Evaluation Scheme & Syllabus for

Master of Technology

(Electronics Design and Technology)

(Effective from the Session: 2019-20)
# COURSE AND EXAMINATION SCHEME

## M.Tech (Electronics Design and Technology) Regular Semester I

<table>
<thead>
<tr>
<th>S. N</th>
<th>Course Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Credit</th>
<th>Evaluation Scheme</th>
<th>Subject Total</th>
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### Semester IV

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### POWER ELECTRONICS SYSTEM DESIGN:
Characteristics & protection of power devices such as - GTOs, IGBTs, RCTs, MCTs, SITHs, LASCRs, MOSFET, Solar Renewable energy systems, Design of Transformers, selection of core material, insulating material and wires, Design of high frequency transformer, Design of inductors, Linear power supply, Switch Mode Power Supplies, Converter topology - buck, boost, buck-boost, derived converter topologies, flyback converter, forward converter, push-pull converter, half Bridge converter, full Bridge converter, special converters, PWM control techniques, study of PWM control ICs and driver IC’s, design of base drive circuits, design of input section, output section & control section, protection circuit design for power supplies, design concept of uninterrupted power supplies, CVT.

### RECOMMENDED BOOKS:
- **Rashied**, Power Electronics Circuit Device and Application.

### DESIGN OF DIGITAL SYSTEMS:
Introduction to Digital design; Variable entered mapping (VEM), plotting theory and reading theory, minimizing function of more than six variables, Hierarchical design, controller (FSM), case study, FSM issues, timing issues, pipelining, resource sharing, testability, synchronization, fault analysis in combinational circuit, setup/hold time of various types of flip-flops, synchronization between multiple clock domains, reset
recovery, proper resets. VHDL: different models, simulation cycles, process, concurrent and sequential statements, loops, delay models, library, packages, functions, procedures, coding for synthesis, test bench. FPGA: logic block and routing architecture, design methodology, special resources, programming FPGA, constraints, timing closure, case study.

RECOMMENDED BOOKS:
• Skahil, K., VHDL For Programmable Logic 1st Edition, Pearson, 2004
• J. Bhasker, VHDL Primer
• David Pellerin, Edward A. Thibault Ph.D, Practical FPGA Programming in C 22 Apr 2005

MDT-103 ELECTRONICS PRODUCT DESIGN:
Introduction to Industrial Design, the design process, product design methodology, product planning, anatomy of design process, Aesthetics, Elements of design, Ergonomics, ergonomic issues in designing electronic products, design of controls, design of display. Ergonomics & Aesthetics consideration for development of control panel, Engineering considerations for Control panel layouts, layout of components, control mountings, structural design, Overview of PCB design, general considerations for PCB layout, rules and parameters, Design rules for analog circuit PCB, Design rules for digital circuit PCB, Design rules for PCBs

RECOMMENDED BOOKS:
• Dan Cuffaro, Isaac Zakensenberg, The Industrial Design 2013
• A.K. Chitale, R.C. Gupta, Product design and manufacturing, Prentice, Hall of India.
• Kevin Otto, Kristin Wood, Product Design.

MDT-104 ELECTROMAGNETIC & RADIO FREQUENCY INTERFERENCE COMPATIBILITY SYSTEM DESIGN:

RECOMMENDED BOOKS:
• Henry W. Ott, Electromagnetic Compatibility Engineering August 2009
• Donald R. White, Electromagnetic Interference and Compatibility Jun 1981
MDT-201  ANALOG AND DATA CONVERSION SYSTEMS:
Linear IC applications, Design and error budget analysis of signal conditioners for low level ac and DC applications. Analog to digital and digital to analog converters. SHA and analog multiplexers, Signal Conditioners with Instrumentation Auto-zero/chopper/isolation/charge amplifier, scaling & level shifting circuits, V to F & F to V converters, V to I & I to V converters. Design of analog circuits for capacitive and inductive transducers. Data transmission, General requirements, types of transmission, EIA standards in circuits design.

RECOMMENDED BOOKS:
- DE Pippenger & EJ Tobuben, Linear & Interface Circuits Applications, Mc Graw Hill

MDT-202  EMBEDDED SYSTEM DESIGN:
Concept of embedded system design, embedded computing, RISC architecture, embedded software development, S/W Development environment – Cross Compiler, Linker, Debugger, Stand-alone systems. Introduction to ARM and Cortex architecture and ARM/THUMB instruction set, Memories, Interfacing memory with processor, Different Peripheral devices. Clocks and Power Management, Embedded system development process, Determine the requirements, Design the system architecture, Choose the operating system, Choose the processor, development platform and programming language, Testing and debugging.

RECOMMENDED BOOKS:
- The Definitive Guide to the ARM Cortex-M3, (2nd Edition), Newnes (imprint of Elsevier), 2009
- Devid E Simon, An Embedded software primer, Pearson education Asia, 2001

MDT-203  VLSI DESIGN:
Basic electrical properties of MOS and Bi-CMOS circuits: MOS transistor operation in linear and saturated regions, MOS transistor threshold voltage, MOS switch and inverter, Bi-CMOS inverter, latch-up in CMOS inverter, inverter properties, Stick Diagram & Lay out - λ-rules, System Design - FSM - Model, ASM Chart. ASIC design flow, Partitioning, Floor planning, Placement, Routing, Field Programmable Gate Arrays (FPGA)
RECOMMENDED BOOKS:
- CMOS digital integrated circuits by Kang and Leblibici, TATA McGRAW HILL.

MDT-204 RELIABILITY OF ELECTRONIC EQUIPMENTS:
Introduction to concepts of reliability, nature of reliability problems in electronic equipment, series configuration, Parallel Configuration, Mixed Configuration, Methods of Solving Complex Systems, Mean Time to Failure (MTTF) and Mean Time between Failure (MTBF) of Systems, Maintainability, Availability Concepts, System Downtime, Mean time to Repair (MTTR), Trade Off, Reliability Improvement, Improvement of Components, Redundancy, element Redundancy, Unit Redundancy, Standby Redundancy, Reliability Prediction, Similar Equipment Techniques, Similar Complexity Techniques, Similar Function Techniques, Part Count Techniques, Part Stress Analysis Techniques, Fault Analysis Techniques, System Safety Analysis, Failure Modes and Effects Analysis, Fault Tree Analysis- Concepts and Procedures, Rules for Fault Tree Construction, Reliability Calculation through Fault Tree.

RECOMMENDED BOOKS:
- Dr. R.K. Aggarwal, Reliability Engineering
- Dr. A.K. Govil, Reliability Engineering
- L.S. Srinath: Reliability Engineering, 3rd ed. East-West Press,

ELECTIVE PAPERS 1

E-01 3D PRINTING & REVERSE ENGINEERING

RECOMMENDED BOOKS:
E-02 DESIGN OF PHOTOVOLTAIC SYSTEM:
Introduction to photovoltaic energy conversion, Solar radiation and measurement, Solar cell and their characterization, Influence of insolation and temperature, Maximum power point tracking, Electrical storage with Batteries, controllers, DC power conditioning, AC power conditioners for grid connection, Solar power drives, Applications for pumping/refrigeration, Economic analysis of PV system, Energy analysis of PV system.

RECOMMENDED BOOKS:

E-03 WIRELESS COMMUNICATION:
Wireless Communication Systems, Evolution of mobile radio communications; the cellular concept; frequency reuse; channel assignment strategies; handoff strategies; interference and system capacity; improving capacity in cellular systems. Mobile Radio Propagation, free space propagation model; basic propagation mechanisms; outdoor propagation models; indoor propagation models . Frequency modulation vs. amplitude Modulation; amplitude modulation; angle modulation, digital modulation; BPSK, DPSK, QPSK; RAKE Receiver; characteristics of speech signals; quantization techniques; adaptive differential pulse code modulation; linear predictive coders; FDMA; TDMA; Wireless Networking, fixed network transmission hierarchy; traffic routing in wireless networks; wireless data services.

RECOMMENDED BOOKS:
- Andreas F. Molisch, Wireless Communications, 2nd Edition

E-04 ADVANCE DIGITAL SIGNAL PROCESSING:

RECOMMENDED BOOKS:
ELECTIVE PAPERS 2

E-01 OPTICAL FIBER COMMUNICATION
Introduction to EM theory, wave propagation in conductors & Dielectrics, boundary conditions.

**Optical fibers**: Dielectric slab waveguides, optical fiber structures, optical fiber modes & configurations, mode theory for circular waveguides, single mode fibers, manufacturing of optical fibers & cables.

**Signal degradation in optical fibers**: Attenuation, dispersion-intramodal & intermodal, Design optimization of SM fibers.

**Optical Sources**: Light Emitting diodes, Laser diodes, reliability consideration, Materials, performance parameters and specifications.

**Power Launching and Coupling**: Source to fiber power launching, Lensing schemes for coupling improvement, Fiber to Fiber joints, LED coupling to single mode fibers, fiber splicing, optical fiber connectors.

**Photodetector**: Physical principles of photodiode- PIN, APD performance parameters and specifications.

**Optical phenomena**: Wave propagation in isotropic media, in crystals, Birefringence, Linear & quadratic Electro-Optic effect, Acousto-optic effect, Magneto-Optic devices, nonlinear optics.


**Optical Fiber Sensors**: Multimode passive, Multimode active, single mode fiber sensors.

RECOMMENDED BOOKS:
- Gerd Keiser (McGraw Hill), Optical Fiber Communication
- John Gowar (PHI 1993), Optical Communications System
- Pallale Bhattacharya, Semiconductor Optoelectronic Devices. Prentic Hal of India (EEE), 1995 Edition:
- J.wilson-J.F.B. Hawkes “ Opto Electronics, an Introduction”

E-02 ELECTRONIC SYSTEM PACKAGING:
Electronic systems and needs, physical integration of circuits, packages, boards and complete electronic systems; system applications like computer, automobile, medical and consumer electronics with case studies and packaging levels. Electrical design considerations – power distribution, signal integrity, RF package design and Power delivery in systems. CAD for Printed Wiring Boards (PWBs) and Design for Manufacturability (DFM). PWB Technologies, Single-chip (SCM) and Multi-chip modules (MCM), flex circuits. Recent trends in manufacturing like microvias, sequential build-up circuits and high-density interconnect structures. Materials and processes in electronics packaging, joining methods in electronics; lead-free solders. Surface Mount Technology– design, fabrication and assembly. Embedded passive components; thermal management of PWBs, thermo-mechanical reliability, design for reliability, electrical test and green packaging issues.

RECOMMENDED BOOKS:
- Prof. G.V. Mahesh, An Introduction to Electronics Systems Packaging.
E-03 DESIGN OF CONTROL FOR RENEWABLE ENERGY SYSTEM OPTIMIZATION:
Introduction, fundamentals of automatic control, automatic control principle, design aspects of proportional, integral, derivative and PID controllers and their tuning. Advance control techniques: batch, cascade, ratio, feed forward, adaptive and their applications to industry. Design aspects of digital control system. Case study on process control systems i.e. sugar, fertilizer, steel, power and chemical industries.

RECOMMENDED BOOKS:
- Donald P. Eckman, "Automatic Process Control", Willey Eastern Ltd.
- Patranabis, Automatic Process Control

E-04 EMBEDDED IOT SYSTEM DESIGN:
Rise of embedded systems and their transition to intelligent systems and to Internet of Things - RFID, NFC, Web of Things - Network of interconnected and collaborating objects. Embedded systems architecture: Key hardware and software elements, typical embedded processors like ATOM. Low power and very low power embedded systems, peripherals and sensors in embedded systems, peripheral interfacing - SPI and I2C, Hardware and software protocol stacks - MAC, Routing and application layers, performance considerations. Embedded Systems Design: Partitioning to hardware and software; principles of co-design; performance of these systems estimation of speed, throughput, power and energy consumption; hardware design elements design, validation, and testing tools; software platforms OS and applications, code optimization, validation and robust code generation; system integration, debugging and test methodology; tools for coding, debugging, optimization, and documentation; measurement of system performance, Linux distributions for embedded systems using tools from Yocto project; Creating virtual prototypes - hardware software emulation. Applications: Healthcare and home automation examples.

RECOMMENDED BOOKS:
- Wolf, M., Computers as components Third edition, Morgan Kaufmann, 2012
- Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, 8 Nov 2013
- Cuno Pfister, Getting Started with the Internet of Things, 17 May 2011