SHIVAJI UNIVERSITY, KOLHAPUR - 416004,
MAHARASHTRA
PHONE:EPABX–2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर - ४१६००४, महाराष्ट्र
दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी विभाग ०२३१–२६०९०९४

Estd. 1962
"A++" Accredited by
NAAC(2021)
With CGPA 3.52

जा.क्र.शिवाजी वि./अमं/732 दिनांक. 09/10/ 2023

प्रति,

मा. अध्यक्ष व सदस्य,
सर्व अभ्यास/अस्थायी मंडळे (सायन्स)
शिवाजी विद्यापीठ, कोल्हापूर

विषय :– शैक्षणिक वर्षे 2023–24 पासून एम.एस्सी. अभ्यासक्रमाच्या आराखडया (Structure) बाबत.

महोदय/महोदया,

उपरोक्त विषयास अनुसरून आदेशान्वये कळविण्यात येते की, राष्ट्रीय शैक्षणिक धोरण, 2020 ची राज्यातील अंमलबजावणीच्या अनुषंगाने विद्यापीठ अधिकार मंडळाच्या निर्णयानुसार शैक्षणिक वर्षे 2023–24 पासुन एम.एस्सी. अभ्यासक्रमासाठी सोबत जोडलेला कॉमन आराखडा **(Structure)** व **Formatting (Templet)** लागू करण्यात आले आहे याची नोंद घ्यावी.

सदरची बाब सर्व शिक्षक, विद्यार्थी व संबंधीतांच्या निदर्शनास आणावी.

कळावे,

आपला विश्वासू

(डॉ. एस. एम. कुबल)
उपकुलसचिव

प्रतः–

प्र.अधिष्ठाता विज्ञान व तंत्रज्ञान विद्याशाखा
मा.संचालक परीक्षा व मुल्यमापन मंडळ
परीक्षक नियुक्ती विभाग–1,2
सर्व परीक्षा विभाग (ऑन)
माहितीसाठी व पुढील योग्य त्या कार्यवाहीसाठी.

Estd. 1962
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SHIVAJI UNIVERSITY, KOLHAPUR - 416 004, MAHARASHTRA
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शिवाजी विद्यापीठ, कोल्हापूर - ४१६ ००४,महाराष्ट्र
दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१—२६०९०९३/९४

SU/BOS/Science/499 **Date: 10/07/2023**

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.

Subject: Regarding syllabi of **M.Sc. Part-I (Sem. I & II) as per NEP-2020** degree programme under the Faculty of Science and Technology.

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 revised syllabi, nature of question paper and equivalence of M.Sc. Part-I (Sem. I & II) as per NEP-2020 degree programme under the Faculty of Science and Technology.

M.Sc.-Part I (Sem. I & II) as per NEP-2020			
1.	Microbiology (HM)	10.	Data Science
2.	Pharmaceutical Microbiology (HM)	11.	Computer Science
3.	General Microbiology	12.	Information Technology (Entire)
4.	Electronics	13.	Food Science & Technology
5.	Embedded Technology	14	Food Science & Nutrition
6.	Geology	15.	Biochemistry
7.	Sugar Technology (Entire)	16.	Biotechnology
8.	Alcohol Technology (Entire)	17.	Medical Information Management
9.	Agro Chemical & Pest Management (AGPM)	18.	Environmental Science
		19.	Physics

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website **www.unishivaji.ac.in**)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

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

Thanking you,

Dy Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

SHIVAJI UNIVERSITY, KOLHAPUR

Established: 1962

A^{++} Accredited by NAAC (2021) with CGPA 3.52

Structure and Syllabus in Accordance with

National Education Policy - 2020

with Multiple Entry and Multiple Exit

Master of Science (Electronics)

under
Faculty of Science and Technology

(To Be Implemented From Academic Year 2023-24)

INDEX

1. Preamble

The Department of Electronics, Shivaji University, Kolhapur is at the forefront of the academics, research and development work in the field of Science and Technology. It has been recognized at National level by the UGC since 1987 and funded under UGC SAP. Currently M.Sc., M.Phil. and Ph.D. programs are offered. Teaching-Learning in the Department includes smart classroom and MOODLE. The Department enjoys industry partnerships in the niche area of research and development. The department is hosting centre of excellence in VLSI-IoT system design in the partnership with industry with grants in aid support by RUSA.

2. Duration

The M.Sc. programme will be a full-time TWO years i.e. 4 semesters.

3. Eligibility for Admission

- B.Sc. Electronics
- Admission through University Entrance exam only.
- Only entrance marks should be considered for admission process.
- Reservation of Seats as per rules of Government of Maharashtra

4. Medium of Instruction

The medium of instruction will be English only.

5. Programme Structure

Structure in Accordance with National Education Policy - 2020
With Multiple Entry and Multiple Exit Options
M.Sc. (Electronics) Part – I (Level-6.0)

	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures + Tutorial/ (Hours / week)	Practical (Hours / week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
Semester-I										
Major Mandatory	MMT-101	4	--	4	80	32	3	20	8	1
	MMT-102	4	--	4	80	32	3	20	8	1
	MMT-103	2	--	2	40	16	2	10	4	1
	MMPR-104		8	4	80	32	3	20	8	1
Major Elective	MET-105	4	--	4	80	32	3	20	8	1
Research Methodology	RM-106	4	--	4	80	32	3	20	8	1
Total				22	440			110		
Semester-II										
Major Mandatory	MMT-201	4	--	4	80	32	3	20	8	1
	MMT-202	4	--	4	80	32	3	20	8	1
	MMT-203	2	--	2	40	16	2	10	4	1
	MMPR -204	--	8	4	80	32	3	20	8	1
Major Elective	MET-205	4	--	4	80	32	3	20	8	1
OJT/FP	OJT-206			4	80	32		20	8	
Total				22	440			110		
Total (Sem I + Sem II)				44						

<table>
<tr><td>• MMT – Major Mandatory Theory
• MMPR – Major Mandatory Practical
• MET – Major Elective Theory
• MEPR – Major Elective Practical
• RM - Research Methodology
• OJT/FP- On Job Training/ Field Project</td><td>• Total Marks for M.Sc.-I : 1100
• Total Credits for M.Sc.-I (Semester I & II) : 44
• Separate passing is mandatory for University and Internal Examinations</td></tr>
<tr><td colspan="2">*Evaluation scheme for OJT/FP shall be decided by concerned BOS</td></tr>
<tr><td colspan="2">• Requirement for Entry at Level 6.0:
Completed all requirements of the relevant Bachelor’s degree (Level --) with principal/major subjects Electronics</td></tr>
<tr><td colspan="2">• Requirement for Exit after Level 6.0:
Students can exit after completion of Level 6.0 with Post Graduate Diploma in Electronics</td></tr>
<tr><td colspan="2">• Requirement for Entry at Level 6.5: ……..
Completed all requirements of the relevant Bachelor’s degree (Level 6.0) with principal/major subjects Electronics
OR
Completed all requirements of the relevant Master’s degree (Level 6.0) with principal/major subjects Electronics</td></tr>
</table>

Structure in Accordance with National Education Policy - 2020
With Multiple Entry and Multiple Exit Options
M.Sc. (Electronics) Part – II (Level-6.5)

	Course Code	Teaching Scheme			Examination Scheme					
		Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
		Lectures + Tutorial (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
Semester-III										
Major Mandatory	MMT-301	4	--	4	80	32	3	20	8	1
	MMT-302	4	--	4	80	32	3	20	8	1
	MMT-303	2	--	2	40	16	2	10	4	1
	MMPR-304	--	8	4	80	32	3	20	8	1
Major Elective	MET-305	4	--	4	80	32	3	20	8	1
Research Project	RP-306		8	4	#					
Total				22						
Semester-IV										
Major Mandatory	MMT-401	4	--	4	80	32	3	20	8	1
	MMT-402	4	--	4	80	32	3	20	8	1
	MMT-403	4	--	4	80	32	3	20	8	1
Major Elective	MET-404	4	--	4	80	32	3	20	8	1
Research Project	RP-405		12	6	##					
Total				22						
Total (Sem III + Sem IV)				44						

• MMT – Major Mandatory Theory • MMPR – Major Mandatory Practical • MET – Major Elective Theory • MEPR – Major Elective Practical • RP- Research Project	• Total Marks for M.Sc.-II : **1100** • Total Credits for M.Sc.-II (Semester III & IV) : 44 • ***Separate passing is mandatory for University and Internal Examinations***
# Evaluation scheme for Research Project shall be decided by concerned BOS	
## Evaluation scheme for Research Project shall be decided by concerned BOS	
• **Requirement for Exit after Level 6.5:** **Students can exit after completion of Level 6.5 with Post Graduate in Electronics**	

6. Programme Outcomes (POs)

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.

7. Course Codes

M.Sc. Semester - I		
Course Code	**Major Mandatory**	
MMT-101	Computer Organization (4 credit)	MSU0325MML912G1
MMT-102	Microwave Technology (4 credit)	MSU0325MML912G2
MMT-103	Foundations of Digital Design (2 credit)	MSU0325MML912G3
MMPR-104	Practical Lab - I (4 credit)	MSU0325MMP912G4
RM-106	Research Methodology (4 credit)	MSU0325RML912G
MET-105	**Major Elective**	
	Industrial Automation (4 credit)	MSU0325MEL912G1
	Machine Learning (4 credit)	MSU0325MEL912G2
	Measurements and Instrumentation (4 credit)	MSU0325MEL912G3
M.Sc. Semester - II		
	Major Mandatory	
MMT-201	Digital Signal Processing (4 credit)	MSU0325MML912H1
MMT-202	8051 Architecture and Programming (4 credit)	MSU0325MML912H2
MMT-203	Advanced Digital Design (2 credit)	MSU0325MML912H3
MMPR-204	Practical Lab - II (4 credit)	MSU0325MMP912H4
OJT-206	On Job Training/Field Project (4 credit)	MSU0325FPP912H
MET-205	**Major Elective**	
	VHDL Programming (4 credit)	MSU0325MEL912H1
	Digital Communication (4 credit)	MSU0325MEL912H2
	Satellite Communications (4 credit)	MSU0325MEL912H3
M.Sc. Semester - III		
	Major Mandatory	
MMT-301	Control Theory (4 credit)	MSU0325MML912I1
MMT-302	Computer Networks (4 credit)	MSU0325MML912I2
MMT-303	Green Electronics (2 credit)	MSU0325MML912I3
MMPR-304	Practical Lab - III (4 credit)	MSU0325MMP912I4
RP-306	Research Project - I (4 credit)	MSU0325RPP912I
MET-305	**Major Elective**	
	Advanced Microcontroller and System Design (4 credit)	MSU0325MEL912I1
	FPGA Based Systems (4 credit)	MSU0325MEL912I2
	Cellular Mobile Communications (4 credit)	MSU0325MEL912I3
M.Sc. Semester - IV		
	Major Mandatory	
MMT-401	Analog and Digital Circuit Design (4 credit)	MSU0325MML912J1
MMT-402	Optoelectronics (4 credit)	MSU0325MML912J2
MMT-403	Real Time Embedded Systems (4 credit)	MSU0325MMP912J3
RP-405	Research Project - II (6 credit)	MSU0325RPP912J
MET-404	**Major Elective**	
	Arduino and Internet of Things (4 credit)	MSU0325MEL912J1
	PLC and SCADA (4 credit)	MSU0325MEL912J2
	Antennas (4 credit)	MSU0325MEL912J3

8. Syllabus

M. Sc. Electronics (Part I) (Level-6.0) (Semester I)
(NEP-2020)
(Introduced from Academic Year 2023-24)

Title of Course: Computer Organization
Course Code: MSU0325MML912G1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

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 I **(15 Lectures)**

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 II **(15 Lectures)**

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 III **(15 Lectures)**

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 IV **(15 Lectures)**

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.

Seminars, Tutorials, Problem solving session and group discussions on above four units

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)

Title of Course: Microwave Technology
Course Code: MSU0325MML912G2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

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.
4. The students will be able to understand principles of operation of tube and semiconductor active microwave devices.
5. They will learn microstrip line, measurements and antennas at microwave frequencies.

Unit I Electrostatics, steady magnetic field and Maxwell's Equations (15 Lectures)
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

Unit II Electromagnetic Waves (15 Lectures)
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

Unit III Transmission Lines (15 Lectures)
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

Unit IV Waveguides, Cavity Resonators and Passive Microwave Devices (15 Lectures)
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. Microwave Tubes, Solid state devices, Microstrip lines, Microwave measurements, Microwave antennas.

Seminars, Tutorials, Problem solving session and group discussions on above four units

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.
11. K. C. Gupta and Amarjit Singh, Ed., Microwave Integrated Circuits, Wiley Eastern Ltd. 1978
12. Carol G. Montgomery, Ed., Techniques of Microwave Measurement, Vol. 1. New York : Dover Publications, Inc., 1966
13. Edward L. Ginzton, Microwave Measurements, New York : McGraw-Hill Book Company, Inc., 1957
14. A. Z. Fradin, Microwave Antennas. Oxford : Pergamon Press, 1961
15. Merill I Skolink, Introduction to Radar Systems, New Delhi : TMH Publishing Comp., 1997
16. Constantine A. Balanis, Antanna Theoty : Analysis and Design, Singapore : John Wiley and sons (ASIA) Pte. Ltd., 2002
17. Annapurna Das and Sisir K.Das, Microwave Engineering, New Delhi : Tata McGraw-Hill Publishing Company Ltd., 2000

Title of Course: Foundations of Digital Design
Course Code: MSU0325MML912G3
Total Credits: 02
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand key ideas behind digital system design.
2. Design combinational and sequential circuit design necessary as a foundation of VLSI technology.

Unit I Combinational Logic Design: (15 Lectures)
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.

Unit II Sequential Logic Design: (15 Lectures)
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.

Seminars, Tutorials, Problem solving session and group discussions on above four units

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.

Title of Course: Practical Lab - I
Course Code: MSU0325MMP912G4
Total Credits: 04

(Two experiments and certified journal- 4-credits)

Title of Course: Industrial Automation
Course Code: MSU0325MEL912G1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Identify different components of an Automation System
2. Design controllers
3. Interface I/O devices to PLC module
4. Program PLC for different applications

Unit I Introduction to Process Control and Automation (15 Lectures)

Process Control Principles, Control System Evaluation, Analog and Digital Processing.
Controller principles – Process characteristics and Control System Parameters.
Automation – Types of Automation and Architecture of Industrial Automation Systems.

Unit II Measurement Systems (15 Lectures)

Measurement Systems Specifications – Static Characteristics, Dynamic Characteristics.
Sensors and Measurement Systems for Temperature, Displacement, Level, Pressure, Flow, Humidity.
Signal Conditioning Circuits.

Unit III Tuning of Controllers (15 Lectures)

Types of controllers – Discontinuous Controllers, Continuous Controllers and Composite Controllers.
Proportional-Integral-Derivative (PID) Control, Tuning of PID Controller, Implementation of PID Controller.

Unit IV Programmable Logic Controller and its Applications (15 Lectures)

Introduction to Sequence Control, Programmable Logic Controller (PLC) – Overview, Functions, Architectural features, Specifications of PLC Onboard/Inline/Remote IO's.
PLC Programming Languages – Ladder Diagram, Functional Block Diagram, Instruction List, Structured Text and Sequential Function Charts.
Introduction to Timers, Counters, Arithmetic Instructions, Logical Instructions, Data Handling Instructions.
PLC based Applications – Traffic light control, Tank level control, Conveyor system.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. Curtis Johnson, "Process Control Instrumentation Technology", Pearson Education, (8th Edition), (2013).
2. S. Sen, S. Mukhopadhyay, A. K. Deb, "Industrial Instrumentation Control and Automation", Jaico Publishing House, (1st Edition), (2013).
3. Madhuchhanda Mitra, Samarjit Sengupta, "Programmable Logic Controllers and Industrial Automation", Penram International Publishing India Pvt. Ltd., (2nd Edition), (2012)

Title of Course: Machine Learning
Course Code: MSU0325MEL912G2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Identify different components of machine learning
2. Design neural networks
3. Use machine learning algorithms for different applications

Unit I Fundamental of Neural Network (15 Lectures)

Canonical form of biological Neuron, Notion of Artificial Neuron, Electronic Comparison between Biological and Artificial Neural Networks, Advantages and Application domains of Artificial Neural Network Neuron, Concept of Artificial Neural Network, Models of Artificial Neuron: McCulloch-Pitts Model, Basic Elements, Activation Functions, Artificial Neural Network Architectures: Single and Multilayer, Feed Forward, Recurrent, Learning Process, Types of Learning

Unit II Supervised Learning (15 Lectures)

Perceptron Networks, Learning Rule, Perceptron, Adaptive Linear Neuron, Delta Rule, Back Propagation Network, Training and Testing Algorithms, Radial Basis Function Network, Time Delay, Functional Link, Tree, Wavelet Neural Networks.

Unit III Unsupervised Learning (15 Lectures)

Fixed Weight Competitive Network, Theory, Architecture, Training Algorithm: Kohonen Self-Organizing Feature Maps, Learning Vector, Quantization, Adaptive Resonance Theory Network, ART-1 and ART-2.

Unit IV Electronic Neural Circuit and Applications (15 Lectures)

Realization of Logic Gates, Parity Checker, Half and Full Adder, Neural Fault Detector, Design considerations of Digital Neural Controller, Application Examples, Software-Hardware Implementation: Computer/Microcontroller based Neural Systems.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. S. N. Sivanandam, S. N. Deepa,"Principles of Soft Computing", Wiley, India (P) Ltd., Ist Indian Edition,
2. S. Rajsekaran, G. A. VijayalaxmiPai," Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and applications", PHI, New Delhi
3. Rajkumar Roy, Mario Koppen "Soft Computing and Industry: Recent Applications", Springer.
4. A.M. Ibrahim, Introduction to Applied Fuzzy Electronics, Prentice Hall of India,New Delhi.
5. V.B. Rao and H.V. Rao, C++ Neural Networks and Fuzzy Logic, B.P.B. Publications, New Delhi.
6. B. Yegnanarayana, Aritifical Neural Network, PHI, New Delhi
7. Alision carling, Introduction to Neural Network, Galgotia Publications, New Delhi.
8. B. Kosko,Neural Network and Fuzzy System, PHI, New Delhi
9. J. M. Zurada, Introduction to Artificial Neural systems, 6th Edition, Jaico Publishing House, Delhi
10. B. Yegnanarayana, Artificial Neural Networks, 6th Edition, PHI, New Delhi
11. Satish Kumar, Neural Networks: A class room Approach, Tata Microcontroller ,McGraw Hill, New Delhi

Title of Course: Measurements and Instrumentation
Course Code: MSU0325MEL912G3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able 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.

Unit I Measurements (15 Lectures)
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.

Unit II Measurement systems (15 Lectures)
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.

Unit III Motion and dimensional measurement (15 Lectures)
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.

Unit IV Velocity, acceleration and process parameters measurement (15 Lectures)
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

Seminars, Tutorials, Problem solving session and group discussions on above four units

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.

Title of Course: Research Methodology
Course Code: MSU0325RML912G
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Use research methodologies based on identified research problem.
2. Conduct literature survey
3. Write research papers
4. Design electronic systems

Unit I Introduction to Research Methodology (15 Lectures)

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.

Unit II Literature Review and Research Tools (15 Lectures)

Database, Scopus, Science Direct, Web of Science, Citation Index, Impact Factor, H-index, i10-index, i20-index.

Statistics in Research, Measures of Dispersion, Measures of Skewness, Regression Analysis, Correlation Techniques.

Unit III Research Writing (15 Lectures)

Structure and Components of Research Report, Writing Project Proposal, Paper Writing for Journals as per IEEE format, Paper Presentation in Conference, Preparation of Effective Slides, Pictures, Graphs, and Citation styles.

Unit IV Techniques for Electronic System Design (15 Lectures)

Embedded based System Design, VLSI based System Design, Communication System Design, Optoelectronics System Design, Wireless Systems, Antenna Design.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. Research Methodology – Methods and Techniques, C. R. Kothari, Wiley Easter Ltd, New Delhi 1985.
2. Embedded Systems - Architecture , Programming and Design, McGraw Hill Education, 3rd Edition, 2017.
3. Harnessing VHDL Programming with EDA Tools, R. K. Kamat, S. A. Shinde and P. K. Gaikwad, Springer Publications (2011).
4. Optical Fiber Communications - Principles and Practice, John M. Senior, Pearson Education, 3rd Edition, 2009.
5. Advances in Microstrip and Printed Antennas, Kai Fong Lee, Wei Chen, John Wiley and Sons Inc. New York 1997.
6. Protocols and Architectures for Wireless Sensor Networks, Holger Karl, Andreas Willig, John Wiley, 2005.
7. Wireless Sensor Networks - An information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier, 2007.

M. Sc. Electronics (Part I) (Level-6.0) (Semester II)
(NEP-2020)
(Introduced from Academic Year 2023-24)

Title of Course: Digital Signal Processing
Course Code: MSU0325MML912H1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Analyze discrete time system
2. Design and analyse FIR and IIR digital filters
3. Explain Discrete Fourier Transform, its properties and applications
4. Explain architecture of Digital Signal Processor and its applications

Unit I Discrete-Time Signals and Systems (15 Lectures)

Basic elements of Digital Signal Processing system, Advantages of Digital over Analog Signal Processing, Sampling of analog signals, Sampling theorem, Discrete-time signals: Representation, Classification, Manipulations. Discrete-Time systems: Input-Output description, Block diagram representation, Classification. Convolution, Correlation.

Unit II Analysis of Discrete-Time Systems (15 Lectures)

Z-Transform and region of convergence, Inverse Z-Transform, Analysis of Linear Time-Invariant (LTI) systems in Z domain: Transient and Steady state responses, Causality and Stability. Frequency Domain Sampling: Discrete Fourier Transform (DFT), Inverse Discrete Fourier Transform (IDFT), DFT as a Linear Transformation. Fast Fourier Transform (FFT) Algorithms: Radix2 Decimation in Time (DIT) and Decimation in Frequency (DIF) algorithms to compute DFT.

Unit III Design and Realization of Digital Filters (15 Lectures)

Structures for Finite Impulse Response (FIR) system: Direct-Form, Cascade-Form and Linear Phase. Design of FIR filter: Windowing and Frequency-sampling. Structures for Infinite Impulse Response (IIR) system: Direct-Form, Cascade-Form and Parallel-Form. Design of IIR filter: Impulse Invariance and Bilinear Transformation.

Unit IV DSP Architecture and Applications (15 Lectures)

Comparison between General Purpose Processor and Digital Signal Processor, Architectural features of Digital Signal Processors, Fixed point and floating point numeric representation and arithmetic, Different generations of DSP Processors, Applications of DSP to image processing and speech processing.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms and Application", 4th Edition, Pearson Education Publication
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", McGraw Hill Education.
3. P. Ramesh Babu, "Digital Signal Processing", 4th Edition, Scitech Publications.
4. A. Ambardar, "Digital Signal Processing: A Modern Introduction", Cengage Learning India.
5. S. Salivahanan, A Vallavaraj, C. Guanapriya, "Digital Signal Processing", 1st Edition, Tata McGrawHill.
5. Phil Lapsley, "DSP Processor Fundamentals – Architectures and Features", Wiley publication.
6. P. Pirsch, "Architectures for Digital Signal Processing", John Wiley publication.

7. B. Venkataramani, M. Bhaskar, “Digital Signal Processors – Architecture, programming and applications”, McGraw Hill Education.

Title of Course: 8051 Architecture and Programming
Course Code: MSU0325MML912H2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Able to demonstrate the basic architecture of 8051 microcontroller.
2. Able to Program 8051microprocessor using Assembly Level Language and C.
3. Understand the interrupt system of 8051 and the use of interrupts.
4. Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
5. Interface 8051 to external memory and I/O devices using its I/O ports.

Unit I **(15 Lectures)**

Introduction to embedded systems, embedded system applications, embedded system components, microprocessor v/s microcontroller, hardware architectures – Von-Neumann v/s Harvard architecture, Instruction set architectures – CISC v/s RISC, programming languages – HLL, ALP; 8051 architecture, programmers model, 8051 memory map, interfacing external CODE and DATA memory, general purpose GPRs, Program Status Word, Register banks, 8051 stack, 8051 clock, instruction cycle, RESET, 8051 family and peripherals (89C51, 89C52, 89C51RD2, 89c2051).

Unit II **(15 Lectures)**

8051 instruction set, addressing modes, Instruction timing; 8051 peripherals: 8-bit I/O ports – P0-P3, dual function, 8051 timers, timer modes, Timer/counter applications, Interrupts, interrupt types, priorities, ISRs, PUSH-POP v/s bank switching, Serial Port, baud rates, transmission-receiption using polling mode/interrupt mode.

Unit III **(15 Lectures)**

Programming languages – HLL, assembly language, advantages of HLL, C programming language, C Character Set, Identifiers and Keywords, Data types, operators and constants, variables. C statements – declaration, assignment, function call, branching, looping; C functions, arrays, pointers, structures, unions.

Unit IV **(15 Lectures)**

C51 Language extensions for 8051, C51 keywords, memory areas, memory types, memory models, data types, bit variables and bit addressable data, special function registers, pointers, function attributes, Embedded C Programming exercises.

Seminars, Tutorials, Problem solving session and group discussions on above four units

References:

1. Keil Inc, Cx51 users guide.
2. Kenneth Ayala, The 8051 Microcontroller, 3rd Edition, Cengage Learning India
3. Ajay Deshmukh, MICROCONTROLLERS: THEORY AND APPLICATIONS, McGraw Hill Education

Title of Course: Advanced Digital Design
Course Code: MSU0325MML912H3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Students become able to design CMOS based combinational circuit design necessary as a foundation of VLSI technology.
2. Students become able to design CMOS based sequential circuit design necessary as a foundation of VLSI technology.

Unit I Foundations of CMOS Technology: (15 Lectures)
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.

Unit II CMOS Based Logic Design: (15 Lectures)
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.

Seminars, Tutorials, Problem solving session and group discussions on above four units

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.

Title of Course: Practical Lab - II
Course Code: MSU0325MMP912H4
Total Credits: 04

(Two experiments and certified journal- 4-credits)

Title of Course: VHDL Programming
Course Code: MSU0325MEL912H1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Students get introduced with HDL programming languages.
2. Students become able to write VHDL codes for various combinational and sequential designs.
3. Students become able to understand basics of VLSI design with Concurrent Statements in VHDL.
4. Students become able to understand basics of VLSI design with sequential Statements in VHDL.

Unit I Introduction to VHDL (15 Lectures)

History of VHDL, Advantages of HDLs over Sequential Languages, VHDL library and package declaration, VHDL Component, Entity syntax, Signal modes, Architecture syntax, Process, Concurrent Signal Assignments. Concept of RTL Synthesis. Simulation. Introduction to EDA Tools. Design Flow.

Unit II Objects and Data Types (15 Lectures)

Class: Constant, Variable, Signal. Data Types: Boolean, Integer, Character, Bit, Array, Type Declaration, Vectors and slices, bit string literals, Concatenation, Aggregate, Enumerated. 9-Value Logic: std_logic vs std_ulogic. Sub types, Multidimensional Array. Relational and Arithmetic Operators. Init value. Generics. Signal assignment, Concurrency, Delay in VHDL Statements.

Unit III Concurrent Statements (15 Lectures)

Concept of Concurrent statements, Concurrent VHDL Construction: *process* statement with design example, *when-else* statement with design example, *with-select* statement, signal declaration and *block* statements with program example

Unit IV Sequential Statements (15 Lectures)

Sequential VHDL Construction: *if-then-else* statements, *case* statement, *variable* declaration and assignments. Loops: *for* and *while.* Architecture modeling styles. Design Examples: Multiplexor, De-Multiplexor, Decoder, Encoder, Synchronous counters using state machines.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. VHDL Primer, J. Bhaskar, Pearson Education.
2. VHDL for Designers, Stefan S and Lennart Lindh, Prentice Hall.
3. VHDL by Douglas L. Perry, Mc Graw Hill Publications.

Title of Course: Digital Communication
Course Code: MSU0325MEL912H2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

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

Unit 2 **(15 Lectures)**
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 Lectures)**
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 Lectures)**
Case studies: Paging system, cellular telephone, global positioning satellite, Facsimile, Videotext.

Seminars, Tutorials, Problem solving session and group discussions on above four units

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.

Title of Course: Satellite Communications
Course Code: MSU0325MEL912H3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. The students will be able to understand various modulation, encoding and decoding techniques involved in satellite communications
2. They will be able to understand various aspects of satellite channel and satellite transponder
3. They will be able to understand various multiple access formats used in satellite communications

Unit I Modulation, Encoding and Decoding (15 Lectures)
History of satellite communications, review Orbital mechanics, Analog modulation, Digital Encoding, Spectral shaping, Digital decoding, Error correction Encoding, Block Waveform Encoding, Digital Throughput

Unit II Satellite channel (15 Lectures)
Electromagnetic field propagation, Antennas, Atmospheric losses, receiver Noise, Carrier to Noise ratios, satellite link analysis, Frequency Reuse by dual polarization, Spot beams in satellite downlinks. Satellite ranging systems

Unit III Satellite Transponder, FDMA (15 Lectures)
Transponder model, the satellite front end, RF filtering of digital carriers, Satellite signal processing, Transponder Limiting, Non-linear satellite amplifiers, Effect of non-linear amplification on digital carriers
FDMA - FDMA system, Nonlinear amplification with multiple FDMA Carriers, FDMA, FDMA Nonlinear analysis, FDMA channelization, AM/PM conversion with FDMA, Satellite switched FDMA

Unit IV TDMA and CDMA (15 Lectures)
TDMA -The TDMA system, preamble design, Satellite Effects on TDMA performance, Network synchronization, SS TDMA
CDMA - Direct Sequence CDMA system, Performance of DS CDMA, satellite systems, Frequency Hopped CDMA, Antijam advantages of spectral spreading, Code Acquisition and Tracking

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. Robert M. Gagliardi, Satellite Communications, New Delhi : CBS Publishers and Distributors, 2000
2. Timothy Pratt, Charles W. Bostian, Jeremy E. Allnutt, Satellite Communications, Singapore : John Wiley and Sons Inc. 2003
3. Dennis Roddy, Satellite Communications. New York : McGraw-Hill, 2001

Title of Course: OJT
Course Code:
Total Credits: 04

M. Sc. Electronics (Part II) (Level-6.5) (Semester III)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Control Theory
Course Code: MSU0325MML912I1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Explain various concepts related to control system
2. Design and analyze control system
3. Explain importance of stability of control system
4. Find time and frequency response of control system
5. Use control system components and controllers

Unit I Introduction (15 Lectures)

Basic components of control system, Open-loop and closed-loop control systems, Effect of feedbacks on control system performance, Type of feedback control systems, Transfer function, Pole & zero concept, Mathematical modeling of electrical systems and mechanical systems, Block diagram reduction techniques, Signal flow graph.

Unit II Time-Domain Analysis and Stability (15 Lectures)

Type and order of control system, Test signals, Unit-step response and Time-domain specifications, Time response of first and second order systems, Concept of Stability: absolute, relative and marginal, Nature of system response, Routh Hurwitz stability criterion, Root locus method.

Unit III Frequency-Domain and State Variable Analysis (15 Lectures)

Frequency response of control system, Frequency-domain specifications, Relation between time domain and frequency domain responses, Nyquist stability criterion, Stability analysis with Bode plot, Introduction to state space analysis, State space representation for i) Electrical Network ii) n^{th} order differential equation and iii) Transfer function. State model from transfer function using: Direct, parallel, cascade and decomposition method.

Unit IV Control System Components and Controllers (15 Lectures)

Sensors in control systems – Potentiometer and Tachometer. Design of Proportional (P), Proportional Integral (PI), Proportional Derivative (PD), Proportional Integral Derivative (PID) controllers, Compensator Networks - lag and lead.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. Farid Golnaraghi and Benjamin C. Kuo, "Automatic Control System", 9^{th} Edition, Wiley.
2. Katsuhiko Ogata, "Modern Control Engineering", 5^{th} Edition, Prentice Hall.
3. Norman S. Nise, "Control System Engineering", 5^{th} Edition, Wiley.
4. I. J. Nagrath and M.Gopal, "Control Systems Engineering", 5^{th} Edition, New Age International Publishers.
5. S. K. Bhattacharya, "Control Systems Engineering", 1^{st} edition, Pearson Education

Title of Course: Computer Networks
Course Code: MSU0325MML912I2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand basic concept of computer networks.
2. Understand network software & network standardization.
3. Understand the role of networking devices.

Unit I **(15 Lectures)**

Introduction to Computer Networks: Introduction: Definition of a Computer Network; What is a Network?, Components of a computer network: Use of Computer networks; Networks for companies,Networks for people, Social Issues: Classification of networks; Based on transmission technology, Basedon the their scale, Local area networks, Metropolitan area networks, Wide area networks, Wirelessnetworks:

Unit II **(15 Lectures)**

Network Software & Network Standardization: Introduction: Networks Software; Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Service Primitives: Referencemodels; The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IPReference Models: Network standardization; Who's who in the telecommunication world?, Who's who inthe standards world, Who's who in the Internet standards world? Detailed over view of layers of OSI and TCP/IP

Unit III **(15 Lectures)**

Physical Layer: Introduction: Network topologies; Linear Bus Topology, Ring Topology, Star Topology,Hierarchical or Tree Topology, Topology Comparison, Considerations when choosing a Topology:Switching; Circuit switching, Message switching, Packet switching, Implementation of packet switching,Relationship between Packet Size and Transmission time, Comparison of switching techniques:Multiplexing; FDM – Frequency division multiplexing, WDM – Wavelength division multiplexing, TDM– Time division multiplexing:

Unit IV **(15 Lectures)**

Networking Devices: Introduction; Goal of networking devices: Repeaters; Uses of Repeaters: Hubs; Classification of Hubs, Stackable Hubs, USB Hub: Switches; Switching Methods, Comparison of switching methods, working with Hubs and Switches, Cables Connecting Hubs and Switches, Managed Hubs and Switches, Port Density: Bridges; Bridge Implementation Considerations, Types of Bridges: Routers; Dedicated Hardware versus Server-Based Routers, Advantages and Disadvantages of dedicatedhardware routers, Drawbacks of Routers: Gateways; Advantages of gateways, Gateways Functionality:Other Devices; Modems, Proxy Server, Wireless router, Brouter, Wireless Access Point (WAPs).

Seminars, Tutorials, Problem solving session and group discussions on above four units

References

1. Computer Networks Protocols, Standards and Interface – Black C.
2. Computer Networks – Stalling A.S.
3. Computer Networks – Tannenbaum A.S.
4. Internetworking with TCP/IP : Principles, Protocols and Architecture – Comer
5. Computer Networks and Distributed Processing - Martin J.

Title of Course: Green Electronics
Course Code: MSU0325MML912I3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Understand general concepts of Green electronics (Understand)
2. Recognize various techniques to recycle and reuse (Knowledge)

Unit I Introduction to Green Electronics and environmental regulations (15 Lectures)

Environmental concerns of the modern society, Overview of electronics industry and their relevant regulations in China, European Union and other key countries, Restriction of Hazardous substances (RoHS), Waste Electrical and electronic equipment (WEEE), Energy using Product (EuP) and Registration, Evaluation, Authorization and Restriction of Chemical substances (REACH).

Unit II Green electronics materials, products and Recycling (15 Lectures)

Introduction to green electronic materials and products. X-Ray Fluorescence (XRF) for identifying hazardous substances in electronic products. Technology and management on e-waste recycle system construction, global collaboration and product disassemble technology.

Text Books

1. Goldberg L.H., Green Electronics / Green Bottom Line, Environmentally Responsible Engineering, 1st Edition Newnes 2000 ISBN 0-7506-9993-0
2. Shina, Sammy G. Green Electronics Design and Manufacturing. New York: McGraw-Hill Professional, 2008.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. John X. Wang, "Green Electronics Manufacturing: Creating Environmental Sensible Products", CRC Press Indian Prentice Hall, 2012.

Title of Course: Practical Lab - III
Course Code: MSU0325MMP912I4
Total Credits: 04

(Two experiments and certified journal- 4-credits)

Title of Course: Advanced Microcontroller and System Design
Course Code: MSU0325MEL912I1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Demonstrate knowledge of the architecture of a modern microcontroller
2. Understand the different architectures of microcontroller
3. Able to programming the microcontroller
4. Able to interface external devices to microcontroller

Unit I **(15 Lectures)**

System Design: Minimum system with 89C51/PIC microcontrollers to monitor frequency, voltage,displacement, liquid level, weight, speed, traffic light control system with software development forabove. Isolation Techniques: Realys, opto-couplers and their specifications, Interfacing of Relays andoptocouplers with microcontrollers, isolation methods for heavy and a.c. loads. Signal Transmission: Vto I and I to V Conversion, V to F and F to V Conversion.

Unit II **(15 Lectures)**

Transducers and digital sensors for temperature, pressure and speed, signal conditioning, InstrumentationAmplifiers for RTD, thermocouple, bridge and LVDT, System design with 89C51 for measurement andcontrol of temperature, pressure, speed using ON/OFF, Proportional and PID modes, stability aspects ofthe system, s/w development.

Unit III **(15 Lectures)**

ARM Architecture: Introduction to ARM microprocessor and its features, Architecture, Programmingmodel, Processor Operating States, registers, Exceptions, ARM organization – 3-stage/5-stage pipelinedARM organization.

Unit IV **(15 Lectures)**

Introduction to the ARM Instruction set Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, Conditional Execution. ALP programming.

Seminars, Tutorials, Problem solving session and group discussions on above four units

References

1. K.J. Ayala, The 8051 Microcontroller, Thomson Press (India) Ltd.
2. Microcontrollers: theory and applications By Ajay V Deshmukh, TMH.
3. Microprocessors application in Process control – S.I. Ahson, TMH.
4. Transducer Interfacing Handbook, D.H. Sheingold, Analog Devices Technical Handbook
5. Norwood, USA.
6. ARM System-on-chip Architecture, Steve Furber, Addison Wesley
7. Datasheets and application notes of 8051 (P89C51RD2), AVR (ATMEGA32), PIC (16F877) and TIMSP430 microcontroller

Title of Course: FPGA Based Systems
Course Code: MSU0325MEL912I2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Students become able to understand FPGA Design Flow for system design.
2. Students become able to Compare FPGA and other Reconfigurable Devices.
3. Students become able to understand VLSI design Technology.
4. Students become able to design and test the FPGA based system

Unit I Programmable Logic Technology (15 Lectures)
Basics and Types Programmable Logic, PLA, PAL, GAL, SPLDs, CPLD: Families, Features, Architecture – XC 9500, Functional Block, Macrocell, Product Term Allocator, Switch Matrix, I/OBs. Pin Locking, Timing Models. ISP Features and Advantages.

Unit II FPGA Technology (15 Lectures)
FPGA Architecture, Features, Basic Building Blocks of FPGA: CLBs, IOBs, CLB Function Generators: F, G, H. Architectural Resources, Programmable Interconnects, Power Distribution in FPGA, Configuration. FPGA vs CPLD.

Unit III FPGA Design Flow (15 Lectures)
Introduction to HDL Programming, Advantages of HDLs over Sequential Programming Languages, Objects and Data Types in VHDL, Architecture Modeling Styles in VHDL, Finite State Machines Coding using VHDL: Stepper Motor Driver, Synchronous Counters

Unit IV EDA Tools for FPGA Platform Development (15 Lectures)
EDA Tools (Xilinx ISE) Design Flow, Embedded Development Kit: Core Generator, ICON and ILA Cores. Chip Scope-Pro based testing platform.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. VHDL Primer, J. Bhaskar, Pearson Education.
2. VHDL for Designers, Stefan S and Lennart Lindh, Prentice Hall.
3. VHDL by Douglas L. Perry, Mc Graw Hill Publications.
4. Digital Principles and Practices, John F. Wakerly, Prentice Hall International Editions.
5. Xilinx Chipscope Pro to Visualize FPGA Internal Signals, Pawan Gaikwad, LAP Lambert Academic Publishing.

Title of Course: Cellular Mobile Communications
Course Code: MSU0325MEL912I3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. learn and identify the mobile communication system.
2. acquires transceiver characteristics in mobile communication system
3. work out the operation of digital systems.
4. train to solve computational problems and analyses for mobile communication.

Unit I **(15 Lectures)**

Introduction to Cellular mobile systems, Elements of Cellular radio system, Design, specifications of analog systems, Cell coverage for signal and traffic

Unit II **(15 Lectures)**

Cell-site antennas and mobile antennas, Co-channel interference reduction, Types of non-co-channel interference, Frequency management and channel assignment

Unit III **(15 Lectures)**

Handoffs and dropped calls, operational techniques and Technologies, switching and traffic

Unit IV **(15 Lectures)**

Introduction to digital systems, Digital cellular systems, Intelligent cell construction and Applications, Features of handset, SMS, Security.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. William C.Y. Lee, Mobile Cellular Telecommunications: Analog and Digital Systems, Singapore: McGraw-Hill, 1995
2. William C.Y. Lee, Mobile Communication Engineering, McGraw-Hill.

Title of Course: Research Project - I
Course Code:
Total Credits: 04

M. Sc. Electronics (Part II) (Level-6.5) (Semester IV)
(NEP-2020)
(Introduced from Academic Year 2024-25)

Title of Course: Analog and Digital Circuit Design
Course Code: MSU0325MML912J1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Able to design regulators and power supply
2. Able to analyze and design Multivibrator and Oscillators
3. Understand the analysis and design circuits using operational amplifiers
4. Understand the design of digital circuits

Unit I **(15 Lectures)**

Zener series and shunt regulators, transistors as series and shunt regulators, regulator design with discrete components and IC 741/78xx, current sources and their design with discrete components and ICs, SMPS design.

Unit II **(15 Lectures)**

Design of multivibrators, (AMV, MMV, BMV) using ICs (555, 741), schimitt trigger, triangular waveform generator, design of oscillators (wein bridge, phase shift colpitt, harltey) using 741, PLL IC LM565, VCO LM566, analog multiplexer IC4051/52, design of RF tuned amplifier

Unit III **(15 Lectures)**

CMOS-TTL and TTL-CMOS interfaces, design of counter using FF and counter ICs, Oscillator design using Schmitt trigger (7414), inverter and NAND gate, MMV using gates and ICs (74/54121, 74221), design of binary to gray code converter, design of BCD to excess-3, excess-3 to BCD converter, design of full adder using MUX, design of16-1 using 4 4-1 MUXs, design of parity checker, memory interfacing, RAM ROM and EEPORM

Unit IV **(15 Lectures)**

Design of ON OFF, proportional and PID controller, design of capacitance and inductance meter, design of DVM using 7107, design of frequency synthesizer, design of digital multimeter.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. Introduction to system design using ICs- B.S. Sonde, Wiley Western Ltd.
2. Circuit Consultants Handbook ,Hemmnigway
3. Microprocessor and Microcontroller – BPB handbook
4. Digital Fundamentals, Floyd, USB, New Delhi
5. Designing with OP-AMP analog and digital ICs, S.Francio, McGraw Hill.
6. Application and Design with analog ICs, J.Michel Jacob, Printice Hall of India

Title of Course: Optoelectronics
Course Code: MSU0325MML912J2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able 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.

Unit I Introduction and structure (15 Lectures)

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.

Unit II Transmission characteristics, losses and preparation methods (15 Lectures)

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.

Unit III Connections, sources and detectors (15 Lectures)

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.

Unit IV Measurements (15 Lectures)

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.

Seminars, Tutorials, Problem solving session and group discussions on above four units

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.

Title of Course: Real Time Embedded Systems
Course Code: MSU0325MML912J3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. To understand the application specific real time constraints.
2. Design and develop real time embedded systems.
3. To develop PIC microcontroller applications with emphasis on real time response.
4. To employ RTOS components for real time designs.

Unit I **(15 Lectures)**

Introduction to Real time embedded systems, Microchip PIC microcontroller: PIC microcontroller features, scaling of PIC MCU families, overview of baseline, midrange, enhanced midrange, and high-end core devices.
Core architecture: PIC Architecture, Program memory, Addressing Modes, Instruction set.
MPLAB IDE overview: Using MPLAB, Toolbars, Select Development Mode And Device Type, Project, Text Editor, Assembler, MPLAB Operations.

Unit II **(15 Lectures)**

PIC MCU Hardware: reset, clock, control registers, register banks, program memory paging, Ports, interrupts, Timer and Counter, watchdog timer, power up timer, sleep mode, state machine programming.
Overviews of PIC tools – Development softwares, compilers, debug tools.

Unit III **(15 Lectures)**

Introduction to RTOS, Scheduler, objects, services. Tasks, task states and scheduling, synchronization, communication and concurrency.
Kernel objects: Semaphores, queues, pipes, event registers, signals, and condition variables.
Exceptions and interrupts: Introduction, Exception v/s Interrupt, Applications of exceptions and interrupts.

Unit IV **(15 Lectures)**

Timer and timer services: Introduction, Real-time clock and system clock, Programmable interval timers, Timer ISRs, Timing wheels, soft timers.
I/O subsystem: Basic I/O concepts, The I/O subsystem.
Memory Management: Introduction, Dynamic memory allocation in Embedded systems, Fixed-size memory allocation, blocking v/s non-blocking memory functions, H/W memory management units

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. Ajay V Deshmukh, Microcontrollers: theory and applications, TMH.
2. Myke Predko, Programming & Customizing PICmicro Microcontrollers, TMH.
3. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers, Newnes.
4. David W Smith,PIC in Practice, Newnes.
5. John Morton, PIC: Your Personal Introductory Course, Newnes.
6. Qing Li, Caroline Yao, Real-Time Concepts for Embedded Systems, CMP Books.
7. David E. Simon, An Embedded Software Primer, Addison-Wesley.
8. Raj Kamal , Embedded Systems: Architecture, Programming and Design, 2nd Edition, McGraw-Hill Education, ISBN-10: 00701253
9. Jean J. Labrosse, MicroC OS II: The Real Time Kernel, Publisher: CMP Books, ISBN-10: 9787820103

Title of Course: Arduino and Internet of Things
Course Code: MSU0325MEL912J1
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Able to explain IoT concepts such as sensing, actuation and communication.
2. Able to interface devices for sensing, actuation, processing, and communication
3. Able to development of Internet of Things (IoT) prototypes

Unit I **(15 Lectures)**

Introduction to IoT: IoT fundamentals, IoT Architecture and protocols, IoT platforms, IoT components, Applications of IoT, Arduino Architecture, Arduino IDE, Arduino Libraries, Arduino library manager, Arduino Board manager, Arduino Boards: Arduino Uno, Arduino nano- ATmega328p, ATmega168, ESP8266 wifi module, nodeMCU ESP8266, nodeMCU ESP32.
Embedded C programming for Arduino: C Character Set, Identifiers and Keywords, constants, variables, and Data types. Typical Arduino C program structure, Arduino IDE Sketchbook, example programs.

Unit II **(15 Lectures)**

Arduino programming examples: interfacing led, push button, displays: 7-segment display, 16*2 lcd display, graphic display, interfacing sensor and actuators with Arduino – sensors, types of Sensors, analog and digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay and Motor with Arduino.

Unit III **(15 Lectures)**

Connecting to Internet with ESP8266 WiFi module, ESP8266 nodeMCU board, brief overview of TCP-IP Protocols, HTTP, Introduction to ESP8266 Wi-Fi Module, Arduino libraries for ESP8266 Wi-Fi module, Web server- introduction, configuration, Sample project: ESP8266 WEB server for temperature display(DHT11).

Unit IV **(15 Lectures)**

IOT Cloud Platforms: Virtualization concepts and Cloud Architecture, Cloud computing and its benefits, ThingSpeak API and MQTT, Interfacing ESP8266 with Web services.

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference

1. Bala Divya, ESP8266: Step by Step Book for ESP8266 IOT, Arduino Nodemcu Dev Kit, Amazon Kindle Edition,

Title of Course: PLC and SCADA
Course Code: MSU0325MEL912J2
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Develop and explain the working of a PLC with the help of a block diagram.
2. Classify input and output interfacing devices with PLC.
3. Design PLC based application by proper selection criteria, developing GUI and ladder program.
4. Execute, debug, and test the programs developed for digital and analog operations.
5. Develop the architecture of SCADA and explain the importance of SCADA in critical infrastructure.
6. Describe the SCADA protocols and digital control systems.

Unit I **(15 Lectures)**

Role of automation in Industries, benefits of automation, Necessity of PLC, History and evolution of PLC, Definition as per NEEMA (National Electrical Engineering Manufacturers' Association), types – fixed/modular/dedicated, Overall PLC system, PLC Input and output modules (along with Interfaces), CPU, programmers and monitors, power supplies, selection criterion, advantages and disadvantages, specifications, comparison of various PLCs manufactured by Allen Bradley, Siemens, ABB, Mitsubishi, GE, Fanuc and Schneider.

Unit II **(15 Lectures)**

Input ON/OFF switching devices, Input analog devices, Output ON/OFF devices, Output analog devices Sensors-temperature, pressure, flow, level Actuators-Electrical, pneumatic, hydraulic Encoders-Incremental, Absolute Transducers, Limit switches, proximity sensors Control Elements- Mechanical, Electrical, Fluid valves

Unit III **(15 Lectures)**

Programming languages for PLC, Ladder diagram fundamentals, Rules for proper construction of ladder diagram Timer and counter- types along with timing diagrams, Reset instruction, latch instruction MCR (master control relay) and control zones Developing ladder logic for Sequencing of motors, ON OFF, Tank level control, ON OFF temperature control, elevator, bottle filling plant, car parking, traffic light controller.

Unit IV **(15 Lectures)**

Introduction, definitions and history of Supervisory Control and Data Acquisition, typical SCADA system architecture, important definitions HMI, MTU, RTU, communication means, Desirable properties of the SCADA system, advantages, disadvantages, and applications of SCADA. Functions and features of SCADA systems, SCADA Protocols and Distributed Control Systems

Seminars, Tutorials, Problem solving session and group discussions on above four units

References

1. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers: Principles and Application", PHI Learning, New Delhi, 5th Edition
2. Gary Dunning, Introduction to Programmable Logic Controllers, Delmar Publishers
3. John R. Hackworth, Frederick D., Hackworth Jr., Programmable Logic Controllers Programming Methods and Applications., 3rd edition, Pearson Education, 2005.
4. L. A. Bryan, E. A. Bryan , Programmable Controllers Theory and Implementation , Industrial Text Company Publication, 2nd edition, 1998.

Title of Course: Antennas
Course Code: MSU0325MEL912J3
Total Credits: 04
Course Outcomes: Upon successful completion of this course, the student will be able to:

1. Students will review basic antenna concepts, understand auxiliary potential functions, linear wire antennas
2. They will be able to understand point sources-their arrays, pattern multiplication
3. They will also be able to understand loop, traveling wave and broad band antennas

Unit I Basic Antenna Concepts (15 Lectures)
Radiation pattern, Beam area, Radiation power density, Radiation intensity, Directivity, Gain, Aperture concept, Antenna efficiency, Half power beam width, Beam efficiency, Bandwidth, Polarization, Input impedance, Antenna radiation efficiency, Antenna vector effective length and effective areas, Maximum directivity and maximum effective area, Effective height, Friss transmission formula, Duality of antennas, Antenna temperature

Unit II Radiation Integrals and Auxiliary potential functions Linear wire antennas (15 Lectures)
Vector potential for an electric current source, Vector potential for magnetic current source, Electric and magnetic fields for electric and magnetic current sources, Solution of the inhomogeneous vector potential wave equation, Far field radiation, Infinitesimal dipole, Small dipole, Region Separation, Finite length dipole, Half-wavelength dipole, Linear elements near or on infinite perfect conductors, Ground effects

Unit III Point Sources and arrays of point sources (15 Lectures)
Power theorem and its application to an isotropic source, Radiation Intensity, Source with Hemispheric, unidirectional cosine, bidirectional cosine, sine(doughnut), sine- squared (doughnut), unidirectional cosine-squared power patterns, Directivity, Source with arbitrary shape Gain, Field patterns, Arrays of two isotropic point sources, Nonisotropic but similar point sources and the principle of pattern multiplication, pattern synthesis by pattern multiplication, Nonisotropic and dissimilar point sources, Linear arrays of n isotropic point sources of equal amplitude and spacing, Null directions

Unit IV Loop, Traveling wave, broadband and other types of antennas (15 Lectures)
Small circular loop, Circular loop of constant current, Circular loop with nonuniform current, Ground and Earth curvature effects, Polygonal loop antennas, V antenna, Rhombic antenna, Helical antenna, electricmagnetic dipole, Yagi-Uda array of linear elements, Yagi-Uda array of loops, basics of microstrip antennas, Plane reflector, Corner reflector

Seminars, Tutorials, Problem solving session and group discussions on above four units

Reference Books

1. John D.Kraus, Antennas, New Delhi: Tata McGraw-Hill Publishing Company Ltd, 1999
2. Constantine A.Balanis,Antenna Theroy Analysis and Design, Wiley India P. Ltd, 2010

Title of Course: Research Project - II
Course Code:
Total Credits: 06

9. Scheme of Teaching

- The teaching scheme includes conducting theory lectures, practicals, group discussions, demonstrating videos, class tests, assignments, and seminars etc.
- Each unit in theory course shall comprise 15 lectures, each of 60 minutes' duration and there shall be four lectures per theory course per week.

10. Examination Pattern

- Pattern of examination will be Semester System.

Theory:

- For each theory paper, 20% marks will be based on internal assessment and 80% marks for semester examination (external assessment)
- There will be separate passing for internal and external exam.

Practical:

- The Major Mandatory Practical (MMPR) Examination is Semester wise before theory examination.
- For each practical course, 20% marks will be based on internal assessment and 80% marks for semester examination (external assessment).

On Job Training:

Field Project:

Research Methodology:

For each theory paper, 20% marks will be based on internal assessment and 80% marks for semester examination (external assessment)

11. Nature of Question Paper and Scheme of Marking

Theory:

Mandatory / Elective Course (4 Credit)

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)

Mandatory Course (2 Credit)

Maximum marks 40

Time 2 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). (8)

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

Q.2. (8)

a)
b)

Q.3. (8)

a)
b)

Q.4. (8)

a)
b)

Q.5. (8)

a)
b)

Q.6. (8)

a)
b)

Q.7. (8)

a)
b)

Practical:

Nature of Practical Paper and Scheme of Marking

Practical Paper : 100 Marks

12. Equivalence of courses

M. Sc. Part I and Part II

Old Course				Equivalent Course		
Sem No.	**Course Code**	**Title of Old Course**	**Credit**	**Course Code**	**Title of New Course**	**Credit**
I	CC-101	Measurement & Instrumentation	04	MET-105	Measurements and Instrumentation	04
I	CC-102	Foundations of Microwave Technology	04	-	-	-
I	CC-103	Computer Organization	04	MMT-101	Computer Organization	04
I	CC-104	Advanced Digital Design	04	-	-	-
II	CC-201	Digital Communication	04	MET-205	Digital Communication	04
II	CC-202	Advanced Microwave Technology	04	-	-	-
II	CC-203	Advanced Power Electronics	04	-	-	-
II	CC-204	Optoelectronics	04	MMT-402	Optoelectronics	04
III	CC-301	Control Theory	04	MMT-301	Control Theory	04
III	CCS-302	Computer Networks	04	MMT-302	Computer Networks	04
III	CCS-303	Microcontroller System Design and ARM Architecture	04	-	-	-
III	DSE-304	Industrial Automation	04	-	-	-
III	DSE-304	Biomedical Instrumentation	04	-	-	-
III	DSE-304	MATLAB Programming for Numerical Computation	04	-	-	-
III	DSE-304	Hardware-Software Co-design	04	-	-	-
III	DSE-304	Satellite Communications	04	MET-205	Satellite Communications	04
III	DSE-304	Soft Computing	04	-	-	-
III	DSE-304	VHDL Programming	04	MET-205	VHDL Programming	04
IV	CC-401	Digital Signal Processing	04	MMT-201	Digital Signal Processing	04
IV	CCS-402	Analog and Digital Circuit Design	04	MMT-401	Analog and Digital Circuit Design	04
IV	CCS-403	Real Time Embedded Systems	04	MMT-403	Real Time Embedded Systems	04
IV	DSE-404	Advanced Drives	04	-	-	-
IV	DSE-404	Artificial Intelligence & Machine Learning	04	-	-	-
IV	DSE-404	IoT & Data Analytics	04	-	-	-
IV	DSE-404	ARM Programming and Embedded Communication Protocols	04	-	-	-
IV	DSE-404	FPGA Based Systems	04	MET-305	FPGA Based Systems	04
IV	DSE-404	Antennas	04	MET-404	Antennas	04
IV	DSE-404	Mechatronics	04	-	-	-
IV	DSE-404	Cellular Mobile Communications	04	MET-305	Cellular Mobile Communications	04