

 <p>SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE : EPABX – 2609000, www.unishivaji.ac.in, <b>bos@unishivaji.ac.in</b> शिवाजी विद्यापीठ, गिल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी विभाग २३१-२६०९०९३/९४</p>	<p>SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE : EPABX – 2609000, www.unishivaji.ac.in, <b>bos@unishivaji.ac.in</b> शिवाजी विद्यापीठ, गिल्हापूर - ४१६००४, महाराष्ट्र दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी विभाग २३१-२६०९०९३/९४</p>	
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SU/BOS/Science/ 73

Date: 17 / 11 / 2022

To,  
The Principal,  
All Affiliated Concerned Science Colleges/Institutions  
Shivaji University, Kolhapur.

**Subject :- Regarding syllabi of M. Sc. Electronics Part- I (NEP-2020) degree programme under the Faculty of Science and Technology as per National Education Policy 2020 .**

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M. Sc. Electronics Part- I** under the Faculty of Science and Technology as per **National Education Policy 2020 .**

Sr.No.	Faculty of Science and Technology	Programme/ Course
1	Electronics	M. Sc. Part -I Electronics

This syllabi and nature of question paper shall be implemented from the Academic Year **2022-2023** onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website [www.unishivaji.ac.in](http://www.unishivaji.ac.in) (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,



Dy Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre ( I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

# Shivaji University, Kolhapur



Estd. 1962

'A++' Accredited by NAAC (2021)  
with CGPA 3.52

**Choice Based Credit System with Multiple Entry and Multiple Exit Option  
(National Education Policy 2020)**

**Syllabus for  
Master of Science  
In  
Electronics  
(Under Faculty of Science and Technology)**

**PART I (Level-8)**

**Syllabus to be implemented from the academic year 2022-23**

Department of Electronics  
Shivaji University, Kolhapur

## **M.Sc. Electronics**

### **Choice Based Credit System with Multiple Entry and Multiple Exit Option (National Education Policy 2020) With effect from academic year 2022-23**

#### **Rules and Regulations:**

1. Core courses will be offered only to the students of M.Sc. Electronics.
2. The pre-requisites for discipline specific elective (DSE) courses will be decided by the Departmental Committee.
3. Number of electives and number of students per elective paper will be decided in the Departmental Committee meeting. The merit of M.Sc. entrance will be treated as merit for offering the electives.
4. Students will be encouraged to opt for additional credits. This provision is in view of rewarding the advanced learners. The decision will be at the sole discretion of the Departmental Committee.
5. Minimum attendance required to appear for semester-end examination will be 75% for each credit course.

6. The nature of semester-end examination question paper will be as follows :

Core / Elective course

Maximum marks 80

Time 3 Hrs

- There shall be total seven questions of equal marks out of which Q. No. 1 is compulsory.
- From Q. No. 2 to Q. No. 7 candidate has to attempt any four questions.
- Q. No 2 to Q. No.7 shall have sub questions.

Q.1. Write short answers (Any four). (16)

- a)
- b)
- c)
- d)
- e)
- f)

Q.2. (16)

- a)
- b)

Q.3. (16)

- a)
- b)

Q.4. (16)

- a)
- b)

Q.5. (16)

- a)
- b)

Q.6. (16)

- a)
- b)

Q.7. (16)

- a)
- b)

7. In addition to ascertain the successful assimilation of the prescribed credits the evaluation will be carried out as per the pattern defined in 6.
8. Minimum passing standard will be 40 %. There will be separate heads of passing for internal and semester-end examinations.
9. The practical examination and project evaluation of semester end examination will be adjudged by one internal and one external examiner.

**Choice Based Credit System with Multiple Entry and Multiple Exit Option (National Education Policy 2020)**

**M.Sc. Electronics Programme Structure**

**M.Sc. Part-I (Level-8)**

SEMESTER - I (Duration - Six Months)												
St. No.	Course Code	Title of the Course	Teaching Scheme			Examination Scheme						
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam Hours	Maximum Marks	Minimum Marks	Exam Hours	
<b>CGPA</b>	1	CC-101	4	4	4	80	32	3	20	8	1	1
	2	CC-102	4	4	4	80	32	3	20	8	1	1
	3	CC-103	4	4	4	80	32	3	20	8	1	1
	4	CC-104	4	4	4	80	32	3	20	8	1	1
	5	CCPR-105	Practical	--	16	8	160	64	12	40	16	3
<b>Total (A)</b>			--	--	<b>24</b>	<b>480</b>	--	--	<b>120</b>	--	--	--
<b>Non-CGPA</b>	1	AEC-106	2	2	2	--	--	--	50	20	2	2
SEMESTER - II (Duration - Six Months)												
<b>CGPA</b>	1	CC-201	4	4	4	80	32	3	20	8	1	1
	2	CC-202	4	4	4	80	32	3	20	8	1	1
	3	CC-203	4	4	4	80	32	3	20	8	1	1
	4	CC-204	4	4	4	80	32	3	20	8	1	1
	5	CCPR-205	Practical	--	16	8	160	64	12	40	16	3
<b>Total (B)</b>			--	--	<b>24</b>	<b>480</b>	--	--	<b>120</b>	--	--	--
<b>Non-CGPA</b>	1	SEC-206	2	2	2	--	--	--	50	20	2	2
<b>Total (A+B)</b>			--	--	<b>48</b>	<b>960</b>	--	--	<b>240</b>	--	--	--

<ul style="list-style-type: none"> <li>• Student contact hours per week: <b>32</b> Hours (Min.)</li> <li>• Theory and Practical Lectures: <b>60</b> Minutes Each</li> <li>• CC-Core Course</li> <li>• CCPR-Core Course Practical</li> <li>• AEC-Mandatory Non-CGPA compulsory Ability Enhancement Course</li> <li>• SEC-Mandatory Non-CGPA compulsory Skill Enhancement Course</li> </ul>	<ul style="list-style-type: none"> <li>• Total Marks for M.Sc.-I : <b>1200</b></li> <li>• Total Credits for M.Sc.-I (Semester I &amp;II): <b>48</b></li> <li>• Practical Examination is annual.</li> <li>• Examination for CCPR-105 shall be based on Semester I Practicals.</li> <li>• Examination for CCPR-205 shall be based on Semester II Practicals.</li> <li>• <i>Separate passing is mandatory for Theory, Internal and Practical Examination</i></li> </ul>
<ul style="list-style-type: none"> <li>• <b>Requirement for Entry at Level 8:</b></li> <li>• <b>Completed all requirements of the relevant Bachelor's degree (Level 7) with principal/major subjects Electronics</b></li> <li>• <b>Exit Option at Level 8:</b> Students can exit after Level 8 with <b>Post Graduate Diploma in Electronics</b> if he/she completes the courses equivalent to minimum of 48 credits.</li> </ul>	

### **Program Outcomes for M.Sc. in Electronics**

Program Learning Outcomes detail the knowledge, skills and abilities that a student will demonstrate upon successful completion of the program.

A post-graduate of the M.Sc. Electronics Program will demonstrate:

**PO1: Domain Specific knowledge:** Apply the knowledge of mathematics, science, electronics to the solution of complex science & engineering problems.

**PO2: Problem analysis:** Identify, formulate, review research literature, and analyze complex science & engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/development of solutions:** Design solutions for complex science & engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex science & engineering activities with an understanding of the limitations.

**PO6: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO7: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO8: Communication:** Communicate effectively on complex science & engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO9: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PO10: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

### **Program Specific Outcomes for M.Sc. in Electronics**

A post graduate of the Electronics i.e. M.Sc. Electronics Program will demonstrate:

**PSO1: Professional Skills:** An ability to understand the basic concepts in and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.

**PSO2: Problem-Solving Skills:** An ability to solve complex Electronics Science and Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

**PSO3: Successful Career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

## 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. Doebelin 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  $Z_0$ ,  $\alpha$  and  $\beta$  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, Gyration, 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.

### Module 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.

### Module 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.

### Module 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.

### Module 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 Edition
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 Outcomes:

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 from 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.

#### Module 1:

(15)

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

#### Module 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.

#### Module 3:

(15)

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

#### Module 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, Antenna Theory : 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 Outcomes:

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.