M.Sc. I Electronics (CBCS Pattern) (2019-20)

SEMESTER-I (Duration – Six months)						
	Sr.No.	Course Code	Title of the Course	Teaching Scheme (h/w)		
				Theory & Practical		
				Lectures (per week	Hours (per week)	Credit
			M.Sc. Part I - Semester I			
CGPA	1.	CC-101	Measurement & Instrumentation	4	4	4
	2.	CC-102	Foundations of Microwave Technology	4	4	4
	3.	CC-103	Computer Organization	4	4	4
	4.	CC-104	Advanced Digital Design	4	4	4
	5.	CCPR-105	Practical	16	16	8
Total (A)				-	-	24
Non-CGPA	1	AEC	-	2	2	2
SEMESTER-II (Duration – Six months)						
CGPA	1.	CC-201	Digital Communication	4	4	4
	2.	CC-202	Advanced Microwave Technology	4	4	4
	3.	CC-203	Advanced Power Electronics	4	4	4
	4.	CC-204	Optoelectronics	4	4	4
	5.	CCPR-205	Practical	16	16	8
Total (B)				-	-	24
Non-CGPA	1	SEC	-	2	2	2
Total (A+B)						48

M.Sc. Part I - Semester I
CC-101: Measurements and Instrumentation

Course Objectives:

To understand

1. the configurations and functional descriptions of measuring instruments.
2. the basic performance characteristics of instruments.
3. the techniques involved in various types of instruments.
4. the working principles of sensors, transducers and measuring systems.

Course Outcomes:

Ability to

1. apply concepts of measurement and measurement system.
2. design and implement systems utilizing analog and/or digital control devices
3. apply the concepts of chemistry, physics, and electricity/electronics to motion and measurement.
4. apply the concepts of process measurements, sensor and transducer selection.

Module-1: Measurements (15)

Definition and significance of measurement, classification of instruments and types of measurement applications, elements of an instrument/measurement system. Active and passive transducers, analog and digital modes of operation, null and deflection methods.

Module-2: Measurement systems (15)

Input-output configuration of instruments and measurement systems, methods of correction of instruments and measurement systems. Static characteristics and static calibration, meaning of static calibration. True value, basic statistics, least–squares calibration curves, calibration accuracy versus installed accuracy, combination of components errors in overall system accuracy calculations.

Module-3: Motion and dimensional measurement (15)

Methods of transduction, primary sensing elements and transducers, electrical transducers, classification of transducers. Fundamental standards, relative translational and rotational displacement, calibration, resistive potentiometers, resistance strain gauge, differential transformers, variable–inductance and variable-reluctance pickups, eddy current non contacting transducers, capacitance pickups, piezoelectric transducers, digital displacement transducers (translational and rotary encoders), ultrasonic transducers.

Module-4: Velocity, acceleration and process parameters measurement (15)

Relative velocity: translational and rotational, calibration, average velocity from measured x and t, tachometer encoder methods, laser based methods, stroboscopic methods, translational–velocity transducers (moving coil and moving magnet pickups)

Relative acceleration measurements: Seismic (absolute) displacement pickups, seismic (absolute) velocity pickups, seismic (absolute) acceleration pickups (accelerometers).

Process parameters: Force, torque and shaft power, standards and calibration, basic methods of, bonded strain gauge, differential transformer, piezoelectric, variable reluctance/ FM oscillator digital system, torque measurement on rotating shafts

Text/ Reference Books:

1. Electronic Instrumentation, Kalsi, TMH

2. Measurements and instrumentation, U. A Bakshi and A.V Bakshi, 3rd Edition
3. Modern Electronic Instrumentation and measurements technique, Cooper and Helfrick, PHI.
4. Measurement Systems, Applications and Design by Ernest O. Doeblin and Dhanesh N. Manik, 5th Edition, Tata McGraw Hill.
5. A Course in Electrical and Electronic Measurements and Instrumentation by A. K. Sawhney, Dhanpat Rai & Co.

CC-102: Foundations of Microwave Technology

Course objectives:

1. To study fundamentals of electromagnetic waves, use Maxwell's equations
2. To study transmission lines, and to use Smith charts for solving transmission line problems
3. To study waveguides and various passive microwave devices

Course Outcomes:

1. The students will understand wave equations, equations in various media, reflection and refraction of em waves
2. They will be able to write the transmission line equations in various forms, solve transmission line problems, use Smith charts
3. They will be able to obtain field components of TE and TM waves for waveguides and cavity resonators. They will also learn principles of operation of various microwave passive components and their applications.

Module 1: Electrostatics, steady magnetic field and Maxwell's Equations
(15)

Vector analysis, physical interpretation of gradient, divergence and curl, Vector relations in other coordinate systems, Integral theorems, Fundamental relations of the electrostatic field, Gauss's law, Potential function, Field due to a continuous distribution of charge, Equipotential surfaces, Divergence theorem, Poisson's equation and Laplace's equation, electrostatic energy, magnetic induction and Faraday's law, Magnetic field strength and magnetomotive force, Ampere's work law in differential vector form, Energy stored in a magnetic field, Ampere's law for current element, Ampere's force law, Maxwell's equations, Conditions at a boundary surface

Module 2: Electromagnetic Waves
(15)

Electromagnetic waves in a homogeneous medium- solution for free-space conditions, uniform plane-wave propagation, uniform plane waves, Wave equations for a conducting medium, Sinusoidal time variations, conductors and dielectrics, polarization, Direction cosines, Reflection and Refraction of plane waves - Reflection by perfect conductor-normal incidence, Reflection by a perfect conductor-oblique incidence, Reflection by perfect dielectric-normal incidence, Reflection by perfect insulator-oblique incidence, Reflection at the surface of a conductive medium, Surface impedance, Poynting's theorem

Module 3: Transmission Lines
(15)

Distributed constants of a line, A-C steady state solution for Uniform line, Variation of Zo, α and β with frequency, Various exponential forms of A-C steady state solution, hyperbolic form of the solution, Interference and standing wave patterns, Half-wavelength and Quarter wavelength lines, short sections as circuit elements, measurement of standing waves, Smith chart - solving transmission line problems, impedance matching, Coaxial connectors

Module 4: Waveguides, Cavity Resonators and Passive Microwave Devices (15)

Solution of wave equations in rectangular and circular waveguides, TE and TM modes, power loss and power transmission, excitation of modes, field components of rectangular cavity resonators, expression for Q

Terminations, Attenuators, Phase changers, directional couplers, Hybrid Circuits, Corners, Bends, Twists, Faraday rotation, Gyrator, Isolator, circulator, S parameters

Reference Books

1. Edward C. Jordan and Keith G.Balmain, Electromagnetic waves and Radiating Systems. New Delhi : Prentice-Hall of India Pvt. Ltd., 2003
2. William H.Hayt. Jr and John A.Buck, Engineering Electromagnetics. New Delhi : Tata McGraw-Hill Education Private Limited, 2010
3. Walter C. Johnson, Transmission lines and Networks. New Delhi : McGraw- Hill Book Comp., 1988
4. John D. Ryder, Networks Lines and Fields. New Delhi : PHI, 1983
5. Samuel Y. Liao, Microwave Devices and Circuits. New Delhi : PHI, 2001
6. H.R.L. Lamont, Waveguides. London : Methuen and Company Limited, 1963
7. Robert E. Collin, Foundations for Microwave Engineering. New Delhi : McGraw Hill Book Comp.
8. Peter A. Rizzi, Microwave Engineering: Passive Circuits. New Delhi : PHI, 2001
9. F. E. Terman, Electronic and Radio Engineering. New York: McGraw Hill Book Comp. 1955.
10. David M. Pozar, Microwave Engineering, Singapore : John Wiley and Sons (ASIA) Pte. Ltd.,2004

CC-103: Computer Organization

Course Objectives:

1. To learn the basic concepts in Computer organization.
2. To learn various Computer architectures.
3. To learn the progress in computing techniques.

Course Outcomes:

1. To use an operating system such as DOS.
2. To define computer components.
3. To specify components for application specific computing system.
4. To identify the basic components of a computing system to be used for a specific application.

Unit 1: (15)

Introduction : Computer system organization – hardware and software components, overview of Operating System, Computer booting process, Instruction set architectures, Chronology of Microprocessor Development w.r.t. CISC/RISC families, Timeline of POWER PC, Alpha SPARC families. Operating system case study: DOS, UNIX.

Unit 2: (15)

Fundamental Architectures: Defining a Computer Architecture, Von Neumann and Harvard Architectures, bus topologies, pipelining, Superpipelining, Superscalar processors, Very Long Instruction Word (VLIW) architectures, multithreaded processors – superthreading, hyperthreading.

Unit 3: (15)

Parallel Processors – Flynn's taxonomy. SIMD, MIMD and multi-computer approaches.

Implementation Considerations: memory technologies, Hierarchical Memory Systems, caches, prefetching techniques, virtual memory, pipelining, ternary logic, packaging considerations, wafer scale integration.

Unit 4: (15)

Implementation of Functional Units: Memory Management, Arithmetic Logic Unit, Floating Point Unit, Branch Unit, Vector Unit, Load/Store Unit.

Development Tools: Microcomputer Development Systems (MDS), In Circuit Emulator (ICE), Assembler, Editors, Logic Analyser.

Reference Books:

1. The Essentials of Computer Organization and Architecture, by Linda Null and Julia Lobur ISBN:076370444x, Jones and Bartlett Publishers © 2003
2. Computer Organization and Design, The Hardware/Software Interface, Third Edition (The Morgan Kaufmann Series in Computer Architecture and Design), By David A. Patterson, John L. Hennessy, Publisher: Morgan Kaufman, ISBN- 10: 58606041.
3. Computer Organization and Embedded Systems, by Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian McGraw Hill Higher Education, Fifth Education
4. The Electronics Handbook Edited by Jerry C. Whitaker, Published by CRC Press and IEEE Press (1996), Section VII: Microelectronics and Section XIX: Computer Systems
5. Computer Organization by Stalling
6. Microprocessors and Interfacing, D.V. Hall, McGraw Hill (1986)The Intel Microprocessors: Barry B. Brey, Prentice Hall Of India Ltd. (1997)

CC-104: Advanced Digital Design

Course Objectives:

1. To make the students able to understand key ideas behind digital system design.
2. To introduce the students able to design CMOS based circuit design necessary as a foundation of VLSI technology.
3. To make students able to face NET/SET examination-based questions on Digital Systems and CMOS Design techniques and also to make students able to qualify aptitude tests being conducted by Industries working on VLSI and Embedded system design.

Course Outcome:

1. Students become able to understand key ideas behind digital system design.
2. Students become able to design CMOS based combinational and sequential circuit design necessary as a foundation of VLSI technology.

Module 1: Combinational Logic Design: (15)

Decoder Design using Universal Gates: BCD to Binary, BCD to 7 Segment, 3:8 Decoder, Concept of Redundant Logic. One-hot encoder, One-Cold Encoder and its importance.

Four, Five Variable K-Map, Variable Reduction in K-Map, Folded K-Map, Implementation of Logic Functions: using K-Map, using Multiplexor (MUX) ICs. Comparison between Decoder and DMUX. Full Adder using DMUX. Designing Logic Gates using MUXs. BCD Adder using ICs, Single bit comparator.

Module 2: Sequential Logic Design: (15)

Difference between Flip-Flop (F/F) and Latch, F/F Characteristics, F/F Conversions, Race Condition in JK F/F, Excitation table of F/Fs.

Finite State Machines (FSMs): Moore and Mealy Machine, Asynchronous Counter Design: 2-bit, 3-bit and 4-bit, Glitches, Synchronous Counters Design: 2-bit, 3-bit and 4-bit using FSM. Decade Counter Design using FSM. Synchronous Counter design for given state diagram.

Module 3: Foundations of CMOS Technology: (15)

Construction of p-MOS and n-MOS, MOS Logic Characteristics, Concept of Feature Size, Comparison between TTL and CMOS Technology, CMOS Series Characteristics, TTL Driving CMOS and CMOS Driving TTL.

Module 4: CMOS Based Logic Design: (15)

CMOS as Inverter, Designing CMOS Structure for Logic Gates and for given Boolean Equations, CMOS based combinational circuit design for 2:4 Decoder, 3:8 Decoder, 4:2 Priority Encoder, Half Adder and Full Adder.

Reference Books:

1. Digital Systems Principles and Applications, by R.J.Tocci, PHI Pvt. Ltd.
2. Digital Electronics, by N.G. Palan, Technova Publications.
3. Digital Design Principles and Practices by John F. Wakerly, Prentice Hall International Edition.

M.Sc. Part I - Semester II

CC-201: Digital Communication

Course Objectives:

1. To learn the digital communication.
2. To learn various coding techniques
3. To learn the sampling theory and migration of signal fr0m analog to digital & vice versa
4. Introduction to real life case studies

Course Outcomes:

1. Understand basic concept of digital communication system.
2. Understand the real life applications.
3. Understand why the prevailing systems are digital dominant.

Unit 1 : (15)

Signals Analysis :

Complex Fourier spectrum, Fourier transform, Properties of F.T, sampling theorem, random signals and noise, correlation and power spectrum.

Unit 2: (15)

Digital Communication Systems:

A/D and D/A converter, Coded communication, AM, PWM, PPM, PCM, delta modulation, adaptive delta modulation, quantization and noise consideration.

Digital Transmission and Reception:

Timing, base band systems, ASK, FSK, PSK, QAM.

Unit 3 : (15)

Error detection and coding:

Parity check, CRC, Hamming distance, Hamming codes, Cyclic codes, line synchronization codes, Manchester code, NRZ coding, Walsh codes.

Unit 4 : (15)

Case studies:

Paging system, cellular telephone, global positioning satellite, Facsimile, Videotext.

Reference Books:

1. Analog and Digital Communication systems- M.S. Roden, 3rd Edition, Prentice Hall of India.
2. Modern Digital and Analog Communication Systems- B.P. Lathi.
3. Communication Techniques for digital and Analog signals – M. Kanefsky, John Wiley and Son.
4. Telecommunication – T.H. Brewster, McGraw Hill.
5. Principles of Digital communication, Das, Chatterjee and Mallick, Wiley Eastern Ltd.

CC-202: Advanced Microwave Technology

Course objectives:

1. To study tubes and solid state microwave devices
2. To study strips, hybrid MICs and various microwave measurements
3. To study microwave antennas, radar systems and radio aids to navigation

Course Outcomes:

1. The students will be able to understand principles of operation of tube and semiconductor active microwave devices
2. They will learn strips,fabrication technology of Hybrid MICs and various measurements at microwave frequencies
3. They will also learn antennas at microwave frequencies, various radar systems and navigation systems

Module 1: Microwave Tubes, Solid state Devices
(15)

Limitations of conventional tubes at microwave frequencies, Klystrons-Reentrant Cavities, velocity-modulation process, bunching process, Reflex Klystrons-velocity modulation, electronic admittance, Helix Traveling-wave tubes (TWTs) - amplification process, cylindrical magnetron

Microwave solid state devices – Tunnel diode, GaAs diode, LSA diode, InP diode, CdTe diode Read diode, IMPATT, TRAPATT and BARITT diodes, PIN diode

Module 2: Microstrip Lines and MICs
(15)

Characteristic impedance, losses, Quality factor Q, Parallel Strip Lines-distributed parameters, characteristic impedance, attenuation losses, Coplanar Strip Lines, Shielded Strip Lines

Technology of Hybrid MICs - dielectric substrates, thick film technology and materials, thin film technology and materials, methods of testing, encapsulation, mounting of active devices, Lumped elements for MICs - design of lumped elements, fabrication of lumped elements, circuits using lumped elements, comparison with distributed circuits

Module 3: Microwave Measurements
(15)

Detection of microwave power, Measurement of microwave power - bridge circuit, thermistor parameters, waveguide thermistor mounts, direct reading barretter bridges, Measurement of wavelength - single line cavity coupling system, transmission through two line cavity coupling system, Frequency pulling by reactive load, Typical wave meters, measurement of VSWR, measurement of attenuation – Definition of Attenuation, methods of measurement

Module 4: Microwave Antennas, Radar and Radio Aids to Navigation
(15)

Classification of microwave antennas, General characteristics of microwave antennas, E plane and H plane sectoral horns, Pyramidal horn, design of paraboloid of revolution by aperture method, exciters for paraboloids of revolution, Cassegrain Reflectors

Radar equation, Pulse radar, Duplexer, Doppler Effect, CW radar, FMCW radar, MTI radar, Radio Range, Aircraft landing systems, Radio Direction Finding, Reference Books

1. Samuel Y. Liao, Microwave Devices and Circuits. New Delhi : Prentice-Hall of India, 2001
2. K.C. Gupta and Amarjit Singh, Ed., Microwave Integrated Circuits, Wiley Eastern Ltd. 1978
3. Carol G. Montgomery, Ed., Techniques of Microwave Measurement, Vol.1. New York : Dover Publications, Inc., 1966
4. Edward L. Ginzton, Microwave Measurements, New York : McGraw-Hill Book Company, Inc., 1957
5. A.Z. Fradin, Microwave Antennas. Oxford : Pergamon Press, 1961
6. F. E. Terman, Electronic and Radio Engineering, New York : McGraw Hill Book Company, 1955
7. Merill I Skolink, Introduction to Radar Systems, New Delhi : TMH Publishing Comp., 1997
8. Constantine A. Balanis, Antanna Theoty : Analysis and Design, Singapore : John Wiley and sons (ASIA) Pte. Ltd., 2002
9. Annapurna Das and Sisir K.Das, Microwave Engineering, New Delhi : Tata McGraw-Hill Publishing Company Ltd., 2000

CC-203: Advanced Power Electronics

Course Objectives:

1. To make the students able to understand basics key of Chopper Circuits.
2. To make the students able to Analyze Electrical circuits using Fourier and Laplace Transform techniques.
3. To make students able to face industrial technical interviews successfully, those working on design and development of high power systems.
4. To make students able to understand different types of electrical machines.

Course Outcome:

1. Students become able to understand basics key of Chopper Circuits.
2. Students become able to Analyze Electrical circuits using Fourier and Laplace Transform techniques.
3. Students become able to face industrial technical interviews successfully, those working on design and development of high power systems.
4. Students would be able to understand different types of electrical machines.

Module 1: Basics of Electrical machines: (15)

Introduction to motors, Types of D.C. Motors, BLDC Motors, Torque Speed Characteristics. Types of Induction Motors. Construction and Working of Synchronous Machines and Stepper Motors. Interface techniques of Stepper Motor with IBM PCs and Digital Circuits. Concept of Full-Step, Half-Step and Micro-stepping in Stepper Motors.

Module 2: Choppers: (15)

Introduction and Classification of Choppers, Control Strategies: Pulse Width Modulation, Constant Pulse Width Variable Frequency, Current Limit Control, Variable Pulse Width and Frequency. Chopper Configurations Single Quadrant Chopper, Four- Quadrant Chopper. Step-Down and Chopper with Resistive Load. Step-Up Chopper. Three-Thyristor Choppers, Resonant Pulse Chopper.

Module 3: Transistorised Inverter Circuits: (15)

Half Bridge Inverter: Square Wave Half Bridge Inverter, Quasi-square wave inverter, PWM Inverter, Thyristorized Half Bridge Inverter. Push-Pull Inverter, Single-phase bridge inverter with resistive and inductive load, PWM bridge Inverter, Three phase inverters. Voltage Control of Single Phase Inverter. SPWM, MPWM, Sinusoidal PWM, Modified Sinusoidal pulse width modulation and Phase displacement control. Voltage control of Three Phase inverters.

Module 4: Thyristorised Inverters: (15)

Forced commutated thyristor inverters. i.e. Auxillary commutated inverters, Mc Murray commutated inverter, Complementary commutated inverters /Mc-Murray Bedford inverter, Current source inverter, Series resonant inverter with unidirectional and bidirectional switches, Parallel resonant inverters, Resonant DC link inverter.

Reference Books:

1. Power Electronics P.C. Sen
2. Thyristor power Controllers. C.K Dubey, S. R. Doradla, A. Joshi & R.M. Sinha
3. Power Electronics – By M. Rashid
4. Power Semiconductor drives-S. B. Dewan, G.R. Sleman, A. Strauphan (Wiley Int. Pub.-

John Wiley Sons.)

CC-204: **Optoelectronics**

Course Objectives:

To understand

1. the basic laws and phenomena in the area of optoelectronics.
2. optical fibers communication, fiber sources and detectors,
   LASER and LED, photo diode and phototransistors used as optoelectronic devices.
3. mechanisms of optoelectronic equipment action.
4. method of solving computational problems and different measurements.
5. theoretical & practical preparation of students and apply skills in optoelectronics.

Course Outcomes:

Ability to

1. learn and identify the losses in optical fiber**.**
2. acquires transmission characteristics, losses and preparation method.
3. conversant with the application of optical properties in optical sources and detectors
4. work out the operation of sources and detectors**.**
5. train to solve computational problems and analyses the different measurements.

Module 1: Introduction and structure: (15)

Historical developments, optical fiber communication system, principle of optical communication, advantages of optical fiber communication, total internal reflection, acceptance angle, numerical aperture, skew rays, cylindrical fiber.

Structure of optical fibers, single and multimode fibers, step index and graded index optical fiber.

Module 2: Transmission characteristics, losses and preparation methods: (15)

Infrared transmission, modal dispersion, overall fiber dispersion.

Attenuation, material absorption losses, scattering losses, fiber bends loss and joint loss.

Liquid phase (melting) and vapour phase deposition method.

Module 3: Connections, sources and detectors: (15)

Joints, fiber alignment, splices, connectors, couplers.

Absorption and emission of radiation, Einstein's relation, population inversion, semiconductor LASER and LED, power and efficiency characteristics of LASER and LED, optical transmitter and receiver.

Module 4: Measurements: (15)

Optical detection principles, absorption and emission, quantum efficiency, responsivity, long wavelength cutoff, photodiode and photo transistors. Fiber attenuation, dispersion, refractive index profile, cut-off wavelength, numerical aperture measurements.

Reference books:

1. Optical Fiber Communications, Principles and Practice: John M. Senior, PHI.
2. Optical Fiber Communication: J. Gower, PHI.
3. Optical Fiber Communications: Gerd Keiser, Mc-Graw Hill International Edition.
4. Optical Fiber Systems, Technology Design and Applications: Charles K Kao, Mc-Graw Hill International Edition.