KARNATAK UNIVERSITY, DHARWAD

DEPARTMENT OF ELECTRONICS

M.Sc. Electronics

Syllabus

for

Choice Based Credit System (CBCS)

With Effect From

2018-2019

onwards

The M.Sc. course in Electronics was started during 1995–96 in the Department of Physics under the UGC thrust area programme. Keeping in view of the up gradation in the field of electronics at both academia and industry the curriculum is accordingly prepared. Department is committed to the academic excellence, creativity and all-round development of the students. Over the years the students of the department have occupied good positions in industry/academia at both national and international level.

Programme of Study:

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.

1. 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.

2. **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.

3. **Medium of Instruction:** The medium of Instruction shall be English.

4. **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.

5. **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**

6. **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.

7. **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.

8. **Facilities and activities:** Students are provided, with computer facilities for Internet browsing, library facility, counseling 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) Choice Based Credit System (CBCS)
Teaching and Evaluation Scheme
(From Year 2018-19 onwards)

Sem No	Paper Code No	Title of the paper	Credits/ Week	Teaching Hrs/Week*	Duration of Examination in hrs/ Theory/ Practical	Marks at the exam Proper	Internal Assessment	Total
I	**NOTE: CT: Compulsory Theory CP: Compulsory Practical ET: Elective Theory**							
	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 dissert ati on and 50 for Viva)	25	150

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. ELECTRONICS

FIRST SEMESTER

COURSE ELCT 1.1: SEMICONDUCTOR DEVICE THEORY AND PRACTICE

Teaching hours per week: 4

UNIT-I ***No of credits: 4***

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 Stretman 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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COURSE ELCT 1.2: SIGNALS AND SYSTEMS

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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COURSE ELCT 1.3: PROGRAMMING IN C++ AND BASICS OF PYTHON.

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 of list, 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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COURSE ELCT 1.4: POWER ELECTRONICS DEVICES AND SYSTEMS

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: S**ingle 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. ELECTRONICS

SECOND SEMESTER

Course ELCT 2.1: DIGITAL SIGNAL PROCESSING

Teaching hours per week: 4

UNIT I ***No of credits: 4***

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

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

3) Digital Signal processing: A practical approach. 2nd Edition By Emmanuel

4)

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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COURSE ELCT 2.2: CONTROLS AND INSTRUMENTATION

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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COURSE: ELCT 2.3: MICROPROCESSOR AND MICROCONTROLLER

Teaching hours per week: 4

No of credits: 4

UNIT-I

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 Instrumentation

ELCP 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. ELECTRONICS

THIRD SEMESTER

COURSE ELCT 3.1: DIGITAL COMMUNICATION

Teaching hours per week: 4

UNIT-I

No of credits: 4

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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COURSE ELCT 3.2: INTRODUCTION TO VLSI CIRCUITS

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. ELECTRONICS

FOURTH 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 (2^{nd} 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) Prentice Hall 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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COURSE ELCT 4.3: DIGITAL SYSTEM DESIGN-VHDL

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

Teaching 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 andELCP 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, New Age 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

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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
I	**NOTE: CT: Compulsory Theory CP: Compulsory Practical ET: Elective Theory**							
	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 dissert ati on and 50 for Viva)	25	150

Programme Outcomes (POs)

PO's (1):	To create post-graduates with sound knowledge of fundamentals of Electronics, who can contribute towards advancing science and technology.
PO's (2):	To create post-graduates with sufficient capabilities in Electronics who can become researchers and developers to satisfy the needs of the core Electronics industry
PO's (3):	To develop ability among students to formulate, analyze and solve real life problems faced in Electronics industry.
PO's (4):	To provide opportunity to students to learn the latest trends in Electronics and make them ready for life-long learning process.
PO's (5):	To make the students aware of professional ethics of the Industry, and prepare them with basic soft skills essential for working in community and professional teams.
PO's (6):	To prepare the students for post graduate studies through competitive examinations, enabling them to reach higher echelons of excellence
PO's (7):	To produce electronic professionals who can be directly employed or start his/her own work as Electronic circuit Designer, Electronics consultant, testing professional, Service engineer and even an entrepreneur in electronic industry
PO's (8):	Develop designing and analyzing attitude about networks and wireless communication

Course outcomes (COs)

ELCT-1.1 Semiconductor device theory and practice	
CO's (1):	Describe the properties of materials and application of semiconductor electronics
CO's (2):	Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
CO's (3):	Demonstrate the switching and amplification application of the semiconductor devices
CO's (4):	Demonstrate the control applications using semiconductor devices.
CO's (5):	Identify the fabrication methods of integrated circuits.
CO's (6):	Classify and describe the semiconductor devices for special applications
CO's (7):	Basic concept of shift registers and its MSI Logic families

ELCT-1.2 Signals And Systems	
CO's (1):	To understand mathematical description and representation of continuous and discrete time signals and systems.
CO's (2):	To Develop input output relationship for linear shift invariant system and understand the
CO's (3):	To understand Convolution operator for continuous and discrete time system.
CO's (4):	To Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
CO's (5):	To Understand the limitations of Fourier transform and need for Laplace transform and develop
CO's (6):	The ability to analyze the system in s- domain.
CO's (7):	To Understand the basic concept of probability, random variables & random signals and develop

ELCT-1.3 Programming in C++ and Basics of Python	
CO's (1):	Describe the principles of object oriented programming.
CO's (2):	Apply the concepts of data encapsulation, inheritance in C++.
CO's (3):	Understand basic program and constructs in Python
CO's (4):	Apply the concepts of classes, methods and inheritance to write programs in C++.
CO's (5):	Discuss the computational efficiency of the principal algorithms such as sorting & searching.
CO's (6):	The ability to analyze the Infix, postfix and prefix expressions and Evaluation procedure.
CO's (7):	Understand the basic concepts of Tree Terminology and tree traversal technique.

ELCT-1.4 Power Electronics Devices And Systems	
CO's (1):	Understand the structure of power electronic devices such as diode, BJT, SCR, IGBT, MOSFET and advanced devices such as MCT, IGCT.
CO's (2):	Analyze the operation of these devices Based on the static and dynamic characteristics, their limitation choose these devices for various applications.
CO's (3):	Understand and analyze various gate drive circuits and protection circuits of devices
CO's (4):	Model various devices using modern tools.
CO's (5):	Able to design solar devices as well as some power devices like SMPS etc

ELCP-1.5 Practical-I : Analog and Digital Electronics and	
After the end of the course, a student will be able to:	
CO's (1):	Derive basic logic gates, adder, and subtractor using universal gates.
CO's (2):	know how to generate and visualize different types of signals
CO's (3):	understand the basics of MATLAB commands.
CO's (4):	Illustrate realization of Boolean in SOP and POS form and design it using logic gates
CO's (5):	Design and test combinational circuits. Design and develop sequential circuits

ELCP-1.6 Practical-III : Programming in C++ and Power Electronics	
After the end of the course, a student will be able to :	
CO's (1):	Understand C++, the programming process, and the compilation process.
CO's (2):	Describe and compare machine language and a high level language.
CO's (3):	Discuss the advantages of a high-level language.
CO's (4):	Use an IDE to compile, load, save, and debug a C++ program
CO's (5):	Design Triggering circuits of SCR using LT spice
CO's (6):	Perform the experiment on various convertors and invertors simulation through LT spice

ELCT-2.1 Digital Signal Processing	
CO's (1):	Analyze the discrete time signals and system using different transform domain techniques.
CO's (2):	Design and implement LTI filters for filtering different real world signals.
CO's (3):	Develop different signal processing applications using DSP processor.
CO's (4):	Design and implement IIR filters and FIR DIGITAL filter for different real world signals.
CO's (5):	Basic concept of DSP processor architecture.
CO's (6):	Analyze the Frequency sampling for FIR filter.

ELCT-2.2 Controls And Instrumentation	
CO's (1):	Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
CO's (2):	Determine the (absolute) stability of a closed-loop control system.
CO's (3):	Perform time domain and frequency domain analysis of control systems required for stability analysis.
CO's (4):	Perform time domain and frequency domain correlation analysis.
CO's (5):	Apply root-locus, Frequency Plots technique to analyze control systems.
CO's (6):	Understand fundamental of various electrical measurements
CO's (7):	Understand and describe specifications, features and capabilities of electronic instruments.

ELCT-2.3 Microprocessor and Microcontroller	
CO's (1):	Learn importance of microcontroller in designing embedded application.
CO's (2):	Learn use of hardware and software tools.
CO's (3):	Develop interfacing to real world devices.
CO's (4):	Understand the Basic concept of 8086 Architecture .
CO's (5):	Understand and describe specifications of memory devices and address decoding.
CO's (6):	Understand and analyze the concept of MCS-51 Architecture .

ELCT-2.4 Basic Electronics and Linear Integrated Circuits	
CO's (1):	Explain behavior of FET at low frequency.
CO's (2):	Understand the basic concepts of KVL and KCL
CO's (3):	Understand the characteristics of IC and Op-Amp and identify the internal structure
CO's (4):	Analyze and identify linear and nonlinear applications of Op-Amp.
CO's (5):	Familiar with DAC, ADC and timers.
CO's (6):	The Basic concept of Operational Amplifier characteristics.

ELCP-2.5 Practical-III : DSP and Instruments	
After the end of the course, a student will be able to :	
CO's (1):	Enumerate the basic concepts of signals and systems and their interconnections in a simple and easy-to-understand manner by employing different mathematical operations like folding, shifting, scaling, convolutions, Z-transform etc. 3. 4.
CO's (2):	Determine transfer function, impulse response and comment on various properties like linearity, causality, stability of a system;
CO's (3):	Predict time and frequency response of discrete-time systems using various techniques like Z-transform, Hilbert transform, DFT, FFT.
CO's (4):	Design digital IIR and FIR filters using filter approximation theory, frequency transformation techniques, window techniques and finally construct different realization structures;.
CO's (5):	Select proper measuring instrument and know requirement of calibration, errors in measurement

ELCP-2.6 Practical-IV : Microprocessor and Microcontroller	
After the end of the course, a student should be able to :	
CO's (1):	To study programming based on 8086 microprocessor and 8051 microcontroller in TASM
CO's (2):	To study 8086 microprocessor based ALP using arithmetic, logical and shift operations.
CO's (3):	To study modular and Dos/Bios programming using 8086 micro processor
CO's (4):	Demonstrate ability to handle string instructions using assembly language programming in TASM
CO's (5):	Demonstrate ability to handle sorting operations and using assembly language programming in TASM

ELET-3.1 Digital Communication

CO's (1):	Understand working of waveform coding techniques and analyse their performance.
CO's (2):	Analyze the performance of a baseband and passband digital communication system in terms of error rate and spectral efficiency.
CO's (3):	Perform the time and frequency domain analysis of the signals in a digital communication system.
CO's (4):	Design of digital communication system.
CO's (5):	Understand working of spread spectrum communication system and analyze its performance.
CO's (6):	Understand various types of Errors detecting and correcting codes

ELET-3.2 Introduction to VLSI Circuits	
CO's (1):	Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
CO's (2):	Understand chip level issues and need of testability.
CO's (3):	Design analog & digital CMOS circuits for specified applications.
CO's (4):	Understand working and Basic concept of CMOS processing technology.
CO's (5):	Analyze the Circuit characterization and estimation.
CO's (6):	Understand the concept of logic design for CMOS circuit.

ELET-3.3 Embedded Systems Design Using ARM Cortex M4

CO's (1):	Describe the ARM microprocessor architectures and its feature.
CO's (2):	Interface the advanced peripherals to ARM based microcontroller
CO's (3):	Design embedded system with available resources.
CO's (4):	Understanding the architecture of STM 32f4 series.
CO's (5):	Overview of Field Programmable Logic Array(FPGA).
CO's (6):	Understand the concept of Serial Communication protocols.

ELCT-3.4 Communication and Digital Circuits	
CO's (1):	Understand the concept of Radio wave propagation.
CO's (2):	Familiar with some important antennas.
CO's (3):	Understanding the concept of modulation and generation.
CO's (4):	Analyze the concept of Optical Fiber.
CO's (5):	Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
CO's (6):	Analyze the concept of Types of Photo detectors.

ELCP-3.5 Practical-V : Digital communication and VLSI	
After the end of the course, a student will be able to :	
CO's (1):	design all basic CMOS circuits using lambda based design rules.
CO's (2):	Simulate circuits within a CAD tool and compare to design specifications.
CO's (3):	Analyse the set up and hold time of output waveforms.

CO's (4):	gain practical experience related to digital communication circuits by circuit simuation.
CO's (5):	understand the basic theories of digital communication in practical.

ELCP-3.6 Practical-VI : Interfacing with Embedded ARM Cortex Controller	
After the end of the course, a student should be able to :	
CO's (1):	programme and interface the various peripherals
CO's (2):	Configure and programme the controller for interfacing with different moduls
CO's (3):	programme and interface the various communication peripherals
CO's (4):	programme and interface the various communication peripherals USART, UART,TTL,I2C

ELCT-4.1 Microwave And Optical Fiber Communication Systems	
CO's (1):	Formulate the wave equation in waveguide for analysis.
CO's (2):	Understand the concepts related to Faraday's law, induced emf and Maxwell's equations
CO's (3):	Apply Maxwell's equations to solutions of problems relating to transmission lines and uniform plane wave propagation.
CO's (4):	Understand the principle of optical laws.
CO's (5):	Analyzing the basic concepts of photo-detector.
CO's (6):	Overview of various Advanced systems and Techniques.

ELCT-4.2 Computer Communication	
CO's (1):	Understand the concept of OSI and TCP/IP reference models.
CO's (2):	Explain and apply concepts of GSM and CDMA system.
CO's (3):	Specify and identify deficiencies in existing protocols, and then go onto select new and better protocols.
CO's (4):	Understand the Concept and principle of Transmission layer.
CO's (5):	Overview of various Routing algorithms.
CO's (6):	Understand the Concept TCP and UDP.

ELCT-4.3 Digital System Design –VHDL	
CO's (1):	Model, simulate, verify, and synthesize with hardware description languages.
CO's (2):	Understand and use major syntactic elements of VHDL - entities, architectures, processes, functions, common concurrent statements, and common sequential statements
CO's (3):	Design digital logic circuits in different types of modeling
CO's (4):	Demonstrate timing and resource usage associated with modeling approach.
CO's (5):	Model, simulate, verify, and synthesize with Behavioral modelling.
CO's (6):	Understand and use of Data flow modeling.

ELCT-4.4 Micro Electro Mechanical Systems	
CO's (1):	To introduce the basic concepts of micro systems and advantages of miniaturization.

CO's (2):	To study the various materials and their properties used for micromachining techniques.
CO's (3):	To teach the fundamentals of micromachining and micro fabrication techniques.
CO's (4):	To impart knowledge of the basic concept of electromechanical effects, thermal effects Micro fluidics and integrated fluidic systems.
CO's (5):	To give exposure to different MEMS devices.
CO's (6):	Understand and use of MOEM systems.

ELCP-4.5 Practical-VII : Optical Fiber communication and VHDL	
After the end of the course, a student will be able to :	
CO's (1):	Demonstrate a clear Understanding in hardware design language VHDL.
CO's (2):	Model a Combinational circuit and sequential circuit using hardware description language VHDL and validate its functionality.
CO's (3):	Design and implement a circuit on a FPGA board.
CO's (4):	Recall analog and digital link, propagation loss, numerical aperture for optical fiber communication.
CO's (5):	Sketch the gain characteristics. And study of intensity modulation