BRANCH: ***Applied Electronics and Instrumentation/ Electronics and Instrumentation Engineering***

SEMESTER - 7

Course Code	***Course Name***	***L-T-P***	***Credits***	***Exam Slot***
AE401	Logic and Distributed Control System	4-0-0	4	A
AE403	Biomedical Instrumentation	3-0-0	3	B
AE405	Advanced Control Theory	3-0-0	3	C
AE407	Digital Control System	3-0-0	3	D
AE409	Optical Instrumentation	3-0-0	3	E
	Elective 3	3-0-0	3	F
AE451	Seminar & Project Preliminary	0-1-4	2	S
AE431	Control System and Signal Processing Lab	0-0-3	1	T

Total Credits = 22 **Hours: 27** **Cumulative Credits= 162**

Elective 3:-

1. AE461 ARM System Architecture
2. AE463 Aerospace & Navigation Instruments
3. AE465 Information Security
4. AE467 CMOS Circuit Design
5. EC370 Digital Image Processing

Course code	Course name	L-T-P-Credits	Year of Introduction
AE401	LOGIC & DISTRIBUTED CONTROL SYSTEM	4-0-0-4	2016

Prerequisite: AE301 Control system

Course objectives

- To give an introductory knowledge about PLC and the programming languages.
- To give basic knowledge in the architecture and local control unit of distributed contr ol system.
- To give adequate information in the interfaces used in DCS.
- To give basic knowledge about Computer Controlled Systems.

Syllabus

Programmable Logic Controller - Architecture of PLC - Design of PLC - PLC Basic Functions - Applications Of PLC - Instructions in PLC - PLC programming methods as per IEC 61131 – SCADA - Distributed Control System - Architectures - Interfaces In DCS - Process Safety & Safety Management System - Risk Terminologies - Instrumented System.

Expected outcome

At the end of the course, students will be able to :

i. Understand the basics of PLC and PLC Programming
ii. Know the whereabouts of implementation of SCADA
iii. Reproduce the working of Distributed Control System
iv. Perform the implementation of DCS
v. Recognise the safety procedures to be maintained in an industry

Text Books

1. John. W. Webb Ronald A Reis - Programmable Logic Controllers - Principles and Applications, Fourth edition, Prentice Hall Inc., New Jersey, 1998.
2. Michael P. Lukas, 'Distributed Control Systems', Van Nostrand Reinhold Co.,Canada,1986
3. Petruzella, 'Industrial Electronics', McGraw Hill, Second edition, 1997.

Reference Books

1. Krishna Kant – Computer based Industrial Control, Prentice Hall, New Delhi, 1997.
2. Thomas A. Hughes, 'Programmable Logic Controllers', ISA press,2007.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Programmable Logic Controller : Evolution of PLC's, Components of PLC, Advantages over relay logic, Architecture of PLC, Programming devices, Discrete and Analog I/O modules, Programming languages, Ladder diagram, Programming timers and counters, Design of PLC, Definition of PLC, , overview of PLC systems, input/output modules, power supplies, isolators. General PLC programming procedures, programming on-off inputs/ outputs. Auxiliary commands and functions: PLC Basic Functions: Register basics, timer functions, counter functions.	9	15%
II	Applications Of PLC : Instructions in PLC	9	15%

	Program control instructions, math instructions, sequencer instructions, Use of PCas PLC, Application of PLC, Case study of bottle filling system, PLC programming methods as per IEC 61131, Developing programs using Sequential Function Chart, Functional Block Diagram, Analog control using PLC (PID controller configuration), Interfacing PLC to SCADA/DCS using communication link (RS232, RS485) , Protocols (Modbus ASCII/RTU) and OPC, Development stages involved for PLC based automation systems.		
FIRST INTERNAL EXAMINATION			
III	Computer Controlled Systems: Basic building blocks of Computer controlled systems, SCADA, Data Acquisition System, Supervisory Control, Direct digital Control.	7	15%
IV	Distributed Control System : DCS - Architectures, Comparison, Local control unit, Process interfacing issues, Communication facilities. Distributed Control System Basics: DCS introduction, Various function Blocks, DCS components/block diagram, DCS Architecture of different makes, comparison of these architectures with automation pyramid, DCS specification, latest trend and developments, DCS support to Enterprise Resources Planning (ERP), performance criteria for DCS and other automation tools.	10	15%
SECOND INTERNAL EXAMINATION			
V	Interfaces In Dcs : Operator interfaces, Low level and high level operator interfaces, Operator displays, Engineering interfaces, Low level and high level engineering interfaces, General purpose computers in DCS, DCS detail Engineering, configuration and programming, functions including database management, reporting, alarm management, diagnosis.	9	20%
VI	Process Safety & Safety Management System : Process safety and Safety Management Systems: Introduction to process safety, risk, risk terminologies, consequence and risk, risk measurement, Process Hazard Analysis (PHA), Hazard and operability study (HaZOp), Safety Integrity Level (SIL), Introduction to IEC61511 standard for Functional safety, protection layers, Safety Instrumented System:	10	20%

	function, architecture, safety life cycle, Application of safety system.		
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE403	BIOMEDICAL INSTRUMENTATION	3-0-0-3	2016

Prerequisite : Nil

Course objectives

- To impart knowledge of the principle of operation and design of biomedical instruments.
- To render a broad and modern account of biomedical instruments.
- To introduce idea about human physiology system

Syllabus

Electro physiology- Bioelectric potential and cardiovascular measurements- Respirator and pulmonary measurements and rehabilitation- Patient monitoring systems- Clinical Laboratory Instruments- Imaging technique & Telemetry.

Expected outcome

At the end of the semester students will

i. be able to understand about human physiology
ii. have knowledge of the principle operation and design and the background knowledge of biomedical instruments and specific applications of biomedical engineering

Text Books

1. Arumugam.M. "*Biomedical Instrumentation*", Anuradha Agencies Publishers, Kumbakonam, 2006.
2. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, "*Biomedical Instrumentation and Measurements*", 2nd Edition, Prentice Hall, New Delhi, 1998.

Reference Books:

1. Geddes L. A. and Baker L. E., *"Principles of Applied Biomedical Instrumentation",* 3rd Edition, John Wiley, New York, 1989.
2. John. G. Webster, *"Medical Instrumentation, Application and Design"* John Wiley, New York, 1998
3. R.S.Khandpur, *"Handbook of Biomedical Instrumentation",* Prentice Hall of India, New Delhi, 2003
4. Richard Aston, *"Principles of Bio-medical Instrumentation and Measurement*", Merril Publishing Company, New York, 1990.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Electro physiology: Review of physiology and anatomy, resting potential, action potential, bioelectric potentials, cardiovascular dynamics, electrode theory, bipolar and uni-polar electrodes, surface electrodes, physiological transducers. Systems approach to biological systems.	7	15%
II	Bioelectric potential and cardiovascular measurements: EMG - Evoked potential response, EEG, foetal monitor. ECG phonocardiography, vector cardiograph, BP, blood flow cardiac output, plethysmography, impedance cardiology, cardiac arrhythmia's, pace makers, defibrillators.	6	15%
FIRST INTERNAL EXAMINATION			
III	Respirator and pulmonary measurements and rehabilitation:	7	15%

	Physiology of respiratory system, respiratory rate measurement, artificial respirator, oximeter, hearing aids, functional neuromuscular simulation, physiotherapy, diathermy, nerve stimulator, artificial kidney machine.		
IV	Patient monitoring systems: Intensive cardiac care, bedside and central monitoring systems, patient monitoring through bio-telemetry, implanted transmitters, telemetering multiple information. Sources of electrical hazards and safety techniques.	7	15%
SECOND INTERNAL EXAMINATION			
V	Clinical Flame photometer - spectrophotometer – Colorimeter- chromatography- Automated Biochemical analysis system - Blood Gas Analyzer: Blood pH Measurement- Measurement of Blood pCO2- Blood pO2 Measurement- Blood Cell Counters: Types and Methods of cell Counting.	7	20%
VI	Recent trends: Medical imaging, X-rays, laser applications, ultrasound scanner, echo cardiography, CT Scan MRI/NMR, cine angiogram, colour doppler systems, Holter monitoring, endoscopy.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Module 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Module 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Module 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE405	ADVANCED CONTROL THEORY	3-0-0-3	2016

Prerequisite: AE301 Control system

Course objectives

- To study the basic theory required for solving complex control problems.
- To do analysis and modelling of systems and signals.

Syllabus

Concept of state space - Linear time varying system - Non-linear system - Describing function analysis -Lyapunov stability analysis – Controllability- Observability - Z- Transform - Discrete root locus.

Expected outcome

- At the end of the semester students will have comprehensive knowledge in advanced control theory.

Text Books/Reference books

1. C. D. Johnson, *Process Control Instrumentation Technology*, 7th ed., Prentice Hall of India, New Delhi, 2003
2. K.Ogata "*Discrete Time Control Systems*" , 1996, PHI.
3. K.Ogata "*Modern Control Engineering*" , 1996, PHI.
4. M. Gopal, "*Modern Control System Theory*",New Age International Publishers, 2nd edition,1996
5. Madangopal "*Digital control and state variables methods*" 1997, PHI.
6. R. C. Dorf and R. H. Bishop, *Modern Control Systems*, 8th ed., Pearson Education, Delhi, 2004

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Concept of state space-state space representation of system, solution of time invariant state equation- state transition matrix. Linear time varying system. Discrete system state space representation and solution.	6	15%
II	Non-linear system, types of non-linearity, singular point, non-linear system stability analysis- phase plane technique, construction of phase trajectories, isocline method.	6	15%
	FIRST INTERNAL EXAMINATION		
III	Describing function analysis : Basic concepts, derivation of describing functions for common non-linearities Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.	7	15%
IV	Lyapunov stability analysis- definition of stability, instability and asymptotic stability. Lyapunov stability theorems. Stability analysis of simple linear systems.	7	15%
	SECOND INTERNAL EXAMINATION		

V	MIMO systems-controllability- Observability- Effect of pole-zero cancellation, Practical examples-controllable and uncontrollable systems-observable and unobservable systems. Optimal control system-definition- design using state variable feedback and error squared performance indices.	8	20%
VI	Z- Transform and digital control system- Z-transfer function- block diagram- signal flow graph- discrete root locus.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE407	DIGITAL CONTROL SYSTEM	3-0-0-3	2016

Prerequisite : AE301 Control system

Course objectives

- To study the stability analysis of digital control system
- To equip the basic knowledge of digital process control design

Syllabus

Discrete Data Control Systems - Signal conversion & processing - Z-transform- inverse Z-transform - Digital control systems- Pulse transfer function - Stability tests Frequency domain analysis of discrete systems - State space representation - Controllability and Observability -

Expected outcome

- At the end of the semester Students will have knowledge of digital process control design.

Text Books

1. B. C. Kuo , "*Digital control systems*" (Second Edition) , Oxford University Press, 2007
2. K. Ogatta, "*Discrete Time control systems* ", 2nd ed. (PHI),1995
3. M. Gopal, "*Digital Control systems and state variable methods*", Tata McGraw Hill.

Reference

1. John Dorsey , "*Continuous & Discrete Control Systems* ", (MGH).
2. Nagrath & Gopal , "*Control System Engineering*" (Wiley Eastern).

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Introduction: Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold and polygonal hold.	6	15%
II	Review of Z transform. z transform and inverse z transform . Relationship between s- plane and z- plane- Difference equation . Solution by recursion and z-transform.	6	15%
	FIRST INTERNAL EXAMINATION		
III	Digital control systems- Pulse transfer function . z transform analysis of closed loop open loop systems- Modified z- transfer function- Stability of linear digital control systems	8	20%
IV	Stability tests- Steady state error analysis- Root loci - Frequency domain analysis- Bode plots- Gain margin and	8	20%

	phase margin		
SECOND INTERNAL EXAMINATION			
V	Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms- conversion of transfer function model to state space model-characteristics equation- solution to discrete state equations.	7	15%
VI	Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback . Dynamic output feedback- Effects of finite wordlength on controllability and closed loop pole placement-	7	15%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE409	OPTICAL INSTRUMENTATION	3-0-0-3	2016

Prerequisite : Nil

Course objectives

- To understand the basic concepts of fiber optics.
- To study optical communication and optical instruments.
- To provide basic knowledge in Laser and its application.

Syllabus

Principle of Optical fiber - Numerical aperture - Types of optical fibers - Optical sources- Optical detectors - Fibre optic sensors - Different types of modulators – Interferometers - Interference filters - Optical spectrum analyzer - Lasers - Population inversion - Semiconductor lasers - Laser Doppler Anemometry - Medical application of lasers.

Expected outcome

- At the end of the semester the students will have knowledge of optical fiber and optical instrumentation techniques.

Text Books/Reference books

1. G. Keiser, “Optical Fibre Communication”, McGraw Hill, 1995.
2. J.Wilson and J.F.B.Hawkes , “Optoelectronics: An Introduction”, Prentice Hall of India.
3. John F. Ready, “Industrial Applications of Lasers”, Academic Press, 1978.
4. John M. Senior, “Optical Fiber Communications-Principles and Practice”, Pearson Education Limited.
5. K.Thygarajan and A.K.Ghatak , “Lasers: Theory and Applications “, Plenum Press.
6. O.Svelto , “ Principles of Lasers “ ,Plenum Press.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Principle of Optical fiber – Acceptance angle and acceptance cone –Numerical aperture – V-number – Types of optical fibers (Material, Refractive index and mode) – properties- Optical sources-Optical detectors. Optical fiber production and fabrication.	6	15%
II	Fibre optic sensors – Fibre optic instrumentation system for measurement of fibre characteristics – Different types of modulators – Interferometric method for measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain – fiber optic gyroscope. Source coupling- Fiber connection-Splicing Techniques.	8	15%
FIRST INTERNAL EXAMINATION			
III	Interferometers – Fabry – perot and Michelson interferometers – Interference filters – Interferometeric method of measurement – Interference filters – Interferometeric method of measurement of optical components – Optical spectrum analyzer.	7	15%

IV	Lasers – Principles of operation – Einstein relations – Population inversion – Optical feedback – laser modes – Classes of laser – Solid state, gas and liquid dye lasers– Semiconductor lasers – Q-switching and mode locking – Properties of laser light.	6	15%
SECOND INTERNAL EXAMINATION			
V	Laser applications: Laser for measurement of distance, length, atmospheric effect and pollutants-Laser Doppler Anemometry (LDA) - Material processing: Laser heating, Melting, Scribing, Trimming, Welding.	8	20%
VI	Medical application of lasers- Laser and Tissue interaction-Laser diagnosis-Laser instruments for microsurgery, Removal of tumors of vocal chords, Brain surgery, dermatology, Oncology and Ophthalmology.	7	15%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE431	CONTROL SYSTEM AND SIGNAL PROCESSING LAB	0-0-3-1	2016

Prerequisite : AE301 & AE306

Course objective

- To give hands on experience in various digital Signal Processing techniques using TMS 320C6X family processors and in control system analysis using MATLAB.

List of Experiments

CONTROL SYSTEM LAB using MATLAB

1. Familiarization of MATLAB commands used in control system design
2. Representation of system in MATLAB: state space representation & transfer function representation
3. Stability analysis using Bode plot, root locus & their pole-zero-gain representation.
4. Implementation of Ziegler- Nicholas/ Cohen-coon tuning method for 1st order system.
5. Analysis of a closed loop system.
6. Implementation of PID control using both m-file and Simulink.
7. Pole placement technique applied to stabilize a system.
8. Realization of a compensator design.
9. Modelling and analysis of a first order system.
10. Modelling of an unstable system (inverted pendulum, ball & plate system etc.)

PC Based Control

1. PLC programming: familiarization of instruction set.
2. PLC programming: simulation of process control.
3. SCADA interface.
4. Familiarization of Distributed Control System (DCS) with different process stations pressure, flow and level.

LabVIEW based Virtual Instrumentation

1. Getting started with LabVIEW: Basic operations, controls, indicators, and simple Programming structures.
2. Debugging a VI and sub-VI.
3. Familiarization of DAQ card.

SIGNAL PROCESSING LAB

1. Familiarization of signal processing commands used in MATLAB Software.
2. Developing elementary signal function modules (m-files) for unit impulse, step, exponent and ramp sequence.
3. Generating continuous and discrete time sequences.
4. Carrying out mathematical operations on signals.
5. Response of LTI system described by difference and differential equation.
6. Developing a program for computing inverse Z-Transform.
7. Developing program for finding magnitude & phase response of LTI System
8. Developing program for computing DFT & IDFT.
9. Developing a program for computing circular convolution.
10. Design of filter: FIR, IIR, ECG Signal filter (can be done as 3 separate experiments).

Expected outcome

- At the end of the semester students are expected to be familiar with the basic signal processing & control system techniques**.**

Course code	Course name	L-T-P-Credits	Year of Introduction
AE461	ARM SYSTEM ARCHITECTURE	3-0-0-3	2016

Prerequisite : Nil

Course objectives

- To introduce the concepts of embedded processors and ARM based development.

Syllabus

Embedded Computers - Embedded System Design - ARM Architecture - Instruction Set - ARM Processor –Assembly programming - Component Interfacing - ARM interfacing programs - Peripherals In ARM Processors - Peripherals and their control - ARM tools and Peripherals - Arm Procedure Call Standard - Example C program.

Expected outcome

- At the end of the semester students must be able to obtain comprehensive knowledge in embedded processors and ARM based system.

Text Books

1. Steve Furber, "*ARM system on Chip Architecture", 2nd Edition, Addison Wesley Publishers*, 2013
2. Wayne Wolf, "*Computers as Components Principles of Embedded Computing System Design*", Morgan Kaufman Publishers, 2001

Reference Books:

1. David Seal, "*ARM Architecture Reference Manual*", 2nd Edition, Addison Wesley Publishers, 2001
2. Frank Vahid and Tony. D.Givargis, "*Embedded System Design - A Unified Hardware/Software Introduction*", John Wiley Sons, 2000.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Embedded Computers – Characteristics of Embedded Computing Applications–Challenges in Embedded Computing. Embedded System Design –Process Requirements – Specification	6	15%
II	ARM Architecture: The ARM Instruction Set Architecture. Bus structure and the peripherals. Register set, Exception modes, Software Interrupt.	6	15%
	FIRST INTERNAL EXAMINATION		
III	ARM Processor – Memory organization and processor initialization [start up code]. Load store instruction set. Assembly programming using Assemblers, Linkers, Loaders and Debuggers. Component Interfacing – Designing with Microprocessor Development and Debugging – Design Example Alarm Clock	8	15%
IV	ARM interfacing programs: GPIO, Timers, Counters, PWM, ADC. Application coding examples: Measurement and control of time, frequency velocity acceleration, power	8	15%

	control and touch monitoring		
SECOND INTERNAL EXAMINATION			
V	Peripherals In ARM Processors: ARM / THUMB architecture. Program structure to Supervisor, Kernel, and User modes. Peripherals and their control: GPIO, Timers, Counters, PWM, ADC and serial communication channels.	7	20%
VI	ARM tools and Peripherals: ARM Development Environment, Arm Procedure Call Standard (APCS), Example C program.	7	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE463	AEROSPACE & NAVIGATION INSTRUMENTS	3-0-0-3	2016

Prerequisite : Nil

Course Objective

- To introduce the basics of aerospace engineering
- To impart ideas on aircraft and navigation instruments

Syllabus

History of aviation and space flight - - basics of aerodynamics - Airplane performance- Introduction to turbojet and turbofan engines- Basic engine instruments- Aircraft compass- Air speed indicator- GPS and GNSS- Introduction to guidance, navigation and avionics- Introduction to navigation and guidance instrumentation- MEMS gyroscopes and accelerometers.

Expected outcome

At the end of semester, the students will

i. be familiar with the basics of aerospace engg and navigation
ii. have an idea about the instrumentation used in aerospace engineering

Text Books

1. Nagaraja.M.S, Elements of electronic navigation, Tata McGraw Hill
2. Pallet.E.H.J , Aircraft instruments- Principles and applications, Pitman Pub

Reference books

1. Ernest O Doebelin, Dhanesh N Manik , Measurement Systems-Application and Design,5th Edition, Tata McGraw Hill, 2007
2. Jewel B Barlow, William H. Rae, Jr. , Alan Pope , Low-Speed Wind Tunnel Testing, , John Wiley, Third Edition, 1999
3. Marcel J. Sidi, Spacecraft Dynamics and Control-A Practical Engineering Approach, , Cambridge University Press, 1997.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	History of aviation and space flight- anatomy of airplane and space vehicle with emphasis on control surfaces- airfoil nomenclature- basics of aerodynamics to illustrate lift and drag- types of drag – finite wings – swept wings –flaps.	6	15%
II	Airplane performance- thrust –power- rate of climb absolute and service ceiling- range and endurance. Introduction to turbojet and turbofan engines. Space vehicle trajectories- Kepler's laws- rocket engines, propellants and staging. (Introductory treatment of the above topics is only expected, no detailed derivations)	8	15%
	FIRST INTERNAL EXAMINATION		
III	Basic engine instruments- Capacitive fuel content- Gauges. Standard atmosphere- Altimeters Aneroid and radio	6	15%

	altimeters.		
IV	Aircraft compass- Remote indicating magnetic compass- Rate of climb indicator- Pitot static system- Air speed indicator- Mach meters- Integrated flight instruments	6	15%
SECOND INTERNAL EXAMINATION			
V	GPS and GNSS, - Automatic Pilots- Aircraft flight simulation instrumentation Introduction to guidance, navigation and avionics- Radio navigational aids- automatic direction finder VHF- Phase-Comparison direction finder.	8	20%
VI	Introduction to navigation and guidance instrumentation- Principle, construction and applications of inertial sensors- Gyroscope and accelerometers- Ring laser gyroscope- Fibre optic gyroscope, MEMS gyroscopes and accelerometers.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE465	INFORMATION SECURITY	3-0-0-3	2016

Prerequisite : Nil

Course Objective

- To understand the threat models and the basic types of authentication mechanisms
- To analyse cryptographic techniques, protocols, formats, and standards.
- To analyse different log files and understand Cyber laws to recover and secure the data.

Syllabus

Introduction to security and services-Cryptography- Securing the systems-Network security topics-Network perimeter security-Computer forensics and Cyber laws

Expected outcome

At the end of the semester students will be able

i. to apply cryptographic algorithms to avoid data accessing by unauthorized users
ii. to implement security algorithms as per the need of organization.

Text Books

1. Bruce Schneier, "*Applied Cryptography"*, Second Edition, John Wiley & Sons, 1996
2. Charlie Kaufman, Radia Perlman, and Mike Speciner, "*Network Security*: Private Communication in a Public World", 2nd Edition, Prentice Hall, 2002.
3. Rick Lehtinen, G. T. Gangemi, SR.,"*Computer Security Basics"*, Second Edition, O'Reilly Pubs, June 2006.

Reference Books:

1. Marije, "*Computer Forensics and Cyber Crime"*: An Introduction, Prentice Hall, 2004.
2. Stephen Northcutt, Karen Kent, and Lenny Zeltser, "*Inside Network Perimeter Security",* Sams Publications, 200
3. William Stallings, "*Cryptography and Network Security"*, Fourth Edition, Prentice Hall, 2005

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Introduction to security and services, vulnerabilities and countermeasures, malicious code, goals of security-prevention, detection, and recovery.	6	15%
II	Cryptography-Types of encryption, confidentiality using symmetric encryption, PKI, RSA, Key management, Diffie- Hellman, ECC, CA, etc., authentication protocols.	6	15%
	FIRST INTERNAL EXAMINATION		
III	Securing the systems-Network security protocols: SSL, IPSEC, Kerberoes, X.509 Authentication service, Electronic mail security S/MME, Application security- SSL, PGP, SET.	7	15%

IV	Network security topics: Network layer security – IPSec – overview, IP and IPv6, IPSec Protocols: AH and ESP, Tunnel Mode and transport mode. Internet Key exchange Protocol- IPSec cookies.	7	15%
SECOND INTERNAL EXAMINATION			
V	Network perimeter security-Secured router configuration, firewall, design principles, trusted systems, VPN, IDS, IPS penetration testing, NAT.	8	20%
VI	Computer forensics and Cyber laws- data recovery, security policies and procedures, Security lifestyle management, security audit, managed security services.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)

Course code	Course name	L-T-P-Credits	Year of Introduction
AE467	CMOS CIRCUIT DESIGN	3-0-0-3	2016

Prerequisite: EC204 Analog integrated circuits

Course objectives

- To give ideas about basic amplifiers, current Mirrors and Differential Amplifiers
- To impart idea of static and switching characteristics of the CMOS Inverter
- To study the operation of pass transistor logic and transmission gates
- To analyse Operational Amplifiers on its design and stability factors
- To familiarise different types of Memory and its decoder Circuits

Syllabus

Review of single stage MOS Amplifiers - current Mirrors - Differential Amplifiers - CMOS Inverter - Sequential Logic Circuits- Different CMOS Flip flop - MOS Operational Amplifiers- Stability and frequency compensation in Op amps - Design of a two stage Op amp - CMOS Circuit and Logic Design - Arithmetic Circuits in CMOS VLSI - Low power design - Designing Memory and Array Structures- Designing Combinational Logic Gates in CMOS.

Expected outcome

- At the end of the semester students will be able to obtain comprehensive knowledge in CMOS Circuit Design.

Text Books

1. Douglas A. Pucknell and K. Eshragian., "*Basic VLSI Design*" 3 rd Edition. PHI, 2000.
2. John P. Uyemura, "*Introduction to VLSI Circuits and Systems*", John Wiley & Sons 2002
3. Kesshab K. Parhi, "VLSI DIGITAL SIGNAL PROCESSING SYSTEMS", John Wiley & Sons 2002
4. Neil. H.E. Weste and K. Eshragian, "*Principles of CMOS VLSI Design*". 2 nd Edition. Addison-Wesley , 2000.
5. R. Jacob Baker, Harry W. LI., & David K. Boyce., "*CMOS Circuit Design*", 3 rd Indian reprint, PHI, 2000.

References

1. Jan M. Rabaey and et al, "*DIGITAL INTEGRATED CIRCUITS*", Pearson Edn. Inc. 2003
2. Kang & Leblebigi "*CMOS Digital IC Circuit Analysis & Design*"- McGraw Hill, 2003
3. Weste and Eshraghian, "*Principles of CMOS VLSI design" Addison*-Wesley, 2002

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	Review of single stage MOS Amplifiers CS, CD, CG and cascode Amplifiers . Design of current Mirrors, Wilson current mirrors and Widlar current mirrors. Band gap voltage reference Differential Amplifiers: MOS Load Current Source, Current Mirror, Cascade Load.	6	15%
II	CMOS Inverter-Static Characteristics, Derivation for VTH,	7	15%

	V IL and VIH Switching Characteristics and Calculation of delay times Sequential Logic Circuits- Different CMOS Flip flops Theory of operation and Circuits of Pass transistor Logic and transmission gate.		
FIRST INTERNAL EXAMINATION			
III	MOS Operational Amplifiers, Cascode and Folded Cascode opamps . Stability and frequency compensation in Op amps. Design of a two stage Op amp DRAM, SRAM, Sense Amplifiers, Design of Row and Column Decoders Flash Memory- NOR and NAND Flash Memory Cell	7	15%
IV	CMOS Circuit and Logic Design-CMOS Logic structures. Advanced techniques in CMOS Logic Circuits-Mirror circuits, Pseudo NMOS, Tri-state circuits, Clocked CMOS, Dynamic CMOS Logic circuits, Dual Rail Logic Networks.	7	15%
SECOND INTERNAL EXAMINATION			
V	Arithmetic Circuits in CMOS VLSI-Bit Adder Circuits, Ripple Carry Adder, Carry Look Ahead Adders, Other High speed adders-Multiplexer based fast binary adders, Multipliers-Parallel multiplier, Wallace Tree and Dadda multiplier, Low power design- Scaling Versus Power consumption, Power reduction techniques.	8	20%
VI	Designing Memory and Array Structures - Memory classification, Memory Core - Read Only Memories, Non-volatile Read Write Memories, Read Write Memories, Content - Addressable or Associative Memories, Memory Peripheral Circuits - Address Decoders, Sense Amplifiers, Designing Combinational Logic Gates in CMOS.	7	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

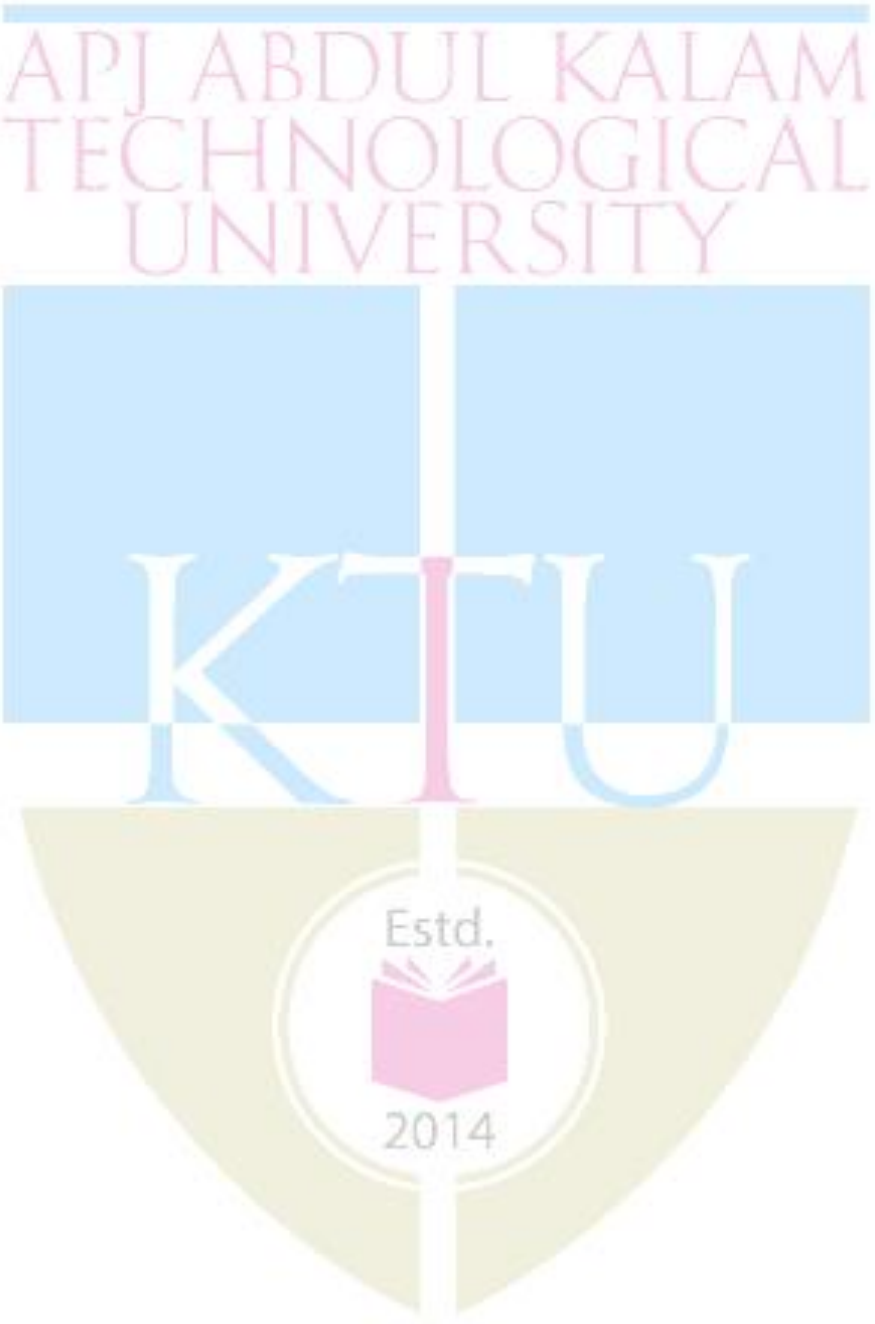
Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)



COURSE CODE	COURSE NAME	L-T-P-C	YEAR OF INTRODUCTION
EC370	**Digital Image Processing**	**3-0-0-3**	**2016**

Prerequisite: EC301 Digital Signal Processing

Course objectives:

1. To study the image fundamentals and mathematical transforms necessary for image transform
2. To study the image processing techniques like image enhancement, image reconstruction, image compression, image segmentation and image representation.

Syllabus:

Digital image fundamentals, 2D Transforms, Image enhancement, Image restoration, Image segmentation, Image compression

Expected outcome:

The students will be able to:

1. Distinguish / Analyse the various concepts and mathematical transforms necessary for image processing
2. Differentiate and interpret the various image enhancement techniques
3. Illustrate image segmentation algorithm
4. Analyse basic image compression techniques

Text Books:

1. Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009
2. **S Jayaraman, S Esakkirajan, T Veerakumar,** Digital image processing ,Tata Mc Graw Hill, 2015

References:

1. Jain Anil K , Fundamentals of digital image processing: , PHI,1988
2. Kenneth R Castleman , Digital image processing:, Pearson Education,2/e,2003
3. Pratt William K , Digital Image Processing: , John Wiley,4/e,2007

Course Plan

Module	Course content	Hours	End Sem. Exam Marks
I	**Digital Image Fundamentals:** Image representation, basic relationship between pixels, elements of DIP system, elements of visual perception-simple image formation model	3	15
	Vidicon and Digital Camera working principles	1	
	Brightness, contrast, hue, saturation, mach band effect,	1	
	Colour image fundamentals-RGB, CMY, HIS models	1	
	2D sampling, quantization.	1	
II	**Review of matrix theory**: row and column ordering- Toeplitz, Circulant and block matrix,	2	15
	2D Image transforms : DFT, its properties, Walsh transform, Hadamard transform, Haar transform,	3	
	DCT, KL transform and Singular Value Decomposition.	3	
FIRST INTERNAL EXAM			

III	**Image Enhancement:** Spatial domain methods: point processing- intensity transformations, histogram processing, image subtraction, image averaging	2	**15**
	Spatial filtering- smoothing filters, sharpening filters	1	
	Frequency domain methods: low pass filtering, high pass filtering, homomorphic filter.	2	
IV	**Image Restoration:** Degradation model, Unconstraint restoration- Lagrange multiplier and constraint restoration	2	**15**
	Inverse filtering- removal of blur caused by uniform linear motion, Weiner filtering,	2	
	Geometric transformations-spatial transformations	2	
SECOND INTERNAL EXAM			
V	**Image segmentation**: Classification of Image segmentation techniques, region approach, clustering techniques	2	**20**
	Segmentation based on thresholding, edge based segmentation	2	
	Classification of edges, edge detection, Hough transform, active contour	3	
VI	**Image Compression:** Need for compression, redundancy, classification of image compression schemes, Huffman coding, arithmetic coding, dictionary based compression, transform based compression,	5	**20**
	Image compression standards- JPEG& MPEG, vector quantization, wavelet based image compression.	3	
END SEMESTER EXAM			

Question Paper Pattern (End semester exam)

Maximum Marks : 100 **Time : 3 hours**

The question paper shall consist of three parts. Part A covers modules I and II, Part B covers modules III and IV, and Part C covers modules V and VI. Each part has three questions uniformly covering the two modules and each question can have maximum four subdivisions. In each part, any two questions are to be answered. Mark patterns are as per the syllabus with 50 % for theory and 50% for logical/numerical problems, derivation and proof.

Course code	Course Name	L-T-P - Credits	Year of Introduction
**451	Seminar and Project Preliminary	0-1-4-2	2016
Prerequisite : Nil			

Course Objectives

- To develop skills in doing literature survey, technical presentation and report preparation.
- To enable project identification and execution of preliminary works on final semester project

Course Plan

Seminar: Each student shall identify a topic of current relevance in his/her branch of engineering, get approval of faculty concerned, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class.

Project preliminary:

Identify suitable project relevant to the branch of study. Form project team (not exceeding four students). The students can do the project individually also. Identify a project supervisor. Present the project proposal before the assessment board (excluding the external expert) and get it approved by the board.

The preliminary work to be completed: (1) Literature survey (2) Formulation of objectives (3) Formulation of hypothesis/design/methodology (4) Formulation of work plan (5) Seeking funds (6) Preparation of preliminary report

Note: The same project should be continued in the eighth semester by the same project team.

Expected outcome.

The students will be able to

i. Analyse a current topic of professional interest and present it before an audience
ii. Identify an engineering problem, analyse it and propose a work plan to solve it.

Evaluation

Seminar : **50 marks**

(Distribution of marks for the seminar is as follows: i. Presentation : 40% ii. Ability to answer questions : 30% & iii. Report : 30%)

Project preliminary : **50 marks**(Progress evaluation by the supervisor : 40% and progress evaluation by the assessment board excluding external expert : 60%. Two progress evaluations, mid semester and end semester, are mandatory.)

Note: All evaluations are mandatory for course completion and for awarding the final grade.