada bindings, other Ada capabilities

TOTAL: 45 PERIODS

REFERENCES:

1. Ada for experienced programmers-Habermann AN, Peary DE-Addison Wiley, 1983.
2. Ada in industry- Heibrunner s- Cambridge UniversityPress-1988.
3. Ada: Introduction & Ada reference manual- HegardH-Springer Verlag
1. Ada: Reference manual, Programming language-Spamger verlag
2. Ada as a second language, Norman H.Cohen, McGraw Hill II edition, 1995.
3. Ada 95: Problem solving and program design, Michael B. Feildman, Elliot B. Koffman, Addison – Wesley, 1999.
4. Ada 95: The Craft of object oriented programming, John English I edition, Prentice Hall, 1996.
5. Herbert schildt, " Java 2 The Complete Reference", McGraw Hill, 2007.

AV8017 **UAV SYSTEM DESIGN** **L T P C**
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of UAV System Design to the engineers and to provide the necessary mathematical knowledge that are needed in modeling and analyzing an unmanned system.The students will have an exposure on various topics such as Design and development of UAVs, payloads and design standards, concluding with case studies of different such unmanned systems and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I INTRODUCTION TO UAV 9

History of UAV –classification –basic terminology-models and prototypes –applications

UNIT II BASICS OF AIRFRAME 9

Airframe –dynamics –modeling- structures –wing design- engines types-equipment maintenance and management-control surfaces-specifications.

UNIT III AVIONICS HARDWARE 9

Autopilot –AGL-pressure sensors-servos-accelerometer –gyros-actuators- power supply-processor, integration, installation, configuration, and testing

UNIT IV COMMUNICATION PAYLOADS AND CONTROLS 9

Payloads-Telemetry-tracking-Aerial photography-controls-PID feedback-radio control frequency range –SAS-flight director-commands and videos-elements of control loops-flight computer sensor-displays-parameter settings-modems-memory system-simulation-ground test-analysis-trouble shooting

UNIT V PATH PLANNING AND MAV 9

Waypoints navigation-ground control software-Recent trends in UAV-Case Studies

REFERENCES:

1. Jane's Unmanned Aerial Vehicles and Targets, Jane's Information Group; ASIN: 0710612575, 1999
2. R. Said and H. Chayeb, "Power supply system for UAV", KTH, 2002.
3. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
4. Skafidas, "Microcontroller Systems for a UAV", KTH, TRITA-FYS 2002:51 ISSN 0280-316 X. 34, 2002
5. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007
6. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998,

1. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics Company, 2001

8. P.J.Swatton , "Ground studies for pilots' flight planning", Sixth edition, 2002.

AP8075 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

L T P C
3 0 0 3

OBJECTIVES:

- To introduce concepts related to Electromagnetic interference in PCBs
- To teach solutions for minimizing EMI in PCBs
- To teach EMI standards in the design of PCBs

UNIT I EMI/EMC CONCEPTS 9

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

UNIT II EMI COUPLING PRINCIPLES 9

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling ; Near field cable to cable coupling, cross talk ; Field to cable coupling; Power mains and Power supply coupling.

UNIT III EMI CONTROL TECHNIQUES 9

Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.

UNIT IV EMC DESIGN OF PCBS 9

Component selection and mounting; PCB trace impedance; Routing; Cross talk control; Power distribution decoupling; Zoning; Grounding; VIAs connection; Terminations.

UNIT V EMI MEASUREMENTS AND STANDARDS 9

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Tx/Rx Antennas, Sensors, Injectors/Couplers, and coupling factors; EMI Rx and spectrum analyzer; Civilian standards - CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

TOTAL: 45 PERIODS

REFERENCES

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.
2. Henry W.Ott.,"Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.
3. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.
4. C.R.Paul,"Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992.
5. Don R. J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.

OUTCOMES:

- Ability to analyze Electromagnetic interference effects in PCBs
- Ability to propose solutions for minimizing EMI in PCBs''

AS8151 ELEMENTS OF SATELLITE TECHNOLOGY LT P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of satellite architecture and technology to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various satellite sub-systems ranging from telemetry, attitude and orbital control, propulsion, structure and satellite mission related concepts and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I SATELLITE MISSION AND CONFIGURATION 9

Mission Overview – Requirements for different missions – Space Environment, Spacecraft configuration- Spacecraft Bus – Payload – Requirements and constraints – Initial configuration decisions and Trade-offs – Spacecraft configuration process – Broad design of Spacecraft Bus – Subsystem layout – Types of Satellites – Constellations – Applications

UNIT II POWER SYSTEM 8

Power sources – Energy storage – Solar panels – Deployable solar panels – Spacecraft Power management – Power distribution – Deep Space Probes

UNIT III ATTITUDE AND ORBIT CONTROL SYSTEM (AOCS) 9

Coordinate system – AOCS requirements – Environment effects – Attitude stabilization – Attitude sensors – Actuators – Design of control algorithms.

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UNIT IV PROPULSION SYSTEMS, STRUCTURES AND THERMAL CONTROL 11

Systems Trade-off – Mono-propellant systems – Thermal consideration – System integration design factors – Pre-flight test requirements – System reliability Configuration design of Spacecraft structure – Structural elements – Material selection – Environmental Loads -Vibrations – Structural fabrication –Orbital environments - Average temperature in Space – Transient temperature evaluation – Thermal control techniques – Temperature calculation for a spacecraft – Thermal design and analysis program structure – Thermal design verification – Active thermal control techniques.

UNIT V TELEMETRY SYSTEMS 8

Base Band Telemetry system – Modulation – TT & C RF system – Telecommand system – Ground Control Systems

TOTAL: 45 PERIODS

REFERENCES:

1. Space Mission Analysis and Design (Third Edition) by James R.Wertz and Wiley J.Larson – 1999.
2. James R.Wertz "Spacecraft Attitude Determination and Control", Kluwer Academic Publisher, 1988.
3. Marcel J.Sidi "Spacecraft Dynamics and Control", Cambridge University press, 1997.
4. Lecture notes on " Satellite Architecture", ISRO Satellite Centre Bangalore – 560 017

AS8251 MISSILE GUIDANCE AND CONTROL L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Missile Guidance and control to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Types of missiles, missile airframe, control and autopilot, guidance laws and weapon delivery system and will be able to deploy these skills effectively in the solution of problems in missile control technology.

UNIT I MISSILE SYSTEMS INTRODUCTION 8

History of guided missile for defence applications- Classification of missiles– The Generalized Missile Equations of Motion- Coordinate Systems- Lagrange's Equations for Rotating Coordinate Systems- Rigid-Body Equations of Motion-missile system elements, missile ground systems.

UNIT II MISSILE AIRFRAMES, AUTOPILOTS AND CONTROL 9

Missile aerodynamics- Force Equations, Moment Equations, Phases of missile flight. Missile control configurations. Missile Mathematical Model. Autopilots — Definitions, Types of Autopilots, Example Applications. Open-loop autopilots. Inertial instruments and feedback. Autopilot response, stability, and agility- Pitch Autopilot Design, Pitch-Yaw-Roll Autopilot Design.

UNIT III MISSILE GUIDANCE LAWS 10

Tactical Guidance Intercept Techniques, Derivation of the Fundamental Guidance Equations, explicit, Proportional Navigation, Augmented Proportional Navigation, beam riding, bank to turn missile guidance, Three-Dimensional Proportional Navigation, comparison of guidance system performance, Application of Optimal Control of Linear Feedback Systems.

UNIT IV STRATEGIC MISSILES 10

Introduction, The Two-Body Problem, Lambert's Theorem, First-Order Motion of a Ballistic Missile , Correlated Velocity and Velocity-to-Be-Gained Concepts, Derivation of the Force Equation for Ballistic Missiles, Atmospheric Reentry, Ballistic Missile Intercept, Missile Tracking Equations of Motion, Introduction to Cruise Missiles , The Terrain-Contour Matching (TERCOM) Concept.

Attested

UNIT V WEAPON DELIVERY SYSTEMS **8**

Weapon Delivery Requirements, Factors Influencing Weapon Delivery Accuracy, Unguided Weapons, The Bombing Problem, Guided Weapons, Integrated Flight Control in Weapon Delivery, Missile Launch Envelope, Mathematical Considerations Pertaining to the Accuracy of Weapon Delivery Computations.

TOTAL : 45 PERIODS

REFERENCES:

1. Siouris, G.M. "Missile Guidance and control systems", Springer, 2003.
2 Blakelock, J. H.; Automatic Control of Aircraft and Missiles, 2nd Edition, John Wiley & Sons, 990.
3. Fleeman, Eugene L.; Tactical Missile Design, First Edition, AIAA Education series, 2001.
4 Garnell, P., "Guided Weapon Control Systems", 2nd Edition, Pergamon Press, 1980.
5. Joseph Ben Asher and Isaac Yaesh "Advances in Missile Guidance Theory" AIAA Education series, 1998
6. Paul Zarchan "Tactical and Strategic Missile Guidance" AIAA Education series,2007

AS8252 SPACECRAFT COMMUNICATION SYSTEMS

L	T	P	C
3	0	0	3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Spacecraft communication systems to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the physical processes.The students will have an exposure on various topics such as Orbital mechanics,elements of satellite communication system, links and multiplexing, multiple access, telemetry ,tracking and telecommand and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I ELEMENTS OF SATELLITE COMMUNICATION **8**

Satellite Systems, Orbital description and Orbital mechanics of LEO, MEO and GSO, Placement of a Satellite in a GSO, Satellite – description of different Communication subsystems, Bandwidth allocation.

UNIT II TRANSMISSION, MULTIPLEXING, MULTIPLE ACCESS AND CODING **12**

Different modulation and Multiplexing Schemes, Multiple Access Techniques FDMA, TDMA, CDMA, and DAMA, Coding Schemes, Satellite Packet Communications.

UNIT III SATELLITE LINK DESIGN **9**

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

UNIT IV SATELLITE TELEMETRY, TRACKING AND TELECOMMAND **9**

Introduction to telemetry systems - Aerospace transducer - signal conditioning – multiplexing methods - Analog and digital telemetry - Command line and remote control system - Application of telemetry in spacecraft systems - Base Band Telemetry system - Computer command & Data handling , Satellite command system-Issues

UNIT V APPLICATIONS **7**

VSAT-VSAT Technologies, Networks MSS-AMSS, MMSS

TOTAL: 45 PERIODS

REFERENCES:

1. Wilbur L. Pritchard and Joseph A.Sciulli, Satellite Communication Systems Engineering, Prentice Hall, New Jersey, 1986.
2. Timothy Pratt and Charles W.Bostain, Satellite Communications, John Wiley and Sons, 1986.
3. Tri T Ha, Digital Satellite Communication, Macmillan Publishing Company, 1986.
4. Kadish, Jules E, Satellite Communications Fundamentals, Artech House, Boston 2000
5. Lida,Takashi ed.,Satellite communications:System and its design technology, Ohmsha Tokyo 2000
6. Maral, Gerard,Satellite communications systems: Systems, techniques and technology, John Wiley, Newyork 2002.
7. Elbert, Bruce R, Satellite communication applications handbook, Artech house Boston 2004.

AV8071 DIGITAL FLY-BY WIRE CONTROL L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Fly-by-wire to the engineers and to provide the necessary mathematical knowledge that are needed in understanding modern aircraft control strategies. The students will have an exposure on various topics such as evolution of FBW, Elements, architecture, design and design issues of DFBW and will be able to deploy these skills effectively in the analyzing and understanding modern control methods.

UNIT I INTRODUCTION TO FLY-BY-WIRE CONTROL 7

Need for FBW systems, Historical perspectives in design Programs-Douglas Long Beach Programs, WPAFB B 47 In House Program, LTV IAP, Sperry Phoenix Programs, CAS and SAS, CCV and ACT concepts.

UNIT II ELEMENTS OF DFBW CONTROL 9

Description of various elements of DFBW systems - Concept of redundancy and reliability, Fault coverage and redundant architecture

UNIT III DFBW ARCHITECTURES 9

Need for redundant architecture, discussion on triplex vs. quadruplex architecture for DFBW system, Concept of cross-strapping, Actuator command voting and servo force voting etc.

UNIT IV SOME REQUIREMENTS FOR DFBW SYSTEM DESIGN 9

Survivable Flight control System programs, ADP Phases-Simplex package Evaluation -FBW without Mechanical Backup-Survivable Stabilator Actuator package, Reliability requirements and their relevance to DFBW system design, redundant power supply requirements, Environmental and weight, volume constraints.

UNIT V DESIGN ISSUES IN DFBW SYSTEM DESIGN 11

Thermal consideration, Built-in-test features, reliable software development, Redundancy management (voting, monitoring), Failure and maintenance philosophies, Implementation, Issues of digital control laws, Generic failures in Hardware and software. Advanced concepts in DFBW System Design

TOTAL: 45 PERIODS

REFERENCES:

1. Vernon R Schmitt, James W Morris and Gavin D Jenny, “Fly By Wire-A Historical Perspective”, SAE International, 1998.
2. AGARD-CP-137, “Advances in Control systems”, (Chap.10, 17,21, 22, 23, 24)
3. AGARD-CP-384, “Active Control Systems Review”, Evaluations and Projections.
4. AGARD-CP-260, “Stability and Control” (Chap.15)
5. ‘Modern Air Combat’, Salamander Books Ltd , 2001.

AV8072 FAULT TOLERANT COMPUTING **L T P C**
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Fault Tolerance to the engineers and to provide the necessary mathematical knowledge that are needed in understanding the necessary procedures involved. The students will have an exposure on various topics such as Redundancy, Fault Tolerant system architecture and design, error handling and recovery and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I FAULT TOLERANCE 10

Principles of fault tolerance – redundancy – quantitative reliability – evaluation – exception handling. Application of fault tolerant systems in aircraft – reliability strategies – Fault Tolerant Processor – Hardware and software

UNIT II ERROR DETECTION 12

Measure for error detection – Mechanisms for error detection – Measures for damage confinement and damage assessment – Protection mechanisms – Protection in multi-level systems

UNIT III ERROR RECOVERY 12

Measures for error recovery – mechanisms for error recovery – check points and audit trials – the recovery cache – Concurrent processes – recovery for competing process – recovery for cooperating process – distributed systems – fault treatment – location and repair.

UNIT IV SOFTWARE FAULT TOLERANCE 4

The recovery block scheme – Implementation of recovery block – Acceptance – tests – run-time overheads

UNIT V SYSTEMS STRUCTURE AND RELIABILITY 7

System structure – systems model – Software / Hardware interaction and multi-level systems – atomic actions – systems reliability – systems specification - Erroneous transitions and states – component / design failure – errors and faults.

TOTAL: 45 PERIODS

REFERENCES:

1. Anderson and Lee, Fault tolerant principles and practice, Prentice – Hall, 1981
2. Siewiorek, C.P. and Swartz, R.S Theory and practice of reliable system design, McGraw – Hill, 1983.
3. John D. Musa, Anthony Jannino, Kzuhira, Okunito, Software reliability measurement, prediction and application, McGraw – Hill, 1989.

AV8073 SOFT COMPUTING FOR AVIONICS ENGINEERS **L T P C**
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Soft-computing to the engineers and to provide the necessary mathematical knowledge that are needed in modeling the related processes.The students will have an exposure on various topics such as Neural Networks, Fuzzy logic and Neuro-fuzzy modeling and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptrons – Adaline – Back propagation Multilayer Perceptron – Radial Basis Function Networks – Unsupervised Learning Neutral Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks – Counter Propagation Networks- Advances In Neural Networks.

UNIT II FUZZY SET THEORY 9

Fuzzy Sets – Basic Definition and Terminology – Set Theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules And Reasoning – Extension Principle and Fuzzy Relations – Fuzzy IF-THEN Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Model – Sugeno Fuzzy Model – Tsukamoto Fuzzy Model – Input Space Partitioning and Fuzzy Modeling.

UNIT III OPTIMIZATION METHODS 9

Derivative Based Optimization – Derivative free Optimization - Genetic Algorithm – Design Issues In Genetic Algorithm , Genetic Modeling – Optimization of Membership Function and Rule Base using GA – Fuzzy Logic Controlled GA.

UNIT IV NEURAL AND FUZZY CONTROL SCHEMES 9

Direct and Indirect Neuro Control Schemes – Fuzzy Logic Controller – Familiarization of Neural Network and Fuzzy Logic Toolbox - Case Studies.

UNIT V NEURO FUZZY MODELLING 9

Fuzzification and Rule Base using ANN – Fuzzy Neuron – Adaptive Neuro-fuzzy Inference System – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling.

TOTAL:45 PERIODS

REFERENCES:

1.“Neural Networks: Algorithms, Applications and Programming Techniques”, Freeman J.A. &D.M. Skapura, Addison Wesley,2000.
2. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education 2004.
3. Anderson J.A “An Introduction to Neural Networks”,PHI, 2001.
4. Timothy J.Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, 1997.
5. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y., 2000.
6. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.

NE8071 DETECTION AND ESTIMATION THEORY L T P C
3 1 0 4

COURSE OBJECTIVES:

- To understand the concepts of detection and estimation.
- To learn the basics of multi-user detection theory
- To understand the theory behind various estimation techniques.
- To understand Wiener filter and Kalman filter in detail.

COURSE OUTCOMES:

- To be able to apply detection and estimation theory to solve communication problems.
- To apply probability and stochastic process concepts in detection and estimation.
- To design Wiener and Kalman filters to solve linear estimation problems.

UNIT I REVEIW OF PROBABILITY AND STOCHASTIC PROCESS 9+3

Conditional Probability, Bayes' Theorem , Random Variables, Conditional Distributions and Densities, moments and distribution of random variables., Stationary Processes Cyclostationary Processes Averages and Ergodicity Autocorrelation Function Power Spectral Density Discrete-Time Stochastic Processes, Spatial Stochastic Processes Random Signals, Relationship of Power Spectral Density and Autocorrelation Function.

UNIT II SINGLE AND MULTIPLE SAMPLE DETECTION 9+3

Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection, The Optimum Digital Detector in Additive Gaussian Noise , Performance of Binary Receivers in AWGN.

UNIT III FUNDAMENTALS OF ESTIMATION THEORY 9+3

Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory, Types of Estimation Problems, Properties of Estimators, Bayes Estimation, Minimax Estimation, Maximum-Likelihood Estimation, Comparison of Estimators of Parameters.

UNIT IV WIENER AND KALMAN FILTERS 9+3

Orthogonality Principle, Autoregressive Techniques, Discrete Wiener Filter, Continuous Wiener Filter, Generalization of Discrete and Continuous Filter Representations , Linear Least-Squares Methods, Minimum-Variance Weighted Least-Squares Methods, Minimum-Variance, LeastSquares, Kalman Algorithm - Computational Considerations, Signal Estimation, Continuous Kalman Filter, Extended Kalman Filter.

UNIT V APPLICATIONS 9+3

Detector Structures in Non-Gaussian Noise , Examples of Noise Models, Receiver Structures, and Error-Rate Performance, Estimation of Non-Gaussian Noise Parameters Fading Multipath Channel Models, Receiver Structures with Known Channel Parameters, Receiver Structures without Knowledge of Phase, Receiver Structures without Knowledge of Amplitude or Phase, Receiver Structures and Performance with No Channel Knowledge.

TOTAL: 45+15=60 PERIODS

REFERENCES:

1. Thomas Schonhoff, "Detection and Estimation Theory", Prentice Hall, NewJersy,2007.
2. Steven M. Kay, "Fundamentals of Statistical Processing, Volume I: Estimation Theory", Prentice Hall Signal Processing Series, Prentice Hall, PTR, NewJersy, 1993.
3. Harry L. Van Trees, "Detection, Estimation and Modulation Theory", Part I John Wiley and Sons, New York, 2001.

NE8072 MICROWAVES AND RADAR L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Microwave engineering and RADAR concepts to the engineers and to provide the necessary mathematical knowledge that are needed in modeling physical processes.The students will have an exposure on various topics such as Microwave sources, types, principle and working of RADAR and relevant signal processing and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I MICROWAVE SOURCES 10

Passive waveguide components, Microstrip line structure and components, Simple theory and operating characteristics of Reflex klystrons, Two cavity Klystrons, Magnetrons, and TWTS - solid state source - TEDS, IMPATTS, TRAPATT, GaAs FETs and Tunnel diode.

UNIT II RADAR PRINCIPLES 8

Introduction to Radar – Radar range equation – Receiver noise and signal to noise ratio- Radar cross section (RCS) – Radar system – Radar Antennas

Attested

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UNIT III TYPES OF RADARS 10

CW and FMCW radars-Tracking radars-MTI radar -Principles of coherent MTI radars - Digital MTI, Synthetic Aperture radar, Principles of Pulsed Doppler Radar, Low-, High-, and medium-PRF Mode.

UNIT IV RADAR SIGNAL PROCESSING 9

Radar requirements –Matched filters- Radar ambiguity function – Optimum waveforms for detection in clutter – Classes of waveforms – Digital representation of signals -Pulse compression

UNIT V TRACKING RADAR 8

Tracking with radar – Monopulse Tracking – conical scan and sequential lobing – limitations to tracking Accuracy- Kalman Tracker -Fundamentals of Airborne radar

TOTAL: 45 PERIODS

REFERENCES:

2. Fred E.Nathanson " Radar design Principles " Signal processing and the environment, Prentice Hall, 2004
3. Y. Liao, Microwave Devices and Circuits, Prentice Hall, 1980.
4. M.I. Skolnik, Introduction to Radar System (Second Edition) McGraw Hill, 1980.
5. M.I. Skolnik, Radar Handbook (Second Edition) McGraw Hill, 1990.
6. Guy V. Morris, Linda L. Harkness, Airborne Pulsed Doppler radar, Second Edition, Artech House Publishers, 1996.
7. Blackman S.S., "Multiple target tracking with radar applications" Artech House 1986.

NE8073 REAL TIME EMBEDDED SYSTEMS L T P C
3 0 0 3

OUTCOME:

Upon completion of this course, students will understand the advanced concepts of Real-time embedded systems to the engineers and to provide the necessary knowledge for their design and development.The students will have an exposure on various topics such as architecture of embedded systems, connectivity, RTOS, Real time UML and will be able to deploy these skills effectively in the solution of problems in avionics engineering.

UNIT I INTRODUCTION 12

Real Time System – Embedded Systems – Architecture of Embedded System - Simple Programming for Embedded System – Process of Embedded System Development - Pervasive Computing – Information Access Devices – Smart Cards – PIC Microcontroller – ARM Processor.

UNIT II EMBEDDED/REAL TIME OPERATING SYSTEM 9

Operating System Concepts: Processes, Threads, Interrupts, Events - Real Time Scheduling Algorithms - Memory Management – Overview of Operating Systems for Embedded, Real Time, Handheld Devices – Target Image Creation – Programming in Linux, RTLinux, VxWorks, uC/Os-overview.

UNIT III CONNECTIVITY 9

Wireless Connectivity - Bluetooth – Other short Range Protocols – Wireless Application Environment – Service Discovery – Middleware

UNIT IV REAL TIME UML 6

Requirements Analysis – Object Identification Strategies – Object Behavior – Real Time Design Patterns

UNIT V SOFTWARE DEVELOPMENT AND CASE STUDY 9

Concurrency – Exceptions – Tools – Debugging Techniques – Optimization – Case Studies - Interfacing Digital Camera with USB port and Data Compressor.

TOTAL: 45 PERIODS

REFERENCES:

1. R.J.A.Buhr, D.L.Bailey, "An Introduction to Real-Time Systems", Prentice-Hall International, 1999.
2. David E-Simon, "An Embedded Software Primer", Pearson Education, 2007. (UNIT– II)
3. C.M.Krishna, Kang G.Shin, "Real Time Systems", Mc-Graw Hill, 1997. (UNIT- II)
4. B.P.Douglass, "Real Time UML 2nd Edition", Addison-Wesley 2000. ((UNIT – IV)
5. J.Schiller, "Mobile Communication", Addison-Wesley, 1999. (UNIT – III)
6. Dr.K.V.K.K.Prasad, "Embedded/Real Time Systems: Concepts, Design and Programming", DreamTech press, Black Book, 2005. (UNIT – I)
7. R.Barnett, L.O.Cull, S.Cox, "Embedded C Programming and the Microchip PIC", Thomason Learning 2004. (UNIT – I)
8. Wayne Wolf, "Computers as Components - Principles of Embedded Computer System Design", Mergen Kaufman Publisher, 2006.
9. Sriram V Iyer, Pankaj Gupta, "Embedded Real Time Systems Programming", Tata Mc-Graw Hill, 2004.