Scheme and Syllabus of M. Tech Embedded System Design

Batch 2011

SEMESTER First							
Course Code	**Course Title**	**Load Allocation**			**Marks Distribution**		
		L	T	P	External	Internal	Total
MTED 101	Digital Systems Design	3	1	0	100	50	150
MTED 102	Data Communication & Networks	3	1	0	100	50	150
MTED 103	Designing with Power Devices	3	1	0	100	50	150
MTED 104	Real Time Systems	3	1	0	100	50	150
MTED 105	Software Technology for Embedded Systems	3	1	0	100	50	150
MTED 106	Software Technology-lab	0	0	4	50	50	100
MTED 107	Digital Design and Implementation – LAB	0	0	4	50	50	100
	Grand total	15	5	8	700	350	1050

MTED 101 DIGITAL SYSTEM DESIGN

- **INTRODUCTION TO DIGITAL DESIGN**

Number Systems, Signed, Unsigned number, 1's Complement, 2's Complement, Binary Operations - Addition, Subtraction using 1's & 2's Complement etc., Code converters-Excess-3, Gray Code.

- **LOGIC CIRCUIT DESIGN**

Universal Gates, Karnaugh Maps, Minimization of Logic Functions- Sum of Products, Product of Sum, Minimization of Logic Circuit.

- **HARDWARE DESCRIPTION LANGUAGES**

Introduction to VHDL, Design Units, Modeling styles- Behavioral, Structural and Concurrent, VHDL based digital design flow, Data objects, Data types, Delay models- Delta, Inertial, & Transport, Concurrent statements, Sequential statements, Process statements, Conditional & Selective signal assignments, Generate statements, Signal and Variable assignments, Synthesis of statements, Loops- for loop, while loop, Subprograms – Functions, Procedures, Generic, Package, IEEE standard logic library, Test bench, Component declaration, Instantiation, Configuration- declaration & specification.

- **FINITE STATE MACHINES (FSMS)**

Review of Moore and Mealy state machines, Finite state machines, Representation, Design steps, FSM code structure, Synthesis of FSMs.

- **ASYNCHRONOUS SEQUENTIAL CIRCUITS**

Analysis & Synthesis of asynchronous digital circuits, State Reduction, State Assignment, Hazards.

- **TESTING OF DIGITAL CIRCUITS**

Introduction, Types of faults, Fault modeling, Path sensitization, Testing algorithms- D-frontier and PODEM, Linear Feedback Shift Register, Built in Self Test.

- **FPGA Prototyping**

Introduction, Elements of FPGA, FPGA Implementation of following circuits –Full Adder, Subtractor, Decoder, Encoder, Data Selector, Ripple Carry Adder, Arithmetic Logic Unit, ROM, 4X4 Key board controller.

BOOKS:

- Fundamentals of Digital Logic with VHDL design – Stephen Brown, Zvonko Vranesic – Tata McGraw Hill.
- Digital Design Principles – Fletcher.
- Logic and Computer Design Fundamentals – Morris Mano

- VHDL Primer – J. Bhasker – Pearson Education.

REFERENCE :

- Digital System Design Using VHDL – Charles H. Roth.
- Digital System Design – John Wakerley.
- VHDL – 3rd Edition – Douglas Perry – Tata McGraw Hill
- VHDL – Zainalabedin Navabbi.

MTED 102 DATA COMMUNICATION & NETWORKS

INTRODUCTION

Components of network – Topologies – WAN / LAN – OSI – ISO layered Architecture

Modulation and demodulation – Bit error rates – Line coding – Error correcting codes.

DATA LINK LAYER

Design issues – CRC technique and sliding window techniques – Performance analysis of

sliding window techniques – Framing formats – Case Study – HDLC protocols – Medium access control – CSMA / CD, Token ring and token bus, FDDI – Wireless LAN

- Performance analysis of MAC protocols – Bridges.
-

NETWORK LAYER

Circuit switching – packet switching – Design issues – IP addressing and IP diagram –

Routers and gateways – Routing –Sub netting – CIDR, ICMP, ARP, RARP, Ipv6, QoS.

TRANSPORT LAYER

TCP and UDP – Error handling and flow control – Congestion control – TCP Retransmission – Timeout – Socket Abstraction

.APPLICATION SERVICES

Simple Mail Transfer Protocol (SMTP) – File Transfer Protocols (FTP), telnet, the World

Wide Web (WWW), Hypertext Transfer Protocol (HTTP), Domain name service (DNS),

Security, Multimedia applications.

MTED 103 DESIGNING WITH POWER DEVICES

- **POWER SEMICONDUCTOR DEVICES**

General characteristics of Power devices such as GTOs, Power BJT ,Power MOSFET,IGBT, MCT.

- **TRANSFORMER DESIGN**

Fundamentals, Selection of core material, Insulating material and wires, Design Methodology of pulse transformers, High Frequency transformers, Design of Transformers for PWM converters

- **COILS**

Fundamentals, Selection of core material, Insulating materials and wires, Design of inductors for power frequency, Radio frequency & High frequency

- **SWITCH MODE POWER SUPPLIES**

Basic regulators-Buck,Boost, Buck Boost, Derived topologies-flyback, forward, Pushpull, half & full bridge converter, Special converters like Cuk' converter, PWM control techniques, Study of PWM control ICs Design of base derive circuits, Design of input section, output section & control section, Thermal design concepts, EMI/EMC considerations, Protection circuit design for power supplies.

- **UPS AND OTHER POWER SUPPLIES**

Concept of Uninterrupted power supplies, Inverter preferred (online UPS), Line preferred UPS system (offline UPS system), Line interactive UPS system, Reliability of UPS system, Solar cells as power source devices & their characteristics.

BOOK:

1. George Chryssis, 'High frequency switching power supplies: theory & design" McGraw Hill Book Co. 1984 (Text)

REFERENCES:

1. K.Kitsum, " Switch mode power conversion –basic theory and design" Marcel Deckker Inc, 1984
2. N.Radhakrishnan and S.R.Bhat, "Design and technology of low power transformers and inductors" CEDT, July 1998

MTED 104 REAL TIME SYSTEMS

INTRODUCTION

Introduction – Issues in Real Time Computing, Structure of a Real Time System, Task
classes, Performance Measures for Real Time Systems, Estimating Program Run Times.
Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms, Uniprocessor scheduling of IRIS tasks, Task assignment, Mode changes, and Fault Tolerant Scheduling.

PROGRAMMING LANGUAGES AND TOOLS

Programming Languages and Tools – Desired language characteristics, Data typing, Control structures, Facilitating Hierarchical Decomposition, Packages, Run – time (Exception) Error handling, Overloading and Generics, Multitasking, Low level programming, Task Scheduling, Timing Specifications, Programming Environments, Run – time support.

REAL TIME DATABASES

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main
Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two – phase Approach to improve Predictability,
Maintaining Serialization Consistency, Databases for Hard Real Time Systems.

COMMUNICATION

Real – Time Communication – Communications media, Network Topologies Protocols,
Fault Tolerant Routing. Fault Tolerance Techniques – Fault Types, Fault Detection. Fault
Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure

handling.

EVALUATION TECHNIQUES

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for

Hardware Redundancy, Software error models. Clock Synchronization – Clock, A Nonfault – Tolerant Synchronization Algorithm, Impact of faults, Fault Tolerant Synchronization in Hardware, Fault Tolerant Synchronization in software.

BOOKS:

C.M. Krishna, Kang G. Shin, "Real Time Systems", McGraw - Hill International Editions, 1997

By Albert M. K. Cheng , “Real-time systems: scheduling, analysis, and verification” wiley

MTED 105 SOFTWARE TECHNOLOGY FOR EMBEDDED SYSTEMS

1. **Software Technology:-** Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

2. **Introduction To Data Representation:-** Data representation ,Two's complement, Fixed point and Floating Point Number Formats ,Manipulating Bits in -Memory, I/O Ports, Low level programming in C ,Primitive data types , Arrays, Functions ,Recursive Functions, Pointers, Structures & Unions ,Dynamic Memory Allocation ,File handling ,Linked lists, Queues, Stacks

3. **Mixing C and Assembly:-** C and assembly, Programming in assembly ,Register Usage Conventions ,Typical use of Addressing Options, Instruction Sequencing , Procedure Call and Return , Parameter passing ,Retrieving Parameters , Everything in pass by value ,Temporary variables

4. **Input/Output Programming:-** I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

5. **Memory Management:-** Direct Memory Access, Local and Global Scope, Automatic and Static Allocation, Distinguishing Static from Automatic Object Creation, Initialization and Destruction, Dynamic Allocation

Unified Modeling Language:- UML basics, Object state behavior - UML state charts - Role of scenarios in the definition of behavior - Timing diagrams - Sequence diagrams - Event hierarchies - types and strategies of operations - Architectural design in UML concurrency design - threads in UML

7. **Software Tools:-** DJGPP C/C++ compiler, linker, loader and utilities, The ASM assembler, µCOS-II Preemptive Kernel, Multi C Non-Preemptive Kernel

REFERENCE BOOKS

1. Daniel W.Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education.
2. Bruce Powel Douglas, "Real time UML, second edition: Developing efficient objects for embedded systems (The Addison Wesley Object technology series)", 2nd edition 1999, Addison Wesley
3. Hassan Gomma, "Designing concurrent, distributed, and real time applications with UML", Pearson Education, 2000

4. C.M. Krishna, Kang G. Shin, "Real Time Systems", McGraw - Hill International Editions, 1997
5. By Albert M. K. Cheng , “Real-time systems: scheduling, analysis, and verification” wiley

MTED 106 LAB- Software Technology For Embedded System

1. Using C Pointers, Arrays, Structures and Union develop programs.
2. Write programs on File Handling.
3. Create a linked list ADT with functions for Creation, Insertion, Deletion & Searching.
4. Write programs to implement stack and queue.
5. Try examples by Embedding Assembly code in C and observe the performance.
6. Develop programs to perform Data Conversion from one form to another .
7. Write a sequence of Intel protected-mode instructions to implement functions in assembly.
8. Develop programs to implement ISR in Assembly and C.
9. Develop C functions to implement Polled Waiting Loops, FIFO queue.
10. Develop programs to implement Dynamic Memory Allocation, Recursive Functions.

MTED 107 ADVANCED DIGITAL DESIGN & IMPLEMENTATON (LAB)

- Design and Implementation of following features in Counter:-Counter with Asynchronous reset & clear signal, Synchronous Counter, Mod 10 Counter, FSM.

- Design and Implementation of ALU with following features:-Addition, Subtraction, Multiplication, Division, Square, Factorial, AND, OR, EXOR, EXNOR, Increment, Decrement, 1's Complement, 2's Complement etc.

- Design and Implementation of 8 X 8 Key board controller.

- Design and Implementation of Shift Register with following features:-Parallel in Serial out, Serial in Parallel out, Parallel in Parallel out, Serial in Serial out, Universal Shift Register.

- Design and Implementation of Hardware Multiplier.

- Design and Implementation of Universal Asynchronous Transmitter & Receiver.

M.Tech Embedded System Design

SEM 2								
Course Code	Course Title	Load Allocation				Marks Distribution		
		L	T	P	Total	Internal	External	Total
MTED 201	Embedded System Design	3	1	0	4	50	100	150
MTED 202	Neural Networks & Fuzzy Logic	3	1	0	4	50	100	150
MTED 203	Advanced Micro processor and micro controllers	3	1	0	4	50	100	150
MTED 204	Real Time Operating System	3	1	0	4	50	100	150
MTED 205	Computer Architecture	3	1	0	4	50	100	150
MTED 206	Advanced Micro Controller-LAB	0	0	4	4	50	100	150
MTED 207	Real Time Operating System -LAB	0	0	4	4	50	100	150
	Grand total	15	5	8	28	350	700	1050

2nd Semester

MTED 201 EMBEDDED SYSTEM DESIGN

- **INTRODUCTION AND EXAMPLES OF EMBEDDED SYSTEMS**

Concept Of Embedded System Design: Design challenge, Processor technology, IC technology, Design technology, Trade-offs

- **CUSTOM SINGLE PURPOSE PROCESSOR HARDWARE, GENERAL-PURPOSE PROCESSOR**

introduction, basic architecture, operation, super-scalar and VLSIIW architecture, application specific instruction set processors (ASIPS), microcontrollers, digital signal processors, selecting a microprocessor.

- **MEMORY**

Introduction, Memory writes ability, Storage performance, Tradeoff s, Common memory types Memory hierarchy and cache

- **AVR 8515 MICROCONTROLLER**

Architecture and Programming in assembly and C. Interfacing Analog and digital blocks: Analog-to-Digital Converters (ADCs), Digital to-Analog, Converters (DACs)., Communication basics and basic protocol concepts, Microprocessor interfacing: I/O addressing, Port and Bus based, I/O, Memory mapped I/O, Standard I/O interrupts, Direct memory access, Advanced communication principles parallel, serial and wireless, Serial protocols I2C, Parallel protocols PCI bus, Wireless protocol IrDA, blue tooth.

- **DIFFERENT PERIPHERAL DEVICES**

Buffers and latches, Crystal, Reset circuit, Chip select logic circuit, timers and counters and watch dog timers, Universal asynchronous receiver, transmitter (UART), Pulse width modulators, LCD controllers, Keypad controllers. Design tradeoffs due to thermal considerations and Effects of EMI/ES etc.

- **SOFTWARE ASPECT OF EMBEDDED SYSTEMS**

Challenges and issues in embedded software development, Co-design

- **EMBEDDED SOFTWARE DEVELOPMENT ENVIRONMENTS**

Real time operating systems, Kernel architecture: Hardware, Task/process control subsystem, Device drivers, File subsystem, system calls, Embedded operating systems, Task scheduling in embedded systems: task scheduler, first in first out, shortest job first, round robin, priority based scheduling, Context switch: Task synchronization: mutex, semaphore, Timers, Types of embedded operating systems, Programming languages: assembly languages, high level language.

- **DEVELOPMENT FOR EMBEDDED SYSTEMS**

Embedded system development process, Determine the requirements, Design the system architecture, Choose the operating system, Choose the processor, Choose the development platform, Choose the programming language, Coding issues, Code optimization, Efficient input/output, Testing and debugging, Verify the software on the host system, Verify the software on the embedded system

BOOKS

- Frankvahid/Tony Givargis, “Embedded System Design- A unified Hardware/software Introduction”.
- David E Simon, " An embedded software primer ", Pearson education Asia, 2001.
- Dreamteach Software team,” Programming for Embedded Systems”□ AVR 8515 manual
- J.W. Valvano, "Embedded Microcomputor System: Real Time Interfacing"
- Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.

MTED 202 NEURAL NETWORKS & FUZZY LOGICS

- Neural networks characteristics, History of development in neural networks principles, Artificial neural net terminology, Model of a neuron, Topology, Learning, types of learning, Supervised, Unsupervised, Re-inforcement learning. Knowledge representation and acquisition.

- Basic Hop field model, Basic learning laws, Unsupervised learning, Competitive learning, K-means clustering algorithm, Kohonen`s feature maps.

- Radial basis function neural networks, Basic learning laws in RBF nets, Recurrent back propagation, Introduction to counter propagation networks, CMAC network, and ART networks.

- Applications of neural nets such as pattern recognition, Optimization, Associative memories, speech and decision-making. VLSI implementation of neural networks.

- Fuzzy Logic: Basic concepts of fuzzy logic, Fuzzy vs. Crisp set, Linguistic variables, Membership functions, Operations of fuzzy sets, Fuzzy IF- THEN rules, Variable inference techniques, De-Fuzzification, Basic fuzzy inference algorithm, Fuzzy system design, FKBC & PID control, Antilock Breaking system (ABS), Industrial applications.

Books Recommended:

1. Neural Networks - by Simon Haykin
2. Fuzzy logic with engineering application - by ROSS J.T (Tata Mc)
3. Neural Networks & Fuzzy Logic - by Bart Kosko
4. Neural computing theory & practice - by P.D. wasserman (ANZA PUB).
5. Introduction to applied Fuzzy Electronics-Ahmad M.Ibrahim (PHI)
6. Introduction to artificial neural systems - by J.M. Zurada.(Jaico Pub)
7. An introduction to Fuzzy control - by D. Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub.)
8. Fuzzy Neural Control - by Junhong NIE & DEREK LINKERS (PHI)
9. Related IEEE/IEE publications
10. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C.Berkiu & Trubatch, IEEE Press

MTED 203 REAL TIME OPERATING SYSTEM

1. **Fundamentals of Operating Systems:-** Overview of OS services and goals, Various Types of Real Time Operating Systems, Real-time Versus Conventional Operating System. Introduction to Embedded Operating Systems.

2. **Operating Systems Concepts:-** Process and Thread concept, Scheduling, Process Synchronization Mechanisms and Deadlocks, Mutual Exclusion, Memory Management, Paging and Segmentation, File System Management.

3. **Linux Operating system and Architecture:-**Installation, Configuring and Compiling kernel**,** Linux Kernel Internals, Shell Programming, System Call Interface,

Processes and Signal, POSIX thread concepts, IPC Mechanism (Pipes, FIFOs , Semaphore, Shared Memory, Message Queues and Sockets).

4. **Advanced Linux Programming:-** Memory Management, Interrupt Handling, Timers, Introduction to Kernel Module Programming and Device Drivers, Module Concept, Linking a Module to a Kernel.

5. **Real Time Kernels:-** Installation, Configuring and Compiling RTlinux Kernel, Real time FIFO, Creation of RTlinux threads, Inter process communication between RT Task and Linux Process .Getting Started with µC/OS-II and its Concepts, Kernel Structure, Task Management, Time Management, Inter Task Communication & Synchronization. Comparison of VxWorks, eCos, uClinux, Windows CE etc.

REFERENCE BOOKS

1. Abraham Silberschatz Peter B. Galvin, G.Gagne, "Operating System Concepts", 6th Edition, Wesley Publishing
2. Advanced Linux Programming by Mark Mitchell, Jeffery Oldham Techmedia Publication
3. µC/OS-II, The real time Kernel, Jean J. Labrossy, Lawrence: R & D Publications.
4. Charles Crowley, "Operating Systems-A Design Oriented approach", McGraw Hill 1997
5. C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997
6. Tanenbaum, "Distributed Operating Systems", Pearson Education
7. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 1999

MTED 204 COMPUTER ARCHITECTURE

INTRODUCTION TO COMPUTER DESIGN

Review of fundamentals of CPU, Memory and IO – Performance evaluation – Instruction set principles – Design issues – Example Architectures - instruction level parallelism- Pipelining and handling hazards – Dynamic Scheduling – Dynamic hardware prediction – Multiple issue – Hardware based speculation – Limitations of ILP – Case studies.

INSTRUCTION LEVEL PARALLELISM WITH SOFTWARE APPROACHES

Compiler techniques for exposing ILP – Static branch prediction – VLIW & EPIC – Advanced compiler support – Hardware support for exposing parallelism - Hardware versus software speculation mechanisms – IA 64 and ltanium processor.

MEMORY AND I/O

Cache Memory - Cache performance, Reducing cache miss penalty and miss rate, Reducing hit time – Main memory and performance – Memory technology - Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system

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INTERCONNECTION NETWORKS AND CLUSTERS

Simple network - interconnection network media, connecting more than two computers - network topology - practical issues for commercial interconnecting networks – examples - crosscutting issues for interconnecting networks – clusters - designing a cluster fallacies and pitfalls.

MULTIPROCESSORS AND THREAD LEVEL PARALLELISM

Symmetric and distributed shared memory architectures – Performance issues – Synchronization – Models of memory consistency – Multithreading.

BOOKs/REFERENCE

1. A.Kai Hwang, "Advanced Computer architecture", Mcgraw - Hill, Inc 1987
2. Kai Hwang and Faye A.Briggs, "Computer Architecture and Parallel Processing", McGraw-Hill 1989
3. John L.Hennessey and David A.Patterson, "Computer Architecture: A Quantitative Approach", Third Edition, Morgan Kaufmann, 2003
4. D.Sia, T.Fountain and P.Kacsuk, "Advanced computer Architectures: A Design Space Approach", Addion Wesley, 2000

MTED 205ADVANCED MICROCONTROLLERS

- The PIC18 Microcontrollers: History and Features
- PIC18 Architecture & Assembly Language Programming
- Branch, Call, and Time Delay Loop
- PIC18 I/O Port Programming
- Arithmetic, Logic Instructions and Programs
- Bank Switching, Table Processing, Macros, and Modules
- PIC18 Programming in C
- PIC18 Hardware Connection and ROM Loaders
- PIC18 Timer Programming in Assembly and C
- PIC18 Serial Port Programming in Assembly and C
- Interrupt Programming in Assembly and C
- LCD and Keyboard Interfacing
- ADC, DAC, and Sensor Interfacing
- SPI Protocol and DS1306 RTC Interfacing
- Motor Control: Relay, PWM, DC, and Stepper Motors

- Introduction to ARM and AVR 8515 microcontroller: Architecture and Programming in assembly and C

BOOKs/REFERENCE

1. Daniel Tabak, "Advanced Microprocessors", McGraw Hill. Inc., 1995
2. James L. Antonakos, "The Pentium Microprocessor", Pearson Education, 1997
3. Steave Furber, "ARM system - on - chip architecture", Addison Wesley, 2000
4. John.B..Peatman, "Design with PIC Micro controller", Pearson Education, 1988
5. Gene. H.Miller, "Micro Computer Engineering", Pearson Education, 2003
6. James L Antonakos, "An Introduction to the Intel family of Microprocessors", Pearson Education, 1999
7. Barry B.Breg,, "The Intel Microprocessors Architecture, Programming and Interfacing", PHI, 2002

MTED 206 Lab-Real Time Operating System

1. Create processes using different system calls like fork, exec, wait etc. Develop program for a Orphan and Zombie process.
2. Develop programs to create threads, passing data to threads, joining threads and using thread attributes.
3. Develop programs to interface system call.
4. Develop programs to use different IPC's- Pipes, Message Queues, FIFO and Sockets
5. Develop programs to use different synchronization techniques – Semaphore, Shared Memory, Mutex.
6. Write Device Driver modules that registers a character device with major no and with File Operations -Open, Release, Read, Write etc.
7. Develop programs to implement Realtime FIFO.
8. Using socket program develop a simple file transfer programs.
9. Write programs to determine CPU usage in a multitasking environment in µCOS-II.
10. Develop programs to demonstrate stack- checking feature of µCOS-II

MTED 207ADVANCED MICROCONTROLLERS LAB

- Simple programs for sorting a list of numbers in ascending and descending order.
- Sorting a list without destroying the original list.
- Code conversion - Binary to Gray/Gray to Binary.
- Program for addition of BCD numbers.
- Interface an LED array and 7-segment display
- Interfacing of PIC18 with LCD
- Interfacing of PIC18 with Keyboard Interfacing

- Interfacing of PIC18 withADC, DAC
- Interfacing of PIC18 with temperature Sensor
- Interfacing of PIC18 with DS1306 RTC
- Interfacing of PIC18 with DC Motor Control
- Interfacing of PIC18 with Stepper Motors

SEM 3								
Course Code	Course Title	Load Allocation				Marks Distribution		
		L	T	P	Total	Internal	External	Total
MTED 301	Electronic Instrumentation Technology	3	1	0	4	50	100	150
MTED 302	System On Chip	3	1	0	4	50	100	150
MTED 303	RF Design	3	1	0	4	50	50	150
MTED 304	ThesisSeminar*	0	0	10	10	50	100	150
Grand total		6	2	10	18	150	300	600

M. Tech. Embedded System Design

SEM 4					
Subject Code	Subject	Schedule of Teaching			
		L	T	P	Total
MTED 401	Thesis*	0	0	28	28

* The students will complete their Thesis work and submit copies of the Thesis report to the University as per its existing procedures. The Internal and External Examiners appointed by the University will evaluate the same through a Viva-voce examination and award **Distinction / Pass / Fail** to the Thesis.

MTED 301 ELECTRONIC INSTRUMENTATION TECHNOLOGY

- **OVERVIEW**

This module covers modern sensors and advanced measurement systems for a diverse range of applications. The students are familiarized with various sensors and sensor technologies, data acquisition and display technologies, so as to enable them to make optimal decisions in product design. Several advanced cutting edge instrumentation technologies like sensor networks, sensor fusion, advanced display technologies, etc. are covered from design and applications point of view.

- **MEASUREMENT TERMINOLOGY**:

Input and output, range, accuracy, precision, resolution, sensitivity, linearity, repeatability, reproducibility, calibration and traceability, Testing, quality assurance and safety.

- **TRANSDUCERSANDSENSORS**.

Sensors and transducers: Temperature sensors, resistive sensors, capacitive sensors, electrostatic sensors, piezoelectric sensors, ultrasonic sensors, radiological sensors and MEMS. Optical sensing techniques: Common electromagnetic sensors, IR sensors, passive

IR sensors, photo-resistive sensors, photovoltaic sensors, photodiodes, photoelectric detectors, solid state lasers. CCD and CMOS sensors.

- **DATA ACQUISITION :**

Signal conditioning: concepts, amplifiers and filters. Analog to digital conversion. Systems and considerations in Analog and digital data acquisition systems. multiplexers / de-multiplexers. Concepts of signal Transmission and telemetry. System interfacing : serial and parallel interfacing. OSI network model. Interfacing standards- UART (RS232), USB, RS485, GPIB, Ethernet and Fieldbus.

- **DISPLAY SYSTEMS**

Recorders and data loggers. Indicating instruments. Digital display methods and devices: segmental displays, Dot matrix, LED, LCD, projection devices, CRT .

- **EMERGING TOPICS:**

Introduction to sensor networks, sensor fusion, soft and intelligent sensors. System on module. Virtual instrumentation. Intelligent instrumentation. Fault tolerance.

Real time systems : introduction, reference model, scheduling approaches. Real time operating systems.

BOOKS:

1. Measurement systems - Application and design by Ernest O. Doebelin , McGraw-Hill.
2. Electronic instruments and instrumentation technology by MMS Anand, Prentice-Hall, India.
3. Electrical and electronic measurements and instrumentation, by AK Sawhney and Puneet Sawhney, Dhanpat Rai & Sons.

MTED 302 SYSTEM ON CHIP (SOC)

- System on Chip Technology Challenges
- System On a Chip (SOC) components.
- SoC Design Methodology
- Parameterized Systems-on-a-Chip
- System-on-a-chip Peripheral Cores
- SoC and interconnect centric Architectures
- System level design representations and modeling languages.
- Target architecture models.
- Intra-chip communication.
- Graph partitioning algorithms.
- Task time measurement.
- Interconnect latency modeling.
- Back annotation of lower level timing to high-level models.
- Synthesis of SOC components.
- System Level, Block Level and Hardware/Software Co-verification
- SOC components: emulation, co-simulation, Physical Verification.

BOOKS/REFERENCES

- Wayone Wolf," Modern VLSI Design: SOC Design"
- Prakash Rashnikar, Peter Paterson, Lenna Singh" System-On-A-Chip Verification methodlogy & Techniques", Kluwer Academic Publishers.
- Alberto Sangiovanni Vincentelli," Surviving the SOC Revolution: A Guide to Platformbased Design", Kluwer Academic Publishers.

MTED 303RF DESIGN

- Introduction to RF Electronics.
- Basic concepts in RF design.
- MOS Review
- Path Loss
- Small Signal Model
- Receiver Design
- RF Transreceivers
- Low Noise RF amplifiers and Mixers.
- RF Power amplifiers.
- RF Oscillators.

Text/References

- Behzad Razavi, "RF Microelectronics", Pearson Education.
- Reinhold Ludwig, Paul Bretchko,"RF Circuit Design: Theory & Applications "
- Peter b. Kenington, "High Linearity RF Amplifier Design ", Artech House MicrowaveLibrary.
- Jeremy Everard, "Fundamentals of RF Circuit Design With Low Noise Oscillators",
- John Wiley & Sons Ltd.