Syllabus

The M.Sc. Course is a two-year programme spread over four semesters each of sixteen weeks duration. There will be two categories of courses offered by the Department Viz., Compulsory and Elective Courses (as per regulation 7.2). A compulsory course means a course in Electronics, which a student admitted to M.Sc. Programme in Electronics, should successfully complete to receive M.Sc. degree in Electronics. An Elective course means a course offered in Electronics by the department, for the students of other departments. A student admitted to M.Sc. programme in Electronics should necessarily opt the compulsory courses in Electronics and elective courses offered by the other departments. Students have the freedom to choose from among the prescribed elective courses as per university guide line.

Compulsory courses consist of 14 theory courses and 07 practical and o1 project courses. The Project is in the Fourth semester.

The two Elective courses offered by the Electronics Department for the students of other departments, comprise one theory course each in the second and third semesters only.

Credits:

A student shall complete 96 credits to complete postgraduate course in Electronics with 24 credits per semester. The credits for each of the theory (compulsory and elective) courses and for each of the practical/project (compulsory) courses shall be 4. For the I and IV semesters, there shall be 24 credits for the compulsory courses and for the II and III semesters, there shall be 20 credits for the compulsory courses. There shall be 4 credits each for the open elective courses offered by the other students during II and III semesters. In each of the first three semesters, there are two practical courses each of 04 credits and fourth semester comprises of 01 practical and 01 project courses of each 04 credits. A student shall register for 24 credits per semester.

Sem No	Paper Code No	Title of the paper	Credit/Week	Teaching Hrs/Week*	Duration of Examination in hrs/ Theory/ Practical	Marks at the exam Proper	Internal Assessment	Total
	NOTE: CT: Compulsory Theory CP: Compulsory Practical ET: Elective Theory							
I	ELCT 1.1	Semiconductor Device Theory and Practice	4	4	3	75	25	100
	ELCT 1.2	Signals and Systems	4	4	3	75	25	100
	ELCT 1.3	Programming in C++ and Basics of Python	4	4	3	75	25	100

	ELCT 1.4	Power Electronics Devices and Systems	4	4	3	75	25	100
	ELCP 1.5	Practical –I: Analog & Digital Electronics and MATLAB	4	4	4	75	25	100
	ELCP 1.6	Practical-II: Programming in C++ and Power Electronics	4	4	4	75	25	100
II	ELCT 2.1	Digital Signal Processing	4	4	3	75	25	100
	ELCT 2.2	Controls and Instrumentation	4	4	3	75	25	100
	ELCT 2.3	Microprocessor and Microcontroller	4	4	3	75	25	100
	ELET 2.4	Basic Electronics & Linear Integrated Circuits	4	4	3	75	25	100
	ELCP 2.5	Practical –III: DSP and Instrumentation	4	4	4	75	25	100
	ELCP 2.6	Practical – IV: Microprocessor & Microcontroller	4	4	4	75	25	100
III	ELCT 3.1	Digital Communication	4	4	3	75	25	100
	ELCT 3.2	Introduction to VLSI Circuits	4	4	3	75	25	100
	ELCT 3.3	Embedded Systems Design using ARM Cortex M4	4	4	3	75	25	100
	ELET 3.4	Communication and Digital Circuits	4	4	3	75	25	100
	ELCP 3.5	Practical - V: Digital Communication & VLSI	4	4	4	75	25	100
	ELCP 3.6	Practical – VI: Interfacing with Embedded ARM Cortex Controller	4	4	4	75	25	100
IV	ELCT 4.1	Microwave and Optical Fiber Communication Systems	4	4	3	75	25	100
	ELCT 4.2	Computer Communication	4	4	3	75	25	100
	ELCT 4.3	Digital System Design-VHDL	4	4	3	75	25	100
	ELCT 4.4	Micro Electro Mechanical Systems	4	4	3	75	25	100

	ELCP 4.5	Practical - VII : Optical Fiber Communication & VHDL	4	4	4	75	25	100
	ELCP 4.6	Project:	6	6	4	125 (75 for dissertation and 50 for Viva)	25	150

M.Sc. Electronics Degree Programme:

Duration of the Degree Course: M. Sc. Degree Course is of Two years duration spread over Four semesters each of sixteen weeks duration.

Eligibility for Admission: B.Sc. degree of this University or of any other University recognized as equivalent there to with the optional combinations of i) Electronics, Physics, Mathematics and ii) Electronics, Computer science, Mathematics. The minimum percentage of marks in optional subjects as well as in aggregate will be as per the prevailing rules of the University.

Admission Intake: 25 students for the First semester (it may vary from time to time with the permission from the University). This includes admission under enhanced fee structure. Other rules for admission are as per University notification from time to time.

1. Attendance: Every student must have at least 75% attendance in each of the course (Theory and Practical) in each semester. Shortage of attendance will be dealt with as per the University rules from time to time.

2. Medium of Instruction: The medium of Instruction shall be English.

3. Scheme of Instruction:

In each Semester there will be Compulsory FOUR theory Courses and TWO Practical Courses.

Each theory Course is of FOUR hours of Lectures per week. Each practical course is of FOUR contact hours per week. These include Seminars, Tutorials and Discussion classes. Internal assessment shall be based on written tests/practical tests conducted during the semester.

Each theory and practical Courses shall carry 100 marks out of which 25 marks are for Internal Assessment (IA) test. Various components of IA of 25 marks are as: Attendance-3 marks, written test/Seminar/Assignment – 22 marks.

The total maximum marks for compulsory courses (Theory & Practical) for I semester shall be 600 and for IV semester shall be 650 and for each of II and III semesters shall be 500.

Project: Every student has to perform a Project course in the FOURTH Semester. This may be either theoretical or experimental project relating to electronics subject. More than one student may be

allowed to work on a particular project. Project course carries 150 marks, of which 25 is for IA, 50 marks for viva-voce examination with a presentation and 75 marks for the evaluation of project report.

4. Scheme of Evaluation: Evaluation of each of the courses will have two components, the first being internal assessment (IA) and the second being the semester-end examinations. For a theory and practical courses having a credit award of 4, the total maximum marks shall be 100. Out of the total of 100, 25 marks shall be earmarked for the IA and remaining 75 marks for the semester -end examination. For the project, having a credit award of 06, the total maximum marks shall be 150, out of the total of 150, 25 marks shall be earmarked for IA and the remaining 125 marks for the semester end examination.

Examination: Examination will be conducted at the end of the each semester as per the regulations governing PG Programmes in the faculty of Science & Technology. At semester end examination each theory course will have ONE question paper of 3 hours duration and will carry maximum marks of 75. The internal assessment tests will be conducted during the semester. The mode of conducting Internal Assessment tests may involve a common test for all the courses of that semester. Each practical course will have examination generally, of four hours duration and will carry a maximum of 75 marks at the end of semester. Internal assessment for 25 maximum marks is made through test/seminars.

Project: Each student should submit Project report at the end of IV semester to become eligible for examination. The evaluation of project report carries a maximum of 75 marks. The viva-voce examination carries a maximum of 50 marks and will be in the form of presentation. Internal Assessment for 25 maximum marks is made through test/seminar.

Question Paper Pattern: There will be FIVE questions in a question paper of each theory course for the semester end examination. Each question carries 15 marks. Of the five questions, one question each will be drawn from each of the FOUR units for each compulsory course in the syllabus. Each question will have an internal choice drawn from same unit. Each question will consist of two parts, the one part of 10 marks and the other part of 5 marks. The fifth question, also carrying 15 marks shall contain four sub questions (one from each unit) with an option to answer any three. The four sub questions may be in the form of a problem/short answer question/question for explanation of a concept.

Distribution of Marks:

Theory Course:	Max Marks
Examination	75
Internal assessment	25
Total	100
Practical Course:	
Examination (Inclusive of 5 Marks for Journal and 10 Marks for viva-voce)	75
Internal assessment	25
Total	100
Project:	
Examination (Project Dissertation- 75, Viva-Voce-50)	125
Internal assessment	25
Total	150

5.   Maximum period for the completion of the M.Sc. Degree Programme:

There shall be carry-over benefit from first to fourth semester. The maximum number of years required by a student to complete the degree is as specified the University from time to time.

6.   Rules and Award of Degree:

The minimum for a pass in each course shall be 40% (Semester end exam and internal assessment put together) and 50% in aggregate when all courses of four semesters are put together. There shall be no separate minimum either for semester end examination or for internal assessment.

Award of Degree: Students after successfully completing all the courses prescribed for all the four semesters by scoring minimum of 50% in aggregate will qualify for the award of M.Sc. degree in Electronics.

Results (Marks and Grading): Results of the candidates are declared based on the marks obtained and grades earned and the class awarded as per the University rules.

7.   Facilities and activities: Students are provided, with computer facilities for Internet browsing, library facility, counselling facility and Epsilon club facility. Epsilon club is an association of members consisting of Department Teachers, Research scholars and students. Through which students and Research scholars are encouraged to give lectures and to participate in extracurricular activities. Through this club special lectures by eminent scientists and staffs are arranged often.

M.Sc. Electronics
FIRST SEMESTER

ELCT 1.1	Semiconductor Device Theory and Practice
ELCT 1.2	Signals and Systems
ELCT 1.3	Programming in C++ and Basics of Python
ELCT 1.4	Power Electronics Devices and Systems
ELCP 1.5	Practical-I: Analog & Digital Electronics and MATLAB
ELCP 1.6	Practical-II: Programming in C++ and Power Electronics

M.Sc. ELECTRONICSFIRST SEMESTER

COURSE ELCT 1.1: SEMICONDUCTOR DEVICE THEORY AND PRACTICE

Teaching hours per week: 4
No of credits: 4

UNIT-I

Crystal lattices: periodic structures, cubic lattices, planes and directions, diamond lattice, bonding forces in solids. Energy bands, direct and indirect semiconductors. Charge carrier concentration, Fermi level, electron and hole concentration at equilibrium, Temperature dependence of carrier concentration. Drift of carriers in electrical and magnetic field. Optoelectronic devices: Photodiodes, current and voltage in illuminated junction, solar cells, photo-detectors and Light emitting diodes.

12 hours

UNIT-II

Op-Amp introduction, Instrumentation amplifier, Waveform generators, Active filters- low pass, High pass, bandpass, band stop and all pass filters, Schmitt trigger, Precision Rectifier, Sample- Hold circuits. Timer 555 applications: Monostable & Astable Multivibrators, Monolithic waveform generators, V-F and F-V converters. Analog multipliers, PLL, Universal active filter and switched capacitor filter.

12 hours

UNIT-III

Performance Specifications of A-D and D-A Converters, D-A conversion Techniques-Weighted Resistor DACs, Voltage mode R-2R ladder DAC. A-D converter: Successive-Approximation ADC, Flash Converters, Integrating TypeConverters. Digital Arithmetic circuits: ALU, Parallel binary adder, Design of Full adder, carry look ahead adder. Flip –Flop circuits: NAND and NOR latches, clocked flip-flop (S-R, J-K, D and T). **12 hours**

UNIT-IV

Counters: Synchronous and asynchronous counters, UP/DOWN counter and counter applications. Shift Registers: Concept of Shift Registers and its applications MSI Logic families: Decoders, BCD-to-7 segment decoder/driver, encoders, Multiplexers and their applications, Demultiplexers, Magnitude Comparator, and Data bus operation. Memory devices: Read-Only memories, ROM architecture, Types of ROMs, flash memory. Programmable Logic Devices: Basic idea, PLD architecture (PROM), PAL, PALs, Applications of a programmable Logic Devices-GAL 16V A and Programming PLDs **12 hours**

Text books:

1. Solid state electronics devices. Ben G Streatman and Sanjakuma Banarji. Pearson (2016)
2. "Op–Amps and Linear Integrated Circuits", Ramakant A Gayawad, PHI India ltd
3. "Digital Systems- Principles and Applications" R. J. Tocci, 6/e, PHI India Ltd.,
4. "Digital Fundamentals" Floyd–Merrill's, International Series

Reference books:

1. Semiconductor Physics & Devices Basic Principles (2004) Donald A Neamen, McGraw Hill (3rd Edition)
2. "Linear Integrated Circuits", D. Roy Choudhary and Shail Jain, New Age International (P) Ltd.
3. "Digital Principles and Applications" A. P. Malvino and Leach, TMH, 1991
4. "Digital Logic and Computer Design". Morris Mano, PHI India Ltd.,

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Teaching hours per week: 4

No of credits: 4

UNIT-I

Introduction: Overview of specific signals and systems, Classification of signals, Basic operations on signals. Elementary signals. Systems viewed as interconnections of operations, Properties of systems. **Time Domain representations of Linear Time-Invariant systems:** Introduction. Impulse response representations of discrete and continuous time LTI systems. Differential and difference equation representations of LTI Systems. Block Diagram representation (discrete-time).   **12 hours**

UNIT-II

Fourier Representation of Signals: Introduction, Discrete-Time periodic signals, The discrete- Time Fourier series, and Continuous-Time periodic signals. The Fourier series discrete time non-periodic signals, Fourier transform and properties of Fourier representation. **Application of Fourier Representation:** Introduction, frequency response of LTI systems, Fourier transforms representation for periodic signals, Convolution and Multiplication with mixtures periodic and non-periodic signals. Fourier transforms representation for discrete time signals. Sampling and reconstruction of continuous time signals.   **14 hours**

UNIT-III

Representation of Signals Using continuous-Time Complex Exponentials: Introduction, Eigen function property, LT representation, convergence, Pole-Zero. Unilateral L-T, Properties of Unilateral LT. Inversion of Unilateral L-T, Solving Differential Equations with Initial Conditions, LT Methods in circuit analysis. Properties of Bilateral LT.   **12 hours**

UNIT-IV

Representation of signals Using Discrete-Time Complex Exponentials: The Z-Transform: Introduction, Z-transform, properties of the ROC, properties of the Z-transform. Inversion of Z- transform, analysis of LTI systems. The unilateral Z-Transform.   **12 hours**

Text books:

1) "Signals and Systems", Simon Haykin and Barry Van Veen-John, Wiley and sons, Inc.

Reference books:

1)   "Signals and Systems", Oppenenbeim, A. S. Willsky, 2/e Pearson education, In.,

2)   "Signals and Systems", Bagli and Shah, Mahalaxmi Publications, Kolhapur.

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Teaching hours per week: 4
No of credits: 4

UNIT – I

Introduction - Object oriented programming characteristics of an object oriented language. Basic concepts of object oriented programming language. Applications of oops. **C++ programming language** - Basic structure of c++ program, compiling and linking. Tokens, datatypes, Arithmetic operators, relational, operators, special operators, expressions and evaluation of expressions, scope Resolution operator, Derefencing operator. Decision making and control loop structures:If, if… else statement, switch statement, do… While, while and for loop statement.   **16 hours**

UNIT – II

Functions in C++: The main function, function prototyping, call by reference. **Classes and objects**: Defining member functions, nesting of member functions, function overloading, memory allocation for objects, static and dynamic allocation. **Pointer and polymorphism**: polymorphism pointer to objects, pointers to derived classes, pointer to functions. **Managing console I/o operations: C++ streams, unformatted i/o operations**. **Structures**: declaration, initialization, nested of structure, pointer to structures. **Inheritance:** extending classes, derived classes.   **12 hours**

UNIT – III

Data Structures: Classification, basic Operations. **Stacks**: Representation of stack in C using Array, Operations of stack, Application of stack, Infix, Postfix, & Prefix Expressions, postfix expression evaluation. **Queue:** Representation of Queue using Array, Operations on queue, Double ended and Circular queue. **Linked List**: Advantages of linked list, basic component oflist, representation of list, basic operation of singly list, types of list, Circular linked list, doubly linked list. **Trees:** Tree terminology, classification, representation of tree, binary tree, tree traversal.   **12 hours**

UNIT – IV

Sorting: Bubblesort, selection sort **Searching:** Basic searching techniques, binary search, interpolation search. **Python Introduction**- Overview of Python programming language, introducing the python interpreter, program execution, execution model variations, Interactive prompt. **Introducing python object types**- The python conceptual hierarchy, pythons core data types, numbers, strings, Dictionaries, Tuples, Files, Numeric type.   **12 hours**

Text books:

1)   Learning python by B. Nagesh Rao, Cyber plus

2)   C++ Programming language -3rd edition- by Bjarne stroustrup, Addison Wesley Publication

3)   Object oriented programming language by E Balagurusamy ,Tata Mc-Graw Hill (6th edition)

4)   Object oriented programming language using C++ by A.M.Padma Reddy, Nandi Publication.

Reference books:

1)   Learning python powerful object oriented programming by Mark Lutz (5th edition) , 'O' Reilly Media Publication.

2)   Python programming for Beginners by Joseph Joyner, Mihails Konoplovs publication.

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Teaching hours per week: 4

No of credits: 4

UNIT I

Introduction: Applications of power Electronics, Power semiconductor devices, Types of Power Electronic Circuits. Reverse recovery characteristics of diode, Power diode types, Effect of Forward and Reverse Recovery Time. **Semiconductor Power Electronic Devices**: Gate and Switching Characteristics of SCR, IV characteristics of DIAC, TRIAC, GTO, PUJT–Power Transistors–Power FETs–LASCR–Two transistor model of SCR – Protection of Thyristors against over voltage – over current, dv/dt and di/dt.   **12 hours**

UNIT II

SCR Triggering Techniques: Turn on circuits for SCR – triggering with single pulse and train of pulses–synchronizing with supply. Different commutation techniques, Series and Parallel operations of SCRs. **Controlled Rectifiers:** Single phase–three phase–half controlled and fully controlled rectifiers–Waveforms of load voltage and line current under constant load current

12 hours

UNIT III

Choppers: Chopper classifications, Principle of Step down and Step up operations, Control Strategy of Chopper, Buck, Boost and Buck–Boost regulator. **DC motor drives:** Basics of DC motors, Semi converter, full converter and Dual converter motor drives, BLDC Motor Drives.
12 hours

UNIT IV

Voltage Source Inverter: Single-phase half bridge inverter, full bridge inverter, voltage and current waveforms, Mc-Murray commutation circuit, three-phase bridge inverter, voltage and current waveforms, Concept of PWM inverters. **Applications:** Battery charger–SMPS–UPS, PWM Solar Charge controller.   **12 hours**

Text Books:
1.   Dubey G. K., Doradla S. R., Joshi A. and Sinha R. M. K., "Thyristorised Power Controllers", New Age International Private Limited.

2.   Rashid M. H., "Power Electronics Circuits Devices and Applications", 3rd Ed., Pearson

References:
1.   Sen: Power Electronics, TMH, 1987.
2.   Dubey: Thyristorised power controllers, Wiley Eastern 1986.
3.   Vithayathil: Power Electronics – Principles and applications McGraw-Hill, 1995.
4.   Lander: Power Electronics, 3rd Edition, McGraw-Hill, 1994.

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COURSES IN PRACTICALS

ELCP 1.5: Practical-I: Analog & Digital Electronics and MATLAB and ELCP 1.6: Practical-II: Programming in C++ and Power Electronics

(EACH PRACTICAL IS OF 4 HOURS PER WEEK AND WITH FOUR CREDITS)

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M.Sc. Electronics

SECOND SEMESTER

ELCT 2.1   Digital Signal Processing

ELCT 2.2   Controls and Instrumentation

ELCT 2.3   Microprocessor and Microcontroller

ELET 2.4   Basic Electronics & Linear Integrated Circuits (OEC)

ELCP 2.5   Practical-III: DSP and Instrumentation

ELCP 2.6   Practical-IV: Microprocessor & Microcontroller

M.Sc. ELECTRONICSSECOND SEMESTER

Course ELCT 2.1: DIGITAL SIGNAL PROCESSING

Teaching hours per week: 4
No of credits: 4
UNIT I

Discrete Fourier Transform (DFT): Introduction, Properties of DFT, Circular shift of a sequence, Circular convolution, Linear convolution using DFT. Overlap-save and overlap-add methods of linear filtering. **Efficient Computation DFT:** Introduction, Decimation-in-time FFT algorithm and in-place computations, and Decimation-in-frequency FET algorithm and in-place computations, Applications FFT algorithm in linear filtering. **12 hours**

UNIT II

IIR Filter Design: Introduction, Design of IIR digital filter from analog filters, Impulse invariance, Design based on numerical solution of differential equations, bilinear transformation, Matched Z Transform. Characteristics of Buterworth and Chebyshev Filters. And problems on these filters. **12 hours**

UNIT III

FIR Filter Design: Introduction, Impulse response of linear Phase FIR filters, Design of Linear Phase FIR filters using Windows- Rectangular. Characteristic features of Barlett, Hanning, Hamming, and Blackmann windows. Frequency sampling and Equiripple FIR filter design criteria, comparison of IIR and FIR digital Filters. **12 hours**

UNIT IV

Digital Filter Structures: Basic IIR filter Structures: Direct forms (I&II), Cascade and parallel realizations. Signal Flow graph and Transposed structure. Basic FIR filter structures: Direct from, linear phase and lattice FIR structures. DSP processor architecture. **12 hours**

Text books:

1) "Digital Signal Processing", Proakis, Prentice Hall of India Ltd.

2) Digital Signal processing: A practical approach. 2nd Edition By Emmanuel C Ifeachor, BarrieW Jervis. Pearson Publishers

Reference books:

1) "Digital Signal Processing", Rabiner and Gold, Prentice Hall of India Ltd

2) "Digital Signal Processing", Sanjit. K. Mitra, Tata-McGraw Hill.

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Teaching hours per week: 4

No of credits: 4

UNIT-I

Control Systems: Introduction, examples of Control Systems and Closed-loop versus Open-loop controls. **Mathematical Modeling of dynamic systems:** Transfer function and impulse- response function, automatic control systems, modeling in state space, State-space representation of dynamic systems, Electrical and Electronic systems, Signal flow graphs.   **12 hours**

UNIT-II

Transient and steady state response analysis: First-order and Second-order systems, Ruthe's stability criterion, Effects of Integral and derivative control actions on systems performance, Steady-state errors in unity-feedback control systems. **Root-Locus analysis:** Root-Locus plots, General rules for constructing Root Loci, Positive-feedback Systems.   **12 hours**

UNIT-III

Control Systems Design by the Root-Locus Method: Preliminary design considerations Lead and Lag compensations, Lag-Lead compensation. **Frequency-Response Analysis:** Bode diagrams, Polar plots, Log-Magnitude-versus-Phase plots, Nyquist stability criterion, Stability analysis, Relative stability.

                    12 hours

UNIT-IV

Digital Instruments: Dual slope integrating type DVM, Integrating type DVM, Continuous Balance DVM, 3-1/2 digit, Resolution and sensitivity of digital meters, General specification of DVM, MP based Ramp type DVM, Digital Multimeters, Digital Frequency meter, Digital PH meter, Digital Phase meter, Digital Capacitance meter Digital readout oscilloscope, Digital storage oscilloscope and IEEE 488 Bus.   **12 hours**

Text books:

1)   "Modern Control Engineering", K. Ogata, 4/e, PHI, 2003.

2)   "Electronic Instrumentation" H.S. Kalsi, TMH 1995

Reference books:

1)   "Modern Control Engineering", D. Roy Choudhary, PHI, 2005.

2)   "Automatic Control Engineering", B.C. Kuo, 7/e, PHI, 1995.

3)   "Modern Electronic Instrumentation and Measurement Techniques", A.D. Helfric and W.D. Cooper, PHI of India Ltd.,

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Teaching hours per week: 4

UNIT-I   No of credits: 4

8086 Microprocessor and its Architecture: Internal Microprocessor architecture, Real mode memory addressing, **Addressing modes:** Data addressing modes, program memory-addressing modes. Stack memory addressing modes. **Instruction Set:** data movement instruction, Arithmetic and logic instructions, Program control instructions with an example programs.Assembler details. **12 hours**

UNIT-II

Hardware Specifications: Pin-outs and the pin functions, Clock-generator (8284A), Bus buffering and latching, Bus timing Ready and wait state, **Memory Interface and Basic I/O Interface:** Memory devices, Address decoding, 8088 (8-bit) memory interface 8086 (16-bit) memory interface. Introduction to I/O interface, I/O port address decoding, 8255 PPI. interfacing. Basics of Interfacing devices   **12 hours**

UNIT-III

Introduction to Microcontrollers: Microcontrollers & Microprocessors, MCS-51 Architecture, Registers in MCS-51, 8051 pin description, pin connectors, Parallel I/O ports and memory organization. 8051 addressing modes, Instruction Set. Assembly Language Programming Tools, Development Systems and Tools   **12 hours**

UNIT-IV

8051 Programming: MCS-51 Interrupts, Timer/Counters and Serial Communications. **Interfacing:** Interfacing of keyboard, 7-segment LED, LCD, ADC, and DAC, Stepper motor, Waveform -Sine wave , Square wave generation.   **12 hours**

Text books:

1) "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium Pro Processor Architecture, Programming and Interfacing", B.B.Brey, 4/e, PHI.

2) "The 8051 Microcontrollers and Embedded Systems", M.A. Mazidi and J.G. Mazidi, Pearson Education, Inc.,

Reference Books:

1) "Microprocessor and Interfacing, Programming and Hardware", 2/e, Douglass V. Hall, McGraw Hill International Edition, 1992.

2) "Software, Hardware and Applications", Walter A. Tribel and Avatar Singh, PHI, 1995.

3) "Microcomputer Systems: The 8086/8088 Family Architecture, Programming and Design",Yu Cheng Lin and Glen A. Gibson, PHI, 1992.

4) "The 8086 Microprocessor: Programming & Interfacing the PC", K.J. Ayala, Penram International Publishing (India) Pvt, Ltd., 1995.

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COURSES IN PRACTICALS

ELCP 2.5: Practical–III: DSP and InstrumentationELCP 2.6: Practical–IV: Microcontrollers

(EACH PRACTICAL IS OF 4 HOURS PER WEEK AND WITH FOUR CREDITS)

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M.Sc. Electronics

THIRD SEMESTER

ELCT 3.1 Digital Communication

ELCT 3.2 Introduction to VLSI Circuits

ELCT 3.3 Embedded Systems Design using ARM Cortex M4

ELET 3.4 Communication and Digital Circuits (OEC)

ELCP 3.5 Practical - V: Digital Communication & VLSI

ELCP 3.6 Practical- VI: Interfacing with Embedded ARM Cortex Controller

M.Sc. ELECTRONICSTHIRD SEMESTER

COURSE ELCT 3.1: DIGITAL COMMUNICATION

Teaching hours per week: 4
No of credits: 4

UNIT-I

Communication: Introduction, Differences between digital and analog communication systems, Block diagram of a digital communication system. Digital Transmission of Analog signals: Introduction, Sampling Theory and Practice, Ideal Sampling and Reconstruction low pass signals, Practical sampling, Quantization of analog signals: Uniform Quantization, non-uniform Quantization, Differential quantization. Coded transmission of analog Signals: PCM system, Differential Pulse Code Modulation (DPCM), Delta Modulation and Time-Division Multiplexing (T1 system). **12 hours**

UNIT-II

Random Signal Theory: Probability mass functions & Statistical averages, Probability density functions & Statistical averages. **Baseband Transmission of Binary Data:** The inter symbol interface problem, Ideal solution, Raised Cosine Spectrum, Correlative-level coding, Base band transmission of M-ray Data, Eye Pattern, Adaptive Equalization. **Digital Modulation Techniques:** Binary Modulation Techniques; ASK, PSK, and FSK Generation and Detection of Binary Modulated Waves, Quadrature phase-shift Keying, Optimum (or Correlation) receivers: Matched Filter receiver, Properties of Matched Filter. **12 hours**

UNIT-III

Spread Spectrum Modulation: Introduction, Pseudo-Noise Sequences, Properties of Maximum-length sequences, notion of Spread Spectrum, Direct-sequence Spread Coherent Binary PSK, Frequency-Hop Spread Spectrum: Slow-Frequency and Fast-Frequency Hopping. CDMA and Multipath suppression. **Information theory:** Measure of Information, Properties of Entropy, Extension of a DMS, source coding theorem, Prefix Coding, Huffman Coding, Channel coding, Mutual Information and properties of Mutual Information. **12 hours**

UNIT-IV

Error Control Coding: Introduction, Methods of Controlling Errors, Types of Errors, Types of codes, Linear Block Codes, Matrix Description of Linear Block Codes, Error detection and error correction capability of linear block codes, Single error-correcting Hamming Codes, Binary cyclic codes, Encoding using an (n-k) bit shift register, Golay Codes, BCH Codes, Burst-error Correcting codes and Convolution Codes. **12 hours**

Text books:

1) "Digital Communications", Simon Haykin, John Wiley & Sons Publications.

2) "Digital and Analog Communication Systems" K. Sam Shanmugam, John Wiley & sons (Asia) pte ltd., 2000.

Reference books:

1) "Principles of Communication Systems", 2/e, Taub Schilling, TMH, 1991.

2) "Digital Communications, Fundamentals and Applications", Bernard Sklar, 2/e, Pearson Education.

3) "Coding Theory", by Abrahanson, Prentice Hall of India.

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Teaching hours per week: 4

No of credits: 4

UNIT-I

Introduction to CMOS circuits and MOS transistor theory: MOS transistor, MOS transistor switches, CMOS logic, alternate circuit representation, CMOS-NMOS comparison. MOS transistor Theory: Introduction, MOS device design equations, the complimentary CMOS inverter-DC characteristics, alternate CMOS inverter, transmission gate- DC characteristics, latch up.

12 hours

UNIT-II

CMOS processing technology: Wafer processing, oxidation, selective diffusion, the silicon gate process, Silicon On Insulator, CMOS process environment, lay-out design rules, layer representation, lambda based p-well rules, lambda based SOI rules, double metal design rules, Process parameterization: abstract layers, spacing rules, construction rules.   **12 hours**

UNIT-III

Circuit characterization and performance estimation: Resistance estimation, capacitance estimation, switching characteristics: Fall time, Rise time, Delay, Determination of conductor size. Power consumption: static dissipation, dynamic dissipation, charge sharing, scaling, yield.

14 hours

UNIT-IV

CMOS circuit and logic Design: CMOS complimentary logic, Pseudo-nMOS logic, dynamic CMOS logic, clocked CMOS logic, Domino logic, Cascade Voltage Switch logic, modified domino logic, pass transistor logic, clocking strategies, I/O pads.   **12 hours**

Text books:

1.   Principle of CMOS VLSI Design,a system perspective-Neil H.E. Weste and Kamran Eshraghian, Addison-Wesley.

2.   "Introduction to VLSI Circuits and Systems", John P. Uyemura, John Wiley & Sons (Asia) Pte. Ltd., 2003.

Reference books:

1.   VLSI Fabrication Principles", S.K. Ghandhi, 2/e, John Wiley & Sons (Asia) Pte. Ltd., 2003.

2.   VLSI Technology", 2/e, S.M. Sze, McGraw-Hill, 1988.

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COURSE ELCT 3.3: EMBEDDED SYSTEMS DESIGN USING ARM CORTEX M4

Teaching hours per week: 4
No of credits: 4

UNIT-I

Embedded systems: Embedded systems Overview, Design Challenges, Processor technology, IC Technology, Design Technology, and Tradeoffs. Application Specific IC (ASIC), Field Programmable Logic Array (FPGA) and Microcontrollers, Digital signal Processor (DSP). Development boards, Programming, Compiler and linker, program flow, operating systems support, benchmarks.

12 hours

UNIT-II

ARM Cortex Architecture: Evolution of ARM Architecture, ARM Cortex M3 processor, Exceptions and interrupts, Sleep modes, Introduction to instruction set (16 bit & 32 bit), Assembly syntax, Bit field and Bit band operations, Introduction to Cortex M4 processor, Floating point unit, Floating point and DSP instructions **12 hours**

UNIT-III

STM32F4 microcontrollers : Architecture of STM32F4 series microcontroller, power controller, Reset and Clock Unit, General Purpose I/O(GPIO), Nested Vectored Interrupt controller (NVIC) , Analog to digital converter, Digital to Analog Converter (DAC), DMA controller. **12 hours**

UNIT-IV

Timers: Counter modes, PWM wave generation, Capture/Compare channels, Watchdog Timer, Real Time Clock (RTC). **Serial Communication protocols:** Inter IC communication (I2C), **Universal** Synchronous and Asynchronous Receive Transmitter (USART), Serial Peripheral Interface (SPI), Introduction to CAN bus. **12 hours**

Text books:

1. Embedded System Design , A Unified Hardware/ Software Introduction Technology 3rd edn 2011   By Frank Vahid/ Tony Givargis, Walley

2. Microcontrollers. Hardware and Firmware for 8-bit and 32-bit devices, By Franco Zappa. 1st edition (2017) Societa editrice esculapio.

Reference books:

1. Discovering the STM32 Microcontroller by Geoffrey Brown (2016)
    http://creativecommons.org/licenses/by-nc-sa/3.0/

2. STM32F4 Datasheets and reference manuals from www.st.com

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COURSES IN PRACTICALS

ELCP-3.5: Practical-V: Digital Communication & VLSI

ELCP-3.6: Practical-VI: Interfacing with Embedded ARM Cortex Controller

(EACH PRACTICAL IS OF 4 HOURS PER WEEK AND WITH FOUR CREDITS)

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M.Sc. Electronics

FOURTH SEMESTER

ELCT 4.1   Microwave and Optical Fiber Communication Systems

ELCT 4.2   Computer Communication

ELCT 4.3   Digital System Design-VHDL

ELCT 4.4   Micro Electro Mechanical Systems

ELCP 4.5   Practical- VII : Optical Fiber Communication & VHDL

ELCP 4.6   Project

M.Sc. ELECTRONICSFOURTH SEMESTER

COURSE ELCT 4.1: MICROWAVE AND OPTICAL FIBER COMMUNICATION SYSTEMS

Teaching hours per week: 4
No of credits: 4

UNIT-I

Electromagnetic Theory: Maxwell's equations, Fields in media and boundary conditions, the wave equation and the basic plane wave solutions, General Plane wave solutions, energy and power. **Waveguide Theory:** General solutions for TEM, TE and TM waves parallel plate waveguide, Rectangular waveguide. **Transmission Line theory:** Field analysis of transmission lines, Smith chart, Single stub tuning, Double stub tuning and the quarter wave transformer.

12 hours

UNIT-II

Antennas: Types of antennas, Hertz and Marconi antennas, Yagi-Uda antenna, Reflector antenna, lens antenna, Helical antenna, Log periodic antenna, Phased array antenna, Microstrip antenna **Microwave Tubes**-Two cavity Klystron, Reflex Klystron and TWT **Microwave Solid- state devices and components :** Varactor diodes, PIN diodes, Tunnel diodes, GUNN diode. Basic properties of dividers and couplers, Wave-guide directional couplers, Coupled line directional couplers and Microwave Systems (qualitative).   **12 hours**

UNIT-III:

Optical Fibers: Basic optical laws, optical fiber modes and configurations, mode theory for circular waveguide- Maxwell's equation and waveguide equations, Signal attenuation, **optical sources**- Topics from semiconductor Physics, LEDs and Laser diodes.   **12 hours**

UNIT-IV:

Photodetectors : Physical principle, PIN and Avalanche type photodetectors. Optical receiver Operation – Digital signal Transmission, Error sources, Receiver configuration. **Advanced Systems and Techniques**:- WDM, optical Amplifiers, Mechanical and Integrated-optical switches.

12 hours

Text books:

1)   "Microwave Devices Circuits", 3/e, Samuel. Y. Liao, Prentice Hall of India, 1998

2)   "Microwave and Radar: Principles and Applications", 2/e, A.K. Maini, Khanna Publishers. 2001.

3)   Optical Fiber Communications by Gerd Keiser McGRAW – HILL International Ed (2nd Edn)

Reference books:

1)   "Microwave and Radar Engineering", M. Kulkarni, Umesh Publications, 3/e, 003.

2)   "Electronics Communication Systems", 4/e, Wayne Tomasi, Pearson Education.

3)   Modern Electronic Communication", 7/e, G.H. Miller and J.S. Beasley, Prentice Hall of India.

4)   "Microwave Engineering", 2/e, David M. Pozar, John Wiley & Sons (Asia) Pte, Ltd, 1999.

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COURSE ELCT 4.2: COMPUTER COMMUNICATION

Teaching hours per week: 4

No of credits: 4

UNIT-I

Introduction: The use of computer network, Network Hardware, Network software, The OSI reference models, The TCP/IP reference model, Comparison of OSI & TCP/IP reference models. **Physical layer & Transmission**: Guided Transmission media – co-axial cable, Fiber optics, Comparison of Fiber optics and copper wire. Wireless Transmission: IR transmission. **12 hours**

UNIT-II

Physical layer & Transmission (Cont): FDM, TDM and CDM. Public Switched telephone networks: Structure of Telephone systems, Local loop Modems, ADSL and fiber. Circuit switching, Packet Switching Hybrid Switching. Mobile Telephone systems: From 1G, 2G and 3G. **12 hours**

UNIT-III

The Data Link Layer: Data Link Layer design issues, Error detection and correction, Elementary data link protocols, sliding window protocols performance. **The Medium Access Sub-layer:** The local and metropolitan area networks, the ALOHA protocols, IEEE standard 802 for LAN. Ethernet, Bluetooth and RFID. **14 hours**

UNIT-IV

The Network Layer: Design issues, Routing algorithms – optimality principle, shortest path algorithm, flooding, distance vector routing. Congestion control algorithms, Network layer in the Internet. **The Transport Layer:** Transport service, transport protocols, Internet transport protocol (TCP & UDP). **12 hours**

Text books:

1) "Computer Networks", Andrew S. Tanenbaum and David J. Wetherall (5th Edition) PrenticeHall of India Publishers.

Reference books:

1) "Computer Networks, Protocols, Standard and Interfaces", Ulyses Black, Prentice Hall of India Pub.

2) "Data Communication and Networking", Behrouz. A. Forouzan, McGraw Hill, 5th Edition

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Teaching hours per week: 4

No of credits: 4

UNIT-I

INTRODUCTION TO VHDL:VHDL terms, Describing hardware in VHDL, entity, architecture, signal assignment statements, event scheduling, statement concurrency, structural design, architecture selection, configuration statements and power of configurations. **Basic language elements**: identifiers, data objects, data types. **Behavioral modelling**: introduction, concept of delays (inertial, transport and delta delay) **Sequential processing**: process statements, signal assignments, sequential statements, IF, CASE, LOOP, NEXT, EXIT, ASSERT and WAIT statements.
12 hours

UNIT-II

DATA FLOW AND STRUCTURAL MODELLING: Data flow modeling: concurrent signal assignment statement, concurrent v/s sequential assignment statements, multiple drivers, conditional signal assignment statements, selected signal assignments, block and guarded block statements **Structural modeling:** component declaration, component instantiation, configuration, configuration specification. **12 hours**

UNIT-III

SUBPROGRAM AND PACKAGES: Subprograms: functions and procedures, subprogram overloading, operator overloading, **Packages:** package declaration, package body, implicit visibility and explicit visibility. Examples. **12 hours**

UNIT-IV

ADVANCED TOPICS: Generate statements, aliases, qualified expressions, conversion functions, attributes, text I/O, **Model simulation:** writing a test bench, dumping results into file, reading vectors from file, test bench examples. **Hardware modeling examples:** A clock divider, a generic binary multiplier ,pulse counter, Barrel shifter , state machine modeling. **12 hours**

Text books:

1) VHDL: Programming by Example by Douglass L Perry, 4th edition, McGraw-Hill.

2) VHDL Primer 3/e Bhaskar, Addison Westley Longman(Singapore) Pvt Ltd,2000.

Reference books:

1) Circuit design with VHDL, Volnei A Pedroni, MIT press

2) VHDL- Analysis and Modeling of Digital systems, Zainalabedin Navabi,McGraw-Hill International Editions.

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COURSE ELCT 4.4: MICRO ELECTRO MECHANICAL SYSTEMS

eaching hours per week: 4
No of credits: 4

UNIT - I

INTRODUCTION TO MEMS TECHNOLOGY: Basic definitions, history and evolution of MEMS. Scaling laws in Miniaturization: Scaling in Geometry, in Rigid-body dynamics, in electrostatic forces, in electromagnetic forces and in electricity. MEMS sensors and actuators. Types of MEMS, Applications of MEMS in various disciplines. **Materials for MEMS & Microsystems**: Silicon, Silicon compounds, Silicon piezo-resistors, Gallium Arsenide, Quartz, conducting polymers, Langmuir-Blodgett (LB) film, Fullerenes and CNT.   **12 hours**

UNIT - II

MICRO MACHINING/ FABRICATION: Introduction, photolithography and other lithography methods, structural and sacrificial materials, thin film deposition techniques, Impurity doping processes, Etching, types etching, wafer bonding methods, LIGA. Bulk versus Surface Micromachining.   **12 hours**

UNIT - III

MICRO-OPTO-ELECTROMECHANICAL (MOEM) SYSTEMS: Introduction, light modulators, Beam- splitter ,Microlens and Micro-mirrors **Radio Frequency (RF) MEMS:** Introduction, Review of RF-based communication systems, RF –MEMS MEMS inductors, varactors, tuners, filters, resonators, phase shifters, switches.   **12 hours**

UNIT - IV

MEMS MODELING: Introduction, Basic modeling elements in electrical, mechanical, thermal and fluid systems, Translational pure Mechanical system with spring, damper and mass, analogy between 2nd order mechanical and electrical systems. **Microsystem Design**: Introduction, design considerations, properties of materials. Design of a silicon die for Micro- pressure sensor and packaging of MEMS   **12 hours**

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COURSES IN PRACTICAL

ELCP 4.5: Practical-VII: Optical Fiber Communication & VHDL and ELCP 4.6 (PROJECT)

(PRACTICAL/PROJECT IS OF 4 HOURS PER WEEK WITH FOUR CREDITS)

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M.Sc. Electronics

SECOND SEMESTER OPEN ELECTIVE

ELET-2.4: BASIC ELECTRONICS & LINEAR INTEGRATED CIRCUITS

M.Sc. ELECTRONICS SECOND SEMESTER (ELECTIVE)

ELET-2.4: BASIC ELECTRONICS & LINEAR INTEGRATED CIRCUITS

(ELECTIVE PAPER TO OTHER DEPARTMENTS STUDENTS)

Teaching hours per week: 4

No of credits: 4

UNIT-I

Circuit Variables: Circuit concepts Units, Standards and Dimensions. Electric current, Electric charge, potential difference, Electric power and Energy. Circuit elements: Passive elements and active elements. **Network Law's:** Ohm's Law's, Junction Law's (KCL), Mesh Law's (KVL) Application of Network Law's to simple dc networks theorems- Thevnin's theorem, Norton's theorem Max power transfer theorem.   **12 hours**

UNIT-II

Semiconductors: Energy bands theory, intrinsic semiconductors, extrinsic semiconductor, effect of temperature on Impurity semiconductors and mechanism of current conduction in semiconductor. **Junction Diodes:** p-n junction, an unbiased p-n junction, Energy band of unbiased p-n junction, a biased p-n junction and V-I characteristics of P-n junction. Some special P-N junction:- Photodiodes, LED and Solar Cell. Junction transistor, Transistor static characteristic Self-bias or emitter bias, Two-port representation of Transistor (hybrid Parameter) JFET: Static Characteristic of FET comparison of FET with Bipolar transistor. Applications of BJT and JFET.   **12 hours**

UNIT - III

Operational Amplifier characteristics & Applications: Introduction, Ideal Op-Amp, DC and AC Characteristics.: Instrumentation Amplifier, V to I and I-V converter Precision rectifier, Differentiator and Integrator. Comparator Schmitt trigger wave generators (Square wave and Triangular wave) and first order Low pass and High pass filters.   **12 hours**

UNIT-IV

Special IC: series Op-Amp regulator, IC voltage regulators, 555 Timer as Monostable and Astable operation. D-A and A-D converters, PLL: Basic principles PLL as Frequency multiplication /Division.
        12 hours

Text books:

1) "Foundations of Electronics", D Chattopadhyaya, P.C. Rakshit, B Saha and N N Purkait New Age International Edition.

2) "Linear Integrated Circuit", by D. Roy Choudhary and Shail Jain, New Age International (P) ltd.,

3) "Op-Amp and Linear Integrated Circuits", R.A. Gaikwad, PHI of India ltd.,

Reference books:

1) A Textbook of Electronics (Second Edition) S.L Kakani and K.C.Bhandari

2) "Electronic Principles" A.P. Malvino , TMH Edition.

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M.Sc. Electronics

THIRD SEMESTER OPEN ELECTIVE

ELET-3.4: COMMUNICATION AND DIGITAL CIRCUITS

M.Sc. ELECTRONICS

THIRD SEMESTER (ELECTIVE)

ELET-3.4: COMMUNICATION AND DIGITAL CIRCUITS
(ELECTIVE PAPER TO OTHER DEPARTMENT STUDENTS)
Teaching hours per week: 4
No. of credits: 4

UNIT-I
Radio wave Propagation: Ground or surface wave, Space or tropospheric wave and Sky wave. Ionosphere, Effect of Ionosphere on Radio waves, Skip distance, maximum Usable frequency and Ionospheric fading. **Antenna:** Introduction, loop and ferrite rod antenna, Yagi-Uda, Dish antenna and Microstrip antenna (Qualitative). **12 hours**

UNIT-II

Modulation and detection: Modulation, AM, Power in AM, FM, Comparison of AM & FM. Generation and detection of AM wave. Super-heterodyne radio receiver (Block Explanation)
12 hours

UNIT-III

Optical fiber communication: Principles of light transmission, Fiber index profiles, Modes of propagation, losses in fibers. Types of Light Sources and Photo detectors (Qualitative).

12 hours

UNIT-IV

Digital circuits: Introduction, Decimal, Binary and Hexa decimal number systems, Conversions, Binary addition and subtraction, OR, AND and NOT Circuits. Boolean algebra, De Morgan's Theorem, additional laws and theorems. NOR and NAND gates. Flip-Flop and RS Flip-Flop using NAND gate. **12 hours**

Text books:

1) "Foundations of Electronics", D. Chattopadhyaya, P.C. Rakshit, B Saha and N N Purkait, NewAge International Edition.

2) "Electronic Communications", D. Roddy and J. Coolen, PHI of India ltd.,

Reference books:

1) Electronic Communication Systems. G. Kennady, TMH Edition.

2)   Electronic Principles A.P. Malvino, TMH Edition.

3)   A Textbook of Electronics (Second Edition) S.L Kakani and K.C.Bhandari