Gujarat University

M. Sc. (Electronics Sciences) Semester - III

(Effective from – 2017-2018)

Course	Name of the Course	Lect./ Hrs./ Week	Internal Marks	External Marks	Total Marks	Course Credits
ELE-501	Thin film technology	**4**	**30**	**70**	**100**	**4**
ELE-502	Control Systems-I and Programming in C Language-II	**4**	**30**	**70**	**100**	**4**
ELE-503	Microcontroller-II And Digital Signal processing – II	**4**	**30**	**70**	**100**	**4**
ELE-504	Microwaves-II and Instrumentation-II	**4**	**30**	**70**	**100**	**4**
ELE-505 PR	Practicals	**6**	**30**	**70**	**100**	**4**
ELE-506 PT	Projects	**6**	**30**	**70**	**100**	**4**
TOTAL		**28**	**180**	**420**	**600**	**24**

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ELE– 501: THIN FILM TECHNOLOGY

Fundamentals of modern thin film technology used in microelectronics have been covered in depth. Several vacuum generation & measurement techniques are covered. The syllabus covers all most all the characterization techniques used in modern microelectronics & thin film technology. Fabrication methods of active & passive thin film devices are also incorporated in detail.

Unit I:
Creation of Vacuum with different Vacuum Pumps, Measurement of Vacuum with different Gauges. Evaporation Theory. Physical Vapour Deposition methods, Direct, Flash, Electron Beam, Inductive Heating Evaporation. Uniform deposition. Types of substrate holders. Deposition Monitoring.

Unit II:
Diode Sputtering, DC and RF mode. Magnetron Sputtering DC and RF mode. Ion Beam Sputtering Yield and Influenced factors. ECR Sputtering Technique. CVD methods. Various types of CVD reactions.

Growth of thin films: Substrates Cleaning, Condensation, Nucleation Structural Consequences. Growth stages.

Unit III: Thin film Characterization
Surface and bulk structure determination techniques : X-ray Diffraction, Grazing Incidence XRD, Electron Diffraction, LEED, RHEED Techniques, Electron Microscopy : Scanning Electron Microscopy, Transmission Electron Microscopy, Chemical analysis : Electron Probe Microanalysis-EDAX, Auger Electron Spectroscopy, X-ray photoelectron spectroscopy, ESCA.

Unit IV: Thin Film Devices
Thin Film Passive Devices : Resistors Materials, Design of Resistors. Measurement of Sheet Resistance, Trimming of Resistors, TCR of resistor. Thin Film Capacitors : TFC materials criteria, TFC materials, Design flow.
Thin Film Active Devices : Thin Film Field Effect Transistors, Designing techniques, Effect of design process on I-V characteristics, Thin Film Diodes, Thin Film circuits : complementary invertors.

Reference Books:

1. **Leon I.Maissel and Reinhard Glang**, Handbook of Thin Film Technology, McGraw Hill Int.
2. **K.L.Chopra and L.K.Malhotra**, Thin film technology and applications, Tata McGraw Hill, India
3. **J.J.Coutts,** Active and passive Thin Film Devices, Academic Press
4. **Milton sothering**, The Materials science of thin films**,** Academic Press
5. **K.L.Chopra**, Thin Film Phenomena, Tata McGraw Hill, India
6. **John L.Vossen and Werner Kern**, Thin Film processes edited, Academic Press.
7. **Malcom R.Haskard** , Thin Film Hybrids, Prentice Hall of India
8. **Charles A. Haper**, Handbook of Thick Film Hybrid microelectronics**,** MH.
9. **O.S.Heavans,** Thin Film Physics**,** Mathven & Co. Ltd

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ELE– 502: Control Systems I & Programming in C Language II

The study of control theory is important to understand the various types of control systems used in electronics, instrumentation and other branches of engineering .In the present paper the students are made familiar with the basics of control systems along with their components and characteristics. The basic models and techniques to analyze control systems are also introduced.
Describes advanced topics of C- language such as function, structures, pointers, file management, graphics etc.

Unit - I:
Introduction to control system: Requirement of good control system, open and closed loop systems, feedback and feed forward system, classification of control systems, servomechanism.
Control system components: Opamp used as error detector, servopotentiometers, servomotors, Technogenerator, stepper motor,
Dynamic models and responses: Transfer function, Impulse response and transfer function, properties of transfer function, Advantage and disadvantage of transfer function, poles and zeros of transfer functions.
State variable model, Modeling of mechanical systems, Dynamic models of RLC network, Analogous systems, Representation by nodal method, Gear trains.
Unit - II:
Block diagram Algebra: Canonical form of feedback control system, Rules for block diagram reduction.
Signal Flow Graph: Rules, Properties, Mason gain equation, Use of Mason's gain formula for electrical network.
Feedback control system Characteristics: Stability and sensitivity of a system, Need for standard test signal, Standard test signals, Derivation of steady state error, Analysis of first and second order systems, Role of 'ξ' in second order system, Transient response specification**.**
Unit - III:
Functions : Need for user defined functions, the form of C functions, return values and their types, calling a function, category of functions, non-integer functions, nesting of functions, recursion, functions with arrays, scope and lifetime of variables, ANSI C functions.
Structures and Unions: Structure definition, giving values to members, structure initialization, arrays of structures, arrays within structures, structures within structures, structures and functions, Unions, size of structures, bit fields.
Unit - IV:
Pointers : Concept, accessing the address of variables, declaring and initializing pointers, accessing variables through pointers, pointer expressions, pointer increments and scale factor, pointers and arrays, pointer and character strings, pointers and functions, pointers and structures.
File management in C : Defining, opening and closing a file, I/O operations on files, error handling during I/O operations, random access to files, command line arguments. Preprocessors, Bitwise operations, Graphics in C.
Reference Books:

1. **R.A.Barapate**, Feedback Control Systems **,**Tech-Max Publication.
2. **S.C.Goyal&V.A.Bakshi,** Princples of control systems,Tecnical Publications
3. **I.J.Nagrath & M.Gopal,**Control System Engineering,Wiley Eastern
4. **B.C.Kuo**, Automatic Control Systems PHI
5. **H.T.Kashipura**, Control System Engineering, Akshat Publication.
6. **Balagurusamy E.,** Programming in ANSI C, (IIInd Ed.),TMH Pub., N.Delhi, 2004
7. **P. Day and M.Ghosh,** Programming in C, Oxford Univ. Press, N.Delhi, 2007
8. **Gottfried B.S.,** Programming with C, TMH, N.Delhi, 2000.
9. **Kenetker Y**., Let us C, BPB Pub, N.Delhi, 1991.
10. **Kernighan B.W. and Ritchie D.K.,** C Programming language PHI., N.Delhi, 1999

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ELE– 503: Microcontroller-II & and Digital Signal processing – II

Microcontroller design, testing, writing programs and serial data communication & networking are detailed in this syllabus. Few techniques like interfacing displays, keyboards etc. are taught. Finally some applications are included. Theory and designing of FIR & IIR Digital filters are included in this syllabus.

Unit -I :

An 8051 microcontroller design : Introduction, A microcontroller specification, A microcontroller design, testing the design, timing subroutines look-up tables for the 8051, serial data transmission, serial data communication : Introduction, Network configuration, 8051 data communication modes, example programs.

Unit -II :

Applications : Introduction, keyboard, displays, pulse measurement, D/A and A/D conversions, multiple interrupts, putting it all together.
Microcomputer board using Intel 8031.

Unit -III :

Theory and design of IIR digital Filters : Introduction, Finding the expression for H(s) in the digital domain: The impulse invariant transformation, Designing of Butterworth digital IIR filters, Chebyshev digital IIR filters: Type-I and Type-II, Design of digital filter using Bilinear transformation, Frequency transformation: Low-pass frequency transformation, High-pass frequency transformation, Band-pass frequency transformation, Band-stop frequency transformation, **IIR filter Structures:** Direct form-I IIR filter structures, Direct form-II IIR filter structures, Transposed form IIR filter structures, Parallel form IIR filter structures, Cascade form IIR filter structures, Signal flow graph in filter structure realization, Lattice structure of IIR filter.

Unit -IV:

Theory and design of FIR digital filters: Introduction, Basic principles of FIR filter design, Low-pass FIR filter without using window function, Gibb's phenomenon, Designing other type of FIR filters: High-pass FIR filter, Band-pass FIR filter, Band-stop FIR filter, **FIR filter Structures:** Direct form-I FIR filter structure, Cascade form FIR filter structure, Lattice structure of FIR filters, Comparison of IIR and FIR digital filters, Examples.

Reference Books:

1. **Kenneth J.Ayala,** The 8051 Microcontroller, Architecture, Programming and application, Penram International.
2. **B. Somanathan Nair,** Digital signal processing: Theory, Analysis and Digital filter designing, PHI Publishers.
3. **John G. Proakis and D.G. Manolakis**, Digital signal processing principles, Algorithms and applications, PHI Publishers.

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ELE– 504: Microwaves-II & Instrumentation-II

The students of this course have already studied microwave tubes in Semester – II. In continuation this they will learn about the operation, properties and behavior of some of the microwave solid state active devices.
Topics on measurement techniques of some parameters are also included in one of these units. This will make the students familiar with the microwave measurement techniques.
Advanced instrumentation is used in medical field covering ultrasonic and ecg etc. Other transducers find wide applications in industry.

Unit – I:

Microwave bipolar transistors (physical structure, power frequency limitations), Heterojunction bipolar transistors (HBTs), Microwave Tunnel Diodes (Principles of operation, Microwave characteristics), Microwave Field effect Transistors (Metal semiconductor Field-effect Transistors MESFETS, physical structure, principle of operation, small-signal equivalent circuit, drain current Id, cutoff frequency and maximum oscillation frequency, High electron-Mobility Transistors HEMTs (Physical structure, operational mechanism, performance characteristics, equivalent circuit, electronic applications).

Transferred Electron Devices TEDS Gunn-effect diodes-GaAs diode, background, Gunn effect, Ridley-Watkins-Hilsum (RWH) Theory, differential negative resistance, two valley model theory, High field domains, modes of operation), microwave generation and amplifications).

Unit – II:

Avalanche Transit-time Devices (Read diode, avalanche multiplication, carrier current and external current, output power and quality Factor Q, IMPATT Diode, physical structure, negative resistance, power output and efficiency, Trapatt diode, physical structure, principle of operation, power output and efficiency).
Parametric Devices (Physical description, non-linear resistance and Manley-Rowe power relations, parametric amplifiers, applications).
Microwave Measurements:
Frequency measurements, measurement of power, attenuation measurements, measurement of Phase Shift, measurement of voltage standing wave ratio VSWR, measurement of impedance, measurement of insertion loss, measurement of dielectric constant, measurement of noise factor, measurement of Q of a cavity resonator.

Unit – III:

Strain gauges and measurement of strain, Ballast circuit, Wheastone bridge, Gauge sensitivity, Temperature compensation, Temperature compensation and cancellation techniques, strain gauge calibration, load cell, strain gauge circuitry, uses of strain gauges.
Thickness measurements, measurement of thermal conductivity (gas analyser)

Unit - IV:

Ultrasonic transducer types, Magnetostrictive and piezoelectric, Principle of ultrasonic measurement, Generation of ultrasonic wave, applications of ultrasonic waves, testing of materials by ultrasonic, ultrasonic in means of communication, cutting and machining of hard material, soldering and welding by ultrasonic.
Digital methods for measurement of angular velocity. Measurement of Liquid levels, Flow measurement using hot wire and thermistor.

Reference Books:

1. **Samuel Y.Liao,** Microwave Devices and circuits, P H I.
2. **H.A.Atwater,** Introduction to Microwave Theory, McGraw Hill Book Company.
3. **R.E.Coolins,** Foundation of Microwave Engineering, McGraw Hill Book Company.
4. **K.C.Gupta,** Microwaves, Wiley Eastern Limited, India.
5. **D.C.Sarkar,** Microwave Propagation and Techniques, S.Chand and Company Limited.
6. **H.A.Watson** (ed.), Microwave semiconductor Devices and their circuit Application, McGraw Hill Book Company.
7. **Om P.Gandhi,** Microwave Engineering and Applications, Maxwell Macmillan International Edition.
8. **M.Kulkarni,** Microwave and Radar Engineering**,** Umesh Publications.
9. **Kenneth J.Ayala,** The 8051 Microcontroller, Architecture, Programming and application, Penram International.
10. **K.Padmanabhan & S.Ananthi,** Learn to use microprocessor (EFY).
11. **R.S.Khandpur,** Handbook of Analytical Instruments (TMH)
12. **R.S.Khandapur,** Hand Book of biomedical Instrumentation, (TMH)
13. **A.K.Sawhney**, Electrical and electronic measurements and Instrumentation (Dhanpatrai and Sons).
15. **Bennedict and Weiner** , Industrial Electronics
16. **G.K.Mittal** , Industrial Electronics Khanna Pub..
17. **H.S.Kalsi,** Electronic Instrumentation , TMH
18. **Joseph J. Carr,** Elements of Electronic Instrumentation and measurement, Restor Book PHI.

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ELE– 505PR: PRACTICALS

LIST OF PRACTICALS:

1. R.C. CONTROL CKT. FOR SCR
2. RESISTANCE TRIGGER CKT. FOR SCR
3. RC TRIGGERED CKT FOR SCR CONNECTED IN A BRIDGE
4. TIME DIVISION MULTIPLEX & DEMULTIPLEX
5. STEPPER MOTOR DEMONSTRATION UNIT
6. LOGIC CONTROLLER INTERFACE
7. ELEVATOR INTERFACE
8. DUAL SLOPE A/D CONVERTER
9. KEYBOARD INTERFACE
10. MICROCONTROLLER EXPERIMENTS.
11. MESSAGE DISPLAY (LED/LCD KIT)
12. SQUARE WAVE GENERATION
13. SQUARE OF A NUMBER ≤ 9
14. ADDITION OF NUMBERS
15. PROGRAMMING IN 'C' – I
16. PROGRAMMING IN 'C' – II

15% of new experiments can be introduced AND / OR replaced as per the need, with the permission of the Head.

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ELE– 506PT: PROJECT