MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

M.Sc., ELECTRONICS AND COMMUNICATION

CBCS (2021-2022 onwards)

Objective:

The postgraduate (PG) degree in electronics intends to develop new work opportunities for research-oriented technocrats and entrepreneurs who will shape the scientific and technological arena. Curriculum, course content, and assessment all plays a significant influence in the development of PG students, research scholars and engineers. As a result, it should be compromised with basic understanding of current developments in the sector. Based on this viewpoint, the expert committee created a **syllabus for M.Sc. Electronics and Communication course** that includes a wide range of topics in order to suit industry and research expectations.

Eligibility for Admission

As per the guidelines for the admission of Post Graduate (PG) students by Department of Collegiate Education, Chennai.

Medium of instruction and Examination

Medium of instruction and examination shall be in **ENGLISH.**

REGULATIONS

DURATION OF THE COURSE:

Two Years divided into **Four** semesters. Each semester will be of 90 working days.

COURSE OF THE STUDY:

It's under CBCS (Choice Based Credit System) pattern according to the syllabus and books prescribed from time to time.

ELIGIBILITY:

As per the guidelines for the admission of Post Graduate (PG) students by Department of Collegiate Education, Chennai.

SCHEME OF EXAMINATIONS:

As per the CBCS pattern with SE (Secured External Examinations score) and IA (Internal Assessment score)

QUESTION PAPER PATTERN FOR ALL PG COURSES:

THEORY PAPERS:

MARKS FOR INTERNAL: (Max. Marks: 25)

Marks distribution:

Cycle test and model exam: 15 marks
Assignment : 5 marks
Seminar :5 marks
Total : 25 marks

MARKS FOR EXTERNAL:(Max. Marks: 75, Passing minimum: 38, Time: 3 Hours)

1. Part A (10 x 1= 10 marks), Answer All questions, Two questions from each unit
2. Part B (5 x 5 = 25 marks), Answer All questions, One question from each unit with internal Choice
3. Part C (5 x 8 = 40 marks), Answer All questions, One question from each unit with internal Choice

PRACTICAL PAPERS:

TIME: 3 Hours, Maximum Marks: 50 (External) and 50 (Internal)
Marks will be calculated by laboratory performance, attendance, record note book maintenance, model practical's examination.

INERNSHIP / FIELD WORK (maximum marks): IA: 50 marks and SE: 50 marks

PROJECT WORK (maximum marks): IA: 50 marks and SE: 50 marks

MOOCS online initiative course (maximum marks): IA: 25 marks and SE: 75 marks

Sub. No. (1)	Subject Status (2)	Subject Title (3)	Contact Hrs / Week (4)	Credits (5)	Max Marks/ Exam Time (SE: IA/ Hrs) (6)
SEMESTER – I					
1	Core Theory – 1	Electronic Properties of Materials	6	4	75:25 / 3
2	Core Theory – 2	Mathematical Methods and Network Analysis	6	4	75:25 / 3
3	Core Theory – 3	Analog and Digital System Design	5	4	75:25 / 3
4	Core Theory – 4	Advanced Microprocessors	5	4	75:25 / 3
5	Core Practical - 1	Analog Electronic Design Lab	4	2	50:50 / 3
6	Core Practical - 2	Digital Electronic Design Lab	4	2	50:50 / 3
		Subtotal	**30**	**20**	
SEMESTER – II					
7	Core Theory – 5	Electromagnetics, Microwave and Antenna	5	4	75:25 / 3
8	Core Theory – 6	Optoelectronics and Optical Fiber Communication	5	4	75:25 / 3
9	Core Theory – 7	Digital Communication System	4	4	75:25 / 3
10	Core Theory – 8	Microcontrollers, Embedded System and IOT applications	4	4	75:25 / 3
11	Core – Field Work-1	Field Work	4+	3	50:50 / 3
12	Core Practical – 3	Microcontroller’s lab	4	2	50:50 / 3
13	Core Practical – 4	Embedded System Design and IOT Lab	4	2	50:50 / 3
		Subtotal	**30**	**23**	

Sub. No. (1)	Subject Status (2)	Subject Title (3)	Contact Hrs / Week (4)	Credits (5)	Max Marks/ Exam Time (SE: IA/ Hrs) (6)
SEMESTER – III					
14	Core Theory – 9	Advanced Power Electronics and Virtual Instrumentation	6	4	75:25 / 3
15	Core Theory – 10	Mobile, Optical and Data Communication systems	6	4	75:25 / 3
16	Core Theory – 11	Digital Signal and Image Processing	5	4	75:25 / 3
17	Core Theory – 12	Research Methodology	5	4	75:25 / 3
18	Core Practical – 5	Advanced Communication Lab	4	2	50:50/3
19	Core Practical – 6	DSP MATLAB and LABVIEW instrumentation Lab	4	2	50:50/3
20	Core-MOOCS-1	At least any one of the subject oriented online MOOC courses	-	2	50:50 / 3
		Subtotal	**30**	**22**	
SEMESTER – IV					
21	Core Theory – 13	Introduction of Python and Android Application Tools Development	4	4	75:25 / 3
22	Core Theory –14	VLSI Design and VHDL programming	4	4	75:25 / 3
23	Core Theory – 15	RF Circuit and Satellite Communication	4	4	75:25 / 3
24	Core Practical – 7	VLSI and Android Application development Lab	4	2	50:50/3
25	Core Practical – 8	Object Oriented Programming using Python Lab	4	2	50:50/3
26	Core Elective – 1 (**Select any one**)	a. Field Work b. Study Tour c. Nano Electronics d. Quantum Optical Communication	3+	3	75:25 / 3
27	Core Project - 1	Project Work	7+	8	50:50/3
	Subtotal		**30**	**27**	
	Total		**120**	**92**	

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -I / Ppr.no.1 / Core - 1

ELECTRONIC PROPERTIES OF MATERIALS

OBJECTIVES: To understand the basic electronic properties of materials to explore the novel devices in electronics industries.

UNIT I

Electrical properties of metals: Conductivity, reflection and absorption, Fermi surfaces, superconductivity, thermoelectric phenomena. Conduction in metals oxides, amorphous materials.

UNIT II

Dielectric Properties of materials: Macroscopic electric field, local electric field at an atom, dielectric constant and polarizability, ferroelectricity, antiferroelectricity, phase transition, piezoelectricity, ferro elasticity, electrostriction.

UNIT III

Optical properties of materials: Optical constants and their physical significance, Kramers – Kronig Relations, Electronic intern bond and intra bond transitions Relations between Optical properties and band structure – colour of material (Frenkel Excitons), Bond Structure determination from optical spectra reflection, refraction, diffraction, scattering, dispersion, photoluminescence, Electroluminescence.

UNIT IV

Magnetic Properties of Materials: Diamagnetism, Para magnetism, various contributions to par and dia-magnetism, Adia-batic demagnetization, Paramagnetic susceptibility. Ferromagnetism, ferrimagnetism, ferrites, anti-ferromagnetism, curic point, temperature dependence of saturation magnetization, saturation magnetization at absolute zero, magnons and their thermal excitation, dispersion relation, Neutron Magnetic scattering, Ferrimagnetic and anti-ferrimagnetic order, domains and domain walls, magnetic resonance. Coercive force, hysteresis, methods for parameters measurements.

UNIT V

Materials Properties at Nanoscale: Quantum Confinement in Nanomaterials-Prime materials in Nanotechnology- Nanomaterials: natural and man-made-Semiconductor Nanomaterials-Polymers and Composites-Metal Nanoparticles-Biomaterials-Unique properties of nanomaterials-Microstructure and defects in monocrystalline materials-Effect of nano dimensions on material behavior (magnetic, electrical, optical and thermal properties).

Text Books:

1. Electronic Properties of materials, R.E. Hummel, Springer New York publication
2. Solid State Physics, Dekkar, Mc Graw Higher Ed publication
3. Introduction to Solid State Physics, C.Kittle, Wiley publication
4. Principles of Electronic materials &dev, S.O. Kasap, McGraw Higher Ed Publication
5. Elementary Solid-state physics, M. Ali Omar; Pearson Publication.
6. Nanotechnology: The Science of Small-M.A Shah & K.A Shah, Wiley Publication -First Edition 2013

COURSE RESULTS: The knowledge of materials in electronics should be useful to students for further device development.

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -I / Ppr.no.2 / Core - 2

MATHEMATICAL METHODS AND NETWORK ANALYSIS

OBJECTIVES: This course is to familiarize students with a range of mathematical methods and networks and these are essential for solving problems in electronics.

UNIT I

MATRIX: Elementary transformation – finding inverse and rank using elementary transformation – solution of linear equations using elementary transformations – eigenvalues and eigenvectors – application of Cayley-Hamilton theorem – Diagonalization – Reduction of quadratic form into sum of squares using orthogonal transformation – nature of quadratic form.

UNIT II

EQUATIONS, INTEGRALS AND SOLUTIONS: Differential equations and their solutions, Double integrals in cartesian and polar co-ordinates – application in finding area and volume using double integrals – change of variables using Jacobian - Introduction to Signals and Systems, Bessel functions of first and second kind.

UNIT III

STATISTICS AND TRANSFORM FUNCTIONS: Introduction to Statistics, Population and Sample, Types of Data, Measures of Central Tendency, Measures of Dispersion and Discrete Probability Distribution, Laplace transform and its applications, Analysis of LTI Continuous Time System using Laplace Transform, Z-Transform.

UNIT IV

NETWORK ANALYSIS: Network elements, Network Graphs, Nodal and Mesh analysis, Zero and Poles, Bode Plots, Laplace transforms, Two-port Network Parameters, Transfer functions, Signal representation. State variable method of circuit analysis. AC circuit analysis, Transient analysis

UNIT V

FOURIER SERIES: Dirichlet conditions – Fourier series with period π and 2π – Half range sine and cosine series – simple problems – RMS value.

TEXT AND REFERENCE BOOKS:

1. Advanced Engg. Mathematics, Erwin Kreyszig, Willey Publication, 10^{th} Edition
2. Higher Engg. Mathematics Grewal B.S., Khanna Publishers
3. Goon Gupta and Das Gupta: Fundamentals of Statistics, Vol. 1, The World Press Pvt. Ltd., Kolkata.
4. Miller and Fruend: Modern Elementary Statistics. PEARSON publication.
5. Snedecor and Cochran: Statistical Methods, Oxford and IBH Publishers.
6. Engg. Mathematics: N.P.Bali
7. Laplace and Fourier Transforms, Goyal and Gupta
8. Advanced Mathematics for Engineers: E.S.Sokolinokoff
9. Methods of Applied Mathematics: F.B.Hilderbrand
10. Mathematical methods for Physics: Arfken, A.G. Academic Press.
11. Digital Signal Processing: SanjitMitra,Mcgraw Higher Ed publication.
12. Mathematical methods for physicists and Engineers: M.A. Boas
13. Network Analysis: Von Valkenberg,PEARSON

COURSE RESULTS: The students will be able to solve various differential equations, functions, signals, networks, Fourier series and integral transformations, etc.,

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -I / Ppr.no.3 / Core - 3

ANALOG AND DIGITAL SYSTEM DESIGN

OBJECTIVES: To acquire and understand the basic knowledge of analog circuits and digital logic design

UNIT 1
ANALOG SYSTEM DESIGN: Circuit Design and Analysis using PSPICE – Schematics, attributes and types of analysis in PSPICE, use of PROBE.

UNIT 2
DESIGN AND ANALYSIS-1: Design and analysis of BJT/FET differential and multistage amplifiers, current sources, current mirrors, and active loads, small signal circuit analysis

UNIT 3
DESIGN AND ANALYSIS-2: Operational Amplifiers (OPAMP)-characteristics and Applications- Integrator, Differentiator, Wave-shaping circuits, Active filters, Oscillators, Schmitt trigger circuit, non-sinusoidal oscillators and timing circuits

UNIT 4
DESIGN AND ANALYSIS-3: Design and analysis of signal conditioning circuits, Current to Voltage, Voltage to Current, Voltage to Frequency, Frequency to Voltage converters, Phase Locked Loop (PLL) and its application circuits.

UNIT 5
DIGITAL SYSTEM DESIGN: Digital system design concepts, approaches, basic combinatorial and Sequential circuits, Implementation of systems like ALU, Stop watch. Finite state machines, Control unit design, Applications of FSM like sequence detector, sequence generator, Stepper control programmable logic devices-ROM, PAL, FPGA, CPLD etc., PLD based system design applications.

TEXT AND REFERENCE BOOKS:

1. Analysis and Design of Analog Integrated Circuits: Grey and Mayer
2. Electronic Circuit analysis and design: D.A.Neaman, McGraw Hill.
3. Microelectronic Circuits Analysis and Design: Rashid, PWS pub.
4. Electronic Devices and circuit theory: R. L Boylestad and L.Nashelsky,Pearson
5. M. Mano, Digital Logic and Computer Design, Prentice-Hall India.
6. M. Morris Mano, Michael D. Ciletti, “Digital Design”, Pearson, 2013.
7. Tocci, Wedmer and Moss,” Digital systems principles and applications”, 10thedition Pearson

COURSE RESULTS: Analog and digital system design is must for students to construct their own design in electronics.

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -I / Ppr.no.4 / Core - 4

ADVANCED MICROPROCESSORS

OBJECTIVES: Study of architecture, features and programming of 8086 microprocessors

UNIT I
CISC PRINCIPLES: Classic CISC microprocessors, Intel x86 Family: Architecture - register set – Data formats - Addressing modes - Instruction set - Assembler directives – Interrupts Segmentation, Paging, Real and Virtual mode execution – Protection mechanism, Task management 80186, 286, 386 and 486 architectures.

UNIT II
PENTIUM PROCESSORS: Introduction to Pentium microprocessor – Special Pentium Registers – Pentium Memory Management – New Pentium instructions – Introduction to Pentium Pro and its special features – Architecture of Pentium-II, Pentium-III and Pentium4 microprocessors.

UNIT III
RISC PRINCIPLES: RISC Vs CISC – RISC properties and evaluation – On- chip register File Vs Cache evaluation – Study of typical RISC processor – The PowerPC – Architecture & special features – Power PC 601 – IBM RS/6000, Sun SPARC Family – Architecture – Super SPARC.

UNIT IV
RISC PROCESSOR: MIPS Rx000 family – Architecture – Special features – MIPS R4000 and R4400 – Motorola 88000 Family – Architecture – MC 88110 – MC 88100 and MC 88200.

UNIT V
SPECIAL PURPOSE PROCESSORS: EPIC Architecture – ASIPs – Network Processors – DSPs – Graphics / Image Processors.

TEXT AND REFERENCE BOOKS:

1. Daniel Tabak, “Advanced Microprocessors”, Tata McGraw-Hill, 1995, 2nd Edition.
2.The 80x86 family John Uffenbeck-Design, Programming and Interfacing, III edition.

COURSE RESULTS: Students can understand the need of microprocessors and their features.

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -I / Ppr.no.5 / Practical - 1

ANALOG ELECTRONIC DESIGN LAB

OBJECTIVES: To get the practical training in analog electronic circuit design.

List of experiments consists of:

I. **Waveform generators:** Multivibrators (Monostable, Astable& Bistable), Triangular wave generator (Using op-amp), Wave shaping circuits, S.M.P.S - Voltage controlled oscillator

II. **Amplifiers:** RC coupled amplifier, FET amplifier. (Spice analysis)

III. **Filters:** Butterworth filters, Low pass filter - High pass filters - Band pass filters - Band reject filters (SPICE analysis) IGMF filters, Low pass filters - High pass filters - Band pass filters -Band reject filters Universal filters - Chebyshev filters (SPICE analysis)

IV. **Communication:** Frequency modulation using PLL - Amplitude modulation using OPAMP -Frequency shift keying by PLL - Simulation of inductance using OPAMP gyrator - Negative impedance converter - Frequency multiplication by using PLL

COURSE RESULTS: Students can able to troubleshoot the analog electronic circuit design experiments with various applications.

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -I / Ppr.no.6 / Practical - 2

DIGITAL ELECTRONIC DESIGN LAB

OBJECTIVES: To get the practical training in digital electronic circuit design.

List of experiments given below:

1. Timer experiments using 555 timer. (Astable / Monostable)

2. Study of IC's. Use bread boards.
   i). Familiarization of digital ICs. Astable and monostable multivibrator using logic gates.

3. Study of combinational, sequential & CMOS circuits (Using SPICE)
   - i) Combinational Circuits -
     1. Adder/Subtractor.
     2. Comparators
     3. Encoder/Decoder.
     4. MUX /DEMUX.
     5. Code converters.
   - ii). Sequential Circuits -
     1. Flip-Flops.
     2. Shift Registers.
     3. Counters
   - iii). Sequence Generations.
     1. CMOS Circuits.
     2. Inverter.
     3. Universal Gates.
     4. Boolean Expressions.

COURSE RESULTS: Students can able to troubleshoot digital electronic circuit design experiments with bread boards as well as SPICE software.

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -II / Ppr.no.7 / Core - 7

ELECTROMAGNETICS, MICROWAVE AND ANTENNA

OBJECTIVES: It is intended as a resource for understanding electromagnetics required in current, emerging and future broadband communications systems.

UNIT I

Maxwell's equations, correspondence of field and circuit equations, characteristic impedance and admittance, S-matrix, lossless and lossy Transmission lines, standing wave and standing wave ratio, impedance matching techniques like $\lambda/4$ transformer, single and double stubs use of Smith's chart. Skin depth.

UNIT II

Waveguides: propagation modes, types of waveguides, waveguide components- E and H plane T, Magic 'T' microwave couplers, matched terminations, directional couplers, circulators and isolators, Phase shifters, cables, connectors and Adapters

UNIT III

Microwave: Klystron and Magnetron, travelling wave tube, Microwave switches, Microwave transistors, microwave diodes: Varactor, GUNN diode, PIN diode, IMPATT, TRAPATT, GaAs FET. Power Thermistor, diode, short key diode.

UNIT IV

Antennas: Types of antennas: short dipole antennas, antenna arrays, isotropic, dipole, broadside and end fire arrays, Yagi-Uda, log periodic and rhombic antenna, Reflector antennas, Reconfigurable antennas, Phased array antennas, Cognitive radio, Microstrip Antennas.

UNIT V

Antenna parameters: S parameter, VSWR, Gain, Radiation resistance, Radiation pattern, beam width, bandwidth, efficiency, Polarization. Friis Transmission equation, Radar-cross equation

TEXT AND REFERENCE BOOKS:

1. Electromagnetic: J.D. Kraus, McGraw Hill.
2. Microwave devices and circuits: S.Y. Liao, Prentice Hall.;
3. Solid State Electronic Devices: Ben G. Streetman, Pearson Publication, seventh edition.
4. Antenna Theory: Analysis and Design: Constantine A. Balanis, Wiley Publication.4th edition.
5. Antenna theory and design: Robert S. Elliott, Prentice-Hall publication.
6. Broadband Microstrip Antennas: Girish Kumar, K. P. Ray,Artech House publication.
7. Microwave and Radar Engineering: M. Kulkarni, Umesh Publication.

COURSE RESULTS: It’s a foundation of electronic communication systems.

MSU / 2021-22 / PG –Colleges / M.Sc. Electronics and Communication / Semester -II / Ppr.no.8 / Core - 8

OPTOELECTRONICS AND OPTICAL FIBER COMMUNICATION

OBJECTIVES:

- Understand the basic operating principles of light sources, detectors.
- Understand basic principles of light propagation and modal analyses of optical fiber and system modulation.

UNIT I

OPTOELECTRONICS-I: Lamps and illumination systems, LEDs – working principle and applications, LED lighting, Display devices, indicators, numeric, alphanumeric and special function displays, Liquid Crystal Display elements, Plasma Displays, Multimedia projectors, Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers, Distributed Bragg Reflection (DBR) lasers

UNIT II

OPTOELECTRONICS-II: Photodetectors types and applications, PN and PIN Photodiodes, Avalanche Photodiodes (APD), Optocouplers, Opto-interrupters, LASER used in safety interlocks, power isolators, rotary and linear encoders and remote control. Intrinsic and Extrinsic Fiber optic sensors.

UNIT III

OPTICAL FIBER-1: Optical Fiber Theory, Parameters of Optical Fibers, Types of Optical Fibers-Single Mode and Multi-Mode Fibers, Step Index & Graded Index Fibers. Modal Properties-Waveguide Parameter (V Number), Cut-off wavelength, Dispersion-Intermodal and Intramodal dispersion. Loss Mechanism in Optical Fibers-Adsorption and Scattering, Fresnel Reflection, Micro bending & Macro bending, Connector types and Splices, Misalignment and Mismatch losses.

UNIT IV

OPTICAL FIBER-II: Fiber-Optic transmitters and receivers, Direct Modulators, External Modulators-Electro-Optic Modulators, Electro-Absorption Modulators, Noise in detection process, Noise Equivalent Power (NEP).

UNIT V

OPTICAL FIBER-III: Single Channel System Design, Power budgeting, Transmission Capacity Budgeting, Dispersion Compensation, Nonlinear effects in optical fibers-Stimulated Brillouin Scattering (SBS), Self-Phase Modulation (SPM), Cross-Phase Modulation (XPM), Four-Wave Mixing (FWM).

TEXT AND REFERENCE BOOKS:

1. Optical Engineering Fundamentals B.H. Walker, PHI
2. Electro-Optical Instrumentation Sensing and Measuring with Lasers: SilvanoDonati, Pearson
4. Fiber optics and Optoelectronics: R.P. Khare, Oxford Press.
5.Optical Fiber Communication Principles and Systems A. Selvarajan, S.Kar and Srinivas, TMH
6. Optical Fiber Communications G. Keiser, TMH

COURSE RESULTS: Students can get awareness about optical sources, fiber optics and optical communication through fibers.

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DIGITAL COMMUNICATION SYSTEMS

OBJECTIVES:

- To understand information theory and coding
- To familiarize various coding techniques and methods
- To understand convolutional codes and cryptography
- To get the knowledge on digital modulation techniques and their comparison

UNIT I

INTRODUCTION: Information, Entropy, Information rate, Classification of codes, Kraft McMillan inequality, source coding theorem, Shanon-Fano coding, Huffmann coding, Extended Huffmann coding, Shanon's channel capacity theorem, joint and conditional entropy, mutual information, discrete memory-less channel, BSC, BEC

UNIT II

CODING AND DECODING-1: Hamming weight, Hamming distance, Types of codes, Linear Block codes, Repetition codes, Syndrome decoding, Syndrome property, minimum distance decoding, Cyclic codes, Syndrome calculation, encoder and decoder, important cyclic codes.

UNIT III

CODING AND DECODING-2: Convolutional codes- Quad tree Trellis state diagram, encoding-decoding, time domain approach and transform domain approach, Sequential search and Viterbi algorithm, Principle of turbo coding, Cryptography, Secret key cryptography, block and stream ciphers, DES, data encryption standard, public key cryptography, digital signatures

UNIT IV

DIGITAL MODULATION TECHNIQUES: Phase Shift Keying, Amplitude Shift Keying, Frequency Shift Keying, Coherent Detection of PSK and FSK, Non-Coherent Detection of Differential Phase Shift Keying, Binary Differential Phase Shift Keying and FSK, QPSK, Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying (GMSK), M-ary Signaling, Probability of Error in each Scheme, Comparison of Digital Modulation Techniques.

UNIT V:

SPREAD SPECTRUM TECHNIQUES: Overview of Spread Spectrum Techniques, Pseudo-noise (PN) Sequences, Properties of Pseudo-noise, Sequences, Theory of Spread Spectrum Modulation, Model of Spread Spectrum Digital Communication System, Direct-Sequence Spread Spectrum (DSSS) Systems: Generation and Detection, Example of Direct Sequencing, Processing Gain and Performance, Frequency Hopping Spread-Spectrum (FHSS) Systems: Example, Robustness, Frequency Hopping with Diversity, Fast Hopping versus Slow Hopping, FFH/MFSK Demodulator, Processing Gain, Synchronization: Acquisition and Tracking.

TEXT BOOKS:

1. Digital Communications - Simon Haykin, 4th Edition, John Wiley & Sons, Inc.
2. Taub's Principles of Communication Systems by H Taub, D L Schilling and G Saha, Third Edition 2008, TMH Education Pvt Ltd, New Delhi.
3. Analog and Digital Communications by Hwei P. Hsu, Schaum'sOutline Series, McGraw Hill Education Pvt. Ltd.

4. Digital Communication Fundamentals and Applications byBernardSklar and Pabitra Kumar Ray, Pearson Education, 2006

5. Advanced Electronic Communication Systems by Wayne Thomasi, Sixth Edition, PHI.Modern Digital and Analog Communication Systems by B. P. Lathi, Oxford University Press, Fourth Edition.

6. Digital and Analog Communication Systems by K Sam Shanmugam, John Wiley and Sons Pvt. Ltd.

COURSE RESULTS: Students can understand about various coding, methods and techniques

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MICROCONTROLLERS, EMBEDDED SYSTEM AND IOT APPLICATIONS

OBJECTIVES: To familiarize the students in microcontrollers, embedded concepts and Internet of Things (IOT) applications.

UNIT 1

8051 MICROCONTROLLERS: Microcontrollers and Embedded Processors - Overview of the 8051 Family -8051Architecture - Pin Configuration of 8051 - Instruction Set - Addressing Modes. 8051 Assembly Language Programming - Assembling and Running an 8051 Program - Program Counter and ROM Space on 8051 - Data Types and Directives - 8051 Flag - Bits and the PSW Register - Register Banks and Stack - Timer and Counter – Interrupts.

UNIT II

PIC MICROCONTROLLERS: Hardware Architecture and Pipelining - Program Memory - Register Pile Structure and Addressing Modes - CPU Register - Instruction Set - Simple Programs. MP-ASM Assembler and its use.

UNIT III

TIMER & INTERRUPTS: Timer 2 use - Interrupt Logic - Timer 2 Sealer Initialization - Interrupt Service Routine- Loop Time Subroutine - Code Template - Interrupt Constrains - Improved Interrupt Servicing - External Interrupts and Timers - Timers0 - Compare Mode - Capture Mode.

UNIT IV

I/O PORT EXPANSION AND PERIPHERAL INTERFACING: Synchronous Serial Port Module - Serial Peripheral Interface - Output Port and Input Port Expansion - DAC Output - Temperature Sensor - Serial EEPROM.

UNIT V

APPLICATIONS OF IOT: Introduction to Arduino IDE – writing code in sketch, compiling-debugging, uploading the file to Arduino board, role of serial monitor. Embedded ‘C’ Language basics - Interfacing sensors – The working of digital versus analog pins in Arduino platform, interfacing LED, Button, Sensors-DHT, LDR, MQ135, IR. Display the data on Liquid Crystal Display (LCD), interfacing keypad serial communication – interfacing HC-05(Bluetooth module)- Control/handle 220V AC supply – interfacing relay module.

TEXT AND REFERENCE BOOKS:

1. Muhammad Ali Mazidi, Jarrice Gillispie Mazidi & Rolin D. Mckinlay - The 8051 Microcontroller and Embedded Systems 2nd Edition-Prentice Hall India Private Ltd.

2. John Pickamn - Microcontroller Based Embedded System - Pearson education

3. The 8051 microcontroller & embedded systems using assembly and C –Kennth. J .Ayala, Dhananjay V.Gadre.

COURSE RESULTS: The students shall be able to develop embedded application.

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Field Work

OBJECTIVES:

- To develop skills by visiting nearby industries / organizations.
- Acquire the knowledge and receive guidance from other various tasks or sources of their field visits or survey or study.

1. Formulate and identify the real-world problem, practical difficulties, identify the requirement and develop the solutions according to their field work or internship study.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the work.
4. Explain the acquired knowledge through preparation of report and oral presentations.

This can be an individual work for PG students. Students are advised to select their own field work or study as per the expert guidance receive from the teaching faculties of their own institution. Periodical assessment may be done to evaluate their skills. Students will be permitted to visit nearby industries without affecting their regular theory and practical subjects.

Marks will be given as per the Manonmaniam Sundaranar University, Tirunelveli guidelines. Internal Assessment: 50 marks and External Assessment: 50 Marks

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MICROCONTROLLER'S LAB

OBJECTIVES:

- To get an in-depth knowledge on 8051 Microcontroller programming and its interfacing
- To understand the programming and interfacing of AVR microcontroller

PART I: 8051 Micro controller Programming

1. Familiarize an Integrated Development Environment to create a project, Compiling an Embedded C program, Assembling and Simulation/Debugging IN MCU 8051 IDE
2. Write 8051 Programs in Assembly Language to verify arithmetic and logical operations.
3. Write 8051 Programs in C/ Assembly Language find the largest/smallest number.
4. Write 8051 Programs in C/ Assembly Language for sorting numbers in ascending/descending order.
5. LED Interfacing and Delay Programming.
6. Square wave, Triangular and Sawtooth wave form generation.
7. Interfacing alphanumeric Liquid Crystal Display.
8. Interfacing 4x4 keypad.
9. Interfacing seven segment display.

PART II: AVR Experiments

1. Basic AVR Programming using Assembly OR C (using AVR Studio/any compatible IDE) Addition, Subtraction, Multiplication, Ascending Order, Descending Order, Code Conversion, Memory Swapping.

2. LED Interfacing and Delay Programming.
3. Interfacing 16x2 alphanumeric Liquid Crystal Display.
4. Interfacing 4x4 keypad.
5. Interfacing stepper motor.
6. Interfacing seven segment display.
7. DC motor speed control.
8. Interfacing serial devices such as GSM modem/GPS systems etc.
9. Timer programming
10. Serial programming
11. Interrupt handling
12. PWM Generation

REFERENCE BOOKS:

1. Mazidi, The 8051 Microcontrollers & Embedded Systems, Pearson Education.
2. The 8051 Microcontroller Architecture, programming and applications by Kenneth J. Ayala, West publishing company
3. The AVR Microcontroller and Embedded Systems Using Assembly and C, By Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, Pearson Education.
3. Programming and customizing the AVR Micro controller, By Dhananjay Gadre, McGraw Hill Education
4. AVR ATmega32 data sheet

5. ARM System Developer's Guide -Designing and Optimizing System Software by Andrew N Sloss, Dominic Symes and ChrisWright; Morgan Kaufman publishers, an imprint of Elsevier
7. The Definitive Guide to the ARM Cortex -M3 - Second Edition, by Joseph yiu Newnes publishers an imprint of Elsevier
8. ARM System-on-Chip Architecture, 2/e, Steve Furber, Pearson

COURSE RESULTS: Students can get an in-depth knowledge of 8051 and AVR microcontrollers programming and their interfacing.

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EMBEDDED SYSTEM DESIGN AND IOT LAB

OBJECTIVES:

- To provide a hands-on experience with PIC, ARM microcontrollers programing and interfacing.
- To provide Wireless IOT applications

List of experiments:

PART I: PIC 16F87X BASED EMBEDDED SYSTEMS & RTOS

1. Arithmetic and Logical programs
2. Square wave generation using ports
3. Matrix Key Board & LED interfacing
4. Single digit timer using seven segment displays
5. DC motor driving via H Bridge
6. DAC interface
7. ADC INTERFACE
8. LCD interface
9. Stepper motor control
10. PWM generation
11. Compare and capture operation program
12. Serial communication using RS232C
13. PIC to PIC communication using I2 C bus

PART II: IOT APPLICATIONS

i) WIRELESS DATA ACQUISITION USING SENSOR NODES

1. Setting up a WSN for smart home like applications
2. Implement and simulate network topologies using tools.
3. Connecting devices at the edge and to the cloud.
4. Processing data offline and in the cloud.

ii) VARIOUS CONCEPTS OF EMBEDDED SYSTEM DESIGN

1. IDE’s. Simulation and development tools
2. Implementing simple systems using ARM Cortex M devices
3. Design and implement interfaces for various applications
4. Design and realize application systems

COURSE RESULTS: Students can receive assembly level programming skills for future robotic and IOT applications.

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ADVANCED POWER ELECTRONICS AND VIRTUAL INSTRUMENTATION

OBJECTIVES: To understand the basic concepts of power electronic devices and virtual instrumentation with paradigm of programming languages.

UNIT I

POWER ELECTRONIC DEVICES: Thyristor- characteristics - Turn-on methods-characteristics-PUT-TRIAC-UJT- Phase controlled rectifier-Single phase half wave with RL load-Full wave-controlled converters-Commutation Techniques-Load-Resonant-pulse-Complementary-Impulse-External pulse- Line commutation. Chopper-Operation-Step Up-Types-Inverter-single phase bridge inverter-AC voltage controller-single phase voltage controller with R & RL load-Cycloconverter-single phase-step-up-step-down-Cycloconverter.

UNIT II

INTRODUCTION OF VI: Evolutions of VI, advantages, block diagram and architecture of a virtual instrument, data-flow techniques, Graphical programming, and comparison with conventional programming. Advantages of Virtual Instruments over conventional instruments – Hardware and software.

UNIT III

GUI PROGRAMMING: Graphical user interfaces – Controls and indicators – 'G' programming – Labels and Text –Shape, size and color – Owned and free labels – Data type, Format, Precision and representation – Data types – Data flow programming – Editing – Debugging and Running a Virtual Instrument – Graphical programming palettes and tools – Front panel objects – Functions and libraries.

UNIT IV

FILE STATEMENTS: Loops, WHILE Loops, CASE Structure, Formula nodes, Sequence structures – Arrays and Clusters– Array Operations – Bundle – Bundle/Unbundle by name, graphs and charts – String and file I/O – High-level and Low-level file I/O's – Attribute modes Local and Global variables.

UNIT V

MULTI-PARADIGM PROGRAMMING: Introduction to multi-paradigm programming-basic features, creating variables, mathematical functions, basic plotting - overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours. Matrix generation - Entering a vector, entering a matrix, Matrix indexing, Colon operator, Linear spacing, Colon operator in a matrix, creating a sub-matrix, deleting row or column, Dimension, Transposing a matrix, Concatenating matrices in MATLAB, GNU Octave or Python.

TEXT BOOKS:

1. Power Electronics - Dr.P.S. BIMBHRA
2. Gary Johnson, Richard Jennings, "Lab VIEW Graphical Programming", Third Edition, McGraw Hill, New York, 2006.

3. Sanjay Gupta and Joseph John, “Virtual Instrumentation using Lab VIEW”, Tata McGraw-Hill, First Edition, 2005.
4.“MATLAB A Practical Approach” by Stormy Attaway.

REFERENCE BOOKS

1. Power Electronics –MUHAMMAD H RASHID
2. “Virtual Instrumentation using LabVIEW” byJovitha Jerome second edition 2010.PHI Publishers, New Delhi.
3. Octave/Matlab Primer and Applications: EZ Guide to Commands and Graphics (GNU Octave Matlab Tutorial Series) by Dr S. Nakamura, Published by CreateSpace Independent Publishing Platform
4. GNU Octave Beginner's Guide by Jesper Schmidt Hansen, Packt Publishing.
5. Python Tricks: A Buffet of Awesome Python Features by Dan Bader, Publisher: Dan Bader
6. Python for Everybody: Exploring Data in Python 3by Dr. Charles Russell Severance (Author), Sue Blumenberg (Editor), Elliott Hauser (Editor). Publisher: CreateSpace Independent Publishing Platform.

COURSE RESULTS: The outcome of the students will be expertise theoretically with a virtual instrumentation by LABVIEW programming.

MOBILE, OPTICAL AND DATA COMMUNICATION SYSTEMS

OBJECTIVES: Expanding use of mobile, optical, and digital communication systems will benefit significantly to the students.

UNIT I

MOBILE COMMUNICATION: Mobile communication systems, cellular concepts, role of base station and mobile switching centres, Hands-off considerations, frequency reuse, roaming, SMS, GSM, GPRS, CDMA and EDGE architecture.

UNIT II

TELECOMMUNICATION NETWORKS: Telecommunication Network management overview, Wireless Network fundamentals, OSI model layers, architecture, broadband systems. Introduction to Emerging technologies IP multimedia systems, GSM/CDMA, Wi-Fi, Wi-Max, Blue Tooth, 3G/4G &5G Next Gen. Networks (NGN), IP/ mobile TV

UNIT III

OPTICAL FIBERS: Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations –Mode theory of Circular Wave guides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes – Single Mode Fibers-Graded Index fiber structure. Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination.

UNIT IV

DATA COMMUNICATION: Data communication networks and services, application and layered architecture, OSI model, IEEE 802.3 and IEEE 802.11, Network topologies, LAN and MAC, Data link control, Bridging, switching, addressing, Transmission systems, circuit switching networks, routing, signaling and traffic management

UNIT V

DATA NETWORKING: Packet switching networks, Internetworking – Repeaters, bridges, routers and gateways. Introduction to Routing protocols TCP/IP and Internetworking, TCP/IP protocol suite TCP/IP Sockets Client-Server, computing, Name Service, Application protocols over TCP/IP, IPV6, network architectures and protocols, network security, ATM Networks, High speed LANs – Fast and Gigabit Ethernet, FDDI. Wireless LANs. Bluetooth, Wi-Fi WLAN, WAP and Mobile computing.

TEXT AND REFERENCE BOOKS:

1. Telecommunication T.Vishwanathan, PHI
2. Mobile Cellular Telecommunications, W.C.Y. Lee, McGraw Hill
3. Future Developments in Telecommunication, J. Martin, PrenticeHall
4. Gerd Keiser, "Optical Fiber Communication" McGraw –Hill International, Singapore, 3rd ed.,2000
5. Data Networks D. Bertsekas, R. Gallagher
6. Computer Networking Tanenbaum, PHI
7. Computer Networks U.Black, PHI

COURSE RESULTS: Students can understand the growing importance of mobile, optical and data communication system.

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DIGITAL SIGNAL AND IMAGE PROCESSING

OBJECTIVES:

- It gives the knowledge to transform an image into digital form and performs some process of it.
- To understand the operations, analysis and applications of image processing.
- To study about discrete time systems and to learn about FFT algorithms.

UNIT I

REVIEW OF SIGNALS AND SYSTEMS: Introduction - advantages and limitations of Digital Signal Processing. Infinite Impulse Response (IIR) Filters - Signal Flowgraph- Basic Network structure for IIR filter- Direct- Cascade- Parallel Forms. Design of IIR Digital filters from analog filters- Butterworth design- Chebyshev design- design based on numerical solutions of differential equations- Impulse Invariant Transformation.

UNIT II

FINITE IMPULSE RESPONSE (FIR) FILTERS: Linear phase FIR filters- Frequency response of linear phase FIR filters - Location of the zeros of linear phase FIR filters. Realization of FIR- cascade - lattice design-Fourier Series method- using windows-rectangular-triangular or Barlett windows- Hanning- Hamming- Blackman- Kaiser windows.

UNIT III

DISCRETE FOURIER TRANSFORM: Properties-Circular convolution- Linear Convolution using DFT- relation between Z- Transform and DFT- Fast Fourier Transform; decimation – in time and Frequency - FFT algorithms – General Computation using Radix 2 algorithm.

UNIT IV

FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS: Introduction- Number Representation - Fixed Point- Sign-Magnitude - One's- complement- Two's - complement forms -Addition of two fixed point numbers- Multiplication in Fixed Point arithmetic - Floating point numbers- Block floating point numbers- quantization - truncation- rounding - effects due to truncation and rounding- Input quantization error - Product quantization error - Co-efficient quantization error- zero-input limit cycle Oscillations - Overflow limit cycle Oscillations - Scaling- Quantization in Floating Point realization IIR digital filters - Finite Word Length Effects in FIR Digital Filters- Quantization effects in the Computation of the DFT- quantization errors in FFT algorithms.

UNIT V

IMAGE AND DIGITAL PROCESSING: Image acquisition, Image representations, Image digitalization, Sampling, Quantization, Histograms, Image Quality, Noise in Images, Basic operations on images, Image Enhancement, Pixel intensity transformations, Histogram equalization and matching, noise removal, Edge sharpening, Spatial Filtering, Image smoothing, Morphological operations: erosion, dilation. Image processing applications, Machine Vision, Blob analysis, Metrology, Feature extraction, Pattern Matching. Speech Processing- speech analysis- speech coding- sub band coding- channel vecoder- homomorphic vocoder- digital processing of audio signals- Radar signal processing- DSP based measurements systems.

TEXT AND REFERENCE BOOKS:

1. Digital signal processing: Ifechor- Pearson edn.
2. Desecrate time signal processing: Oppenhiem- Pearson edn.
3. Digital signal processing: Oppenhiem and Sheffer- PHI
4. Introduction to Digital signal processing: Johny R Johnson
5. Digital signal processing: Proakis and Manolakis.
6. Digital signal processing: P Ramesh Babu- Scitech Pub
7. Digital Image Processing Rafael C. Gonzalez, Richard E. Woods, Prentice Hall
8. Fundamentals of Digital Image Processing, A.K. Jain, Prentice Hall

COURSE RESULTS: Students can able to understand the properties of the random signals and images and how to process it.

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RESEARCH METHODOLOGY

OBJECTIVES:

- It is a way to systematically solve a research problem.
- It is a science of studying how research is done scientifically
- It aims to give the work plan of research

UNIT I

RESEARCH METHODOLOGY: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, defining a Research Problem, Techniques involved in Defining a Problem. Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs.

UNIT II

SAMPLES: Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling. Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques.

UNIT III

DATA ACQUISITION AND ANALYSIS: Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation.

UNIT IV

RESEARCH TECHNIQUES: Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses. Chi-square Test, Comparing Variance, As a nonparametric Test, Conversion of Chi to Phi, Caution in using Chi-square test.

UNIT V

ANOVA TECHNIQUES: Analysis of Variance and Covariance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analysis Technique Classification of Multivariate Analysis, factor Analysis, R-type Q Type Factor Analysis, Path Analysis.

TEXT AND REFERENCE BOOKS:

1. “Research Methodology”, C.R. Kothari, Wiley Eastern.
2.“Formulation of Hypothesis”, Wilkinson K.P, L Bhandarkar, Himalaya Publication, Bombay.
3. “Research in Education”, John W Best and V. Kahn, PHI Publication.
4. “Research Methodology A step by step guide for beginners”, Ranjit Kumar, Pearson Education
5. “Management Research Methodology Integration of principles, methods and Techniques”, K.N. Krishna swami and others, Pearson Education.

COURSE RESULTS: Students get an idea about research and research methodologies

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ADVANCED COMMUNICATION LAB

OBJECTIVES:

- The students can familiarize with basic analog communication systems. Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.

List of Experiments:

1. Verification of sampling theorem
2. Pulse position modulation
3. Pulse amplitude modulation and demodulation
4. Pulse width modulation
5. Amplitude shift keying modulation and demodulation
6. Frequency shift keying modulation and demodulation
7. Phase shift keying modulation and demodulation
8. Mixer
9. Automatic gain control
10. P.C.M system using codec
11. Delta Modulation, Adaptive Delta Modulation
12. PLL and Frequency synthesizer
13. Frequency multiplier
14. P.R.B.S. Generator

MATLAB Experiments

15. Digital Modulation and Demodulation ASK, PSK, QPSK, FSK
16. Generation of Signals
17. Sampling and Effect of aliasing
18. Error Control Coding.

COURSE RESULTS: Students acquired the knowledge of different types of communication signals, modulation, demodulation, mixing and so on.

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DSP MATLAB AND LABVIEW INSTRUMENTATION LAB

OBJECTIVES:

- To familiarize MATLAB programming and its applications in DSP
- The students familiarize with DSP AND LABVIEW software's. Integrate theory with experiments using these software's so that the students receive knowledge from the theory course.

Experiments should be completed at least 50% of the both labs.

PART -1: DSP MATLAB experiments:

1.Verification of sampling theorem.
2.Impulse response of a given system
3.Linear convolution of two given sequences.
4.Circular convolution of two given sequences
5.Autocorrelation of a given sequence and verification of its properties.
6.Cross correlation of given sequences and verification of its properties.
7.Solving a given difference equation.
8.Computation of N point DFT of a given sequence and to plot magnitude and phase Spectrum.
9.Linear convolution of two sequences using DFT and IDFT.
10.Circular convolution of two given sequences using DFT and IDFT
11.Design and implementation of FIR filter to meet given specifications.
12.Design and implementation of IIR filter to meet given specifications.
13.Implementation of FFT of a given sequence.
14.Generation of DTMF signals.
15.Implementation of Decimation Process.
16.Implementation of Interpolation Process.

PART -2: Virtual Instrumentation by LABVIEW:

1.Create a VI for performing addition/subtraction/multiplication/division of given numbers. If answer is above 100 indicate it using LED.
2.Design a display for the basic calculator keypad. (Event structure)
3.Creating a VI for waveform generation and manipulations.
4.Design a water level control system. (Shift register)
5.Create a VI to acquire waveform data from signal generator and store the waveform data in array. (Accuracy of stored data)
6.Create a VI to acquire and plot temperature sensor data. (Sampling parameter variations)

TEXT AND REFERENCE BOOKS:

1. Analog electronics with LabVIEW- Kenneth L. Ashley
2. Virtual-Instrumentation-Using-LabVIEW- Jovitha Jerome, PHI Learning Private Limited (2010)
3.PC Interfacing for Data Acquisition and Process Control- Gupta, S. and Gupta, J. P. Instrument Society of America (1988).
4.Ashok Ambardar. 'Analog and Digital Signal Processing'
5. MATLAB: An Introduction with Applications, 4ed Paperback – 2012by Amos Gila- Wiley

COURSE RESULTS: Students will be well-versed with MATLAB and LABVIEW programming.

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ONLINE MOOC COURSES

Students can participate at least any one of the subject oriented (Electronics and or Electronics and Communication) technical online programs or courses (i.e., skill development courses) from SWAYAM, NPTEL, UGC and MHRD approved courses.

Massive Open Online Courses (MOOCs) will provide an affordable and flexible way to learn new skills, advance your career and deliver quality educational experiences at various scale. The objective of this course is to take the best teaching learning resources to all, including the most disadvantaged students. The courses may be included with

(1) video lecture,

(2) specially prepared reading material that can be downloaded/printed

(3) self-assessment tests through tests and quizzes and

(4) an online discussion forum for clearing the doubts.

Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology.

Teachers should provide wonderful opportunities and environments for all students by providing numerous online platforms to enhance their online education. Final examination may be conducted by their own teaching staffs similar to Field Work.

Scheme of evaluation- PG-MOOCs courses (Semester-III, Core MOOCs-1)

i) Internal - 50 marks

Attendance	- 10 marks
Performance & content discussion with teachers	- 20 marks
Class tests (or) Presentation	- 20 marks

a. First Quadrant duration:

Assignments - Audio and Video of engagements of the MOOCs according to the concerned subjects (Electronics and (or) Electronics and Communication). Online video and audio contents in an organized form, Animation, Simulations, video demonstrations, virtual Labs, etc.,

b. Second Quadrant duration:

It may contain text material, e-books, objectives, summary, glossary, case studies, FAQs, and other learning material. Shall contain self-instructional material, e-Books, illustrations, case studies, presentations, web resources such as further references, related links, open-source content on Internet, video, case studies, books including e-books

c. Third Quadrant duration:

It may contain references and web links. Please provide the reference list as a word document give specific links that are viable and direct to appropriate pages. Specify the links to other learning sites. Do not give www.wikipedia.org (or) www.google.com, discussion forum for rising of doubts and clarifying them on a near real time basis by the Course Coordinator or his/her team.

d. Fourth Quadrant duration:

Assessments may include: 1. Quizzes- self graded and 2. The assignments may contain from 200 words to 500 words depending on the course requirements. 3. Multiple Choice Questions (MCQs) may be conducted per module comprise of Quiz.

Total engagement time should be in the range of **one semester per module**. It may contain problems and solutions, which could be in the form of MCQs, fill in the blanks, matching questions, short answer questions, long answer questions, quizzes, assignments and solutions, discussion forum topics and setting up the FAQs, clarifications on general misconceptions.

ii) External – 50 marks

Overall module Performance	- 15 marks
Report and Outcome based	- 25 marks
Presentation or viva-voce	- 10 marks

This course must be outcome perspective. i.e., Audio and or Video or online course outputs, e-materials, web resources with reference links, open-source of internet content, development of online output creations, Depends upon the structure and organization of the MOOCS course in electronics subjects, by the process perspective and by the self-assessment.

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INTRODUCTION OF PYTHON AND ANDROID APPLICATION TOOLS DEVELOPMENT

OBJECTIVES:

- Understand the Python programming basics including functions, variables, and data types, classes and objects, etc.,
- Manipulate and output data using arrays, loops, and operators
- Have a solid understanding of Python syntax
- Understand the Android programming basics with developing application tools

UNIT I

PYTHON INTRODUCTION: Introduction to Python – Features of Python, Python Virtual Machine (PVM), Memory management in Python, Comparison between C and Python. Writing and execution of a Python program, Input & Output statements. Datatypes – Built-in type, Bool datatype, Sequences, Sets, Literals, Constants, Identifiers and Reserved words, Naming conventions in Python. Strings and Characters – Creating Strings, Escape Characters, String formatting operators, String formatting functions.

Operators - Arithmetic, Assignment, Unary minus, Relational, Logical, Boolean, Bitwise, Membership and Identity Operators, Mathematical functions. Lists – creating lists, updating the elements in a list, Built in list operators - concatenation, repetition & membership, Built-in List Methods. Tuples – creating tuples, accessing tuple elements, basic operations on tuples, functions to process tuples. Dictionaries – creating dictionaries, Operations on Dictionaries, Dictionary Methods, Datatype conversions.

UNIT II

STATEMENTS AND FUNCTIONS: Control statements – Conditional Statements: if statement, if…else statement, nested if statement, Looping: while loop, for loop, infinite loops, nested loops, Control Statements: break statement, continue statement, pass statement, assert statement, return statement.

Arrays- creating an array, Importing the array module, Indexing and Slicing on arrays, Types of arrays, working with arrays using numpy, Mathematical operations on arrays.

Functions – Function definition, Function call, returning from a function, returning multiple values, Function arguments- formal & actual, positional, keyword, default, variable length arguments, Local & Global variables, passing a group of elements to a function, Recursive functions, Anonymous functions or Lambada's.

UNIT III

CLASSES AND OBJECTS: Creating a Class, the self-variable, Constructor, Types of variables, Namespaces, Types of Methods, passing members of one class to another class, Inner classes, Inheritance and Polymorphism- Constructors in Inheritance, Overriding super class constructors and Methods, the super () Method, Types of Inheritance. Polymorphism- Operator overloading, Method overloading, Method overriding.

UNIT IV

EXCEPTIONS: Errors in Python Programing, Exceptions, Exception handling, Types of Exceptions, the except block, the assert statement, user defined exceptions, logging the Exceptions.

Files- Types, Opening and Closing a file, working with text and binary files, knowing whether a file exist or not, the with statement, Pickles, seek () and tell methods, Working with Directories, Regular expressions, Sequence characters, Quantifiers and Special Characters in regular expressions, using regular expressions on files.

UNIT V

DEVELOPING FOR ANDROID: Downloading and Installing the Android SDK – Developing with Eclipse – Using the Android Developer tools Plug-In for Eclipse – Support Package. First Android Application: New Android Project – Android Virtual Device – Launch Configurations – Running and Debugging Android Application – Types of Android applications – Android Development Tools.

TEXT AND REFERENCE BOOKS:

1. Core Python Programming – Dr. Nageswara Rao, 2017 edition, Dreamtech Press.
2. Introduction to Computing and Problem-Solving Using Python – E Balaguruswamy, 1e/ Mc Graw Hill.
3. Reto Meier. 2012. Professional Android 4 Application Development. Wiley India Pvt Ltd.
4. Charlie Collins and Michael Galpin. 2012. Android in Practice. Manning Publications Co.
5. Zigurd Mednieks and Laird Dornin. 2011. Programming Android. O'Reilly Media, Inc, New York.

COURSE RESULTS: Students can able to Identify/characterize/define a problem to solve problems by design a program

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VLSI DESIGN AND VHDL PROGRAMMING

OBJECTIVES:

- To study HDL based design approach and to learn digital CMOS logic design.

UNIT I

CMOS TECHNOLOGY: MOS TRANSISTOR – Switches – CMOS Logics – Inverter – Combinational logic – NANDgate – NOR gate Compound gates – Multiplexer – Physical design of NAND, NOR gates –SI semiconductor technology overview – wafer processing – oxidation – epitaxy deposition – Ion Implantation – Diffusion – SI gate insulator process – CMOS technology - n-well process – p well process – Twin-Tub process – silicon on insulator– CMOS process enhancements

UNIT II:

INTRODUCTION OF VHDL: History of VHDL – capabilities of VHDL – hardware abstraction – basic terminology –entity declaration - architecture body declaration – Basic language elements –identifiers – Data objects– Data type operators.

UNIT III:

MODELING TECHNIQUES OF VHDL: Behavioral modeling: Entity declaration – architecture declaration – process statements- variable assignment statements – signal assignments statements – Wait statement – IF statement – Case statement – Null statement – Loop statement – Exit statement – Next statement – Assertion statement – Report statements – More on signal assignment statement – multiple process – postponed process – Data flow style of modeling

UNIT IV

VHDL STATEMENTS: Concurrent signal assignment statement versus signal assignment – Delta delay revisited – Multiple drivers – Conditional signal assignment statement – Selected signal assignment statement – The unaffected value – Block statement- Concurrent assertion statement – Value of the signal. Structural modeling: Component declaration – Component instantiation – Resolving signal value – examples – Half adder – Full adder – Four to one multiplexer – Decoders and encoders.

UNIT V:

ADVANCED FEATURES IN VHDL: Generics – configuration – configuration specification – Configuration declaration –Default rules – Conversion functions – Direct instantiation – Incremental binding -Sub programs – Sub program overloading - operator overloading - signatures – default value of parameters –package declaration - package body – design file – design libraries – order of analysis – implicit Visibility – explicit visibility – attributes in VHDL.

TEXT BOOKS:

1. Neil H.E. West Kamaran Eshraghin, " PRINCIPLES OF CMOS VLSI DESIGN"
2. J.Bhasker, "VHDL PRIMER", Low price Edition, 2001 PHI 3.Charles H.Roth, and Jr. DIGITAL SYSTEM DESIGN USING VHDL, Brooks/Cole Thomson Learning PWS Publishing, ISBN-981-240-052-4

COURSE RESULTS: Students have to realize importance of testability in logic circuit design.

RF CIRCUIT AND SATELLITE COMMUNICATION

OBJECTIVES:

- To understand the basic RF frequency, filter design, amplifier design and circuit design process.
- To understand the fundamentals of satellite communication system.

UNIT I

RF TRANSCEIVER ARCHITECTURES: Receiver front end general design philosophy, Intermodulation, 3rd order intercept point (IP3), Noise Figure, sensitivity, selectivity.

UNIT II

RF FILTER DESIGN: Ideal and approximate filter types, Transfer function and basic filter concepts, filter design issues, RF filter design.

UNIT III

AMPLIFIER DESIGN: Stability consideration, Amplifier design for maximum gain, constant gain circles, constant noise figure circles, Low noise amplifier, RF Power amplifier.
Other RF circuits: Power combiner/divider, directional couplers, hybrid coupler, isolator.

UNIT IV

SATELLITE COMMUNICATION: Fundamentals: concepts, history, developments.
Orbital mechanics and launching: Keplers law, perturbation, orbital effects, types of orbits, launching satellite, launch vehicle technology.

UNIT V

SATELLITE SUBSYSTEM: Attitude and orbit control, thermal control, Power supply, propulsion, telemetry, tracking and command, transponder and antennas. Satellite link design. Applications of satellites and advances in satellite communication.

TEXT AND REFERENCE BOOKS:

1. Analog Communication Kennedy and Davies
2. Microwave devices, circuits & Subsystems for Communication Engineering, Glover, Pennock, and Shepherd
3. RF circuit design, by Chris Bowick
4. RF circuit design by R. Ludwig and P.Bretchko
5. RF Circuit Design, Reinhold Ludwig, Pavel Bretchko, Pearson
6. Satellite communications: Dennis Roddy

COURSE RESULTS: The student will be able to understand the RF design and distinguish between the oscillators and amplifiers. Application of satellite communication will also be essential for signals and modern communication system.

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VLSI AND ANDROID APPLICATION DEVELOPMENT LAB

OBJECTIVES:

- To learn Hardware Descriptive Language (Verilog/VHDL).
- To learn the fundamental principles of VLSI circuit design in digital and analog domain.
- Have to create a simple Android App (HelloWorld) and be able to manage it within the Android Studio environment

Using 8051 microcontroller,

Android Lab:

1. Creating an app to display Hello World.
2. Creating an Android Simple Login Application.
3. Creating Calculator App in Android.
4. Creating simple Home Screen Widget in Android.
5. Creating Android Chat App in Android.
6. Creating Simple Android Camera Application.
7. Creating Basic List View Demo in Android.
8. Creating Google Map in Android.

VHDL Lab:

1. Write a program to Verify the Logic Gates
2. Write a program for Half Adder and Full Adder
3. Write a program for Half Subtractor and Full Subtractor
4. Write a program for Encoder
5. Write a program for Decoder
6. Write a program for Multiplexer
7. Write a program for Demultiplexer.

COURSE RESULTS: Write HDL code for basic as well as advanced digital integrated circuits. Students can learn the Android Studio Application environment.

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OBJECT ORIENTED PROGRAMMING USING PYTHON LAB

OBJECTIVES:

- To acquire programming skills on Object-Oriented Programming concepts in Python
- To get a practical knowledge on interfacing Raspberry Pi with Python.

PART I – **Basic Programs using Python:**

1. Programs based on datatypes, Input & Output and Control Statements
2. Programs based on Arrays
3. Programs based on Strings
4. Programs based on Functions
5. Programs based on Lists and Tuples
6. Programs based on Dictionaries
7. Programs based on Classes and Objects
8. Programs based on Inheritance
9. Programs based on Polymorphism
10. Programs based on Exceptions
11. Programs based on Files
12. Programs based on Regular Expressions

PART II - Programs for interfacing with Raspberry Pi:

1. Push switch and LED interfacing
2. Buzzer interfacing
3. Speed control of DC motor
4. Direction control of DC motor
5. Keypad interfacing
6. Measurement of Light
7. Measurement of Temperature
8. LCD display interfacing

REFERENCES:

1. Core Python Programming – Dr. Nageswara Rao, 2017 edition, Dreamtech Press.

2. Introduction to Computing and Problem-Solving Using Python – E Balaguruswamy, 1e/ Mc Graw Hill.

3. Raspberry Pi Cookbook – Simon Monk, 1e/ O'ReillyMedia, Inc.

4.https://learn.sparkfun.com/tutorials/python-programming-tutorial-getting-started-with- the-raspberry-pi/all

COURSE RESULTS: Students can learn Python scripting elements and discover how to work with scripts, variables, lists, control flow structures, sequence data and so on. They can learn Python language interfaced with Raspberry Pi kit.

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Field Work

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Study Tour

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NANO ELECTRONICS

OBJECTIVES:

- Students need to understand about "NANO" and their requirements of modern society in a focused area to solve the all-world problems.

UNIT I

INTRODUCTION: Region of nanostructures, scaling of devices in silicon technology, estimation of technology limits, Uncertainty principle, Experiments on duality, Schrodinger's equation and its applications to square well potential, square potential barrier (1D). Infinite array of potential wells, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering. Binomial and related distributions, Phase space, Statistical ensembles, applications of classical statistical mechanics, Quantum statistics, Brownian motion, Random walk problem.

UNIT II

CARBON NANOTUBES: Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications – prospects of carbon nanotube nanoelectronics.

UNIT III

QUANTUM ELECTRONIC DEVICES: Concept of Chemical potential, partition function and its applications in computing thermodynamic quantities. Quantum electronic devices, electrons in mesoscopic structures, short channel MOSFET, split-gate transistor, electron wave transistor, electron spin transistor, quantum cellular automata

UNIT IV

QUANTUM BASED RTDS: Quantum transport devices based on resonant tunnelling: - Electron tunnelling – resonant tunnelling diodes (RTDs)- three terminal RTDS, RTD based memory, Single electron devices for logic applications: - Single electron devices – applications of single electron devices to logic circuits.

UNIT V

NANO-BIO DEVICES: Bioelectronics, molecular processor, DNA analyser as biochip, Molecular electronics, Fullerenes, nanotubes, switches based on Fullerenes and nanotubes, basic logic gates and dynamic logic gates, principle of single electron transistor, Coulomb blockade.

TEXT AND REFERENCE BOOKS:

1.Nanoelectronics and Nano systems: K.Goser, P. Glosekotter, J. Dienstuhl, Springer (2005)
2.Quantum Mechanics: Schiff L.I.
3.Fundamentals of Statistical Mechanics and Thermal Physics: Reif
4.Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002
5.T.Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
6.Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

COURSE RESULTS: Students must be capable of addressing problems that require interdisciplinary skills.

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QUANTUM OPTICAL COMMUNICATION

OBJECTIVES:

- To understand the quantum nature of information and to learn how to formulate, manipulate, and process it using physical systems that operate on quantum mechanical principles.

UNIT I

QUANTUM THEORY OF LIGHT& INRORMATION PROCESSING: Quantization of the electromagnetic field, evolution of the field operators, quantum states of the electromagnetic field. Quantum information processing: quantum information, quantum communication, quantum computation with qubits, quantum computation with continuous variables. Density operators and super operators, fidelity, entropy, information and entanglement measures, correlation functions and interference of light, photon correlation measurements.

UNIT II

PHOTON SOURCES AND DETECTORS: Mathematical model of photodetectors, physical implementations of photodetectors, single-photon sources, entangled photon sources, quantum non-demolition photon detectors.

UNIT III

QUANTUM COMMUNICATION WITH SINGLE PHOTONS: Photons as information carriers, quantum teleportation and entanglement swapping, decoherence-free subspaces for communication, quantum cryptography. Quantum computation with single photons.

UNIT IV

QUANTUM COMMUNICATION WITH CONTINUOUS VARIABLES: phase space in quantum optics, continuous-variable entanglement, teleportation and entanglement swapping, entanglement distillation, quantum cryptography. Quantum computation with continuous variables. An ensemble of identical two-level atoms, electromagnetically induced transparency, quantum memories and quantum repeaters, the atomic ensemble of a single qubit, photon-photon interactions via atomic ensembles

UNIT V

SOLID-STATE QUANTUM INFORMATION CARRIERS: Definition and optical manipulation of solid-state qubits, interactions in solid-state qubit systems, entangling two qubit operations, scalability of solid-state devices.

TEXT AND REFERENCE BOOKS:

1. P. Kok and B. W. Lovett, Introduction to Optical Quantum Information Processing, Cambridge university press.
2. L. Mandel, and E. Wolf. Optical Coherence and Quantum Optics, Cambridge University Press.
3. W. H. Louisell, Quantum Statistical Properties of Radiation, McGraw-Hill.
4. D. Bouwmeester, A. K. Ekert, and A. Zeilinger, eds. The Physics of Quantum Information, Springer

COURSE RESULTS: Students can able to understand quantum information and theory

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PROJECT WORK

The objective of the project work is to motivate the students for doing research and to inculcate in them the self-confidence to work independently. each student should do an individual project and they can freely choose their own topic of experimental nature. The project should be of investigative type not a hobby project.

Students are encouraged to take the project work as a challenge so that their project will boost up their industrial career.

Periodic Seminars should be conducted to assess the students. The students should present the progress of the project to their respective guides and get the required assistance from them.

The students will submit Project Report in the form of Dissertation which will be examined by the examiners.

The examination shall consist of

i) Evaluation of the Dissertation copy and

ii) Comprehensive Viva-voce examination.