|| अंतरी पेटवू ज्ञानज्योत ||

(B -२.८८)
NAAC Re-Accredited

NORTH MAHARASHTRA UNIVERSITY JALGAON

SYLLABUS
FOR

M.Sc. ELECTRONICS

(SEMESTER III & IV)
(For Affiliated College)

With Effective from June 2014

Syllabus Structure for M.Sc.-I (Semester III & IV)

Semester	Code	Title of course	Marks			Number of Hours per Week
			Internal	External	Total	
III	ELE 301	VHDL Programming	25	75	100	04
	ELE 302	Digital Image Processing	25	75	100	04
	ELE 303	Wireless sensors & Networks	25	75	100	04
	ELE 304	Special Lab I	25	75	100	08*
	ELE 305	Project I	25	75	100	04
IV	ELE 401	Nanoelectronics	25	75	100	04
	ELE 402	Electromagnetic theory and Antenna engineering	25	75	100	04
	ELE 403(A)#	CMOS Technology	25	75	100	04
	ELE 403(B)#	Agro Electronics	25	75	100	04
	ELE 404	Special Lab II	25	75	100	08*
	ELE 405	Project II	25	75	100	04

*** indicates workload for one batch (10 students)**
#Select any one of the course (Select ELE 403 A or B)

Distribution of marks for theory exam would be as below:

External Examination : 75 Marks per Course
Internal Examination : 25 Marks per Course

Total : 100 marks

Distribution of marks for practical exam would be as below:

Experimental Performance : 40 marks
Record/Journal : 10 marks
Viva-voce : 15 marks
Attendance : 10 marks
Internal : 25 marks

Total : 100 marks

ELE 301: VHDL Programming

Objectives:

1. To understand sequential & combinational logic design techniques.
2. To introduce VHDL.
3. To learn various digital circuits using VHDL
4. To learn PLD, CPLD, FPGA & their application.

Unit 1: **(12P)**

Introduction: VHDL description of combinational networks, Modeling flip flops using VHDL, VHDL models for multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, variables, signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, packages and libraries, VHDL model for a counter.

Additional topics in VHDL: Attributes, Transport and Inertial delays, operator overloading, multi valued logic and signal resolution, IEEE-1164 standard logic, generics, generate statements, synthesis of VHDL code, Synthesis examples, Files and Text IO.

Unit 2: **(14P)**

Designing with programmable logic devices: read-only memories, programmable logic arrays (PLA), programmable array logic (PLAs), other sequential programmable logic devices (PLDs), design of a keypad scanner, designing with programmable gate and complex.

Programmable logic daces : Xlinx 3000 series FPGAs, designing with FPGAs, Xlinx 4000 series FPGAs, using a one–hot state assignment, Altera complex programmable logic devices (CPLDs), altera FELX 10K series CPLDs.

Unit 3: **(12P)**

Design of networks for arithmetic operations: design of a serial adder with accumulator, state graphs for control networks, design of a binary multiplier, multiplication of signed binary numbers, design of a binary divider.

Unit 4: **(12P)**

Digital design with SM charts: state machine charts, derivation of SM CHARTS, realization of SM charts, implementation of the dice game, alternative realization for SM charts using microprogramming, linked state machines.

Unit 5: **(10P)**

VHDL models for memories and buses: static RAM, A simplified 486 bus model, interfacing memory to a Microprocessor bus. Floating-point arithmetic: representation of floating-point numbers, floating-point multiplication, other floating-point operations.

TEXE BOOKS:

Charles Hurth, jr digital systems design using VHDL, Thomson learning, inc, 9th reprint 2006.

REFERENCE BOOKS:

1. Fundamentals of digital logic design with VHDL by Stephen brown & zvonko vanesic, Tata McGraw-HILL, New Delhi, 2nd ED, 2007.
2. Digital System Design with VHDL by Mark zwolinski , 2 Ed , Pearson education ,2004
3. Circuit Design with VHDL by Volnei A pedroni , MIT press, 2004
4. VHDL Primer by J. Bhasker, PHI publication
5. VHDL a Design Orientation Approach by S S Limaye, McGraw Hill

ELE 302: Digital Image Processing

OBJECTIVES

1. To study the image fundamentals and mathematical transforms necessary for image processing.
2. To study the image enhancement techniques
3. To study image restoration procedures.
4. To study the image compression procedures.
5. To study the image segmentation and representation techniques.

UNIT I DIGITAL IMAGE FUNDAMENTALS (12P)

Elements of digital image processing systems, Vidicon and Digital Camera working principles, Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT (14P)

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION (12P)

Image Restoration - degradation model, unconstrained restoration - Lagrange multiplier and constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV IMAGE SEGMENTATION (12P)

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and Merging – Segmentation by morphological watersheds – basic concepts –Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION (10P)

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

TEXTBOOK

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson, Second Edition, 2004.
2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson 2002.

REFERENCES

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB',Pearson Education, Inc., 2004.
3. D,E. Dudgeon and RM. Mersereau, , Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, , Digital Image Processing' , John Wiley, New York, 2002
5. Milan Sonka et aI, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.

ELE-303: WIRELESS SENSOR & NETWORKS

OBJECTIVES:

1. To study the applications such as disaster management, military and security using sensor networks.
2. This course provides a broad coverage of challenges and latest research results related to the design and management of wireless sensor networks.
3. Covered topics include network architectures, node discovery and localization, deployment strategies, node coverage, routing protocols, medium access arbitration, fault-tolerance, and network security**.**

UNIT I : OVERVIEW OF WIRELESS SENSOR NETWORKS (08P)

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II : ARCHITECTURES (14P)

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

UNIT III : NETWORKING SENSORS (16P)

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV : INFRASTRUCTURE ESTABLISHMENT (12P)

Topology Control , Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V : SENSOR NETWORK PLATFORMS AND TOOLS (10P)

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TEXT BOOKS

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

ELE 304 Special Lab I

Group A (Any five) VHDL Programming

1. Practical Based on VHDL Programming (Combinational Logic)
    a. Parity Generator and checker
    b. Hamming Code Generator
    c. Manchester code Generator
2. Designing of 4 ´ 2 bit Multiplier using VHDL
3. Practical Based on VHDL Programming (Sequential)
    a. 8 bit binary counter
    b. Universal shift register
4. Four bit ALU design using VHDL
5. Design of Simple Memory (RAM) model using VHDL.
6. Keyboard Scanning (Counter Method) using VHDL
7. Designing of Traffic light Controller using VHDL.
8. Implementation of 8 bit multiplexer on FPGA Board.
9. Designing of Digital logic for RPM Measurement using VHDL.
10. Code Converter (BCD to seven Segment)
11. Design of Modulo-7 Counter using FSM Model

Group B (Any five) Digital Image Processing

1. Develop a program in C / MATLAB to perform Sharpening, Blurring and Contrast adjustment
2. Develop a program in C / MATLAB to understand Edge detection, embossing and Enlarge and reduce of image.
3. Develop a program in C / MATLAB to Read and display different image files:-
   BMP, GIF, TGA, TIFF, JPEG.
4. Develop a program in C / MATLAB to perform erosion, dilation, opening and closing operation over image.
5. Develop a program in C / MATLAB to perform skeletonization operation over finger print.
6. Develop a program in C / MATLAB to perform Color image filtering.

Group C WIRELESS SENSOR & NETWORKS

1. To established a link between transmitter and receiver with Zigbee module.
2. To study data logging unit.
3. To study the CC2500 module for link formation between TX and RX.
4. To Study the network layers used in wireless communication.

ELE 401:Nanoelectronics

Objectives:

1. To study the fundamentals of nanotechnology.
2. To learn the unique properties of nanomaterials.
3. To study various synthesis techniques and characterization of nanomaterials.
4. To learn the various application of nanoelectronics.

Unit 1: Fundamentals of Nanotechnology (10P)

Introduction of nano scaling of devices, Nano size and properties, classification of nanostructured materials, introduction of nanowires, nanorods, nanoshells, nanotubes, nanofluids, Applications of nanomaterials in: Electronics Devices, Optoelectronics Devices, Quantum computers, Insulation, Phosphors, Medicine, Renewable energy, Sensors.

Unit 2: Unique properties of Nanomaterials (14P)

Microstructure and defects in Nano crystalline materials, Effect of Nano Dimensions on Materials behavior (Effect on Elastic Property, Melting point, Diffusivity, Grain growth characteristics, Solubility, Magnetic Properties, Electrical properties, Optical Properties, Thermal Properties, Mechanical Properties).

Unit 3: Synthesis Techniques (14P)

Bottom Up Approach: Physical Vapour Deposition (PVD), Chemical Vapour Deposition (CVD), Spray Pyrolysis, Sol gel technique, Hydrothermal, Wet Chemical Synthesis, Top Down Approach: Mechanical alloying, Equal Channel Angular Pressing, High Pressure Torsion, Accumulative Roll Bonding (ARB).

Unit 4:Characterization Techniques (12P)

X-Ray Diffraction (XRD), Small Angle X-ray Scattering (SAXS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM), Fourier Transmission Infrared Spectroscopy (FTIR), Ultraviolet Visible Spectrophotometer.

Unit 5:Applications in electronics (10P)

Electrons in mesoscopic structures, short channel MOSFET, split-gate transistor, electron wave transistor, electron spin transistor, Molecular electronics, Fullerenes, nanotubes, switches based on Fullerenes and nanotubes, Nanoelectronics with tunneling devices, resonant tunneling diode (RTD), three terminal RTDS, RTD based memory, Principle of single electron transistor.

Text / Reference Books:

1. Texbook of Nanoscience and Nanotechnology, B. S. Murty, P. Shankar, Baldev Raj, University Press IIM
2. Nanoelectronics and Nanosystems: K.Goser, P. Glosekotter, J. Dienstuhl, Springer (2005).

ELE402 Electromagnetic Theory &Antennas Engineering

OBJECTIVES:

- Know and use standard antenna characterization parameters such as: impedance, far-field radiation pattern, scattering pattern, gain, directivity, bandwidth, beam width, polarization, efficiency, antenna temperature.
- Understand electromagnetic radiation mechanism and its physics and be able to compute radiation form several common antenna structures.
- Design simple antennas such as dipoles, microstrip patches, and waveguide horns to achieve specified performance.
- Design antenna arrays with required radiation pattern characteristics.
- Understand self and mutual impedance and the basics of numerical analysis for antennas.
- Be able to critically evaluate requirements and potential design options for antenna applications.

Unit-1: Electromagnetic Waves (12P)

Review of Maxwell's equations and their meaning, continuity equation, electric and magnetic wave equations in time domain and frequency domain, wave propagation in conducting and non-conducting media, skin depth and high frequency propagation, boundary conditions at the interface between two mediums, Poynting theorem and its applications

Unit-2: Transmission Lines (14P)

Types of transmission lines, microstrip lines, two wire transmission line, transmission line equations for voltages and currents, inductance and capacitance per unit length of two wire and coaxial cable transmission line, characteristic impedance, propagation constants, attenuation and phase constants, phase velocity, reflection and transmission coefficients, SWR, line impedance, normalized impedance and admittance, Smith chart construction and applications, single stub and double stub matching, applications to reflection of EM-waves at interfaces for normal incidence

Unit-3: Waveguides and Components (18P)

Concept of waveguides, frequency range, relation to transmission lines Rectangular Waveguides: TM and TE Modes, concept of cut-off frequency, guide impedance, phase velocity, guide wavelength for TE and TM modes, Applications to TE mode in rectangular waveguide, power losses in rectangular waveguide Circular waveguide introduction only

Optical Fiber: principles of operation and construction, difference between conducting circular waveguide and fiber Different methods of excitation of TE and TM modes in waveguides Cavity Resonators, Q factor of cavity resonators

Unit-4: Electromagnetic Radiation (16P)

Potentials of electromagnetic fields, retarded potential, radiation from oscillating dipole, concept of near zone and radiation zone, radiation resistance, role of antenna in exciting different TE, TM modes in wave guides Antenna Parameters: gain, directivity, power, aperture, Friis equation, radiation pattern Application Areas: antenna temperature, Signal to Noise Ratio (SNR), remote sensing, RADAR equation Antennas Types: $\lambda/2$ antenna, antenna arrays, horn antennas,

parabolic dish antennas, End fire antenna – Yagi Uda, patch antenna, microstrip antennas EMI and EMC Generation of Microwaves: principle, physical structure and working of - Gunn effect diodes, magnetron oscillator, reflex Klystron oscillator

Note: In the case of antennas and microwave devices, mathematical analysis of equivalent circuits and processes is not expected.

Text / Reference Books:

1. Microwave Devices and Circuits, Samuel Y. Liao, PHI, 3rd Edition, 2002.
2. Principles of Electromagnetics, N. Sadiku, Oxford University Press.
3. Electromagnetics with Applications, Kraus and Fleiseh, McGraw Hill, 5th Edn, 1999.
4. Electromagnetics, J.D. Kraus, 4th Edn, McGraw Hill, 1992

ELE 403(A): CMOS Technology

Objectives:

1. To understand basic electrical properties of MOS Transistor.
2. To learn about the CMOS layout.
3. To learn the designing of logic gates and sequential circuits.

Unit 1: Basic Electrical properties of MOS Transistor (16P)

Threshold voltage Vth, transconductance gm for MOS,CMOS and Bi-CMOS transistors, Inverters, Zpu/Zpd, MOS Transistor circuit model, Latch-up in CMOS circuits, Inverter principle, Depletion and enhancement load inverters, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, and Dynamic behavior, Propagation Delay, Power Consumption.

Unit 2: MOS Circuit layout (10P)

Scalable design rules, Floor planning methods, Stick diagrams, MOS device layout: Transistor layout, Inverter layout, CMOS digital circuits layout and simulation

Unit 3: Logic gates and layouts (18P)

MOS transistor figure of merit, the pass transistor, the nMOS inverter, determination of pull-up to pull-down ratio for nMOS inverter driven by another nMOS inverter, determination of pull-up to pull-down ratio for an nMOS inverter driven by one or more pass transistors. Alternative forms of pull up, MOS transistor circuit model. Static complementary gates, switch logic, Alternative gate circuits, low power gates, Resistive and Inductive interconnect delays.

Unit 4: Sequential Circuits (08P)

Static latches, Flip flops and Registers, Dynamic Latches and Registers, CMOS Schmitt trigger, Monostable sequential Circuits, Astable Circuits. Memory Design: ROM and RAM cells.

Unit 5: BiCMOS Logic Circuits (08P)

Introduction, BJT Structure and operation, Basic BiCMOS Circuit behavior, Switching Delay in BiCMOS Logic circuits, BiCMOS Applications

References:

1. **Essentials of VLSI Circuits and Systems,** K. Eshraghian
2. **Digital Integrated Circuits,** Rabey, Pearson Education
3. **CMOS Digital IC Circuit Analysis and Design,** Kang and Leblebigi

ELE 403(B)Agro electronics

Objectives:

1. To understand basics of agriculture and soil properties.
2. To learn about the various sensor needed for automation.
3. To understand the use of ICT in agriculture.
4. To learn the concept of green house and instrumentation for green house.

1. Basics of Agriculture: (14P)

Introduction to Soil Science- Soil structure, Soil properties, Soil processes Formation of Soil, types of soils, Organisms and soil processes, Soil as a medium for plant growth, Soil moisture & efficiency soil pH values and crop production Chemical analysis of soil, water bearing capacity, Soil erosion and conservation, measurement of soil parameters.

Introduction to Crop Science- Elementary crop science, Basic principles and advances in photosynthesis. Paste and disease management, Post harvesting, Role of fertilizers, Different types of crops. (Floriculture, Horticulture , Mushroom culture, etc.)

2. Agriculture equipments and Automation: (22P)

Introduction to agriculture measurement techniques,: Agricultural parameters (Temperature, pH, Conductivity, Salinity, Soil Moisture,) operating principles of sensors and actuators for Agriculture, Measurement of temperature, Measurement of pH and conductivity, Soil analysis and soil testing, soil moisture measurement, Introduction to Agro meteorology: RH, Wind speed and direction, Radiation, rain Agro meteorological instruments: Anemometer, Use of PLDs, Microprocessors and Microcontroller, Data converters, Display devices, in agricultural automation.

Use of opto-electronic devices for measurement and control of physical parameters in agri-electronics, Salinity tester, specific ion analyzer, field usable , pH meter. Agricultural equipment and automation, Automatic drip irrigation.

3. Computers & Special Information technology in Agriculture: (14P)

SIT, GIS/ GPS software's Applications for Ground water modeling, crop forecasting & estimate, soil erosion etc, Use of Digital Image processing, Satellite missions, Hyper spectral remote sensing, physics of optical & microwave remote sensing, thermal mapping.

Simulators used for study of crop growth. Data logger, features of data loggers, data loggers for dedicated use in agriculture, Computer based automatic weather station.

4. Green House Instrumentation: (10P)

Green House Instrumentation: Green House Technology introduction, instrumentation required for tissue culture techniques, Use of simple electronic circuits for control for physical parameters like temperature, humidity and irrigation, and indication of physical parameters.

References:

1. Treaties on Agro-Physics & Agri electronics : Dr. G.N. Acharya & Dr. D.G. Hapse
2. Fundamentals of remote sensing: George Joseph
3. Fundamentals of Soil: V.N. Sahi- Kalyani Publication
4. Principles of Agricultural Engineering – A.M. Michale
5. Spatial information technology I.V. Muralikrishna Vol I & II BS Pub

ELE 404 Special Lab II

Group A Nanoelectronics

1. Synthesis the ZnO nanoparticles using hydrothermal method.
2. Synthesis of ZnO Nanoparticles using sol gel techniques.
3. Study the parameters of nanoparticles using UV Visible spectrophotometer.
4. Find the energy band gap of semiconductor using four probe method.

Group B Electromagnetic theory & Antenna Engineering

(Use C / MATLAB)

1. To plot Equipotential contours and field lines for given charge distribution
2. Use of Smith chart for transmission line pattern and verify using C
3. Use of MATLAB for potential distribution in a region bound by two conductors
4. Use of MATLAB for directivity pattern for simple antennas
5. Study of minimum 5 different types of antennas

Group C (Any five) Agroelectronics

1. Measurement of soil parameters (pH, conductivity, moisture)
2. Measurement of meteorological parameters (wind speed, wind direction, temp.)
3. Use of GPS software to gather data related agriculture
4. Development of automation for green house parameters using microcontroller / PLC.
5. Development of automated drip irrigation system using microcontroller / PLC.
6. To design, built and test temperature controller for green house applications.
7. To measure moisture content in seeds/ grains (Using capacitive sensor)

OR

Group C (Any five) CMOS Technology

1. Draw transistor schematic for 4 bit parallel binary adder and sketch layout using tools.
2. Draw transistor schematic for multiplier and sketch layout using tools.
3. Sketch layout and study RAM memory cell using tools.
4. Draw sticks diagram and layout for different flip flops.
5. Sketch layout and study modulo-27 counter using tools.

ELE 305/ ELE405 Project I & II

Guide lines

Format of the project course

The project work is to be carried out in light of following guidelines in TWO SEMESTERS.

SEMESTER –III **(ELE 305 : Project I):**

The Detail Contents are as follows:

1. Preparation of the Synopsis & Presentation
2. Literature Review
3. Time Schedule
4. Resource Planning Comprises:
    - Preparatory experiments
    - Hardware experiments
    - Software experiments: Algorithms, flow charts, Coding of the project work using selected programming language.

SEMESTER –IV **(ELE 405 : Project II):**

5. Paper planning or Paper writing and presentation skills
6. Report writing, submission and Presentation.

Distribution of total 100 Marks is as under:

- Internal marks: 25
- External marks: 75

Note: overall the examiner should evaluate performance of the student by considering his/her internal performance during the year.

Opportunities after completion of M.Sc.(Electronics)

After completion of M. Sc. Electronics with good academic record, student will get opportunities in the following fields/sectors

- Lectureship - After NET/SET
- M.Tech.----after GATE
- Research
- BSNL----as a TTA (Telecom Technical Assistant)
- Railway ----as a Section Engineer
- Air force ----as Technical Officer after clearing EKT Exam
- UPSC---- Indian Engineering Services (ES)
- Private sector-Electronics/IT companies.