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Master of Technology in Digital Instrumentation

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTDI 201		Advance Control System	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. To study the description and stability of non-linear system.
2. To study the conventional technique of non-linear system analysis.
3. To study the analysis discrete time systems using conventional techniques.
4. To study the analysis of digital control system using state-space formulation.
5. Enable the stability and performance analysis and design of nonlinear systems and controllers.
6. Enable the use of control schemes which adapt to unknown and/or slowly varying systems.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

The students will be able to

Knowledge and understanding

1. Demonstrate knowledge of the effects of non-linearities on the operation of control systems.
2. Show an understanding of methods for reducing nonlinear effects in control systems.
3. Demonstrate knowledge of the principal structures used for adaptive control systems.

Intellectual skills

1. Obtain locally linearized models for nonlinear dynamic systems.
2. Apply the describing function method to nonlinear feedback systems.
3. Use backstepping design for control of nonlinear systems.
4. Design adaptive controllers, for linear and nonlinear systems.

Practical skills

1. Simulate nonlinear control systems using Matlab and Simulink.
2. Implement adaptive control schemes for engineering systems.

Transferable skills and personal qualities

Use the relevant simulation tools, and apply parameter estimation methods, in other areas.

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Syllabus

Unit-I

Describing function analysis of non-linear control systems: Introduction to non-linear control systems, Describing function analysis and Stability of Nonlinear control systems.

Types of nonlinear elements – ideal relay, saturation, ideal relay with dead zone, saturation with dead zone, hysteresis; Stability analysis of closed loop systems having nonlinear element and a linear transfer function block in the forward block, by using Nyquist method; Limit cycles; Phase plane trajectory of linear second order systems; Concepts; Phase plane trajectory of the closed loop systems having nonlinear element and a linear transfer function block in the forward block.

Unit-II

State Space Approach

Advantage of state space approach, Concept of state model, derivation of transfer function from the state model, Review of basic control systems; Modeling of dynamics in state space; Eigen-values and eigen-vectors, Modal transformation; State transition matrix and its computation; Solution of closed loop dynamics in state space.

Unit-III

Controllability and observability

Test for controllability and observability for continuous time system; Time varying case, minimum energy control, time invariant case, Minimal polynomial, Principle of duality, Controllability and observability from Jordan canonical form and other canonical forms.

Stability in the sense of Lyapunov, Routh Hurwitz stability analysis; Nyquist stability analysis; Jury's stability test.

Unit-IV

Modal Control

Effect of state feedback on controllability and observability, design of state feedback control through pole placement, Response due to step reference input; State solution with examples, full order observer and reduced order observer, Stabilisability of higher order systems.

Unit-V

Discretisation of continuous-time state dynamics, pole placement via state feedback, stabilisability of discrete-time state dynamics, multi-rate sampling and corresponding response of closed loop state dynamics.

References

1. *B. C. Kuo, Digital Control Systems –Oxford University Press, 1992.*
2. *K. Ogata, Discrete-time Control Systems –Prentice-Hall, 1987.*
3. *George J. Thaler and Marvin P. Pastel, Analysis and Design of Nonlinear Feedback Control Systems –McGraw-Hill, New York, 1962.*
4. *Donald G. Schultz and James L. Melsa, State Functions and Linear Systems –McGraw-Hill Education, 1967.*
5. *Chi-Tsong Chen, Linear System Theory and Design –Oxford University Press, New York, 1999.*

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List of experiments.

Matlab and Simulink.

1. Characteristics of nonlinear behaviour, linearized models.
2. Phase-plane methods; approximate construction of state trajectories.
3. Describing functions; use in predicting oscillations.
4. Stability theory, Lyapunov functions; methods of construction and use K-Y lemma; circle criteria.
5. Compensation for nonlinearities; feedback linearization.
6. Integrator back stepping and iterative back stepping design.
7. Model reference control and model reference adaptive control of linear systems; adaptive laws and stability analysis.
8. Robust issues in adaptive control, dead-zoon and sigma modifications in adaptive laws.
9. Adaptive control of nonlinear systems and adaptive back stepping.
10. Reduced order controller and its modeling application.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI 202		Electronics System Design	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

To develop and apply the skill of logic design using latest tools and technology.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student will be able to study the basics of logic design.
2. Student will be able to apply and develop the research work, about the design methods.
3. Student will be able to have problem solving techniques for controlling e logical system.
4. Student will be able to take awareness of latest technologies and developments.
5. Student will be able to test the electronics system.

Syllabus

Unit-I

DESIGN CONCEPTS & LOGIC CIRCUITS

Digital Hardware, Design Process, Design of Digital Hardware Variables & Functions Logic gates & Networks synthesis, SOP, POS forms, Introduction to VHDL.

Unit-II

OPTIMIZED IMPLEMENTATION OF LOGIC FUNCTIONS:

Strategy for minimization, incompletely specified functions, Multiple output circuits, Multilevel synthesis & Analysis Building Block of combinational circuits, Multiplexers Decoders, Encoders Code Converters, sequential circuits: flip-flop, registers counters. Subsystem Design: Data-paths; adder, Shift registers ALU, Memory; NVRWM, Flash memories, 6-Transistor RAMs. Latch up in CMOS Circuits.

Unit-III

SYNCHRONOUS SEQUENTIAL CIRCUITS

Basic Design Steps, Mealy state Model, Design of FSM.

Unit-IV

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ASYNCHRONOUS SEQUENTIAL CIRCUITS
Analysis, Synthesis, State Reduction, State Assignment, Hazards.

Unit-V
TESTING OF LOGIC CIRCUITS
Fault Model, Path sensitizing, Random testing, Circuits with Tree Structure.

References

1. *TINDER; Engineering Digital Design.*
2. *FLETCHER; An Engineering Approach to Digital Design.*
3. *MANO; Logic and Computer Design Fundamentals.*
4. *A.Anand Kumar "Fundamental of digital Circuits".*
5. *Stephen Browne, Vranesic "Fundamental of digital logic design with VHDL"*

List of experiments.

1. Introduction to Hardware Description Language (HDLs).
2. Design all universal gates and flip-flops using different coding styles of VHDL.
3. Design of decoder using VHDL.
4. Design of Encoder using VHDL.
5. Design of MUX and DeMUX using various modeling styles.
6. Design of Flip-flop using VHDL.
7. Design a 4- Bit parallel counter using VHDL.
8. Design a 4- Bit shift Register using VHDL.
9. Design a ALU using behavioral modeling.
10. Design counter using sequential modeling.

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI 203		Intelligent Instruments and system	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
To introduce the student to the concept on Intelligent Instrumentation.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

Students will be able

1. To study the basics of Intelligent Instrumentation.
2. To study the various Data Acquisition Methods.
3. To study basics of Virtual Instrumentation.
4. To study VI programming.
5. To implement programming in Virtual Instrumentation.

Syllabus
Unit-I
Introduction
Intelligent versus Dumb instruments, Historical Perspective, Current status, software based instruments. Review of digital transducers. Interfacing micro computers. Computer ports to high power devices. Optical shaft encoder communication standards. Concepts of Real Time system and its application.

Unit-II
Data Acquisition Method
Analog and Digital IO, Counters, Timers, Basic ADC design, Logic control systems, Continuous & Batch modes, Single and multi loop controller. Details of Data logger and its application. Interfacing methods of DAQ hardware, software structure. Use of data Sockets for networked communication and controls.

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Unit-III

Virtual Instrumentation

Architecture of Virtual instrument and its relation to operating system. Introduction to graphical programming, data flow & graphical programming techniques.

Unit-IV

VI Programming Techniques

Advantage of VI techniques, VIs and sub VIs loops and charts, arrays, clusters and graphs, case and sequence structure, formula nodes, string and file ,I/O Code Interface Nodes and DLL links.

Unit-V

Programming

Software development for Temperature (Low and High), Level, Speed, pressure etc.

References

1. *Lisa K. Wells "Labview for Every one, PHI.*
2. *Barry Paton, "Sensor, Transducers and Labview", Prentice Hall.*
3. *Barney G C, Intelligent Instrumentation: Micro processor application in measurement and control, Prentice Hall, Engle Wood Cliff NJ.*
4. *P. C.Interfacing for data Acquisition & Process Contro S.Gupta, 2nd Edition/Instrument Society of America, 1994.*
5. *Garry M. Johnson "LAB view Graphical Programming", TMH.*

List of Experiments.

Simulation Software (TINAPRO/ PSPICE/ LABVIEW/ CIRCUIT MAKER).

1. To test and study of operation of all logic Gates for various IC's.
2. Implementation of AND, OR, NOT, NOR, X-OR and X-NOR Gates by NAND and NOR Universal gates.
3. Binary Addition by Half Adder and Full Adder circuit.
4. Binary Subtraction by Half Subtractor and Full Subtractor circuit.
5. Design a BCD to excess-3 code converter.
6. Study of RS, JK, T & D flip-flops.
7. Multiplexer/Demultiplexer based boolean function realization.
8. Study and Application of 555 timer (Astable, Monostable, Schmitt trigger, VCO).

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI211		Advance Process Control	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

Student should understand and analyze model based process control engineering problems.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student will be able to describe dynamics of various processes.
2. Student will be able to learn and analyze the effect of various controller tuning methods.
3. Student will be able to impart knowledge on the Multi variable Process control.
4. Student will be able to design model based control system.
5. Student will be able understand and explain the fuzzy logic systems.

Syllabus

Unit-I

Introduction: Review of basics of Process Control, Control objective and benefits, Control system elements.

Mathematical Modeling and dynamic performance analysis process for control: Basic Concepts in Modeling, models from fundamental laws, empirical model identification, dynamic performance analysis of first order, second order, multi-capacity processes, Effect of Zeros and time delay.

Unit-II

Stability Analysis: Frequency response, design of control system, controller tuning and process identification. Zigler-Nichols and Cohen-Coon tuning methods, Bode and Nyquist stability criterion. Process identification.

Unit-III

Multi variable Process control: Cascade control, Ratio control, override control, selective control, Auctioneering control, plant wide control, Split range control, modeling of multi variable process, Design of Multi variable controllers.

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Unit-IV

Model Based Control: Feedback-feedforward, delay compensation, Internal Model controller (IMC): Concept, IMC designs Procedure. Smith predictor, optimal controller, Model Predictive controller (MPC), Dynamic matrix controller (DMC). Self Tunning Controller.

Unit-V

Fuzzy logic systems and Fuzzy controllers: Introduction, Basic Concepts of Fuzzy Logic, Fuzzy Sets, Fuzzy Relation, Fuzzy Graphs, and Fuzzy Arithmetic, Fuzzy If-Then Rules, Fuzzy Logic Applications, Neuro -Fuzzy Artificial , Neural networks and ANN controller, Introduction to PLC, DCS .

References

1. *C.D. Johnson, "Process control Instrumentation Technology"Prentice Hall Inc.,2007.*
2. *Bella G. Liptak,"Process control and Optimization", Instrument Engineers Handbook, volume 2,CRC Press and ISA,2005*
3. *D.R.Coughanowr,, "Process system analysis and control",Mcgraw-Hill International, Edition 2004.*
4. *D.P. Eckman,"Automatic Process control"John Willey, 7th Edition, NewYork1990.*
5. *D.M Consedine," Process Instruments and control Handbook", Second Edition, Mcgraw,1999.*
6. *D.E. Seborg, T.F. Edger, and D.A. Millichamp, 'Process Dynamics and Control', John Wiley*
7. *and Sons, 2nd Edition, 2004.*
8. *B.W. Bequette, 'Process Control: Modeling, Design and Simulation', PHI, 2006.*
9. *Thomas E. Marlin 'Process Control', (McGraw-Hill International Edition)*
10. *Stephanopoulos George,Chemical Process Control-, PHI*
11. *T.J.Ross ,Fuzzy Logic with Engineering Applications.*

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI 212		Instrumentation and Automatic control	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
To Develop and apply the skill of logic design using latest tools and technology.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student will be able to study the basics of Instrumentation.
2. Student will be able to apply and develop the research work, about the control.
3. Student will be able to have problem solving techniques for controlling the faults.
4. Student will be able to take awareness of latest technologies and developments.
5. Student will be able to automate the system.

Syllabus
Unit-I
Basic concepts of measurement: Introduction to transducers, Measurement and its aim, functional elements of an instrument, performance characteristics.
Pressure and vacuum measurement: Manometers, Bourdon tubes, bellows, diaphragms, Pirani gauges, thermal conductivity gauges.
Flow measurement: Various types e.g. Head type, Area, some electrical methods of flow measurement.
Temperature Measurement: Temperature scales, Mercury in glass thermometers, filled in systems, thermocouple, RTD's and bimetallic type, Radiation pyrometers.
Measurement of displacement, velocity and acceleration. Miscellaneous Measurements: Measurement of humidity, moisture and level Composition Analysis: Spectroscopic analysis, analysis of moisture in gases, pH in concentration measurement.

Unit-II
Introduction to Virtual Instrumentation: Historical perspective, Classification of different instruments / instrumentation system. Definition and architecture of virtual instrumentation system, salient

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features and application area of virtual instrumentation.

Unit-III

Common Instrument Interfaces: Current loop, RS 232, RS485, GBIP. Use of library functions to communicate with different instruments.

Unit-IV

Introduction to Computer Control systems in Process Control: DCS Configuration, control console equipment, communication between components, local control units, DCS flow sheet symbols, DCS I/O hardware and setpoint stations. Supervisory control and data acquisition system (SCADA). Programmable Logic Control: Introduction, relative merits over DCS and relays, programming languages, Hardware and system sizing, PLC installation, Maintenance and trouble shooting.

Unit-V

Introduction to Automation: Fully automatic systems, semi automatic systems and manual control systems, tele-operated systems, measurement system, control system, microprocessor based controller, introduction to PLC & DCS.

References

1. *Doebelin E O, "Measurement Systems – Application and Design", McGraw Hill, New Delhi (1975).*
2. *Patranabis D, "Problems of Industrial Instrumentation" , Tata McGraw Hill, New Delhi, 14th Reprint (1993)*
3. *Cooper W D, "Electronic Instrumentation and Measurement Techniques", PHI Pvt Ltd., New Delhi (1982)*
4. *Nakra B C and Chaudhary A K, "Instrumentation, Measurement and Analysis", TMH, New Delhi (1985).*
5. *Mani and Rangan, "Instrumentation devices and systems", Tata McGraw Hill, New Delhi (1997).*
6. *Johnson Curtis D, "Process Control Instrumentation Technology", Prentice Hall of India, New Delhi (1997).*

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTDI 213		Biomedical Signal Processing	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. To understand the basic signals in the field of biomedical.
2. To study origins and characteristics of some of the most commonly used biomedical signals, including ECG, EEG, evoked potentials, and EMG.
3. To understand Sources and characteristics of noise and artifacts in bio signals.
4. To understand use of bio signals in diagnosis, patient monitoring and physiological investigation
5. To explore research domain in biomedical signal processing.
6. To explore application of established engineering methods to complex biomedical signals problems.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. The student will be able to model a biomedical system.
2. The student will be able to understand various methods of acquiring bio signals.
3. The student will be able to understand various sources of bio signal di stortions and its remedial techniques.
4. The students will be able to analyze ECG and EEG signal with characteristic feature points.
5. The student will have a basic understanding of diagnosing bio-signals and classifying them.

Syllabus

Unit-I

Fundamentals of Discrete-Time signals and systems:Concepts of system, signal. Sampling Process. Impulse Response. Z-Transform, Discrete Transfer function, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT). Medical Applications.

Unit-II

The Electro-encephalogram(EEG): Applications, Signal Processing, Modeling and Artifacts. Nonparametric and Model-based spectral analysis, EEG segmentation, Joint Time-Frequency Analysis. Evoked Potential Modalities, Noise Characteristics, Noise reduction by Ensemble Averaging and Linear Filtering, Single-Trail Analysis and adaptive Analysis Using Basis Functions.

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Unit-III

Wavelets:Continuous Wavelet Transform. Discrete wavelet transform. Reconstruction. Recursive multi resolution decomposition. Types of wavelets-Haar wavelet, Daubechies wavelet, Biorthogonal wavelet. Coislet wavelet, Morlet wavelet, Mexican Hat wavelet, Symlet wavelet.
Medical applications.

Unit-IV

The Electromyogram (EMG):The electrical Activity of Muscles, Amplitude Estimation in the surface EMG, Spectral Analysis of the surface EMG, Conduction velocity Estimation, Modeling the EMG, EMG Signal Decomposition.

Unit-V

The Electrocardiogram(ECG):Heart Rhythms, Heart beat Morphologies, Noise and Artifacts, Baseline Wander, Power line interference, Muscle Noise Filtering, QRS Detection, Wave Delineation, Data Compression, Heart Rate Variability, Acquisition and RR Interval conditioning , Spectral Analysis of Heart Rate Variability.

References

1. *D. C. Reddy,"Biomedical Signal Processing Principles and Techniques", Tata McGraw-Hill, 2005.*
2. *R.M. Rangayyan,"Biomedical Signal Analysis A Case Study Approach" John Wiley, 2002.*
3. *Willis J. Tompkins,"Biomedical Digital Signal Processing", Prentice Hall of India Publications, 1995.*
4. *Proakis, "Digital Signal Processing", PHI Publications, 2007.*
5. *John L. Semmlow, "Bio-signal and Biomedical Image Processing", Marcel Deccar Publications, 2004*

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI 221		Embedded System	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
Students should be able to understand the design of small Embedded system applications.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

Student will be able

1. Apply the concept of microcontroller architecture and interrupts.
2. Understand the concept of RTOS.
3. Demonstrate the design of microcontroller based embedded system.
4. Students should be able to use an Integrated Development Environment (IDE) as a modern software tool for embedded system development.

Syllabus
Unit-I
Introduction to Embedded system, classification of embedded system, PIC Micro Controller, CPU architecture, registers, instruction sets, addressing modes, loop timing, on chip Peripherals of PIC.

Unit-II
Motorola MC68H11 Family Architecture, Registers, Addressing modes, Instructions, Interrupts, features of interrupts- Interrupt vector and Priority, timing generation and measurements, Input capture, out capture.

Unit-III
The RISC design philosophy, Salient features of ARM processor family-ARM7 /ARM9/ ARM9E/ ARM10/ ARM11, ARM core dataflow model, Registers, current program status register, pipeline, SPSR, Instruction set.

Unit-IV
Software development and tools: Embedded system evolution trends. Round- Robin,Round-robin

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with Interrupts, function- One- Scheduling Architecture, Algorithms. Introduction to- assembler- compiler- cross compilers and Integrated Development Environment (IDE) Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

Unit-V

Real Time Operating Systems: Task and Task States, tasks and data, semaphores and shared Data Operating system Services- Message queues- Timer Function- Events-Memory Management, Interrupt Routines in an RTOS environment, basic design Using RTOS.

References

1. *David E Simon, " An embedded software Primer" Pearson education Asia.*
2. *John B Peat man " Design with Micro controller" Pearson education Asia.*
3. *onartthan W. Valvano Brooks/cole " Embedded Micro Computer Systems.Real time Interfacing", Thomson learning.*
4. *Andrew N. Sloss,Dominic Symes, Chris Wright "ARM System Developer's Guide Designing and Optimizing System Software".*

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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI 222		Internet Of Things	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

1. To understand the basics of Internet of Things
2. To get an idea of some of the application areas where Internet of things can be applied
3. To understand the middleware for Internet of Things
4. To understand the concepts of Web of Things
5. To understand the concepts of Cloud of Things with emphasis on Mobile cloud computing
6. To understand the IOT protocols

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

Student will be able to

1. Identify and design the new models for market strategic interaction
2. Design business intelligence and information security for WoB
3. Analyze various protocols for IoT
4. Design a middleware for IoT
5. Analyze and design different models for network dynamics

Syllabus

Unit-I

INTRODUCTION

Definitions and Functional Requirements Motivation -Architecture-Web 3.0 View of IoT–Ubiquitous IoT Applications–Four Pillars of IoT–DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT : Overview–Communication middleware forIoT–IoT Information Security.

Unit-II

IOT PROTOCOLS

Protocol Standardization for IoT –Efforts–M2M and WSN Protocols–SCADA and RFID Protocols Issues with IoT Standardization–Unified Data Standards–Protocols–IEEE 802.15.4 – BACNetProtocol–Modbus–KNX–Zigbee Architecture–Network layer–APS layer–Security.

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Unit-III
WEB OF THINGS
Web of Things versus Internet of Things–Two Pillars of the Web–Architecture Standardization for WoT –Platform Middleware for WoT–Unified Multitier WoT Architecture–WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing–Cloud Middleware – Cloud Standards–Cloud Providers and Systems–Mobile Cloud Computing–The Cloud of Things Architecture.

Unit-IV
INTEGRATED
Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things-Network Dynamics: Population Models–Information Cascades-Network Effects-Network Dynamics: Structural Models -Cascading Behavior in Networks-The Small-World Phenomenon.

Unit-V
APPLICATIONS
The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments-Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications-Smart Grid–Electrical Vehicle Charging.

References

1. *Honbo Zhou,The Internet of Things in the Cloud: A Middleware Perspective –CRC Press–2012*
2. *Dieter Uckelmann; Mark Harrison; Florian Michahelles Architecting the Internet of Things-(Eds.)–Springer–2011*
3. *Networks, Crowds, and Markets: Reasoning about a Highly Connected World-David Easley and Jon Kleinberg, Cambridge University Press-2010*
4. *The Internet of Things: Applications to the Smart Grid and Building Automation by-Olivier Hersent, Omar Elloumi and David Boswarthick-Wiley-2012*
5. *Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internetof Things–Key applications and Protocols", Wiley, 2012*

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Master of Technology in Digital Instrumentation

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI223		Spintronics	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
1. To understand the basic Principles of spintronics
2. To learn the various Spintronic Materials, Technology and Devices

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Student will be able to analyze the spintronics concept.
2. Student will be able to analyze spintronics relaxation methods.
3. Student will be able to understand spin transfer torque.
4. Student will able to explain spin injection methods.

Syllabus
Unit-I
Introduction: History and overview of spin electronics, Classes of magnetic materials, the early history of spin, Quantum Mechanics of spin, The Bloch sphere, Spin-orbit interaction, exchange interaction.

Unit-II
Spin relaxation: Spin relaxation mechanisms, Spin relaxation in a quantum dots, the spin Galvanic effect. Basic electron transport, Spin-dependent transport, Spin dependent tunneling.

Unit-III
Spin-transfer torques: Intuitive picture of spin-transfer torques, spin-transfer drive magnetic dynamics, Current-driven switching of magnetization and domain wall motion, Domain wall scattering and Current-Induced switching in ferromagnetic wires.

Unit-IV
Spin injection: Spin injection, spin accumulation, and spin current, Spin hall effect, Silicon based spin electronic devices: Toward a spin transistor, Spin LEDs: Fundamental and applications, Spin photo-

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electronic devices based on Heusler alloy, Electron spin filtering, Monolithic and Hybrid Spintronics.

Unit-V

Advances in Spintronic Materials, Technology and Devices: Materials for spin electronics, Nanostructures for spin electronics, Deposition techniques, micro and nanofabrication techniques, Spin-Valve and spin-tunneling devices: Read Heads, MRAMS, Field Sensors, Spintronic Biosensors, Quantum Computing with spins.

References

1. *Bandyopadhyay, Marc Cahay. Introduction to Spintronics, Second Edition:Supriyo*
2. *Handbook of Spintronics, Editors: Xu, Yongbing, Awschalom, David D., Nitta, Junsaku (Eds.)*

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTDI 204		Simulation and Modeling-2	0	0	0	30	20	0	0	6	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):
Students should be able to understand the design of small embedded system applications.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

Student will able to

1. Apply the concept of microcontroller architecture and interrupts.
2. Understand the concept of RTOS.
3. Demonstrate the design of microcontroller based embedded system.
4. Students should be able to use an Integrated Development Environment (IDE) as a modern software tool for embedded system development.

List of experiments.

1. *Introduction to IDE and Assembler directives.*
2. *8051 Assembly language programming for addition, subtraction, multiplication and division of two 8-bit numbers.*
3. *8051 Assembly language programming using Arithmetic instructions*
4. *8051 Assembly language programming using Logical Instructions*
5. *8051 Assembly language programming for code conversions*
6. *8051 Assembly language programming for Timers in different modes.*
7. *I/O port programming in embedded C.*
8. *Timers and Counters programming in embedded C for time delay.*
9. *Programming of LCD in embedded C.*
10. *Programming of parallel ADC and DAC in embedded C.*
11. *Interfacing Stepper Motor.*
12. *ARM Assembly language programming for addition, subtraction, multiplication and division of two 8-bit numbers.*
13. *ARM Assembly language programming using Arithmetic instructions*
14. *ARM Assembly language programming using Logical Instructions*

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