|| अंतरी पेटवू ज्ञानज्योत ||

(B -२.८८)
NAAC Re-Accredited

NORTH MAHARASHTRA UNIVERSITY JALGAON

SYLLABUS

FOR

M.Sc. ELECTRONICS

(SEMESTER I & II)

(For Affiliated College)

With Effective from June 2013

NORTH MAHARASHTRA UNIVERSITY
M.Sc. Electronics

Objectives:

- To enhance the knowledge in multidisciplinary approach in the field of Basic Technologies in electronics, Embedded Systems, Robotics, Advance Communication and Nanoelectronics .
- To provide quality education through innovative teaching and learning processes.
- To promote scientific, research and educational activities towards the advancement of the theory and practice of Electronics fields and related arts and sciences.

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

Semester	Code	Title of the Course	Marks			Number of Hours per Week
			Internal	External	Total	
I	**ELE-101**	Solid State Electronics Devices	**25**	**75**	**100**	**04**
	ELE-102	Analog Circuits Analysis	**25**	**75**	**100**	**04**
	ELE-103	Digital Communication	**25**	**75**	**100**	**04**
	ELE-104	Embedded Systems and Robotics	**25**	**75**	**100**	**04**
	ELE-105	Electronics Practical – I	**25**	**75**	**100**	**08***
II	**ELE-201**	Optoelectronics Devices	**25**	**75**	**100**	**04**
	ELE-202	Linear Integrated Circuits Applications	**25**	**75**	**100**	**04**
	ELE-203	Industrial Automation and Process Control	**25**	**75**	**100**	**04**
	ELE-204	PIC and RTOS	**25**	**75**	**100**	**04**
	ELE-205	Electronics Practical – II	**25**	**75**	**100**	**08***

*** indicates workload for one batch (10 students)**

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

Proposed Sem III & IV course titles

Semester	Code	Title of the Course
III	**ELE-301**	**VHDL Programming**
	ELE-302	**Digital Image Processing**
	ELE-303	**Wireless sensors & Network**
	ELE-304	**Special Lab I**
	ELE-305	**Project**
IV	**ELE-401**	**Nanoelectronics**
	ELE-402	**Electromagnetic theory and Antenna engineering**
	ELE-403	**CMOS Technology**
	ELE-404	**Special Lab II**
	ELE-405	Project

ELE 101: Solid State Electronics Devices

Unit 1: Junction and Interface (8Hrs)

p-n junction , linearly graded and abrupt junctions, diode equation , static I-V characteristics, break-down mechanisms in pn-junction , dynamic behavior of pn -junction, effect of temperature on pn-junction diode.

Unit 2: Special Semiconductor Devices (8Hrs)

Gunn Effect and diode, Zener effect and Zener diode, Tunnel diode, PIN diode, Varactor diode Schottky diode.

Unit 3: Bipolar Junction Transistors (12 Hrs)

Amplification and Switching: The Load Line, Amplification, Switching; Fundamentals of BJT operation: Charge Transport in a BJT. Amplification with BJT's; Minority Carrier Distribution and Terminal Currents: Solution of the Diffusion Equation in the Base Region, Evaluation of the Terminal Currents, Approximations of the Terminal Currents, Current Transfer Ratio: Generalized Biasing: The Coupled-Diode Model, Charge Control Analysis; Switching: Cutoff, Saturation. The Switching Cycle, Turn-On Transient, Turn-Off Transient, Shottky Diode Clamp, Specifications for Switching Transistors; Other Important Effects: Drift in the Base Region, Base Narrowing, Avalanche Breakdown, Injection Level; Thermal Effects, Base Resistance and Emitter Crowding; Frequency Limitations of transistors: Capacitance and Charging Times, Transit Time Effects, High-Frequency Transistor.

Unit 4: Field-Effect Transistors (10Hrs)

The Junction FET: Pinch-off and Saturation. Gate Control, Current-Voltage Characteristics; The GaAs MESFET, The High Electron Mobility Transistor (HEMT), Short Channel Effects; The MISFET: Basic Operations, The Ideal MOS Capacitor, Effects of Real Surfaces, Threshold Voltage, Control of Threshold Voltage, Substrate Bias Effects, Capacitance Effects and Self-Aligned Transistors. Short-Channel Effects

Unit 5: Switching Devices and Negative Conductance Microwave Devices (10Hrs)

Switching Mechanisms: The p-n-p-n Diode, The Two-Transistor Analogy, Variation of with α with Injection. Forward-Blocking State, Conducting State, Triggering Mechanisms; The Semiconductor Controlled Rectifier: Gate Control, Turning off the SCR,

The IMPATT Diode, the Gunn Effect and Related Devices: The Transferred Electron Mechanism, Formation and Drift of Space Charge Domains.

Reference Books:

1) Solid State Electronics Devices by Ben G. Streetman, Prentice Hall of India pvt ltd.
2) Semiconductor Devices by D. Nagchaudhari, TMH publications
3) Semiconductor Optoelectronics Devices by Pallab Bhattacharya, Pearson Education publication, 2nd Edition
4) Physics of Semiconductor Devices by S. M. S/c, Wiley Eastern ltd.
5) Principles of Electronic Materials & Devices by S. O. Kasap, TMH publications

ELE 102: Analog Circuits Analysis

Unit 1: BJT Small-signal Analysis (12Hrs)

Introduction; Transistor modeling, two port system, Approximate model for common emitter configuration, Hybrid equivalent model for CE, CB configuration, Small signal equivalent circuit for common emitter fixed bias & voltage divider bias configuration; Common Emitter configuration: unbypassed & bypassed. Emitter follower configuration; common base configuration; approximate hybrid equivalent circuit: CE & CB configuration, fixed bias Configuration. Complete Hybrid equivalent model.

Unit 2: FET Small-signal Analysis (8Hrs)

Introduction; JFET small-signal model, fixed bias and self bias configuration, design of FET amplifier circuits, AC equivalent circuits; Common Source follower, common gate configuration.

Unit 3: Frequency response of BJT and JFET (8Hrs)

Introduction, Decibel, general frequency consideration, bode plot, Low frequency response of BJT and FET amplifier, Miller Effect Capacitance, High frequency response of BJT and FET amplifier, Multistage frequency effect, frequency response of multistage amplifiers.

Unit 4: Large-signal Amplifier Analysis (10Hrs)

Introduction; Classes of amplifier operation, Series-fed Class A amplifier: maximum power and efficiency; Transformer coupled power amplifier, transformer impedance matching, AC and DC load line, signal swing and output AC power, power and efficiency calculation, maximum theoretical efficiency; Class B amplifier operation; Class B amplifier circuit; distortion; power transistor heat sinking.

Unit 5: Feed Back Amplifiers and Oscillator Circuits Analysis (10Hrs)

Feedback concepts; Feedback connection types; Practical feedback circuit; Feedback amplifier (phase, frequency); Oscillator operation; Tuned Oscillator, Hartley oscillator, Colpitts Oscillator, Crystal Oscillator using transistor; Unijunction Oscillator.

Reference Books:

1) Electronic Devices and Circuit Theory by Robert Boylestad, Prentice Hall of India Private ltd, New Delhi.
2) Solid State Electronic Circuits for Engineering Technology by Manera, McGraw Hill Pub.
3) Electronic Devices and Circuits by Cheruku & Krishna
4) Analysis and Design of Integrated Electronic Circuits by Paul M. Chirlian.

ELE 103: Digital Communication

Unit 1: Signals and Systems (10 Hrs)

Classification of signals, energy and power signals, Phaser and line spectrum, system: linear, non linear, time invariant, time varying, Casual, non-casual, stable and unstable systems. Fourier series, Fourier transforms, Parseval's Power theorem, Rayleigh's Energy Theorem, Spectral Density Functions: Energy spectral density, Power Spectral Density, Properties of spectral density function, Autocorrelation function, Cross Correlation functions, and frequency response of LTI systems.

Unit 2: Digital Communication system (10 Hrs)

Block diagram description of elements of the digital communication system, the sampling theorem, Aliasing error, PAM, PPM, PWM, PCM signal generation and detection, uniform and non-uniform quantization, Companding in PCM, SNR, Delta Modulation, Adaptive Delta Modulation, Comparison of digital Pulse Modulation Methods, Time Division Multiplexing, Frequency Division Multiplexing,

Unit 3: Digital modulation techniques (8 Hrs)

Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Differential Encoded PSK (EPSK), Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift Keying (BFSK), M-ary FSK, MSK, Comparison of digital modulation techniques, Synchronization techniques: Carrier synchronization, Bit or Symbol Synchronization.

Unit 4: Data transmission and coding technique (8Hrs)

Integrate and dump filters (Receiver), Optimum Receiver (or optimum filter), matched filter, correlation, Error Probabilities of Baseband Signal Schemes: Detection of PCM, ASK, PSK Signal, Detection of FSK signal, Parity Coding, Linear Block Codes, Cyclic Codes, Convolution Codes: Code tree, Trellis and state Diagram for a Convolution Encoder, Decoding Methods of Convolution Code: Viterbi Algorithm for decoding of convolution codes, Sequential Decoding for Convolution Codes.

Unit 5: Spread Spectrum Techniques (6 Hrs)

Introduction, Model of Spread Spectrum Digital Communication System, Generation of Pseudo-noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS) Signals, Frequency HOP Spread Spectrum (FH-SS) signals, Slow, fast frequency Hopping, CDMA system based on FH-SS, Comparison of spread Spectrum Methods.

Unit 6: Advanced Communication Systems (6 Hrs)

Satellite Communications: FDMA, TDMA, CDMA, mobile Radio: Frequency Reuse, Cell Splitting, Propagation Problem in Mobile Radio, Broadband Integrated Services Digital Network: B-ISDN Implementation, optical FTTH, Asynchronous Transfer mode (ATM).

Reference: -

1. Digital Communication by J. S. Chitode, Technical Publication Pune.
2. Digital Communications by Bernard Sklar (Pearson Education, Asia Publ)
3. Modern Digital and Analog Communication Systems by B.P. Lathi.
4. Analog and Digital Communications by Hwei Hsu (Schaum Outline MGH)

5. Digital Communications By Symon Haykin (John Wilay Publication)
6. Modern Digital Communication System by Leon W Couch (PHI Publ)
7. Digital Communications by J G Proakis (MGH Publ)
8. Analog and Digital Communication systems by M.S. Roden, 3rd Edition, Prentice Hall of India.
9. Communication Techniques for digital and Analog signals by M. Kanefsky, John Wiley and Son.
10. Telecommunication by T.H. Brewster, McGraw Hill.
11. Principles of Digital communication by Das, Chatterjee and Mallick, Wiley Eastern Ltd.

ELE 104: Embedded Systems & Robotics

Unit 1: Basics of Microcontrollers (08 Hrs)

Architectural features of different types of architectures used in Microcontrollers like Van Neumann, Harvard, CISC, RISC, and SISC architectures. Special features like watchdog timer, digital signal processors, clock monitor, resident program, loader, monitor, General applications of Micro-controllers.

Unit 2: 16 bit Microcontrollers (12 Hrs)

Hardware: CPU, Address & data buses overview of the Atmel family MCU, Architecture of Atmega 16. Memory Map of Atmega 16: on chip RAM, on chip ROM/EPROM; I/O ports, Programmable Timers and High speed output & input captures; Interrupts: Maskable & non maskable instructions: Data transfer, data and bit manipulation, arithmetic and logical, program flow control instructions, simple and loop programs.

Unit 3: Interfacing Applications (08Hrs)

Interfacing Light Emitting Diodes, 7-segment display, keypad, dc motors, stepper motor and Digital to Analog converter to Atmega 16.

Unit 4: ARM 32 bit MCU (10 Hrs)

Introduction to 32 bit Processors; Architectures & organization: ARM based MCU's, ARM programming model, simple programs.

Unit 5: Robotics and Applications (10Hrs)

Introduction, physical configurations, Cartesian co-ordinate, polar co-ordinate, Cylindrical and body and arm configuration, technical features, robotics motion, Body and arm motions, wrist motions, programming languages, victors assembly language and machine control language, work cell control and interlocks, Robotics sensors – vision sensors, touch sensors and voice sensors ,need of robotics in industries, material transfer, machine loading, spray painting, Welding, processing operation, assembly and inspection.

Reference Books:

1) Architecture, Programming, Interfacing & System Design by Raj Kamal, Pearson education Publications.
2) Microcontrollers [Theory & Applications] by Ajay Deshmukh, TMH Pub.
3) CAD/CAM-computer Aided Design and Manufacturing by M. P. Grover and E. W. Zimmers, Jr, PHI, New Delhi
4) Microcontrollers, Features & Applications by D. S. Yadav & A. K. Singh, New Age International Publications.
5) Avr Microcontroller and Embedded Systems: Using Assembly and C by Janice Mazidi, Sarmad Naimi, Muhammad Ali Mazidi PHI publication.
6) Embedded Systmes And Robotics by Subrta Ghoshal, Cengage Learning Asia

ELE 105: ELECTRONICS PRACICAL - I

Group A: (Any three)

1) Measurement of conductivity of given sample using four probe method at different temperature.
2) Measurement of Hall Co-efficient.
3) Measurement of energy gap of semiconductor device.
4) Study of CV characteristics of Semiconductor diode.
5) Switching characteristics of Diode and Transistor.

Group B: (Any three)

1) Designing and analysis of two Stage RC coupled CE amplifier using BJT.
2) Designing and analysis of Crystal Oscillator using transistor.
3) Study of frequency response of Common source JFET amplifier.
4) Designing and analysis of Class B Push Pull Amplifier using BJT.
5) Determination of h-Parameters of BJT.

Group C: (Any three)

1) Study Pulse Code Modulation and Demodulation.
2) Study of FSK modulation and Demodulation.
3) Study of PSK modulation and Demodulation.
4) Study of Pulse Amplitude Modulation and Demodulation.
5) Study of PPM, PWM and Demodulation.
6) Study of Delta Modulation and Demodulation.

Group D: (Any three using ARM microcontroller)

1) Interfacing of Matrix Key Board.
2) Interfacing of 7- Segment Display/LCD.
3) Interfacing of DC/ Stepper Motor
4) Design of waveform Generator.
5) Measurement of temperature/Displacement.
6) Interfacing of Relay.

ELE 201: Optoelectronics Devices

Unit 1: Heterostructures (7Hrs)

Hetrojunction, light – current relationship in spontaneous emission, stimulated emission and gain, optical gain in direct band gap semiconductor, Febry- Perot cavity and threshold condition.

Unit 2: Laser diode and properties (11Hrs)

LASER as an amplifier of light, necessary condition for amplification, special properties of LASER , Study of three & four level LASERs, study of tunable and semiconductor LASER, applications of LASER, Carrier confinement and injected carrier utilization, threshold current density and differential quantum efficiency, Temperature dependence of Jth , optical anomalies and radiation confinement loss in asymmetric hetrojunction lasers.

Unit 3: LED and LCD (8Hrs)

LEDs: Introduction, operation, Structure of LED, High radiation surface emitting LED, edge emitting double heterojunction LED, electroluminescent materials, direct and indirect gap materials, LED characteristics curves, parameters: quantum efficiency, radiation power, radiation efficiency, modulation capability, applications.

LCD: Introduction, types of LCD, construction, electrical characteristics, dynamic scattering, twisted nematic, application, comparison with LED.

Unit 4: Light Detectors (12Hrs)

Idea of light detectors, Natural and quantum specialized light detectors, Types of special light detector – thermal and quantum detectors, Types of quantum photo detectors- photo resistive, photovoltaic and , photo multiplier tube, Important characteristics of light detectors-spectral response, efficiency material used for photo-detectors.

Unit 5: Optical Fiber (10 Hrs)

Introduction, total internal reflection, acceptance angle, numerical aperture, skew rays, electromagnetic waves, modes in a planer guide, phase & group velocity, phase shift with total internal reflection, the evanescent field, cylindrical fiber mode, mode coupling, step index fiber, graded index fiber, single mode fiber: cutoff wavelength, mode field diameter and spot size, effective refractive index, equivalent step index method.

Reference Books:

1. Introduction of Optical Electronics by K.A. Jones, Harper and Row.
2. The Laser by Jeff Hecht, McGraw Hill
3. Optical and Optoelctronic Instrumentation by Shanthi Prinvce, K. Annapurani, Scitech Publication pvt. Ltd, Chennai.
4. Semiconductor Optoelectronics Devices by Pallab Bhattacharya, Pearson Education publication, 2^{m} Edition
5. Optical Fiber Communication by John Senior, PHI
6. An Introduction to Fiber Optic Systems by John Powers, Irwin Pub.

ELE 202: Linear Integrated Circuits Applications.

Unit 1: Comparators and Controls (10 Hrs)

Introduction; Effect of noise on comparator circuits: Positive Feedback- upper threshold voltage, lower threshold voltage, zero crossing detector with hysteresis as a memory element, voltage level detectors with hysteresis, voltage level detector with independent adjustment of hysteresis & center voltage, battery charger control circuits, on-off control principles- comparators in process control, the room thermostat as a comparator, selection/design guideline. An independently adjustable set point controllers, IC precision comparator, window detector, propagation delay.

Unit 2: Selected Application of Op-Amps (8 Hrs)

Introduction; high resistance DC voltmeter, universal high resistance voltmeter, voltage-to-current converters, diode testers, zener diode tester, LED tester, furnishing a constant current to a ground load, short circuit currents measurements & current to voltage converter, measuring current from photo detectors, current amplifier, solar cell energy measurements, phase shifter, the constant velocity recording process, record playback, tone control, ac to dc converter, dead zone circuits, precision clipper, triangular to sine wave converter.

Unit 3: Differential Instrumentation & Bridge Amplifiers (8 Hrs)

Improving the basic differential amplifiers, instrumentation amplifier, sensing & measuring with the instrumentation amplifier, basic bridge amplifier, adding versatile to the bridge amplifier, the strain gauge & measurement of small resistance changes, balancing a strain gauge bridge, increasing strain gauge bridge output, a practical strain gauge application, measurement of pressure, force & weight.

Unit 4: Modulating, Demodulating & Frequency Changing with the Multiplier (8 Hrs)

Introduction, multiplying DC voltages, Squaring a number of DC voltage, frequency doubling, phase-angle detection, Introduction to Amplitude Modulation, standard amplitude modulation, demodulation of an AM voltage, demodulating a balanced modular voltage, single side band modulation and demodulation, frequency shifting, analog divider, finding square roots, universal amplitude modulation receiver.

Unit 5: Integrated Circuit Timers (8 Hrs)

Applications of the 555 as an Astable Multivibrator, one shot, monostable operation & Application, introduction to counter timers, the XR 2240 programmable timer/counter, Timer/counter applications, switch programmable timer, major building blocks of PLL, Detector, filter circuits, voltage controlled oscillators, typical monostable PLL ICs, the LM565 PLL, Designing some practical circuit using LM565

Unit 6: Switch Mode Power Supply (6 Hrs)

Introduction; the back switching regulator & its analysis, the boost switching regulator & analysis, externally driven switching regulator, monolithic switching regulator sub systems, self oscillating switching regulators, device type LM105/LM376 switching regulators, guidelines & precautions while handling regulators.

Reference Books:

1) Operational Amplifiers & Linear Integrated Circuits by R. F. Coughlin, F. F. Drisoll, 4th ed. Prentice Hall.
2) Integrated Circuits by K. R. Botkar, Khanna Publications
3) Operational Amplifiers (Design & Applications) by Tobey, Graeme (McGraw Hill)
4) A monograph on Electronics Design Principles by Groyal, Khetan, Khanna Publications.

ELE 203: Industrial Automation and Process Control

Unit 1: Industrial Automation (4Hrs)

Introduction: Industry, Automation & Control, Industrial automation versus Industrial IT, Roll of automation in industry, Economy of scale and scope, types of production system and automation system.

Unit 2: Architecture of Industrial Automation system (8Hrs)

Elements of Industrial automation, Actuator system, Actuators: Electrical, Pneumatic & Hydraulic, Control system: Types, Control Elements: Mechanical & Electrical, Architecture, Automation Pyramid, Basis of system selection.

Unit 3: Measurement System (16Hrs)

Specification, Static characteristics: Range, Sensitivity, Linearity, Hysteresis, Resolution, Accuracy and Precision, Dynamic Characteristics: Step Response and Frequency performance, Random Characteristics. Temperature measurement: Thermocouple, Pressure and force measurement: Load cell, Burden Tube, Displacement and Speed Measurement: Fiber Optic position sensor, Variable reluctance type speed motor, Flow Measurement: Orifice Meter, Level Measurement: Ultrasonic, Humidity measurement: Hygrometer, pH Measurement.

Unit 4: Signal Conditioning system (6Hrs)

Introduction, Elements of measurement system, AC & DC Bridge, Amplifiers: Capacitive, Differential & Instrumentation Amplifiers, Errors and Calibration: Type of errors and analysis, arithmetic mean, standard deviation, calibration and error reduction.

Unit 5: Process Control (6Hrs)

Introduction, Characteristics of process, models: Mathematical model, higher order system model, time delay, multiple input and output system.

PID control: P, I, PI, PD, and PID control, Guideline for selection of control, control and tuning, implementation of PID control, feed-forward control.

Unit 6: PLC (8Hrs)

Discrete state process control: Definition, discrete variable, Process specification, event sequence, Relay controllers and ladder diagram, Programmable Logic controllers: Architecture, Input output devices, Structure of PLC programming.

References: -

1. Measurement System Application and Design by E.O. Doeblin, Mcgraw-Hill, Singapore, (4/e) 1990.
2. Process Control Instrumentation Technology by C. D. Johnson, PHI Publication.
3. Sensors and Transducers by D. Patranabis (2/e), PHI, New Delhi, 2003.
4. Principles of Measurement Systems by J.P. Bentley (3/e), Longman, U.K., 1995.
5. Control Sensors and Actuators by C.W. de Silva, Prentice Hall, New Jersey, 1989.

6. Programmable Logic Controller and Introduction by W. Bolion Newnes Publication.
7. Principles of Control Systems by S. P. Eugene Xavier, Joseph Cyril Babu J. S chand Publication.
8. Basic Electrical Measurements by M.B.Stout, 2/e, Prentice Hall of India, New Delhi, 1981.
9. Analog Signal Processing by R.Pallas-Areny and J.G.Webster, John Wiley, NY, 1999.
10. Introduction to Instrumentation and Measurements by R.B. Northrup (2/e), CRC Press, Boca Raton, 2005.

ELE 204: PIC and RTOS

Unit 1: **(10Hrs)**

Introduction to microchip PIC microcontroller: PIC microcontroller features, scaling of PIC MCU families, overview of baseline, midrange, enhanced midrange, and high-end core devices. Core architecture: PIC Architecture, Program memory, Addressing Modes, Instruction set.

MPLAB IDE overview: Using MPLAB, Toolbars, Select Development Mode and Device Type, Project, Text Editor, Assembler, MPLAB Operations.

Unit 2: **(10Hrs)**

PIC MCU Hardware: reset, clock, control registers, register banks, program memory paging, Ports, interrupts, Timer and Counter, watchdog timer, power up timer, sleep mode, state machine programming. Overviews of PIC tools – Development software, compilers, debug tools.

Unit 3: **(14Hrs)**

Introduction to RTOS, Scheduler, objects, services. Tasks, task states and scheduling, synchronization, communication and concurrency. Kernel objects: Semaphores, queues, pipes, event registers, signals, and condition variables. Exceptions and interrupts: Introduction, Exception v/s Interrupt, Applications of exceptions and interrupts.

Unit 4: **(14Hrs)**

RTOS concepts: Timer and timer services: Introduction, Real-time clock and system clock, Programmable interval timers, Timer ISRs, Timing wheels, soft timers. I/O subsystem: Basic I/O concepts, The I/O subsystem. Memory Management: Introduction, Dynamic memory allocation in Embedded systems, Fixed-size memory allocation, blocking v/s non-blocking memory functions, H/W memory management units

Reference Books:

1. Microcontrollers: theory and applications By Ajay V Deshmukh, TMH.
2. Programming & Customizing PICmicro Microcontrollers by Myke Predko, TMH.
3. Designing Embedded Systems with PIC Microcontrollers by Tim Wilmshurst, Newnes.
4. PIC in Practice by David W Smith, Newnes.
5. PIC: Your Personal Introductory Course by John Morton, Newnes.
6. Real-Time Concepts for Embedded Systems by Qing Li, Caroline Yao, CMP Books.
7. An Embedded Software Primer by David E. Simon, Addison-Wesley.
8. Embedded Systems: Architecture, Programming and Design by Raj Kamal, 2nd Edition McGraw-Hill Education, ISBN-10: 0070151253
9. MicroC OS II: The Real Time Kernel by Jean J. Labrosse, Publisher: CMP Book.

ELE 205: ELECTRONICS PRACICAL - II

Group A: (Any three)

1) To find the wavelength and angular diversion of He-Ne LASER.
2) To study the characteristics of photo-detectors: LDR, Photodiode/photo-transistor.
3) Study of Opto-Coupler and its application.
4) Measurement of Numerical aperture of optical fiber.
5) Characteristics study of LED.

Group B: (Any three)

1) Design Built and test Mono-stable and Astable Multi-vibrators using IC 555.
2) To Study the PLL using IC LM565.
3) Design, Built and test instrumentation amplifier.
4) Design, built and test F to V / V to F convertor.
5) Design, Built and test Window and Peak Detector.

Group C: (Any three)

1) Study of PID Controller.
2) Study of AND gate and OR gate using PLC.
3) Study of Load Cell.
4) Study of displacement sensor: LVDT.
5) Study of pH Measurement.

Group D: (Any three)

1) Interfacing of LED with PIC microcontroller.
2) Interfacing of Keyboard with PIC microcontroller.
3) Interfacing of opto-coupler with PIC microcontroller.
4) Interfacing of Relay with PIC microcontroller.
5) Study of sound generator using PIC microcontroller.