RAMAIAH
Institute of Technology

CURRICULUM

for the Academic year 2019 – 2020

ELECTRONICS AND INSTRUMENTATION ENGINEERING

VII & VIII SEMESTER B.E

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Ramaiah Institute of Technology (RIT) (formerly known as M.S.Ramaiah Institute of Technology) is a self-financing institution established in Bangalore in the year 1962 by the industrialist and philanthropist, Late Dr. M S Ramaiah. The institute is accredited with "A" grade by NAAC in 2014 and all engineering departments offering bachelor degree programs have been accredited by NBA. RIT is one of the few institutes with prescribed faculty student ratio and achieves excellent academic results. The institute was a participant of the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. All the departments have competent faculty, with 100% of them being postgraduates or doctorates. Some of the distinguished features of RIT are: State of the art laboratories, individual computing facility to all faculty members. All research departments are active with sponsored projects and more than 304 scholars are pursuing PhD. The Centre for Advanced Training and Continuing Education (CATCE), and Entrepreneurship Development Cell (EDC) have been set up on campus. RIT has a strong Placement and Training department with a committed team, a good Mentoring / Proctorial system, a fully equipped Sports department, large air-conditioned library with over 1,35,427 books with subscription to more than 300 International and National Journals. The Digital Library subscribes to several online e-journals like IEEE, JET etc. RIT is a member of DELNET, and AICTE INDEST Consortium. RIT has a modern auditorium, several hi-tech conference halls and all are air-conditioned with video conferencing facilities. It has excellent hostel facilities for boys and girls. RIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association. RIT obtained Academic Autonomy for all its UG and PG programs in the year 2007. As per the National Institutional Ranking Framework, MHRD, Government of India, Ramaiah Institute of Technology has achieved 64th rank in 2019 among the top 100 engineering colleges across India.

About the Department:

Department of Instrumentation Technology was established in the year 1992 and renamed as Electronics and Instrumentation Engineering in the year 2014 by VTU. The department has been accredited by NBA three times. The synergy of the progressive management, committed faculty, staff, and students are ensuring in excellent academic results year after year. The department is well equipped with modern laboratories and has one of best state of art PLC and SCADA laboratory with Allen Bradley PLCs and SCADA from Schneider Electric. The department has an active MoU with Mitsubishi Electric India Pvt Ltd.

The goal and objective of the department is to prepare the students Industry-ready by aligning Electronics and Instrumentation Engineering education program to the current technology and the best practices in the area of Embedded system, Sensor technology and Industrial Automation technologies in general and specially for deployment of these technologies in building Industrial Automation Systems with latest advances in Information, Communication and Networking.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs.

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization.
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations.
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs.

QUALITY POLICY

We at Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned.

VISION OF THE DEPARTMENT

To become centre of excellence in the field of Electronics and Instrumentation Engineering for education and research.

MISSION OF THE DEPARTMENT

To empower and imbibe students with technical knowledge and practical skills in the field of Electronics and Instrumentation Engineering, enabling them to work as professionals in globally competitive environment and contribute to the society through research and higher studies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO 1: To analyze and solve problems in Electronics and Instrumentation Engineering related to industry and research by applying knowledge in mathematics, physical science and engineering.

PEO 2: To design and commission an industrial automation system.

PEO 3: To communicate effectively, work with team, practice professional ethics, and engage in lifelong learning.

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Identify, analyze, design and implement—problems in diverse and multidisciplinary background emphasizing control and industrial automation, using modern tools.

PSO2: Understand the impact of engineering solutions in societal, environmental context and manage the projects efficiently.

PSO3: Adhere to professional ethics, lifelong learning, team building skills and communicate effectively.

Curriculum Course Credits Distribution

Batch 2016-20

Semester	Humanities, Social Sciences & Management (HSMC)	Basic Sciences / Lab (BS)	Engineering Sciences/ Lab (ES)	Professional Courses- Core (Hard core, soft core, Lab) (PC-C)	Professional Courses - Electives (PC-E)	Other Electives (OE)	Project Work (PW)	Internship/ other activities (IS/ECA)	Total semester load
First	2	9	14						25
Second	4	9	12						25
Third		4		21					25
Fourth		4		21					25
Fifth				22	4				26
Sixth				15	4		6		25
Seventh	2			10	12				24
Eighth						4	15	6	25
Total	8	26	26	89	20	4	21	6	200

SCHEME OF TEACHING
VII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	EI71	IPR	HSMC	2	0	0	0	2	2
2.	EI72	Power Electronics and Drives	PC-C	4	0	0	0	4	4
3.	EI73	Industrial Data Network	PC-C	3	0	0	1	4	3
4.	EIE3X	Departmental Elective (group III)	PC-E	4	0	0	0	4	4
5.	EIE4X	Departmental Elective (group IV)	PC-E	4	0	0	0	4	4
6.	EIE5X	Departmental Elective (group V)	PC-E	3	0	0	1	4	3
7.	EIL74	Power Electronics and Drives Lab	PC-C	0	0	1	0	1	2
8.	EIL75	Industrial Data Network Lab	PC-C	0	0	1	0	1	2
			Total					**24**	

Elective Code	Elective Title (group III)
EIE31	Statistical Process Control
EIE32	VLSI design
EIE33	Fundamentals of Data structures and Algorithms
EIE34	Internet of Things

Elective Code	Elective Title (group IV)
EIE41	Aircraft instrumentation
EIE42	Real time systems
EIE43	Digital Control Systems
EIE44	Design of Embedded Instrumentation System

Elective Code	Elective Title (group V)
EIE51	Power Plant Instrumentation
EIE52	Wireless Sensor Networks
EIE53	Design of Embedded Systems
EIE54	Digital Signal Processors

SCHEME OF TEACHING
VIII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits					Contact Hours
				L	T	P	S	Total	
1.	XXOExx	Institutional Elective: **OPEN ELECTIVE**	OE	4	0	0	0	4	4
2.	EIIN / EIE6X	Internship/ Departmental Elective (group VI)	IN/PC-E	4	0	0	0	4	4
3.	EIP	Project Work	PW	0	0	15	0	15	30
4.	EAC	Extra-Curricular/Co-Curricular Activities	EAC	0	0	2	0	2	-
			Total						

Elective Code	Elective Title
EIE61	Cyber Physical Systems
EIE62	Automobile Instrumentation
EIE63	Instrumentation and Control in Petrochemical Industries
EIE64	Machine Learning
EIE65	Electromagnetic Interference and Compatibility in System Design

VII Semester

INTELLECTUAL PROPERTY RIGHTS

Course Code: EI71 **Credit: 2:0:0:0**
Prerequisite: Nil **Contact Hours: 28**
Course Coordinator: Dr. H. S. Niranjana Murthy

Course Content:

Unit 1

Basic Principles of IPR Laws: History of IPR-GATT, WTO, WIPO & Trips Role of IPR in Research & Development & Knowledge era, Concept of property, Marx's theory of property, Constitutional Aspects of Intellectual property, Different forms of IPR – copyright, trade mark, Industrial Designs, Layout designs of Integrated circuits, Patents, Geographical Indications, Traditional Knowledge, Plant varieties, Trade secrets.

Unit II

Copyright: Evolution of copy right law in India, Justifications, Subject matter of copyright, Terms of protections, Concepts-originality/Novelty idea expression, Fixation & fair Use, Copyrights in software protection, Infringement of copyright and acquisition in Indian context, Introduction to Cyber law of India, Advantages of Cyber Laws, IT act of India, 2000.

Unit III

Trade Mark: Introduction, Functions of a trademark, Essentials of a trademark, Justification: Economic, Quality & advertising, Descriptive & Generic trademark, Certification trademark and collective marks, Fundamental principle of trademark law, Concepts of subject matter acquisition, Implication and benefits of registration, Procedure for registration, infringements of trade marks & defences, relief in suits for infringement.

Unit IV

Patent: Basic principles of patent laws, Historical background, Basis for IP protection, Criteria for patentability, Novelty, Utility and Inventive step, Non obviousness, Non Patentable inventions, Patent searching, Pre-grant and post-grant oppositions, grant or refusal of patents, Infringement and prosecution in India, Patent Drafting: Format, Provisional & Complete specifications, Scopes of inventions, description of invention, drawings, claims.

Unit V

Industrial Designs: Introduction, Justification, Subject matter of design law definition Excluded subject matter Law relating to industrial design and registration in India Infringement of design rights Semiconductor & IC Layout Designs: semiconductor topography design rights. Infringement.

Text Books

1. Prabuddgha Ganguli, Intellectual Property Rights, TMH Publishing co. Ltd. 2001.
2. Dr.B.L.Wadhera, Intellectual Property Law Handbook, Universal law Publishing Co. Ltd. 2002.
3. Thomas T Gordon and Arthur S Cookfair, Patent Fundamentals for Scientists and Engineers, CRC Press 1995.
4. Prof.T.Ramakrishna, Course materials for one year P.G.Diploma in IPR from NLSIU, Bangalore.

References

1. P. Narayan Intellectual property Law 3rd Edition Eastern Law house 2001.
2. David Bainbridge, Intellectual Property, 5th Edition, Indian reprint 2003, Pearson edition.
3. World Intellectual Property Organizations (WIPO) Handbook/Notes.

Course Outcomes (COs):

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

1. Analyse the various IPR regimes & appreciate fair use of IPR principles, rights and duties in the learning and research process. (PO-6,7,8,10, PSO-2,3)
2. Analyse the meaning and laws related to copyright & its infringements. (PO-6,7,8,10, PSO-2,3)
3. Analyse the meaning and laws related to trademark & its infringements. (PO-6,7,8,10, PSO-2,3)
4. Analyse the meaning of patent law & understand the procedure for drafting of patent for an invention. (PO-6,7,8,10, PSO-2,3)
5. Analyse the laws related to Industrial Designs & Semiconductor IC layout Designs & its infringements. (PO-6,7,8,10, PSO-2,3)

POWER ELECTRONICS AND DRIVES

Course Code: EI72 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Mr.Ovhal Ajay Ashok

Course Content:

Unit I

Power Semiconductor Devices: Applications of Power Electronics, Power semiconductor devices, Control Characteristics, types of power electronic circuits, peripheral effects, Power Transistors: Power BJT's–switching characteristics, switching limits, power MOSFET's–switching characteristics, gate drive. IGBT's, di/dt and dv/dt limitations, isolation of gate and base drives, simple design of gate and base drives.

Unit II

Thyristors: SCR, SCR characteristics, TRIAC, TRIAC characteristics, UJT, two-transistor model, Thyristor firing circuits: R, R-C and UJT triggering circuit. Thyristor commutation Circuits.

Unit III

Rectifiers and Choppers: Rectifiers: Single Phase Operation–Power Factor–Effect of Source Inductance–Single and Multi-Quadrant Operation with DC Motor Load – Steady State Analysis. DC-DC Converters: Buck, Boost, Buck-Boost, Cuk Converters–Circuit Configuration and Analysis – Choppers – Single and Multi-Quadrant Operation with DC Motor Load – Steady State Analysis.

Unit IV

Electric Drives and its Dynamics: Electric Drives: Concepts, Advantages of Electric drives, parts of Electric drives, choice of Electric drives, Dynamics of Electric drives: torque equations, multi-quadrant operation, drive parameters, load torques, steady state stability, speed control of electric drives, Selection of Motor power rating: thermal model, classes of motor duty, determination of motor rating, Closed loop Control of Drives.

Unit V

Inverters and Application of Power Electronic Converters: Inverters – Single Phase Bridge Inverters – PWM Inverters, Uninterrupted Power Supply (UPS), Residential & Industrial applications: space heating & air conditioning, high frequency fluorescent lighting, Induction heating, electric welding, Integral half cycle controllers.

Text Books

1. Ned Mohan, Tore M. Undeland and William P. Robbins, Power Electronics Converters, Applications and Design, John Wiley and Sons, Third Edition, 2002.
2. Muhammad. H, Rashid, Power Electronics Handbook, Butterworth-Heinemann, Third edition, 2011.
3. G.K Dubey, Fundamentals of Electrical Drives, Narosa publishing house, 2nd Edition.
4. Vedam Subrahmanyam, Electric Drives, Concepts and applications, Tata McGraw-Hill, Second Edition, 2009.

References

1. Bimbhra P. S, Power Electronics, Khanna Publishers, Fourth Edition, 2006.
2. Vedam Subrahmanyam, Thyristor Control of Electric Drives, Tata McGraw Hill, First Edition, Reprint 2008.
3. Singh. M .D, Khanchandani. K.B, Power Electronics, Tata McGraw-Hill, Second Edition, 2008.
4. BimalBose, Power Electronics and Motor Drives-Advances and Trends, Academic press, 2006.
5. Williams. B.W, Power Electronics: Devices, Drivers, Applications and Passive Components, Macmillan, Second Edition, Reprint 2007.

Course Outcomes (COs):

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

1. Understand the operation of power semiconductor devices. (PO-1,2,3,4,9, PSO-1,3)
2. Understand the characteristics of Thyristors and triggering and commutation circuit for it.(PO-1,2,3,4,9, PSO-1,3)
3. Analyze rectifier, chopper DC-DC converter circuits with DC motor load. (1,2,3,4,9, PSO-1,3)
4. Understand the basics of industrial drives and its dynamics. (PO-1,2,3,4,9, PSO-1,3)
5. Analyze the working of inverters and application of power electronic converters in power supplies, residence and industry. (PO-2,3,4,9, PSO-1,3)

INDUSTRIAL DATA NETWORKS

Course Code: EI73 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Ms. J.V. Alamelu

Course Content:

Unit-I

Data Network Fundamentals: Network hierarchy and switching – Open system interconnection model of ISO OSI model [including Fiber optic communication]– Network Topologies and IEEE standards [IEEE 802.1, 802.3,802.4,802.5].

Unit - II

Internetworking: Network Devices – Open system configuration with bridges and Gateways – Routing algorithms – Network addressing – IPV4, IPV6- TCP/IP [Industrial ETHERNET] - Special requirements of Networks used in control.

Unit – III

Industrial Field Bus & Protocols: Field Bus Introduction – General Field Bus architecture – Basic requirements of field bus standard – Field bus topology – Foundation field bus HSE – MODBUS TCP – PROFINET – Ether CAT-Inter connectivity - comparisons.

Unit – IV

Industrial Network Protocols: Architecture and requirements, applications of CAN - PROFIBUS - SERCOS - IEEE1588 and other recent Industrial standards.

Unit – V

HART and Group Displays Evolution of signal standards: HART communication protocol– Communication modes – HART Networks – Control system interface – HART and OSI standard comparison. Group Displays – used in DCS, Wireless HART and other wireless standards, Implementation with Case studies.

Text Books

1. A.S. Tanenbaum, Computer Networks, Pearson Education, 2014.
2. Steve Mackay Edwin WrightDeon Reynders John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting, Elsevier, 2004.

References

1. G. K. McMillan, Process/Industrial Instruments Hand book, Tata McGraw Hill, New York.
2. www.sercos.org
3. RomilyBowden, HART Application Guide and OSI communication Foundation.

Course Outcomes (COs):

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

1. Analyze the services and features of the various layers based on ISO OSI Reference model, communication concepts in data networks and recognize the different protocols in each layer and their functions. (PO-2,3,4,9,12, PSO-1,3)
2. Design, calculate, and apply subnet masks and addresses to fulfill networking requirements, data routing based on IP and TCP. (PO-2,3,4,9,12, PSO-1,3)
3. Analyze the features and operations of various application layer protocols by implementing through various Field buses based on Ethernet standards. (PO-2,3,4,9,12, PSO-1,3)
4. Analyze the features and operations of various application layer protocols by implementing through various Field buses based on serial communication. (PO-2,3,4,6,8,9,12, PSO-1,3)
5. Understand the concepts of HART protocol, operator displays, DCS as implemented in Automation industries. (PO-2,3,4,6,8,9,12, PSO-1,3)

STATISTICAL PROCESS CONTROL

Course Code:EIE31 **Credit: 4:0:0:0**
Prerequisite: Process Control (EI54) **Contact Hours: 56**
Course Coordinator: Dr. A. Saravanan

Course Content:

Unit I

Quality Improvement in the Modern Business Environment: The Meaning of Quality and Quality Improvement, Dimensions of Quality, Quality Engineering Terminology, A Brief History of Quality Control and Improvement, Statistical Methods for Quality Control and Improvement, univariate process monitoring and control.

Unit II

Methods And Philosophy of Statistical Process Control: Introduction, Chance and Assignable Causes of Quality Variation, Statistical Basis of the Control Chart Basic Principles, Choice of Control Limits, Sample Size and Sampling Frequency, Rational Subgroups Analysis of Patterns on Control Charts, Discussion of Sensitizing Rules for Control Charts, Control Chart Application, The Rest of the Magnificent Seven, Implementing SPC in a Quality Improvement Program, An Application of SPC, Applications of Statistical Process Control and Quality Improvement Tools in Transactional and Service Businesses.

Unit III

Control Charts for Variables: Control Charts for $\overline{X}$ and R, Statistical Basis of the Charts, Development and Use of $\overline{X}$ and R Charts, Charts Based on Standard Values, Interpretation of $\overline{X}$ and R Charts, The Effect of Nonnormality on $\overline{X}$ and R Charts, The Operating-Characteristic Function, The Average Run Length for the $\overline{X}$ Chart, Control Charts for–x and s, Construction and Operation of $\overline{X}$ and s Charts, The $\overline{X}$ and s Control Charts with Variable Sample Size, Summary of Procedures for $\overline{X}$ and R, and s Charts, Applications of Variables Control Charts.

Unit IV

Control Charts for Attributes: The Control Chart for Fraction Nonconforming, Development and Operation of the Control Chart Variable Sample Size, Applications in Transactional and Service Businesses, The Operating-Characteristic Function and Average Run Length Calculations, Control Charts for Nonconformities (Defects).

Unit V

Other Statistical Process Monitoring and Control Technique: The Cumulative Sum Control Chart, Basic Principles: The CUSUM Control Chart for Monitoring the Process Mean, The Tabular or Algorithmic Cusum for Monitoring the Process Mean, Recommendations for Cusum Design, Exponential weighted moving average [EWMA], EWMA for Monitoring the Process Mean, design of EWMA, combining EPC[Engineering process control] and SPC, MINITAB software.

Text Books

1. Douglas Montgomery, Introduction to Statistical Process Control 7th Edition, Wiley publications.

References

1. John s. Oakland, Statistical process control, sixth Edition, Routledge.
2. Leslie m. Licinsk, Statistical process control.,P.Eng..
3. Peihua Qiu, Introduction to Statistical Process Control, CRC Press

Course Outcomes (COs):

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

1. Acquire knowledge of quality, standards and statistical process control technique. (PO-1,2,4,5,11,12, PSO-1,2,3)
2. Analyze and develop SPC Tools for any manufacturing process. (PO-1,2,4,5,11,12,PSO-1,2,3)
3. Implement the control charts for industry applications. (PO 1,2,4,5,11,12, PSO 1,2,3)
4. Able to develop control charts for attributes. (PO-1,2,4,5,9,10,11,12, PSO-1,2,3)
5. Acquire knowledge of other statistical process monitoring and control techniques. (PO-1,2,4,5,9,10,11,12, PSO-1,2,3)

VLSI DESIGN

Course Code: EIE32 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Ms. K. M. Vanitha

Course Content:

Unit I

Introduction: Introduction, VLSI Design flow, VLSI Design styles. NMOS fabrication. Basic CMOS technology: The P _well process, the n _well process. Process flow: Basic steps-CMOS n well process, twin _well process, Layout design rules, Packaging techniques.MOS transistor: Metal oxide semiconductor structure, MOS system under external bias, Structure and operation of MOSFET.

Unit II

MOS Transistor: Threshold voltage, Body effect. MOSFET current voltage characteristics, Scaling, MOSFET capacitances. MOS Inverters: Static characteristics, Noise immunity, Noise margin, Resistive load inverter, N type load, CMOS inverter, BiCMOS inverters, Latch up in CMOS circuits.

Unit III

Dynamic Switching Characteristics: Sheet resistance, standard unit capacitance, delay unit, inverter delays Delay time, rise time and fall time, switching power dissipation.

Determination of pull up to pull down ratio for an NMOS inverter driven by another NMOS inverter. Determination of pull up to pull down ratio of an NMOS inverter driven through one or more pass transistor. CMOS inverter design: Switching characteristics, estimation of CMOS inverter delay, Driving large capacitive loads, super buffers, propagation delay.

Unit IV

Combinational MOS Logic Circuits: NMOS depletion load circuits, complex CMOS circuits, Pass transistor, Transmission gate. MOS circuit design process: Need for design rules, stick diagram(NMOS and CMOS), mask layout (CMOS). Sequential circuits: The Bistability principle, SR latch, CMOS D latch, edge triggered flip flop. Dynamic logic circuits: Basic principle of PT circuits, Dynamic CMOS circuit techniques: CMOS TG logic, Dynamic CMOS logic, Domino CMOS logic.

Unit V

Semiconductor Memories: Introduction, Dynamic Random access memory (DRAM), Static Random access memory (sram), Read only memories, Non-volatile read write memories. Design for testability: Fault type and models, Controllability, Observability, Ad hoc testing, Scan based techniques, BIST, IDDQ.

Text Books

1. Sung-Mo Kang, Yusuf Leblebici, CMOS digital integrated circuits-Analysis and design, TMH 3rd edition 2003.

References

1. Weste and Eshranhian, Principles of CMOS VLSI Design, Pearson Education, 1999.
2. Kamran Eshraghian, Dougles and A. Pucknell, Essential of VLSI circuits and system, PHI, 2005.

Course Outcomes (COs):

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

1. Analyze the CMOS layout levels, how the design layers are used in the process sequence. (PO-1,2,8,10, PSO-1,3)
2. Describe the general steps required for processing of CMOS integrated circuits. (PO-1,2,8,10, PSO-1,3)
3. Be able to design static CMOS combinational and sequential logic at the transistor level. (PO-1,2,3,8,10, PSO-1,3)
4. Design using different logic styles such as complementary CMOS logic, pass-transistor logic, dynamic logic. (PO-1,2,3,8,10, PSO-1,3)
5. Interpret the need for testability and different testing methods in VLSI. (PO-1,2,3,4,8,10, PSO-1,3)

FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS

Course Code: EIE33 **Credit: 4:0:0:0**
Prerequisite: Object Oriented Programming with C++ & Data structures
Course Coordinator: Ms. Elavaar Kuzhali .S **Contact Hours: 56**

Course Content:

Unit I

Introduction and Basic Data Structures: Introduction – Arrays – Structures – Stacks and queues – Linked list – Array, list implementation and applications

Unit II

Advanced Data Structures: Trees, preliminaries – Binary tree – Tree representation – Tree traversals - Binary search trees

Unit III

Sorting and Hashing: Need for sorting – Selection sort – Insertion sort – Exchange sort – Merge and radix sort – Heap sort – Heaps – Maintaining the heap property – Building a heap – Heap sort algorithm –Quick sort – Description – Performance of quick sort – Analysis of quick sort

Unit IV

Graphs Algorithms: Graphs – Application of graphs – Representation – Dijkstra's algorithm – Minimum spanning trees – Single-source shortest paths – All pairs shortest paths

Unit V

Storage Structures and Management: Indexing – B-Tree indexing – Hashing – General idea – Hash functions – Separate chaining –Open addressing – Rehashing – Extendible hashing – Garbage collection and compaction

Text Books

1. A.S. Tanenbaum, Y. Langram and M. J. Augestiein, Data Structures using C, Second edition, Pearson Education, 2008

References

1. E. Horowitz, S. Sahni and Anderson-Freed, Fundamentals of Data Structures in C, Second edition, University Press, 2007

Course Outcomes (COs):

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

1. Differentiate between Array, Stack and Queue variations through numerous applications (PO-1,2,3,5,9,10,12, PSO-1,3)
2. Implement hierarchical based solutions using different tree traversal techniques (PO-1,2,3,5,9,10,12, PSO-1,3)
3. Implement different problems on sorting and hashing techniques (PO-1,2,3,5,9,10,12, PSO-1,3)
4. Design and develop solutions on graph algorithms (PO-1,2,3,5,9,10,12, PSO-1,3)
5. Develop solutions with different indexing and hashing concepts (PO-1,2,3,5,9,10,12, PSO-1,3)

INTERNET OF THINGS

Course Code: EIE34 **Credit: 3:0:1:0**
Prerequisite: Nil **Contact Hours: 42+14**
Course Coordinator: Ms. Elavaar Kuzhali .S

Course Content:

Unit I

Introduction & concepts: Definition and Characteristics of IoT, Things in IoT, IoT Protocols, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates IoT and M2M, SDN and NFV for IoT, IoT System Management.

Unit II

Developing Internet of Things: IoT Platform Design Methodology, Specifications: Requirements, Process, Domain, Information, Services, Level, Functional, Operational, Integration, Application Development. Python Language: Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date & Time Operations, Classes, Python Packages of Interest for IoT

Unit III

IoT Physical Devices and End Points: Basic Building Blocks of an IoT Device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces: Serial, SPI, I2C
Programming Raspberry Pi with Python: Controlling LED, Interfacing Switch, Interfacing Light Sensor, Client-Server Application

Unit IV

Cloud and Data Analytics: Introduction to cloud storage Models and Communication APIs,MQTT protocol, CoAP protocol, IP based WPAN and WLAN, Routers & Gateways, Sensor Cloud, Python Web Application Framework –Django/Flask, Web Services for IoT, SkyNet Messaging Platform. **Data Analytics for IoT:**Apache, Hadoop, Oozie, Storm, Real-Time Data Analysis, Tools for IoT, IoT Security

Unit V

IoT Case Studies: Home Automation: Smart Lighting, Home Intrusion Detection; Cities: Smart Parking Environment: Weather Monitoring System, Weather Reporting Bot, Air Pollution Monitoring, Forest Fire Detection; Agriculture – Smart Irrigation, IoT Printer

Lab programs

1. Python Programming with Raspberry Pi.
2. Exploring the different components of Raspberry pi, Setting up of the board and booting the board.
3. Implement a Python program for blinking an LED to a Raspberry Pi platform and make suitable assumptions. Implement a Python program for interfacing an LED and a Switch to a Raspberry Pi platform.
4. Implement a Python program for switching light based on LDR reading in Raspberry Pi platform make suitable assumptions.
5. Implement a Python program for sending an email when a switch which is connected to a Raspberry Pi platform is pressed. Make suitable assumptions.
6. Write a Python program for capturing a LDR sensor data every 2 minutes using Raspberry Pi and send it to a server / cloud which will write it to a text file and plot a graph for the same.
7. Write a Python program for implementing a temperature dependent auto cooling system using a Raspberry Pi platform.
8. Write a Python program for capturing a temperature and humidity sensor data every 2 minutes using Raspberry Pi and send it to a server which will write it to a text file.
9. Write a program to communicate information from cloud to node.
10. Write a Python program to Detect the intruder when there is no surrounding lighting using Raspberry Pi.
11. Write a program to Create an UI for controlling lights in different rooms. If lighting is less, alert the user to turn on light in that particular room using Raspberry Pi.
12. Mobile APP development for IOT

Text Book

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Universities Press, 2015

References

1. Perry Lea, “Internet of Things for Architects: Architecting IoT Solutions by Implementing Sensors, Communication Infrastructure, Edge Computing, Analytics, and Security” Packt publishing Ltd, 2018.
2. Jeeva Jose,” Internet of Things”, Khanna Publishing House, 2018.
3. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, ISBN 978-81-265-5686-1 Wiley Publication.

4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
5. http://www.internet-of-things-research.eu/pdf/IERC_Cluster_Book_2014_Ch.3_SRIA_WEB . pdf

Course Outcomes (COs):

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

1. Understand and analyze the Architectural Overview of IoT and its characteristics (PO-1,2,3,5,9,10,12, PSO-1,3)
2. Write python programs using Raspberry Pi for some IoT based prototypes (PO-1,2,3,4,5,9,10,12, PSO-1,3)
3. Understand and analyze the role of IoT data analytics and Tools. (PO-1,2,3,4,5,9,10,12, PSO-1,3)
4. Illustrate the application of IoT and identify Real World Design Constraints. (PO-1,2,3,4,5,6,7,9,10,12, PSO-1, 3)

AIRCRAFT INSTRUMENTATION

Course Code: EIE41 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Mr. M. D. Nandeesh

Course Content:

Unit I

Instrument Display Panels and Layout: Qualitative and quantitative display, director, display, heading display and instrument grouping basic air data system, pitot static probe, heating circuit arrangement.

Unit II

Altitude and Vertical Speed Indicator: Measurement of altitude, servo altimeter, airspeed indicator, mach-meter, mach warning, vertical speed indicator, altitude alerting system.

Unit III

Flight Instrumentation: Gyroscope and its property, transport wandering, gyro horizon erection system for gyro horizon, torque motor and leaving switch system, electromagnet method, turn and bank indicator.

Unit IV

Measurement of Engine Speed Temperature and Pressure: Electrical tachometer system, servo operated tachometer, method and application of temperature measurement, temperature sensing element, servo operated indicator, radiation pyrometer, method of measuring pressure switch.

Unit V

Fuel Quality and Flow and Engine Control Instruments: Quality indicative system, capacitve type fuel quantity by weight, location and connection of tank, fuel quantity, totalizer indicator, fuel flow system, power indicator for reciprocative engine, turbo jet engine, turbo temperature indicator.

Text Books

1. EHJ Pallet, Aircraft Instrumentation, Pearson publication, edition 2009.
2. EHJ Pallet, Aircraft Instrumentation and integrated systems, Longman scientific and Technical.
3. S Nagabhushana and L K Sudha, Aircraft Instrumentation and system, I K International Publication House pvt ltd, Edition 2010

References

1. W H Courthard, Pitman and sound , Aircraft instrumentation design.
2. C A Willams, Aircraft instrumentation Golgatia publishing, New Delhi.

Course Outcomes (COs):

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

1. Understand the functioning of the flight instruments and various types of display devices. (PO-1,7,10,12, PSO-1,2,3)
2. Analyze the working of altitude, airspeed and vertical speed measuring system. (PO-1,2,7,10, PSO-1,2,3)
3. Understand the working and usage of gyroscope in the aircraft system. (PO-1,2,7,10, PSO-1,2,3)
4. Understand the measuring system of engine speed, temperature and pressure. (PO-1,2,7,10,12, PSO-1,2,3)
5. Acquire the knowledge of functioning of fuel flow and fuel quantity measuring system. (PO-1,2,7,10,12, PSO-1,2,3)

REAL TIME SYSTEMS

Course Code: EIE42 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Ms. Elavaar Kuzhali .S

Course Content:

Unit I

Introduction: What is real time, applications of real time systems, a basic model of real time system, and characteristics of real time systems, safety & reliability, types of real time tasks and their constraints, modelling timing constraints. Real time task scheduling: Some important concepts, types of real time tasks and their characteristics, task scheduling, clock driven scheduling, hybrid schedulers, event driven scheduling, Earliest Deadline First (EDF) scheduling, Rate Monotonic Algorithm (RMA). Some issues associated with RMA. Issues in using RMA practical solutions.

Unit II

Handling Resource Sharing and Dependencies Among Real Time Tasks: Resource sharing among real time tasks, priority invasion, Priority Inheritance Protocol (PIP), highest locker protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling real time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed real time systems, centralized clock synchronization.

Unit III

Commercial Real Time Operating Systems: Time services, features of a real time operating system, Unix as a real time operating system, Unix based real time operating system, POSIX, a survey of contemporary real time operating systems, benchmarking real time systems.

Unit IV

Real Time Databases: Example applications of real time databases. Review of basic database concepts, real time databases, characteristics of temporal data. Concurrency control in real time databases. Commercial real time databases.

Unit V

Real Time Communication: Examples of applications requiring real time communication, basic concepts, real time communication in a LAN. Soft real time communication in a LAN. Hard real time communication in a LAN. Bounded access protocols for LANs. Performance comparison, real time communication over packet switched networks. QoS framework, routing, resource reservation, rate control, QoS models.

Text Books

1. Rajib Mall, Real time systems: Theory and Practice, Pearson, 2008.

References

1. Jane W Liu, Real time systems, Pearson Education, 2001.
2. Krishna and Shin, Real time systems, TMH, 1999

Course Outcomes (COs):

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

1. Understand and analyze the concepts of real time systems and real time task scheduling algorithms. (PO-1, 2, 3, 5, 9, 10, 12, PSO-1,2,3)
2. Acquire knowledge about the protocols in handling resources among real time tasks and various methods of scheduling in multiprocessor and distributed systems. (PO-1, 2, 3, 5, 9, 10, 12, PSO-1,2,3)
3. Understand and differentiate the features of commercial real time operating systems. (PO-1, 2, 3,12, PSO-1,3)
4. Acquire knowledge about the concepts and protocols in real time database management systems and real time communication. (PO-1, 2, 3,12, PSO-1,3)

DIGITAL CONTROL SYSTEMS

Course Code: EIE43 **Credit: 4:0:0:0**
Prerequisite: Control systems (EI45) **Contact Hours: 56**
Course Coordinator: Mrs. K. M. Vanitha

Course Content:

Unit I

Computer Controlled System: Configuration of the basic digital control scheme – general sampled data system variables – signal classifications – why use digital control system – Advantages – disadvantages – examples of discrete data and digital control systems. Review of -Sampling process – Frequency domain analysis – ideal samples – Shanon's sampling theorem – generation and solution of process – linear difference equations – data reconstruction process – frequency domain characteristics.

Unit II

Discrete System Modeling: Determination of the z transform – mapping between s and z domains – z transforms of system equations – open loop Hybrid sampled Data Control Systems – open loop discrete Input Data Control System – closed loop sampled data control system – modified z transform method – response between sampling instants – stability on the w plane and jury's stability test – steady state error analysis for stable systems. Continuous to discrete transformation methods- Numerical integration method- pole-zero equivalence(mapping)-Hold equivalence (ZOH, FOH).

Unit III

Design of Digital Control System: Bode diagram-Root locus (design)-Digital P, PI, PID controller, Position and velocity forms.

Unit IV

Discrete Variable Analysis of Digital Control Systems: Conversion of state variable models to transfer functions – conversion of transfer functions to canonical state variable models –control observer Canonical form – state description of sampled continuous time plants – solution of state difference equations – closed form solution – state transition matrix – Caley Hamilton Technique – concept of controllability and observability – Ackermann's formula, dead beat.

Unit V

Linear Quadratic Optimal Control: Parameter optimization and optimal control problems-Quadratic performance index-Control configurations-State regulator design through Lyapunov equation and matrix Riccati equation-optimal digital control system.

Text Books

1. M.Gopal, Digital Control and State Variables Methods, Tata McGraw HILL, 2nd Edition, 2003.
2. Katsuhiko Ogata, Discrete time control system, Pearson education 2003.

Course Outcomes (COs):

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

1. Develop modeling of discrete control system. (PO-1,2,3,4,10, PSO-1,3)
2. Analyze sample data control system and evaluate the stability of digital control system. (PO-1,2,3,4,10, PSO-1,3)
3. Design of a digital controller using time and frequency domain approach. (PO-1,2,3,4,10, PSO-1,3)
4. Analyze digital control using state variable method. (PO-1,2,3,4,10, PSO-1,3)
5. Design of state regulator for optimal control system. (PO-1,2,3,4,10, PSO-1,3)

DESIGN OF EMBEDDED INSTRUMENTATION SYSTEM

Course Code: EIE44 **Credit: 4:0:0:0**
Prerequisite: Embedded Controllers (EI43) **Contact Hours: 56**
Course Coordinator: Dr. Pushpa M.K.

Course Content:

Unit I

System Design Life cycle: Study of V model of life cycle, Component based development process, modeling aspects, Operational analysis, Views and viewpoints, Architecture exploration, reference system engineering process, safety and diagnosability process, Product line Engineering and life cycle, Application Engineering, variability.

Unit II

Signal Conditioning and I/O: Types of signal conditioning, classes of signal conditioning, field wiring and signal measurement, noise interference, minimizing noise (topics with emphasis on amplifiers, filters and data convertors). I/O characteristics of processing element, drivers/buffer, level shifter and latches.

Unit III

Communication and Interfacing modules: Communication protocols, RS 232, RS485 and RS488(GPIB). Study of interfacing modules like relay, keyboard, opto isolators, display system (LED and LCD), accelerometer, sensing elements like temperature, pressure, CO2, humidity etc, IR LED based detection, ultrasonic sensor

Unit IV

Case studies: Controller based weigh scale, Blood pressure monitor system, Ventilator system, Barcode scanner system, Fire and smoke detector system, currency counter system

Unit V

Case studies: Portable wireless sensor system, flow and pressure measurement system, X ray baggage at airport, tachometer and servo motor drive, Motion detector, people counter and finger print biometric system.

References

1. John Park ASD, Steve Mackay CPEng, BSc(ElecEng), BSc(Hons), MBA, Practical data Acquisition for Instrumentation and control, IDC Technologies, Elsevier, 2003
2. A. Rajan and T. Wahl (eds.), CESAR - Cost-efficient Methods and Processes for Safety-relevant Embedded Systems, © Springer-Verlag Wien 2013
3. Application Texas Instruments

Course Outcomes (COs):

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

1. Design life cycle of embedded Instrumentation. (PO-1,7,10,11, PSO-1)
2. Use the signal conditioning circuits in embedded system. (PO-2,9,10,PSO-1)
3. Understand communication system. (PO-2,3,10,PSO-1)
4. Understand and analyze interface modules. (PO-2,3,9,10,PSO-1)
5. Analyze the embedded system. (PO-4,5,9,10, PSO-2)

POWER PLANT INSTRUMENTATION

Course Code: EIE51 **Credit: 3:0:0:1**
Prerequisite: Industrial Instrumentation-I and II (EI44, EI53)
Course Coordinator: Dr. H.S. Niranjana Murthy **Contact Hours: 42**

Course Content:

Unit I

Power Generation: Hydro, thermal, nuclear, solar and wind power. Importance of instrumentation in thermal power plants, nuclear power plants, block diagram, P&I diagram of boilers.

Unit II

Measurements: Current, voltage, power, frequency, power factor. Flow of feed water, fuel, air and steam with correction factor for temperature- steam temperature and steam pressure- drum level measurement- radiation detector, smoke density measurement – dust monitor.

Unit III

Analyzers: Flue gas analyzer, -analyzers of impurities in feed water and steam-oxygen analyzer- chromatography-PH meter- fuel analyzers-pollution monitoring.

Unit IV

Boiler Control: Combustion control, air fuel ratio control-furnace draft control- drum level control-main steam and reheat steam temperature control, super heater control, aerator, de-aerator control, DCS /NCS in power plant, inter lock mechanism in boiler control.

Unit V

Turbine: Measurement of turbine speed, vibration- shell temperature and control- team pressure control, lubricating oil temperature control- cooling system.

Text Books

1. Sam G. Dukelow, The control of Boilers , ISA 1991.
2. Modern power station practice, vol-6, Instrumentation, Controls and testing, Pergamon press, Oxford,1971.
3. Elonka S.M. and Kohal A.L. Standard Boiler Operations, McGraw-Hill,1994

Course Outcomes (COs):

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

1. Analyze various power generation methods and controls. (PO-1,2,7,9, PSO-1,2,3)
2. Understand various measurement solutions for physical parameters monitored in power plant. (PO- 1,2,3,4, PSO-1)
3. Understand various analyzer for monitoring impurity feed water and flue gas etc. (PO- 1,2,3,7, PSO-1,2)
4. Understand boiler control system in power plant. (PO-1,2,4,7, PSO-1,2)
5. Understand measurement and control systems in turbine. (PO-1,2,3,4,9, PSO-1,3)

WIRELESS SENSOR NETWORKS

Course Code: EIE52 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Ms. J. V. Alamelu

Course Content:

Unit I

Overview of Wireless Sensor Networks: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

Unit II

Architectures: Single-Node Architecture-Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Unit III

Networking Sensors: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol.

Unit IV

WSN Protocols: IEEE 802.15.4 MAC – Zigbee, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing, Introduction to Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

Unit V

Sensor Network Platforms And Tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming, Case studies.

Text Books

1. Holger Karl & Andreas Willig, Protocols And Architectures for Wireless Sensor Network", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, Wireless Sensor Networks- An Information Processing Approach, Elsevier, 2007.

References:

1. Kazem Sohraby, Daniel Minoli, &Taieb Znati, Wireless Sensor Networks-Technology, Protocols and Applications, John Wiley, 2007.
2. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.

Course Outcomes (COs):

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

1. Acquire knowledge on WSN architecture and its applications. (PO-2,3,4, 9,12, PSO-1,3)
2. Analyze, Identify network protocol and address physical layer issues. (PO-2,3,4, 9,12, PSO-1,3)
3. Examine the various protocols for MAC, routing, time synchronization, aggregation and distributed tracking. (PO-2,3,4, 9,12, PSO-1,3)
4. Acquire the knowledge and usage of protocols like zigbee, 6LoWPAN and other protocols in WSN environment. (PO-2,3,4, 9,12, PSO-1,3)
5. Acquire the knowledge on Tiny OS, sensor network middleware and programming with nesC for WSN. (PO-2,3,4, 9,12, PSO-1,3)

DESIGN OF EMBEDDED SYSTEMS

Course Code: EIE53 **Credit: 3:0:0:1**
Prerequisite: Embedded Controllers (EI43) **Contact Hours: 42**
Course Coordinator: Ms. Elavaar Kuzhali. S

Course Content:

Unit I

Introduction to Embedded Computing: Complex systems and microprocessors – Design example: Model train controller –Embedded system design process – Formalism for system design – Instruction sets Preliminaries – CPU: Programming input and output – Supervisor Mode, exception and traps – Coprocessor – Memory system mechanism – CPU Performance – CPU power consumption.

Unit II

Computing Platform and Design Analysis: Development and Debugging – Program design – Model of programs– Assembly and Linking – Basic compilation techniques – Analysis and optimization of Execution time, power, energy, program size – Program validation and testing.

Unit III

Process and Operating Systems: Multiple tasks and multi processes – Processes – Context Switching – Operating Systems –Scheduling policies - Multiprocessor – Inter Process Communication Mechanisms – Evaluating operating system performance – Power optimization Strategies for processes.

Unit IV

Overview of Embedded / Real Time Operating Systems: Commonalities of Operating System – POSIX – Differences of OS– Embedded Operating Systems – RTOS – Intro to VXWORKS / MicroC OS2 - RTOS programming – Task creation deletion – task information details – Timers – synchronization with time.

Unit V

RTOS Programming: Task lock and Unlock – multiple tasks – synchronization with task – Task scheduling – mutex – semaphores – ISR - message queues - Pipes - Target Image creation – Windows XP – Porting RTOS on microcontroller based development board.

Lab Programs:

1. Task Creation & Deletion.
2. Task Information details.
3. Use of Timers & Synchronization with time.
4. Task lock & Unlock.
5. Task Synchronization.
6. Task Scheduling.
7. Mutex & Semaphores.
8. Interrupt Services.
9. Watchdog Timers.
10. Message queues & Pipes.
11. Porting of RTOS on microcontroller based development board and mini Project.

Text Books

1. Wayne Wolf, Computers as Components - Principles of Embedded Computer System Design, Morgan Kaufmann Publisher, 2006.
2. K.V.K.K. Prasad, Embedded Real-Time Systems: Concepts, Design & Programming, Dreamtech press, 2005.
3. Jean J Labrose, MicroC/OS – II the Real Time KERNEL, CMP Books second edition.

Course Outcomes (COs):

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

1. Explain the process of designing an embedded system. (PO-1,2,3, PSO-1)
2. Understand the concepts of partitioning an embedded system into hardware and software components to meet specific performance, cost, and power constraints. (PO-1,2, PSO-1)
3. Acquire knowledge of programming techniques for enhancing execution performance, reducing code size, and reducing power consumption. (PO-1,2,3, PSO-1)
4. Understand the concepts of process scheduling, switching, and communication. (PO-1,2,3, PSO-1)
5. Design, analyze and write programs based on RTOS concepts. (PO-1,2,3, PSO-1)

DIGITAL SIGNAL PROCESSORS

Course Code: EIE54 **Credit: 0:1:2:1**
Prerequisite: Nil **Contact Hours: 14+14**
Course Coordinator: Mr. G. Shivaprakash

List of Experiments

1. Introduction to code composer studio
2. Introduction to MATLAB with DSP perspective
3. Real time sine wave generation(bios_sine8_intr)
4. Real time sine wave generation using lookup tables(bios_sine8_intr)
5. Implementation of real time averaging filter(average)
6. DSP/BIOS application to generate sine wave
7. Echo with fixed delay and feedback(echo)
8. Echo with variable delay and feedback(echo control)
9. AM using table for carrier and baseband signals(am)
10. Factorial of number. Calls linear ASM function(factclasm)
11. Factorial of number. Calls function (factorial)
12. Real time FIR averaging filtering of signals(fir)
13. Real time FIR band stop filtering of signals(fir)
14. Real time FIR band pass filtering of signals(fir)

Tutorials

1. TMS320 Family Overview: Overview of the TMS320C6x Generation of Digital Signal Processors, Features and Options of the TMS320C62x/C64x/C67x, TMS320C62x/C64x/C67x.
2. CPU Data Paths and Control: General-Purpose Register Files, Functional Units, Register File Cross Paths, Memory, Load, and Store Paths, Data Address Paths, TMS320C6000 Control Register File, Pipeline/Timing of Control Register Accesses, Addressing Mode Register (AMR), Control Status Register (CSR), E1 Phase Program Counter (PCE1), TMS320C67x Control Register File Extensions (FADCR, FAUCR, FMCR).
3. TMS320C6713 assembly language instructions: Assembly language syntax, introduction to assembler directives.
4. TMS320C62x/C64x/C67x Fixed-Point Instruction Set: Instruction Operation and Execution Notations.
5. Mapping Between Instructions and Functional Units, TMS320C62x/C64x/C67x Opcode Map, Delay Slots, Parallel Operations.

6. Conditional Operations, Resource Constraints, Addressing Modes, Individual Instruction Descriptions (50 instructions).
7. TMS320C67x Floating-Point Instruction Set: Instruction Operation and Execution Notations.
8. TMS320C67x Floating-Point Instruction Set Mapping Between Instructions and Functional Units, Overview of IEEE Standard Single- and Double-Precision Formats, Delay Slots.
9. TMS320C67x Floating-Point Instruction Set TMS320C67x Instruction Constraint, Individual Instruction Descriptions (30 instructions) .
10. Peripherals (SPRU190q): Enhanced Direct Memory Access Controller (SPRU234),
11. External Memory Interface (SPRU266).
12. General-Purpose Input/output (SPRU584).
13. Interrupts: Overview of Interrupts, Globally Enabling and Disabling Interrupts, Individual Interrupt Control.
14. Interrupt Detection and Processing, Performance Considerations, Programming Considerations.

Mini project: one tutorial session will be used for mini project.

- Weekly one lab session for implementing mini project.
- Mini project of implementing a simple interface to the DSK 6713.
- There will be a semester end exam for the project. The team can have maximum three people in a batch.

Text Books

1. Phil lepsley, Jeff Bier, Amit Shoham, DSP fundamentals, IEEE press, 1995, (Chapter-1 to 8, 10,11,12,13).
2. Rulph Chassaing and Donald Reay, DSP and applications with TMS320C6713 and TMS320C6416, Wiley IEEE press, 2/e, 2008.
3. TMS320C6000 CPU and instruction set Reference Guide, Literature Number: SPRU189F, October 2000.
4. TMS320C6000 Assembly language tools users guide-spru 186n, 2004.
5. Data sheets of TMS320C6713B Floating-Point Digital Signal Processor, literature number: SPRS294B, 2005.

References

1. TMS320C6000 DSP peripherals overview, literature number: SPRU190Q.
2. TMS320C67X/C67X+ DSP CPU and instructions reference guide, literature number: SPRU733A.
3. Data sheets of TMS320C6713B floating point DSP, literature number: SPRS294B, 2005.
4. TMS320C6000 programmers guide (spru198)
5. B. Venkata Ramani, M. Bhaskar., TMS320C6000 programming and applications, Tata McGraw Hill.

Course Outcomes (COs):

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

1. Describe the architectural enhancements and features of TMS320C6713. (PO-1,3,4,5,10, PSO- 1,3)
2. Explain the architecture and control registers of TMS320C6713. (PO-1,3,4,5,10, PSO- 1,3)
3. Be able to program TMS320C6713 using assembly language. (PO-1,3,4,5,10, PSO- 1,3)
4. Able to Write real time programs for TMS320C6713(PO-1,3,4,5,10, PSO-1,3)
5. Describe the peripherals of TMS320C6713. (PO-1,3,4,5,10, PSO- 1,3)

POWER ELECTRONICS AND DRIVES LAB

Course Code: EIL74 **Credit: 0:0:1:0**
Prerequisite: Nil **Contact Hours: 14**
Course Coordinator: Mr. Ovhal Ajay Ashok

List of Experiments

1. Static characteristics of Power MOSFET
2. Static characteristics of IGBT
3. Static characteristics of Silicon Controlled Rectifier
4. Static characteristics of TRIAC
5. RC half-wave triggering circuits
6. RC full-wave triggering circuits
7. Line synchronized UJT triggering circuit
8. Commutation circuits for SCR (i)LC circuit (ii) Impulse commutation circuit
9. Single phase fully controlled rectifier (R and RL Loads)
10. Series Inverter.
11. Generation of Firing Signals for Thyristor using Digital circuits
12. Buck converter.
13. Boost Converter.
14. Buck-Boost Converter.

Course Outcomes (COs):

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

1. Study the characteristics of Power electronics devices. (PO-1,2,3,4,9,10, PSO-1,3)
2. Design the triggering circuits for Power electronics devices. (PO-1,2,3,4,9,10, PSO-1,3)
3. Design various commutation circuits for SCR. (PO-1,2,3,4,9,10, PSO-1,3)
4. Design and test rectifiers and inverters. (PO-1,2,3,4,9,10, PSO-1,3)
5. Rig up and test DC-DC converters. (PO-1,2,3,4,9,10, PSO-1,3)

INDUSTRIAL DATA NETWORK LAB

Course Code: EIL75 **Credit: 0:0:1:0**
Prerequisite: Nil **Contact Hours: 14**
Course Coordinator: Ms. J. V. Alamelu

List of Experiments

1. Controllers and OOP in DCS based in tags
2. Remote Supervision of Client / Server solutions
3. Handling of alerts and alarms
4. Operator panel/control station based solutions
5. Implementation of Industrial network protocols.
6. Implementation of Industry applications with message communication with MODBUS
7. Usage of Instruction set for any application
8. Implementation of Instruction set with Factory Talk software
9. Usage of timers and counters in operator panel
10. Report generations
11. Trends and Graphs in operator panel
12. Producer consumer for communication

Course Outcomes (COs):

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

1. To use factory talk view studio, configuration with RSLOGIX 5000 series. (PO-2,3,4,5,9,12, PSO-1,3)
2. Implement several communication modes within PLCs in DCS environment. (PO-2,3,4,5,9,12, PSO-1,3)
3. Implement graphical panel for HMI in remote environment. (PO-2,3,4,5,9,10,12, PSO-1,3)
4. Utilize all object tags for any applications. (PO-2,3,4,5,9,12, PSO-1,3)
5. Implement Instruction set with factory talk and report generation. (PO-2,3,4,5,9,12, PSO-1,3)

VIII – Semester

CYBER PHYSICAL SYSTEMS

Course Code: EIE61 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Ms. J. V. Alamelu

Course Content:

Unit I

Introduction to cyber physical systems, applications, design process, modelling, design and analysis concepts. Modelling dynamic behaviors, continuous dynamics, Newton mechanics, Actor models, properties of systems, Feedback control.

Unit II

Modelling Discrete dynamics, Discrete systems, Finite state machine, extended state machines, Nondeterminism, Examples and applications.

Unit III

Hybrid systems, modal models, classes of hybrid system, Composition of state machines, Concurrent composition, Hierarchical state machine, Concurrent models of composition.

Unit IV

Civilian cyber-physical system applications, Energy Efficient Building, Cyber-Physical System and security for Smart Grid Applications, Cyber-Physical System for Transportation Applications, Video Communications in Unmanned Aerial Vehicle Based Cyber- Physical Systems.

Unit V

Sensor based cyber physical systems and security, Healthcare cyber-physical system applications, Cyber-Physical Medication Systems and Devices to Improve Health Care, Intelligent rehabilitation.

Text Books

1. Lee & Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, second Edition, version 2.0

References

1. Fei Hu, Cyber-Physical Systems: Integrated Computing and Engineering Design, CRC Press.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press

Course Outcomes (COs):

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

1. Understand the concepts of cyber physical system in terms of modeling and analysis. (PO-2,3,10, PSO-1,3)
2. Model the physical systems based on different models. (PO-2,3,10, PSO-1,3)
3. Design and model real time applications. (PO-2,3,6,7,10,12, PSO-1,2,3)
4. Understand the security techniques, safety measures for cyber physical system. (PO-2,3,6,8,10,12, PSO-1,2,3)
5. Design and analyse applications of cyber physical system. (PO-2,3,6,7,10,12, PSO-1,2,3)

AUTOMOBILE INSTRUMENTATION

Course Code: EIE62 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Dr. H. S. Niranjana Murthy

Course Content:

Unit I

Fundamentals of Automotive Electronics: Fundamental of Automotive sub-systems Engine Management System (Gasoline & Diesel), Open loop and closed loop systems components for electronic engine management, vehicle motion control, Transmission (Manual & Automatic), Suspension Systems, Entertainment Systems, ABS, Safety & Warning Systems, Heating and Air-conditioning, Instrument Clusters, Power Sliding door/ Power lift gates.

Unit II

Automotive Sensors & Actuators: Temperature, pressure, oxygen sensors, Engine position, Crank angle position sensors, Fuel metering, Vehicle speed sensor and detonation sensor, flow sensor, Throttle position sensor, solenoids, stepper motors, relays, Actuators: Fuel Injection, Ignition, Hydraulic Actuators, Electrical Actuators, BLDC motors, Drive amplifiers.

Unit III

Electronic Fuel Injection and Ignition Systems: Introduction, Feedback Carburetor control system, throttle body ignition and multi-port or point fuel injection, Fuel injection systems, injection system controls, Advantages of electronic ignition system, Types of solid state ignition systems and their principle of operation, electronic spark timing control system.

Unit IV

Vehicle Motion Control and Stabilization Systems: Adaptive cruise control, Electronic transmission control, Vehicle stabilization system, Antilock braking system, traction control system, Electronic stability program, Diagnostics: CARB, EURO, Bharat regulations, onboard diagnostics, calibrations, diagnostic codes, Freeze frames.

Unit V

Telematics: Audio and vehicle distribution, integration mobile, in-vehicle computing and wireless technologies. Recent advanced Technologies: Common Rail Diesel Injection, Gasoline Direct Injection, Variable Valve Timing, Variable Valve Lifting, Turbo Charger, Hybrid Vehicles, Alternate fuels.

Text Books

1. William B. Riddens, Understanding Automotive Electronics, 5thEdition, (Butterworth Heinemann Woburn), (1998).
2. BOSCH, Automotive Handbook, 6th Edition., Bentley Publishers, 2006

References

1. Young A.P and Griffiths.L, Automobile Electrical Equipment, English Language Book Society and New press.

Course Outcomes (COs):

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

1. Understand the construction and working of mechanical systems and electronic systems in automobiles. (PO-1,2,3,4,9, PSO-1,3)
2. Analyze the working of sensors and actuators used in automobiles. (PO-1,2,3,4,9, PSO-1,3)
3. Analyze the working of electronic fuel injection and ignition systems. (PO-1,2,3,4,9, PSO-1,3)
4. Analyze the operation of Vehicle Motion Control and Stabilization Systems. (PO-1,2,3,4,9, PSO-1,3)
5. Understand the telematics and current advanced technologies in automobile engineering. (PO-1,2,3,4,9, PSO-1,3)

INSTRUMENTATION & CONTROL IN PETROCHEMICAL INDUSTRIES

Course Code: EIE63 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Mr. M. D. Nandeesh

Course Content:

Unit I

Introduction: Petroleum Exploration, production and Refining, Sub process, final product, by-products, constituents of crude Oil.

Unit II

P & I diagram of Petroleum Refinery: Atmospheric Distillation of Crude oil, Vacuum Distillation process, Thermal Conversion process, Control of Distillation Column, Temperature Control, Process control, Feed control, Reflux Control, Reboiler Control.

Unit III

Controls of Chemical Reactors: Temperature Control, Pressure Control, Control of Dryers, Batch Dryers, Atmospheric and Vacuum, Continuous Dryers.

Unit IV

Control Heat Exchangers and Evaporators: Variables and Degrees of freedom, Liquid to Liquid Heat Exchangers, Steam Heaters, Condensers, Reboilers and Vaporizers, Cascade Control, Feed forward Control, Evaporators, Types of Evaporators.

Unit V

Control of Pumps: Centrifugal pump: On-Off level control, Pressure control, Flow control, Throttling control. Rotary pumps: On-Off pressure control. Reciprocating Pumps: On-Off control and Throttling control. Effluent and Water Treatment Control: Chemical Oxidation, Chemical Reduction, Naturalization, Precipitation, Biological control.

Text Books

1. Dr. Ram Prasad, Petroleum Refining Technology, Khanna Publisher, 1st Edition, 2000.
2. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company,1973

References

1. Considine M. and Ross S.D., Handbook of Applied Instrumentation, McGraw Hill, 1962.
2. Liptak B.G., Instrument Engineers Handbook, Volume II, 1989

Course Outcomes (COs):

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

1. Understand the basics of petrochemical industries. (PO-1,10, PSO-1,3)
2. Illustrate the working of chemical reactors, control heat exchangers and evaporators. (PO-1,10, PSO-1,3)
3. Acquire knowledge in working of chemical reactors and evaporators. (PO-1,10, PSO-1,3)
4. Analyze the performance of various control pumps in industries. (PO-1,10, PSO-1,3)
5. Acquire knowledge in different water treatment control techniques. (PO-1,10, PSO-1,3)

MACHINE LEARNING

Course Code: EIE64 **Credit: 3:1:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Mrs. Elavaar Kuzhali.S

Course Content:

Unit I

Introduction: Introduction to machine learning. Examples of machine learning applications, key terminologies, key tasks of machine learning, choosing right algorithms, steps in developing machine learning applications, why Python, getting started with NumPy. **Classifying with k-Nearest Neighbors:** Classifying with distance measurements, A Handwriting Recognition Systems - Examples

Unit II

Splitting datasets one feature at a time: Decision trees: Tree construction, plotting trees in Python with Matplotlib annotations, Testing and storing the classifier, Example – Prediction using decision trees. Classifying with probability theory: naïve Bayes: classifying with Bayesian decision theory, Conditional probability, Classifying with conditional probabilities, Document classification with naïve Bayes, Classifying text with Python, Examples – classification with naïve Bayes.

Unit III

Logistic regression: Classification with logistic regression and the sigmoid function: a tractable step function, Using optimization to find the best regression coefficients, Examples - classification with Logistic regression. Support vector machines: Separating data with the maximum margin, Finding the maximum margin, Efficient optimization with the SMO algorithm, Speeding up optimization with the full Platt SMO, Using kernels for more complex data, Example – Handwriting Classification.

Unit IV

Predicting numeric values - regression: Finding best-fit lines with linear regression, Locally weighted linear regression, Shrinking coefficients to understand our data, The bias/variance tradeoff, Examples. Tree-based regression: Locally modeling complex data, Building trees with continuous and discrete features, Using CART for regression, Building the tree, Executing the code, Tree pruning, Model trees, Examples

Unit V

Grouping unlabeled items using k-means clustering: The k-means clustering algorithm, Improving cluster performance with post processing, Bisecting k-means, Examples. Using principal component analysis to simplify data: Dimensionality reduction techniques, Principal component analysis, Moving the coordinate axes, Performing PCA in NumPy, Examples.

Tutorial:

Implementation of programs in python for

- k-Nearest Neighbors
- Naïve Bayes
- Logistic Regression
- Support Vector Machines
- Forecasting numeric values with regression
- Forecasting numeric values with tree based regression
- K Means Clustering
- Simplification of data using PCA

Text Books

1. Peter Harrington, Machine Learning in Action, Manning Publications, 2012, ISBN 9781617290183

References

1. Ethem Alpaydin, Introduction To Machine Learning, 2nd Edition, PHI Pvt. Ltd-New Delhi, 2010
2. Christopher Bishop, Pattern Recognition and Machine Learning, CBS Publishers & Distributors-New Delhi
3. Tom M Mitchell, Machine Learning, McGraw-Hill, Inc. New York, NY, USA ©1997

Course Outcomes (COs):

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

1. Understand the fundamental concepts and challenges of machine learning. (PO 1,2,5, 9,10,12, PSO 1,2,3)
2. Understand and develop solutions for classification problems using different approaches. (PO 1,2,3,4,5,9,10,12, PSO 1,2,3)
3. Analyze and develop solutions for finding best parameters to classify data. (PO 1,2,3,4,5,9,10,12, PSO 1,2,3)
4. Understand how to apply a variety of learning algorithms for prediction. (PO 1,2,3,4,5,9,10,12, PSO 1,2,3)
5. Apply dimensionality reduction techniques and develop clustering methods as well as approaches to simplify data. (PO 1,2,3,4,5,9,10,12, PSO 1,2,3)

ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY IN SYSTEM DESIGN

Course Code: EIE65 **Credit: 3:0:0:1**
Prerequisite: Nil **Contact Hours: 42**
Course Coordinator: Mr. Ovhal Ajay Ashok

Course Content:

Unit I

EMI/EMC Concepts: 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: 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: Shielding, Filtering, Grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control.

Unit IV

EMC Design of PCBS: 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: 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.

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.
3. Publications, John Wiley and Sons, Newyork, 1988.
4. Bemhard Keiser, Principles of Electromagnetic Compatibility, 3rd Edition, Artech house, Norwood,1986

Course Outcomes (COs):

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

1. Identity location of EMI. (PO-1,2,4,5,6,7, PSO-1,2)
2. Analyze EMI coupling between source to other devices. (PO-1,2,3,4,5, PSO-1)
3. Analyze various methods to control EMI. (PO-1,2,4,5,6,7, PSO-1,2)
4. Design of PCB with EMC. (PO-1,2,4,5,6,7,11,12, PSO-1,2,3)
5. Measure EMI and use various standard to test the device for EMI-EMC compliance. (PO- 1,2,4,5,6,7, PSO-1,2)

PROJECT WORK

Course Code: EIP **Credit: 0:0:15:0**
Prerequisite: Nil **Contact Hours: 85**
Course Coordinator: Dr. H. S. Niranjana Murthy

The students are guided and encouraged to work in teams, to define the problem, analyze, design, develop and implement. The implementation can be in the form of hardware module and/or software simulations. They are encouraged to incorporate innovative ideas, sustainable and environment friendly solutions. The project evaluation takes place continuously with three reviews, project demonstration and external evaluation at the end of the academic year.

The students are also motivated to publish their work in journals; present in conferences; or exhibit their work in various project competitions or exhibitions. The department evaluates and nominates for 'Best Project' award based on the rubrics formed in the department.

Course Outcomes (COs):

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

1. Identify a problem related to industries and/or societal needs, select a suitable method for implementation through conducting elaborate literature/ market survey. (PO-1,2,3,4,5,6,7,10,12 PSO-1,2,3)
2. Design, test and simulate functional blocks or sub-systems of the proposed solution. (PO-2,3,8,9,10,11, PSO-1,2,3)
3. Design, simulate, experiment, integrate and test systems. (PO-2,3,4,5,10, PSO-1,3)
4. Develop skills required for consistent documentation, result analysis and redesign, project management and problem solving. (PO-1,2,4,9,10, PSO-1,2,3)
5. Communicate technical information by means of written and oral presentations. (PO-2,6,7,8,10, 11,12, PSO-2,3)

EXTRA AND CO-CURRICULAR ACTIVITIES

Course Code: EAC **Credit: 0:0:2:0**
Prerequisite: Nil **Contact Hours:**

Students actively participate in various intra-college and intercollegiate, university level extra-curricular activities that exposes them to different people and communities that help them to showcase their talents without fear and gain confidence to face the society in future

Course Outcomes (COs):

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

1. Demonstrate their talents and gain confidence to participate in extracurricular activities in future. (PO-6,7,9,10,12 PSO-2,3)
2. Improve their self-thinking, self- understanding to promote their individual growth and balance between academics and outside commitments. (PO-6,8,9,12 PSO-2,3)
3. Demonstrate enhanced communication and public speaking skills, organizational skills, leadership skills and work in multidisciplinary teams with positive attitude. (PO-6,7,9,10,11,12 PSO-2,3)

INTERNSHIP

Course Code: EIIN **Credit: 0:0:4:0**
Prerequisite: Nil **Contact Hours:**

The student can do the Internship for one month and a report of the Internship with certificate from the company need to be submitted along with a presentation. The evaluation rubrics will be specified by the department.

Course Outcomes (COs):

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

1. Integrate theory and practice. (PO-1,2,3,4,5 PSO-1)
2. Develop work habits and attitudes necessary for success in a career. (PO-6,7,9,10 PSO-2,3)
3. Develop communication, interpersonal and other critical skills in the job. (PO-8,9,10 PSO-2,3)
4. Assess their abilities and interest in their field of study. (PO-3,11,12 PSO-1,3)
5. Work in a team and develop leadership and decision-making skills. (PO-9,11,12 PSO-3)

Open Electives offered to other Departments

BIOMEDICAL INSTRUMENTATION

Course Code: EIO01 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Mr. M D Nandeesh

Course Content:

Unit I

Electrophysiological and Biopotential Recording: The origin of biopotentials; biopotential electrodes; instrumentation and isolation amplifiers; ECG, EEG, EMG, PCG, EOG- lead systems and recording methods, typical waveforms and signal characteristics.

Unit II

Bio-Chemical and Non Electric Parameter Measurements: pH, pO2, pHCO3, electrophoresis, colorimeter, photometer, auto analyzer, blood flow meter, cardiac output, respiratory measurement, blood pressure, temperature, pulse, blood cell counters, differential count.

Unit III

Assist Devices: Cardiac pacemakers, DC Debrillators, dialyser, heart-Lung machine, hearing aids.

Unit IV

Physical Medicine and Bio-Telemetry: Diathermies- Short-wave, ultrasonic and microwave type and their applications, medical simulator, Telemetry principles, frequency selection, bio-telemetry, radio-pill and tele-simulation, electric safely.

Unit V

Recent Trends in Medical Instrumentation: Thermograph, endoscopy unit, laser in medicine, surgical diathermy, cryogenic application, introduction to telemedicine.

Text Books

1. Khandpur,R.S., Handbook of biomedical Instrumentation, Tata McGraw-Hill, New Delhi, Second edition, 2003.
2. Lesile Cromwell, Biomedical instrumentation and measurement, Prentice Hall of India, New Delhi, 2007.

References

1. Joseph.J, Carr and John M.Brown, Introduction to Biomedical equipment technology, Pearson Education Inc. 2004.
2. John G.Webster, Medical Instrumentation Application and Design, John wiley and sons,(Asia) Pvt.Ltd., 2004.

Course Outcomes (COs):

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

1. Understand the concept of bio-potential, electrodes and placement electrodes. (PO-1, PSO-1)
2. Analyse the engineering principles of bioelectric and non-electrical parameters. (PO-1,6,12, PSO-1,3)
3. Analyze the principle of assist devices. (PO-1,6,12, PSO-1,2)
4. Apply the principle of physical medicine and biotelemetry. (PO-1,10, PSO-1)
5. Use the basic concept of imaging and therapeutic equipment. (PO-1,10, PSO-1)

INDUSTRY AUTOMATION

Course Code: EIO02 **Credit: 4:0:0:0**
Prerequisite: Nil **Contact Hours: 56**
Course Coordinator: Ms. J.V. Alamelu and Dr. Christina Grace

Course Content:

Unit I

Industrial processes: Definition, Industry classification, Application oriented (Manufacturing and Utility industry), Operational (Continuous – discrete – batch), Physical (Local and Distributed). **Process automation systems:** Definition, Process without and with automation, Need and benefits of automation. Automation steps: Information acquisition and analysis, Decision making, Control execution. **Process signals:** Definition, Classifications, Input and output, Digital/discrete, Analog/continuous, Pulse.

Unit-II

Automation system structure: Definition, Subsystems: Input Instrumentation subsystem, Control subsystem, Human interface subsystem, Control subsystems. Instrumentation: Structure and components, Physical signal conversion, Signal interfacing standards, Signal conditioning, Process isolation and instrumentation protection, Final control elements (pumps, motors, control valves and solenoid). Human machine interface: Definition, need, hardware based, Software based, Operator panels. Control system: Definition, need, Functions, Structure, Data acquisition and control unit (DACU) Data acquisition unit (DAU), Functional Subsystem, Power supply subsystem, Processor subsystem, Input/output subsystem, Communication subsystem, Supporting subsystem.

Unit-III

Control strategies: Definition, need, Open loop control, Closed loop or feedback control, Discrete control Sequential: control with interlocks Continuous control: Two step and multi-step control, Analog loop control, Evolution of control systems: Mechanical, hydraulic, and pneumatic based, relay based, solid-state based, micro-processor based, Comparisons. Special purpose DACUs: Need, Programmable Logic Controller (PLC), Loop controller, Controller, Remote Terminal Unit (RTU)
Automation strategies: Need, classification, architectures and protocols, Industrial data communication, Centralized control systems, Distributed Control Systems (DCS), Network Control Systems (NCS), Front-end processing, Supervisory Control and Data Acquisition (SCADA) systems, DCS and NCS, Modern control centre.

Unit-IV

Case studies: SCADA applications in industry automation (Railway traction system/power distribution system), PLC based Industrial application (Power plant/ Petrochemical) with VFD (based on automation systems), Material handling and identification technologies - Manufacturing, assembly and conveying systems, Motion control system, Robot controller architectures - Robots in manufacturing automation - Motion planning for robots, Quality control systems.

Unit – V

New Developments: IT-OT convergence, Internet of Things (IoT), Industrial IoT, Industry 4.0: Various industrial revolutions, Features, challenges and difficulties of industry 4.0 (Interoperability, information transparency, decentralized decision making, Cloud computing for industry 4.0, Smart manufacturing, Smart logistics, Smart cities, Smart components, auto-diagnosis and configurability, Cyber-physical systems.

Text Books

1. Overview of Industrial process automation, by KLS Sharma, IIIT, Bangalore

References

1. Process control Instrumentation Technology, CD Johnson, Pearson Education
2. Instrument Engineers Handbook – Vol. 1: Process Measurement and Analysis, Vol. 2: Process Control, by BG Liptak, Butterworth Heinemann
3. Fundamentals of Industrial Control, DA Coggan, ISA
4. Understanding Distributed Processor Systems for Control by SM Herb, ISA

Course Outcomes (COs):

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

1. Understand the different types of processes and systems (PO-1,3,4,9, PSO-1)
2. Analyze different building blocks of Automation system structure. (PO-1,3,4,9, PSO-1)
3. Analyze the concepts of different control strategies and automation strategies utilized in Industrial environment. (PO-1,3,4,9, PSO-1)
4. Apply automation systems in real world applications. (PO-1,3,4,9, PSO-1,2)
5. Understand the various new developments in Industrial automation. (PO-1,3,4,9, PSO-1,3)