Sl. No.	Code	Course Type	Course Title	L	P	T	C
1	AVTE 4110	Core	Avionics System Design & Instruments	2	2	4	6
2	AVTE 4111	Core	Analog& Digital Integrated Circuits FPGA-Based System Design	2	2	4	6
3	AVTE 4112	Core	Aircraft Radar and Microwave	2	2	4	6
4	AVTE 426	Core	Aircraft Data Networking	2	2	4	6
5	CREQ 448	Core	Final Project	0	6	6	6
6	AVTE 419	Core	Power Electronics	2	2	4	6
7	CREQ 449	Secondary	Industrial Engineering	2	0	2	4
8	UREQ 465	General	Professional & Social Ethics Leadership	2	0	2	4
Total				14	16	30	44

The perce. of core hours = 87%	The perce. of theoretical hours = 47%
The perce. of secondary hours = 7%	The perce. of practical hours = 53%
The perce. of general hours= 6%	

Subject Number: AVTE 4110
Subject : Avionics System Design & Instruments.

L T P C
2 0 2 6

Objective of the course:
To cover the essential ingredients of avionics system design including data buses, displays and power systems with emphasis on aircraft interfaces and avionics system architecture and fitting of avionics systems into aircraft as well as the integration of avionics system hardware and software. To gain an insight into the concepts of measurements methods, direct or indirect and essential to appreciate the problems associated with instrumentations, learn basic characteristics, source of errors constructions, transduction principles of sensors & transducers employed in measurements of various non-electrical parameters commonly encountered in almost every branch of engineering

Theoretical syllabus	
Week	**Contents**
1	**Importance and role of avionics**
2-3	**Display and man-machine integration**
4-5	**Aerodynamics and aircraft control**
6	**Fly-by-wire flight control**
7	**Air data and air data systems**
8-9	**Autopilots and flight management systems**
10-11	**Avionics interfaces:** Data buses - Crew displays - Power - Maintenance - Physical interfaces.
12-13	**Avionics system integration** Data bus system - Integrated modular avionics - Commercial off-the-shelf (COTS).
14	**Unmanned air vehicles**
15	**Doppler and altimeter radars - Mapping and multimode radars**
16-17	**Units & dimensions, dimensional analysis.**
18-20	**DC bridge methods, AC bridge methods**
21-25	**Sensors & Transducers** Classifications - Resistance - Reactance change transducers - Potentiometric transducers - RTDs - Thermostats - Hot-wire anemometer - Strain-gauge - Inductive-type transducers - Thermoelectric transducers - Semiconductor sensors - Piezoelectric sensors - Ultrasonic sensors - Photo sensors.
26-30	**Instruments** Analog instruments - electrodynamometer type instruments - Induction type instruments Digital instruments - interfacing signals
Practical syllabus	
1-15	Determined by the department depending on assigned to the students and appropriate for laboratory facilities available.
16-30	Determined by the department depending on assigned to the students and appropriate for laboratory facilities available.

Recommended Books:

Text Books:

- Introduction to Avionics Systems by R. G. Collinson (2nd Edition).
- Avionics Navigation Systems by Myron Kayton and Walter R. Fried.
- Principles of Electronic Instrumentation & Measurements by Howard Berlin and Frank Gaetz.
- Modern Electronic Instrumentation & Measurements Techniques by William D. Cooper.

Reference Books:

- Aircraft Electricity & Electronics by K. Eismin. MC Graw Hill. 1994.

Subject Number: AVTE 4111
Subject : Analog& Digital Integrated Circuits, FPGA-Based System Design
L T P C
2 0 2 6

Objectives of Course:
To provide an insight into analysis and design of analog electronic circuits emphasizing amplifiers that find extensive application in computer, control systems, digital instrumentation, communications & radar, etc. In additive to, learning the design of digital electronic circuits with Field Programmable Gate Arrays.

Theoretical syllabus

Week	Contents
1-2	**Differential amplifier in both its bipolar and FET forms.**
3	**Various output stages**
4-5	**Frequency response of amplifiers**
6-7	**Feedback analysis with focus on practical circuit applications of negative feedback**
8	**Stability problems in feedback amplifiers**
9	**Introduction to analog integrated circuits (bipolar and MOS) leading to analysis of a 741 operational amplifier**
10-11	**Design of filters**
12-13	**Tuned amplifiers**
14-15	**Oscillators**
16-17	**Introduction:** Digital design and FPGA - FPGA-based system design - Manufacturing process
18	**Transistor characteristics - CMOS logic gates - wires - Registers and RAM - Packages and pads**
19	**FPGA architectures - SRAM-based FPGAs**
20	**Permanently-programmed FPGAs**
21	**Circuit design of FPGA fabrics -Architecture of FPGA fabrics**
22	**Logic design process**
23	**Combinational network delay**
24	**Power and energy optimization**
25	**Arithmetic logic elements - Logic implementation using FPGAs**
26	**Physical design (PnR) for FPGAs**
27	**Synthesis process**
28-30	**Sequential design using FPGAs, sequential machine design process, sequential design style, FSM design, ASM design.**

Practical syllabus

1	**Effects of emitter degeneration on gain and frequency response of a BJT differential amplifier**
2	**Lower/upper 3-dB frequencies**
3	**Mid-band gain**
4	**Bandwidth of a BJT amplifier with various feedback technologies**
5	**Performance analysis and optimization of a two stage amplifier with various feedback technologies**
6	**Class-A output stage design using emitter-follower configuration**
7	**Class-B and AB output stages using complementary pair of transistors**
8	**Gain and frequency response of 741 operational amplifier**
9	**Layout of 741 on ORCAD using discrete components**
10	**Component selection and simulation of 741 on Pspice**

11	**PCB manufacturing of 741 Operational Amplifier**
16	**Introduction to Verilog HDL**
17	**Gate-level modeling**
18	**Data flow modeling**
19	**Behavioral modeling, design, simulation.**
20	**Synthesis and fitting of combinational circuits**
21	**Design and implementation of an FSM and memory.**

Recommended Books:

- FPGA-Based System Design, by Wayne Wolf, 2004, Prentice Hall, ISBN: 0131424610.
- Verilog HDL, by Samir Palnitkar, Second Edition, 2003, Prentice Hall, ISBN: 0130449113.
- Advanced Digital Design with the Verilog HDL, by Michael D. Ciletti, First Edition, 2003, Prentice Hall, ISBN: 0130891614.
- Microelectronic Circuits By Adel S. Sedra & Kenneth C. Smith
- Analysis and design of Analog Integrated Circuits By Grey and Meyer.

Subject Number: AVTE 4112
Subject : Aircraft Radar and Microwave
L T P C
2 0 2 6
Objectives of Course:
To provide an introduction to the fundamentals of radar systems with emphasis on pulse radar, CW, FMCW, MTI, MTD, target tracking, radar performance in active environment, ESM, ECM, and ECCM at system level.

Theoretical syllabus

Week	Contents
1	**Introduction to Radar System:** Natural of radar and applications - What it can do?.
2	**Basic radar equation and important factors**
3	**Basic concepts of probabilistic detection used to analyze the performance of radar.**
4	**Principle and applications of CW and FMCW radar.**
5	**Basic concepts of analog/digital MTI.**
6-7	**Adaptive MTI and pulse Doppler radar.**
8-9	Airborne Radar - Space borne Radar - Synthesis aperture radar - SHAR and MST radar.
10-12	**Various tracking radar techniques** Object identification and tracking- Optical flow techniques - Hybrid technique
13-15	**Electronically steered phased array antenna and side lobe cancellation - Radar performance in wartime environment and electronic warfare - Basic principles of electronic support measures - Noise jamming - Frequency agility - Stealth technology and deceptive/expandable ECM**
16-19	**Introduction to microwave communication system, microwave spectrum, advantages and applications of microwave system.**
20-23	**Waveguide:** WG characteristics - Circular and rectangular WG, Passive and active microwave devices including solid state devices - Klystron - Magnetron - TWT and Twystrons as microwave oscillator and amplifier
24-28	**Microwave components and semiconductors - Microwave cavities - Directional coupler - Hybrid circuit - Circulators and isolator**
29-30	**Microwave telecommunication system architecture of the networks -Radar system.**

Practical syllabus

1-2	Basic Pulse Radar range and range resolution measurements
3	Radar cross section area of different types of target
4-5	CW and FMCW radar
6	Pulse Doppler radar with MTI and MTD
7-8	Sequential Lobing and mono-pulse target tracking radar
9	Electronically steered phased array antenna radar
10	Spot noise jamming and Burn-through range
11	Frequency agility and barrage noise jamming
12	Range gate pull off and angle detection jamming (Deceptive ECM)
13-15	Variable density Chaff cloud (Expendable ECM) against tracking radar.
16-17	Waveguide wavelength and VSWR for different loads
18-19	Properties of an isolator
20-21	E-plane & H-plane TEE junction
22-23	Magic Tees
24-25	Coupling and Directivity of a directional coupler

26-27	Measurement of normalized impedance of unknown load.

Recommended Books:

Text Books:

- Introduction to radar System, by M. Skolnik. 2nd Edition.
- Microwave Devices and Circuits By Samuel Y. Liao.
- Pasive and Active Microwave Circuits by J. Helszajn

Reference

- Understanding Radar Systems by Simon Kigsley and Shaun Que.
- Electronic Communication System by George Kenned.

Subject Number: AVTE 426
Subject : Aircraft Data Networking
L T P C
2 0 2 6

Objective of course:
Learn the student concepts of computer networks through its types, systems and protocols used.

Theoretical syllabus

Week	Contents
1	**Networks**: Overview and important concepts - Network categories (PAN, LAN, MAN,WAN, GAN) - Circuit switching vs. Packet switching - Baseband vs. Broadband transmission - Transmission modes (simplex, half duplex, full duplex) - Segments and backbones - Pear to Pear vs. Client/Server Networks - Protocols (elements, functions) - Transfer Rate (Digital BW, Throughput, Goodput).
2-3	**Networking Models:** OSI reference model (Layer1: Physical Layer, Layer2: Data-link Layer, Layer3: Network Layer, Layer4: Transport Layer, Layer5: Session Layer, Layer6: Presentation Layer, Layer7: Application Layer) - TCP/IP model (Network access layer ,Internet layer, Transport layer, Application layer).
4-5	**Physical Layer:** Mediums [Copper(Coaxial cable, Twisted Pair Cables),Fiber Optics (multimode, singlemode) - Wireless (RF, Microwaves, satellites, IR, FSO)] - Networking topologies (Bus, Ring, Dual Ring ,Star, Extended Star, Mesh, Wireless) - Physical vs. logical topologies. Noise (Cross talk, thermal, AC power noise, reference ground noise , EMI/RFI) - Losses (Copper medium losses, Fiber optics losses) -Timing issues (Dispersion, Jitter, Latency) - Coding [Liner coding (NRZL, NRZI, Manchester, Differential Manchester, MLT3) - Block coding (4B/5B, 8B,10B)] - Layer1 Devices (Repeaters, Hubs)
6-11	**Data-link layer protocols:** Ethernet (IEEE 802.3) [Regular Ethernet (mediums, topologies, encoding), Fast Ethernet (mediums, topologies, encoding), Gigabit Ethernet (mediums, topologies, encoding), 10Gigabit Ethernet (mediums, topologies, encoding), frame format ,Data-link Sublayers (MAC, LLC), CRC, MAC addresses (unicast, multicast, broadcast), MAC mechanism (CSMA/CD)]. Token Ring(IEEE 802.5) [Physical layer specifications (mediums, speeds, topologies, encoding), Frame types and Formats(Data Frame, Token Frame, Command Frame, Abort Delimiter Frame), Priority and reservation, MAC mechanism (Token passing)]. Fiber Distributed Data Interface FDDI [Physical layer specifications(mediums, speeds, topologies, encoding), Frame types and Formats(Data Frame, Token Frame, Station management Frame), MAC mechanism (Early Token Release)]. Data-link layer protocols (continued):WiFi (IEEE 802.11) [Physical layer specifications(topologies, FHSS, DSSS, OFDM, architecture, speeds), Versions (legacy, IEEE 802.11a, IEEE 802.11b, IEEE 802.11g, IEEE 802.11n), Frames Formats, MAC mechanism (CSMA/CA)], Bluetooth (IEEE 802.15) (architecture, format, layers)
12	**Layer2 Devices :** NIC - Ethernet Bridge (collision domains, broadcast domains, transparent bridging) - Ethernet Switches, Access point.
13-20	**Network Layer:** IPv4 [Datagram format, fragmentation, classfull addressing (subnetting, supernetting),

	classless addressing]. IPv6 (datagram format, addressing extension headers, tunneling). ICMP(messages, format, error reporting, queuing) - IGMP (group management, messages, format, error reporting) - ICMPv6(messages, format, error reporting). ARP - DNS (Name Space, Resolution, Messages) - NAT. Routing [routing tables, static routing, Dynamic routing, unicast routing, multicast routing, Protocols (RIP, OSPF, BGP)].
21-23	**Transport Layer:** UDP (format, port numbers, sockets) - TCP (format, port numbers, connection establishment and connection termination, flow control, error control, congestion control) - SCTP (format, flow control, error control, congestion control) - QoS (Flow characteristics, flow classes).
24-26	**TCP/IP application layer protocols:** e-mail (SMTP, POP3) - File transferring (FTP) - Web (HTTP, HTML, XML) - VoIP (RTCP, SIP, H323) - Management (SNPM).
27-28	**Security:** Encryption - Viruses - Hacking - Firewalls - VPNs - IPsec - SSL - WEP - WAP.
29-30	**WAN:** Protocols (PPP, PDN) - Systems (ATM, SONET , ISDN, DSL).
Practical syllabus	
1	NIC installation
2-3	Cat 5e cabling, cross and straight through
4	Pear to Pear 2- PC Network
5	LAN via Switches, Extended star LAN
6	Sharing (folders, drives)
7	Sharing Printers
8	Remote Desktop Connection
9-10	Privileges and Security in Win XP
11	Ad hoc WLAN
12	Infrastructure WLAN via AP
13-14	AP as (Client, PTP bridge, PTMP bridge)
15-16	WLAN security (MAC filtering, WEP, WAP)
17	Routers
18-19	Subnetting (Class A, Class B, Class C)
20-21	Utilities (ping, Ipconfig, telnet,traceout, nslookup)
22	Internet Connection Configuration and Sharing
23-26	Web Site Design (HTML, ASP)
27	Win Server 2003 Installation
28-30	Administration and configuration of Win Server 2003

Recommended Books:

Text Books:

Reference

- Data communications and Networking, 4th Edition, by Behronz A. Foruzan
- TCP/IP Protocol Suit 4th Edition, by Behronz A. Foruzan.

Subject Number: AVTE 419
Subject : Power Electronics
L T P C
2 0 2 6

Objective of the course:
It is aimed to design and analysis the electronic devices that used with power electrical.

Theoretical syllabus

Week	
1-4	**Power electronics systems** Introduction - History of power electronics - Power electronics semiconductor device - Power electronics converter - Advantage and disadvantage - Power electronics module - Computer simulation of power electronics circuit- Basic structure of power diode - IV characteristics of power diode - Reverse recovery - Power diode types (general purpose, fast switching and sckootky diodes) - Effect of forward and reverse recovery time of diode - Series and parallel connection of diodes - Diodes and rectifier circuit (half wave and full wave).
4-6	**Power transistor** Power MOSFET - PMOSFET characteristics - Application - Comparison MOSFET and BJT - Insulated Gate BJT - IGBJT structure - Equivalent circuit - Operation - Application.
7-12	**Thyristor principle and application** Basic structure of thyristor - IV characteristics - Two transistor model of thyristor - Turn ON and turn OFF characteristics - Thyristor gate characteristics - Thyristor protection circuit - di/dt protection circuit - dv/dt protection circuit - Snubber circuit design - Gate protection circuit - Heating - Cooling and mounting of thyristor - Gate triggering circuit - Pulse transformer - Photocoupler circuit - Thyristor commutation circuit - Natural commutation - Forced commutation - Load side - Resonant pulse - Complementary - Impulse - External pulse - Line side commutation circuit - Series and parallel connection of thyristor - Thyristor types - Phase controlled - Fast switching - Gate turnOFF- Bidirectional switch - Reverse conduction - Static induction - Light activated - FET-controlled - MOSFET controlled and other thyristor family - Programmable unijunction transistor (PUT) - Slicon unilateral switch (SUS) - Comparison between thyristor and transistor.
13-16	**Controlled rectifier:** Controlled technique, principle of phase controlled rectifier - Single phase half wave rectifier (resistive and resistive-inductive)load - Single phase half wave rectifier (resistive and resistive-inductive)load with freewheeling diode - Single phase full wave rectifier (resistive and resistive-inductive)load - Single phase full wave rectifier (resistive and resistive-inductive)load with freewheeling diode.
17-19	**Inverter** Introduction to inverter and application - Classification of inverters - Voltage source inverters - Current source inverters - Square wave inverters - Quasi square inverter - Pulse modulation inverters - Thyristor in inverters - Single phase half bridge inverters - (resistive and resistive-inductive load) - Single phase full bridge inverters (resistive, resistive-inductive) load - Performance parameter of inverters.

20-21	**Choppers** Introduction to chopper- Basic classification of chopper - Basic operation - Thyristor chopper circuit - Performance parameter.
22-24	**Voltage controller:** Introduction to voltage controller - Principle of ON-OFF control - Principle of phase control - Single phase bidirectional controller with resistive load - Single phase controller with resistive-Inductive load.
25-27	**Charge transport in semiconductor:** Drift current - Hall effect - Current density equation - Scattering mobility of carrier - Effect of electric field on mobility - Temperature effect on mobility - Effect of doping on mobility - Conductivity equations - Diffusion phenomena - Diffusion length - Diffusion in solids - Einstein's relation - Points defects.
28-30	pulse-width-modulated (PWM) inverters; UPS; types of converters; switched mode power supplies, AC and DC motor drives.
Practical syllabus	
1	**Characteristics of thyristor**
2	**Trigger thyristor by A.C current**
3	**Trigger thyristor by D.C current**
4	**Half- wave rectifier of (RL) without freewheeling diode**
5	**Half- wave rectifier of (RL) with freewheeling diode**
6	**Full- wave rectifier of thyristor**
7	**Trigger traic by A.C current**
8	**Trigger traic by D.C current**
9	**A stable Multivibrator (AMV)**
10	**Monostable Multivibrator (MMV)**
11	**The light newsmen by (555)**
12	**Square wave generator by (555)**
13	**A stable Multivibrator with large time**
14	**Circuit of logic test**
15	**Square wave generator by NAND gate**

Recommended Books:

- Cyril W. Lander, "Power Electronics," Third Edition, 1993, McGraw-Hill UK, ISBN: 0077077148.
- Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications," Third Edition, 2004, Prentice Hall, ISBN:0131011405.
- Ned Mohan, William P. Robbins and Tore M. Undeland, "Power Electronics: Converters, Applications and Design," Media Enhanced, Third Edition, 2003, John Wiley & Sons, ISBN: 0471429082.

Subject Number: CREQ 347
Subject : Industrial Engineering
L T P C
2 0 0 4

Objectives of Course:
To learn the student about projects managements techniques through feasibility studying Efficiency considerations in the use of production requirements to solve the problem.

Week	Contents
1-2	**Preview** - Construction the frequency distribution - Representation the data in Histogram - Frequency polygon and ogive - Measures of location and measures of variation
3-6	**Tests of statistical hypotheses** - The nature of a statistical hypothesis - Two types of errors and tests about the mean of a normal distribution - Tests about the mean of a normal population when σ^2 unknown - Tests about the mean of abnormal population - Tests about the difference of two proportions - and tests about the difference of two means
7-10	**Analysis of variance (ANOVA)** - One- way analysis of variance with different sample sizes - Two- way analysis of variance
11-12	**Linear programming (L.P.)** - Definition of the L.P. - Forms of L.P. (general , canonical and standard) - Formulation of the mathematical model of the L.P. - Solving the mathematical model using a graphical and simplex methods - Solving the mathematical model using M-technique and two- phase method
13-15	**Transportation and Assignment models** - Finding the starting solution using northwest corner method - Least cost method - Vogell's approximation method (VAM) and Russel's approximation method (RAM) - Finding the optimal solution using stepping stone and multipliers methods - Solving the assignment models in maximized or minimized
16-17	**Network planning** Graph the network and find the critical path (CP) ; and the program evaluation and review technique (PERT) - Crashing the normal duration to execute the project with least costs
18-19	**Sequencing models** - Processing n jobs through one machine (shortest and largest processing time Spt and Lpt) - processing n jobs through two machines - Processing n jobs through m machines - processing n jobs through two machines with randomly technical routes
20-21	**Replacement and maintenance models** - Using the average total cost as a criterion to determine the period of replacement the machines - Cost of individual replacement for items of machines - Average cost group replacement per period as a criterion to determine the optimal replacement (individual or grouped) - Maintenance model
22-23	**Inventory models** - General inventory model - Static economic order quality (EOQ) models ; EOQ with price break ; and multi - item EOQ with storage limitation - Probabilistic EOQ model

	- Single - period models ; and multi period model
24	**ISO** - Total quality management (TQM) - ISO:9000
25-27	**Quality control** - Acceptance sampling - Calculation the OC-curve for single sampling schemes - rectifying schemes - double sampling schemes - and sequential sampling - Process control and control charts ($\bar{X}$ -chart , R-charts ,σ-charts and P-charts) - Quality level - Sampling plans (single , double and multiple)
28-30	**Reliability** - Reliability - Failure functions - Mean time to failure MTTF - Variance - Hazard rate function - Conditional reliability - Exponential and Weibull reliability functions - Reliability of system with serial and parallel configuration - Combined series – parallel system and high –level and low – level redundancy

Recommended Books:

- Industrial Engineering Mangement by A. Verma, Katson-India.

Subject Number: AVTE 4110
Subject : Professional & Social Ethics and Leadership
L T P C
2 0 0 4

Objectives of Course:
Teach the ethical issues of interest to the professional community to produce engineers who are not only good and responsible engineers, but also good and responsible citizens. In additive to, introducing the subject of leadership with emphasis on various theories, indicators, functions, responsibilities, qualities, and principles of effective leadership.

Week	Contents
1-15	This course introduces contemporary and controversial ethical issues facing the professional community. Topics include moral reasoning, moral dilemmas, law and morality, equity, justice and fairness, ethical standards, and moral development. Upon completion, students should be able to demonstrate an understanding of their moral responsibilities and obligations as members of the workforce and society.
15-30	Leadership being a task of great responsibility, demands courageous, selfless and devoted behavior. Definitions, theories, concepts, and indicators of effective leadership. Various individual - leader-task - team maintenance function. Traits - responsibilities - qualities - principles and approaches of leadership.

Recommended Books:

- TBusiness EthicsT: T Ethical Decision Making and CasesT, by C. Ferrell, John Fraedrich and Linda Ferrell, Sixth Edition, 2005, Houghton Mifflin Company, TISBN: 0618395733:
- Ethics in Engineering, by Mike W. Martin and Roland Schinzinger, Fourth Edition, 2005, McGraw-Hill, ISBN: 0072831154.