IK GUJRAL PUNJAB TECHNICAL UNIVERSITY

Scheme and Syllabus of Master of Technology (EMBEDDED SYSTEMS)

Batch 2016
<table>
<thead>
<tr>
<th>Course Code</th>
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S-Satisfactory, US- Unsatisfactory
LIST OF ELECTIVES

**Elective-I**
MTED-205 Advanced Computer Architecture
MTED-206 Advanced Digital Signal Processing
MTED-207 Embedded System for Wireless and Mobile Communication System

**Elective-II**
MTED 208 Sensor Technology and MEMS
MTED 209 Soft Computing
MTED 210 Advanced Sensor and Actuators

**Elective-III**
MTED-304 Digital Image Processing
MTED-305 Industrial Automation
MTED-306 Embedded Wireless Sensor Networks
MTED-307 Cryptology and Crypto Chip Design

**Elective-IV**
MTED-308 System on Chip
MTED-309 Hardware and Software Co-Design
MTED-310 Medical Electronics and Instrumentation
MTED-311 Autotronics
METHODS OF RESEARCH: Nature and Objectives of research; historical, descriptive and experimental. Study and formulation of research problem. Scope of research and formulation of hypotheses; Feasibility, preparation and presentation of research proposal.

INTRODUCTION TO STATISTICAL ANALYSIS: Measures of central tendency and dispersion: mean, median, mode, range, mean deviation and standard deviation. Regression and correlation analysis. Probability and probability distributions; Binomial, Poisson, Geometric, Negative binomial, Uniform, Exponential, Normal and Log-normal distribution. Basic ideas of testing of hypotheses; Tests of significance based on normal, t and Chi-square distributions. Analysis of variance technique.

DESIGN OF EXPERIMENTS: Basic principles, study of completely randomized and randomized block designs. Edition and tabulation of results, presentation of results using figures, tables and text, quoting of references and preparing bibliography. Use of common softwares like SPSS, Mini Tab and/or Mat Lab. For statistical analysis.

BOOKS RECOMMENDED:

MTED-102 ADVANCED DIGITAL SYSTEM DESIGN

Internal Marks: 50
External Marks: 100
Total Marks: 150

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

ASYNCHRONOUS SEQUENTIAL CIRCUIT: Analysis & Synthesis of asynchronous digital circuits, State Reduction, State Assignment, Hazards.


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 RECOMMENDED:

- Fletcher., *Digital Design Principles*
- J. Bhasker, *VHDL Primer*, Pearson Education.
- Charles H. Roth, *Digital System Design Using VHDL*, CL Engineering
- John Wakerley, *Digital System Design*, Patience Hall
- Zainalabedin Navabbi, *VHDL*, McGraw Hill Education
MTED-103 DATA COMMUNICATION NETWORK

Internal Marks:  50  
External Marks:  100  
Total Marks:  150


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 LAYER: Simple Mail Transfer Protocol (SMTP), File Transfer Protocols (FTP), telnet, World Wide Web (WWW), Hypertext Transfer Protocol (HTTP), Domain name service (DNS), Security, Multimedia applications like VOIP and Teleconferencing.

BOOKS RECOMMENDED:

MTED-104 SOFTWARE TECHNOLOGY

Internal Marks: 50  L T P
External Marks: 100
Total Marks: 150


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.

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.

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.

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.


BOOKS RECOMMENDED:

MTED-105 DESIGNING WITH POWER DEVICES

Internal Marks: 50
External Marks: 100
Total Marks: 150

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, Push-pull, 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.

BOOKS RECOMMENDED:

- George Chryssis, High frequency switching power supplies: theory & design, McGraw Hill Book Co. 1984 (Text)
- K.Kitsum, Switch mode power conversion –basic theory and design, Marcel Deckker Inc 1984.
MTED-106 LAB - I

Module 1

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.

Module 2

1. Design and Implementation of following features in Counter:-Counter with Asynchronous reset & clear signal, Synchronous Counter, Mod 10 Counter, FSM.
2. Design and Implementation of ALU with following features:-Addition,
3. Subtraction, Multiplication, Division, Square, Factorial, AND, OR, EXOR, EXNOR, Increment, Decrement, 1”s Complement, 2”s Complement etc.
4. Design and Implementation of 8 X 8 Key board controller.
5. 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.
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 VLSI/IIW architecture, application specific instruction set processors (ASIPS), microcontrollers, digital signal processors, selecting a microprocessor.

MEMORY: Introduction, Memory writes ability, Storage performance, Tradeoffs, Common memory types, Memory hierarchy and cache.


DIFFERENT PERIPHERAL DEVICES: Buffers and latches, Crystal, Reset circuit, Chip select logic circuit, timers and counters and watchdog 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 RECOMMENDED:

- Dreamteach Software team, *Programming for Embedded Systems*, AVR 8515 manual
- J.W. Valvano, *Embedded Microcomputer System: Real Time Interfacing*
MTED-202 REAL TIME OPERATING SYSTEM

Internal Marks: 50
External Marks: 100
Total Marks: 150


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).

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


Real Time Kernel: Installation, Configuring and Compiling RT linux Kernel, Real time FIFO, Creation of RT linux threads, Inter process communication between RT Task and Linux Process.

BOOKS RECOMMENDED:

- Mark Mitchell, Jeffery Oldham, Advanced Linux Programming, Techmedia Publication
- Jean J. Labrossy, μC/OS-II, The real time Kernel, Lawrence: R & D Publications.
- Tanenbaum, Distributed Operating Systems, Pearson Education
- Raymond J.A.Bhur, Donald L.Bailey, An Introduction to Real Time Systems, PHI 1999
MTED-203 ADVANCED MICROPROCESSOR AND CONTROLLER

Internal Marks: 50
External Marks: 100
Total Marks: 150


BOOKS RECOMMENDED:

- Andrew N. Sloss, Donimic Symes, Chris Wright, *ARM System Developer’s Guide*
- Steave Furber, *ARM system - on - chip architecture*, Addison Wesley, 2000
MTED-204 LAB - II

Internal Marks: 100
Total Marks: 100

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0  0  4

1. Simple programs for sorting a list of numbers in ascending and descending order.
2. Sorting a list without destroying the original list.
3. Code conversion - Binary to Gray/Gray to Binary.
4. Program for addition of BCD numbers.
5. Interface an LED array and 7-segment display
6. Interfacing of PIC18 with LCD
7. Interfacing of PIC18 with Keyboard Interfacing
8. Interfacing of PIC18 with ADC, DAC
9. Interfacing of PIC18 with temperature Sensor
10. Interfacing of PIC18 with DS1306 RTC
11. Interfacing of PIC18 with DC Motor Control
12. Interfacing of PIC18 with Stepper Motors
MTED-205 ADVANCED COMPUTER ARCHITECTURE

Internal Marks: 50

External Marks: 100

Total Marks: 150


INSTRUCTION LEVEL PARALLELISM: The Hardware Approach: Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo’s approach, Branch prediction, High performance instruction delivery- Hardware based speculation. ILP Software Approach: Basic compiler level techniques, Static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues - Hardware verses Software.

MULTI PROCESSORS AND THREAD LEVEL PARALLELISM: Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared memory architecture, Synchronization.


BOOKS RECOMMENDED:

MTED-206 ADVANCED DIGITAL SIGNAL PROCESSING

Internal Marks: 50
External Marks: 100
Total Marks: 150


DESIGN OF DIGITAL FILTERS: Introduction to filter design, types of digital filters, choosing between, fir and iir filters, filter design steps, effect of finite register length in filter design, realization of IIR digital filters and FIR digital filter, design of iir filters from continuous time filters, design of fir filters by windowing.


LINEAR ESTIMATION AND PREDICTION: Maximum likelihood criterion efficiency of estimator, least mean squared error criterion, recursive estimators, and linear predications.

MULTIRATE DIGITAL SIGNAL PROCESSING: Mathematical description of change of sampling rate, interpolation and decimation, continuous time model, direct digital domain approach, interpolation and decimation by an integer factor, single and multistage realization, applications of sub band coding.


DSP CHIPS: Introduction to fixed point and floating point processors, ADSP21xx and TMS320Cxx-Architecture, Memory, Addressing Modes, Interrupts, Applications. Comparison of ADSP21xx and TMS320Cxx series.

BOOKS RECOMMENDED:

- Proakis, Manolakis, *Digital Signal Processing principles, algorithms, and applications*, Prentice Hall India.
- ADSP 2181 manuals
INTRODUCTION TO WIRELESS TECHNOLOGIES: WAP services, Serial and Parallel Communication, Asynchronous and synchronous Communication, FDM, TDM, TFM, Spread spectrum technology.

INTRODUCTION TO BLUETOOTH: Specification, Core protocols, Cable replacement protocol

BLUETOOTH RADIO: Type of Antenna, Antenna Parameters, Frequency hoping


PROGRAMMING WITH JAVA: Java Programming, J2ME architecture, Javax. bluetooth package Interface, classes, exceptions, Javax. obex Package: interfaces, classes Bluetooth services registration and search application, bluetooth client and server application, Overview of IrDA, Home RF, Wireless LANs, JINI

BOOKS RECOMMENDED:

- Rappaport, *Wireless communication*, Pearson
- Schiller, *Mobile communication*, Pearson

MICROMACHINING TECHNIQUES: Introduction to Bulk Micromachining, Isotropic and Orientation-Dependent Wet Etching, Dry Etching, Buried Oxide Process, Silicon Fusion Bonding, Sacrificial Layer Technology, Surface Micromachining using Plasma Etching, Combined IC Technology and Anisotropic Wet Etching, Processes Using Both Bulk and Surface Micromachining, Adhesion Problems in Surface Micromachining, Surface Versus Bulk Micromachining

SMART SENSORS AND MODELING: Introduction to Smart Sensors, Integrated Smart sensors and smart systems, MEMS and NEMS devices, Elastic structures in MEMS and NEMS, Modeling of Thermal Elastic systems, Electrostatic- elastic systems, magnetically actuated systems, Microfluidics (Membrane Pumps, Nanolithography, Nano jets)

BOOKS RECOMMENDED:

- Vikas Choudhary and Krzysztof Iniewski, *MEMS Fundamental Technology and Applications*, CRC press
- K.D. (Guest Editor), *Integrated Sensors, Micro p-actuators and micro-systems*
MTED-209 SOFT COMPUTING

Internal Marks: 50  L  T  P
External Marks: 100  3  1  0
Total Marks: 150


SUPERVISED LEARNING: Basic hop field model, the perceptron, linear reparability, Basic learning laws, Hebb’s rule, Delta rule, Widroff and Huff LMS learning rule, correlation learning rule, In star and out star learning rules. Unsupervised learning, competitive learning, K mean clustering algorithm, Kolwner’s feature maps

RADIAL BASIS FUNCTION: Basic learning laws in RBF network, recurrent networks, recurrent back propagation, Real time recurrent learning algorithm.


BOOKS RECOMMENDED:

- Kosko B, *Neural Networks and Fuzzy Logic*, Prentice Hall
- Haykin S, *Neural Networks*, Pearson Education
- Anderson JA, *An Introduction to Neural Networks*, Prentice Hall
- Sivanandam S and Deepa SN, *Principles of Soft Computing*, Wiley India
MEASUREMENT TERMINOLOGY: Input and output, range, accuracy, precision, resolution, sensitivity,linearity, repeatability, reproducibility, calibration and traceability, Testing, quality assurance and safety.

TRANSDUCERS AND SENSORS: 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.


BOOKS RECOMMENDED:

MTED-304 DIGITAL IMAGE PROCESSING

Internal Marks: 50  L  T  P
External Marks: 100  3  1  0
Total Marks: 150

FUNDAMENTALS OF IMAGE PROCESSING: Introduction, Steps in image processing systems, Image acquisition, Sampling and Quantization, Pixel relationships, Color fundamentals and models, File formats, Image operations, Arithmetic, Geometric and Morphological.


IMAGE SEGMENTATION AND FEATURE ANALYSIS: Detection of Discontinuities, Edge operators, Edge linking and Boundary Detection, Thresholding, Region based segmentation, Morphological Watersheds, Motion Segmentation, Feature Analysis and Extraction.


APPLICATION OF IMAGE PROCESSING: Image classification, Image recognition, Image understanding, Video motion analysis, Image fusion, Steganography, Digital compositing Mosaics, Colour Image Processing

BOOKS RECOMMENDED:

MTED-305 INDUSTRIAL AUTOMATION

Internal Marks: 50  
External Marks: 100  
Total Marks: 150

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COMPUTER BASED CONTRO: Implementing control system using computer or microprocessor; computer based controller: hardware configuration and software requirements.

DISTRIBUTED CONTROL SYSTEM: Meaning and necessity of distributed control; hardware components of DCS; DCS software.

INTRODUCTION PROGRAMMABLE LOGIC CONTROLLER (PLC): What is PLC? PLC versus microprocessor/microcontroller/computer, advantages and disadvantages of PLC, architecture and physical forms of PLC

BASIC PLC FUNCTIONS: Registers: holding, input and output registers; Timers and timer functions; counters and counter functions

INTERMEDIATE PLC FUNCTIONS: Arithmetic functions: addition, subtraction, multiplication, division and other arithmetic functions; Number comparison and conversion.

DATA HANDLING FUNCTIONS OF PLC: Skip function and applications; master control relay function and applications; jump with non-return and return; data table, register and other move functions.

BIT FUNCTIONS OF PLC: Digital bit functions and applications; sequencer functions and applications.

ADVANCED FUNCTIONS OF PLC: Analog input and output functions, analog input and output modules, analog signal processing in PLC; PID control function, network communication function.

PLC PROGRAMMING: PLC programming languages, ladder programming, mnemonic programming and high level language programming.

SCADA: Supervisory control versus distributed control; Layout and parts of SCADA system, detailed block schematic of SCADA system; Functions of SCADA system: data acquisition, monitoring, control, data collection and storage, data processing and calculation, report generation; MTU: functions, single and dual computer configurations of MTU; RTU: functions, architecture / layout; MTU-RTU communication and RTU-field device communication.

BOOKS RECOMMENDED:

- Webb JW and Reis RA, *Programmable Logic Controllers*, Prentice Hall
- Boyer SA, *Supervisory Control and Data Acquisition (SCADA)*, International Society of Automation
MTED-306 EMBEDDED WIRELESS SENSOR NETWORKS

Internal Marks: 50  
External Marks: 100  
Total Marks: 150


MAC PROTOCOLS FOR SENSOR NETWORKS:  Location Discovery-Quality of Sensor Networks-Evolving Standards-Other Issues- Low duty cycle and wake up concepts- The IEEE 802.15.4 MAC Protocols Energy Efficiency


BOOKS RECOMMENDED:

- C.S.R. Prabhu and A.P. Reddi, Bluetooth Technology; PHI
- Rappaport, Wireless communication, Pearson
- Schiller, Mobile communication, Pearson
- C.Y.Lee, Mobile communication, McGraw Hill.
MTED-307 CRYPTOLOGY AND CRYPTO CHIP DESIGN

Internal Marks: 50
External Marks: 100
Total Marks: 150

L T P
3 1 0


Encryptions Techniques: Conventional techniques, Modern techniques, DES, DES chaining, Triple DES, RSA algorithm, Key management, Message Authentication and Hash Algorithm: Authentication requirements and functions secure Hash Algorithm, NDS message digest algorithm, digital signatures, Directory authentication service


BOOKS RECOMMENDED:

MTED-308 SYSTEM ON CHIP

Internal Marks: 50  
External Marks: 100  
Total Marks: 150


MEMORY DESIGN FOR SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor–memory interaction.


VERIFICATION: System Level, Block Level and Hardware/Software Co-verification, SOC components: emulation, co-simulation, Physical Verification.

APPLICATION STUDIES / CASE STUDIES: AES algorithms, Image compression, VOIP, antenna for SOC etc

BOOKS RECOMMENDED:

MTED-309 HARDWARE AND SOFTWARE CO-DESIGN

Internal Marks: 50  
External Marks: 100  
Total Marks: 150


COMPILATION TECHNIQUES AND TOOLS FOR EMBEDDED PROCESSOR ARCHITECTURES: Modern embedded architectures, embedded software development needs, compilation technologies, practical consideration in a compiler development environment.

DESIGN SPECIFICATION AND VERIFICATION: Design, co-design, the co-design computational model, concurrency coordinating concurrent computations, interfacing components, design verification, implementation verification, verification tools and interface verification.

LANGUAGES FOR SYSTEM: Level Specification and Design-I: System – level specification, design representation for system level synthesis, system level specification languages, Languages for System – Level Specification and Design-II: Heterogeneous specifications and multi-language co-simulation, the cosyma system and lycos system.

BOOKS RECOMMENDED:

MTED-310 MEDICAL ELECTRONICS AND INSTRUMENTATION

Internal Marks: 50  L  T  P
External Marks: 100  3  1  0
Total Marks: 150

HUMAN BODY SUBSYSTEMS: Brief description of neuronal, muscular, cardiovascular and respiratory systems; their electrical, mechanical and chemical activities.

CARDIOVASCULAR SYSTEM: Measurement of blood pressure, blood flow, cardiac output, cardiac rate, heart sounds; Electrocardiograph, Phonocardiograph, Plethysmograph.

RESPIRATORY SYSTEM: Measurement of gas volume, flow rate, carbon-dioxide and oxygen concentration in exhaled air.

ELECTRICAL ACTIVITY IN NEUROMUSCULAR SYSTEM AND BRAIN: Neuron potential, muscle potential, electromyography, brain potentials, electroencephalograph.

MEDICAL IMAGING: Fundamentals of imaging, Computed tomography, MRI, Nuclear Medicine, Singlephoton emission computed tomography, PET, Ultrasonography, Electrical Impedance, Tomography.

MEDICAL SAFETY: Electrical Safety, Electrical safety codes and standards; Radiation safety, Chemical safety, Biological safety, Fire and explosive safety, Environmental Safety.


BOOKS RECOMMENDED:

- Webster JG (Ed.), Medical Instrumentation, Application and Design, Wiley India
- Carr JJ and Brown JM, Introduction to Biomedical Equipment Technology, Pearson Education
- Waugh A and Grant A, Ross and Wilson Anatomy and Physiology in Health and Illness, Elsevier
- Webster JG (Ed.), Encyclopedia of Medical Devices and Instrumentation, Vols. 1-4, Wiley
- Bronzino JD (Ed.), The Biomedical Engineering Handbook, CRC Press
MTED-311 AUTOTRONICS

Internal Marks: 50
External Marks: 100
Total Marks: 150

L T P
3 1 0

FUNDAMENTAL OF AUTOMOTIVE ELECTRONICS: Current trends in modern automobiles, Open loop and closed loop systems, Components for electronic engine management, Electronic management of chassis system, Vehicle motion control.

SENSORS AND ACTUATORS: Introduction, basic sensor arrangement, types of sensors such as - oxygen sensors, Crank angle position sensors - Fuel metering / vehicle speed sensor and detonation sensor - Altitude sensor, flow sensor. Throttle position sensors, solenoids, stepper motors, and relays.

ELECTRONIC FUEL INJECTION AND IGNITION SYSTEMS: Introduction, Feed back carburetor systems (FBC) Throttle body injection and multi-port or point fuel injection, Fuel injection systems, injection system controls, Advantages of electronic ignition systems, Types of solid state ignition systems and their principle of operation, Contact less electronic ignition system, Electronic spark timing control.

AUTOMOTIVE ELECTRIC AND ELECTRONIC SYSTEMS: Electrical circuit components: wiring circuits, Printed circuits circuit breaker, symbols and wiring diagrams, Basic electrical Diagnosis and tests.

LIGHTS, SAFETY, DRIVER INFORMATION AND CONTROL DEVICES: Fiber-optic and Computer controlled Lighting, Horn and Horn relay, Vehicle Security systems: seat belts, Air bags, Driver Information and controls: instrument panel, speedometer and odometer Speed Control, Head Up Display, Networks and Multiplexing, Electronic Navigation systems, Cruise control systems.

BOOKS RECOMMENDED: