M.Sc. Applied Electronics

Syllabus

AFFILIATED COLLEGES

Program Code: 32M

2023 – 2024 onwards

BHARATHIAR UNIVERSITY

**(A State University, Accredited with "A++" Grade by NAAC,
Ranked 21st among Indian Universities by MHRD-NIRF)**

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The **M.Sc. Applied Electronics** program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	Pursue a diverse range of careers as Electronic Designers, Consultants and Entrepreneurs.
PEO2	Continue their education leading to research in interdisciplinary areas to emerge as Competent Technologist, Experts, Educators and Scientist.
PEO3	Innovate in ever changing global economic and technological environment maintaining professional discipline and high ethical standard.
PEO4	To enable graduates to acquire technical and managerial leadership positions in their chosen fields.
PEO5	Develop practical skills by providing hands-on experience to succeed in industry / technical profession through meticulous education.

Program Specific Outcomes (PSOs)	
After the successful completion of **M.Sc. Applied Electronics** program, the students are expected to	
PSO1	Capable to analyze real time problems, design appropriate systems to provide solutions that are technically sound, economically feasible and socially acceptable
PSO2	Ability to design and implement projects in the field of Electronics like PIC Microcontroller, Raspberry Pi with Python Programming and Internet of Things with Arduino.
PSO3	Students will be furnished with necessary Soft skills, Aptitude and Technical skills to work in the Software and Hardware Industry.
PSO4	Analyze specific problems relevant to signal and image processing by applying the knowledge of basic sciences, mathematics and core fundamentals.
PSO5	Demonstrate and implement variety of automation system by controlling, processing different signals according to the required specifications keeping in mind it's societal and environment effect.

Program Outcomes (POs)	
On successful completion of the M. Sc. Applied Electronics program	
PO1	Capable to achieve state-of-art knowledge in Electronics, to discriminate, evaluate, analyze and create existing and new knowledge, and integration of the same for enhancement of knowledge.
PO2	Discover, formulate, review and analyze intricate emerging electronics problems to make intellectual knowledge for conducting research in a wider theoretical and practical.
PO3	Extract information about important problems and apply suitable techniques, resources, and modern electronic software tools towards contributing to the development of scientific/technological knowledge in Electronics.
PO4	Comprehend Professional and ethical responsibility in the field of Electronics Profession.
PO5	Identify the need for, and have the preparation and ability to engage in independent and life-long learning with enthusiasm and commitment in the broadest context of technological change.

BHARATHIAR UNIVERSITY, COIMBATORE 641 046

M.Sc., APPLIED ELECTRONICS (CBCS PATTERN)
(Affiliated Colleges)

(For the students admitted from the academic year 2021 – 2022 onwards)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
13A	PIC Microcontroller and its Applications	4	4	-	25	75	100
13B	Linear ICs and its Applications	4	4	-	25	75	100
13C	Microwave and RADAR Navigation Systems	4	4	-	25	75	100
13D	MEMS and Power Electronics	4	4		25	75	100
-	General Electronics Lab	-	-	5	-	-	-
-	PIC Microcontroller & Raspberry Pi with Python Programming Lab	-	-	5	-	-	-
-	Elective I*	4	4	-	25	75	100
	Total	**20**	**20**	**10**	**250**	**250**	**500**
SECOND SEMESTER							
23A	Raspberry Pi with Python Programming	4	4	-	25	75	100
23B	Digital Signal Processing	4	4	-	25	75	100
23C	VHDL Programming	4	4	-	25	75	100
23D	Introduction to Industry 4.0	4	4	-	25	75	100
23P	General Electronics Lab	4	-	5	25	75	100
23Q	PIC Microcontroller & Raspberry Pi with Python Programming Lab	4	-	5	25	75	100
-	Elective II*	4	4	-	25	75	100
	Total	**28**	**20**	**10**	**350**	**350**	**700**
THIRD SEMESTER							
33A	Internet of Things with Arduino	4	4	-	25	75	100
33B	Digital Image Processing	4	4	-	25	75	100
33C	PC Hardware and Troubleshooting	4	4	-	25	75	100
33D	Nano Electronics and Technology	4	4		25	75	100
33P	PC Hardware and VHDL Programming Lab	4	-	5	25	75	100

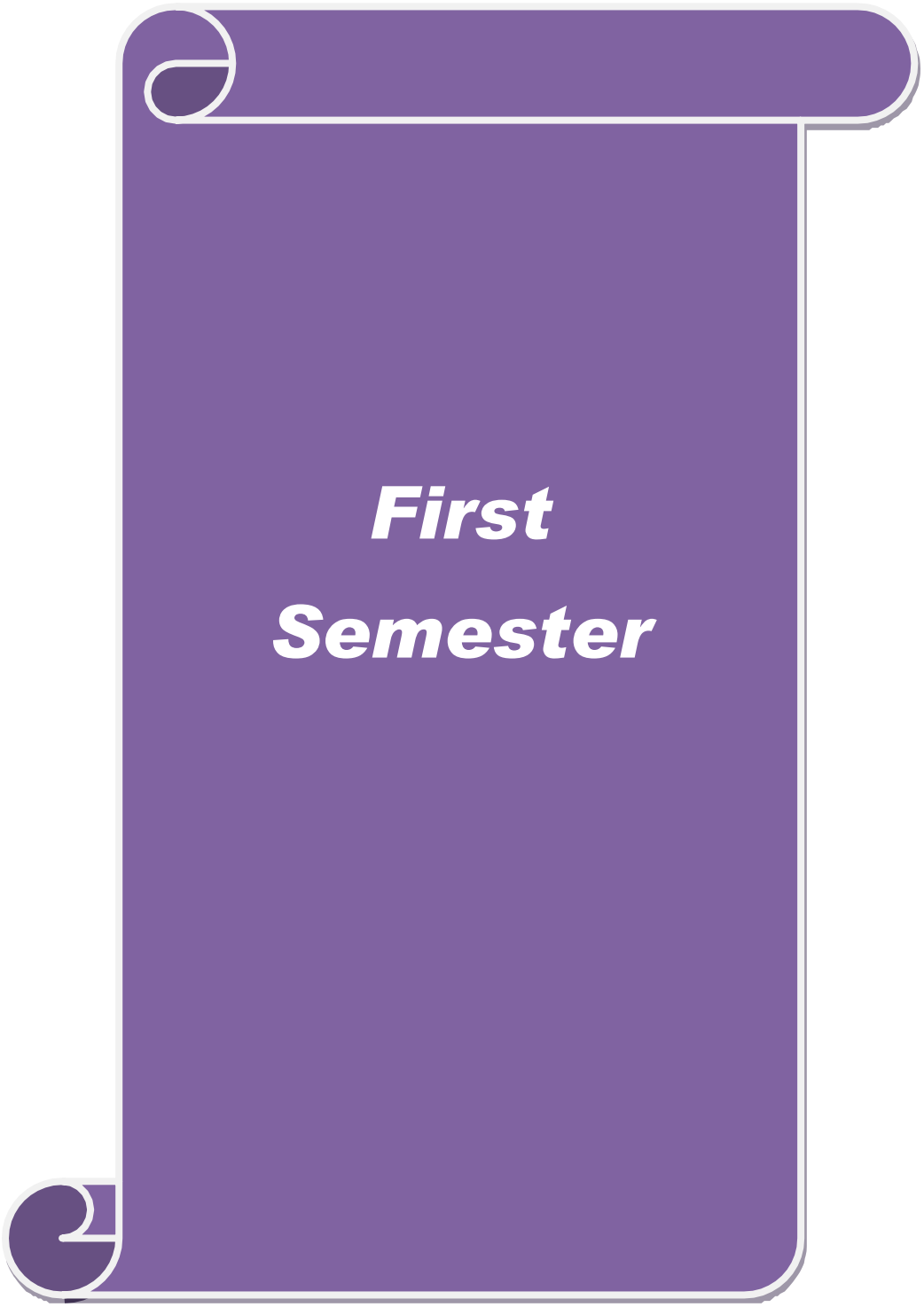
33Q	DSP and DIP Lab	4	-	5	25	75	100
-	Elective III*	4	4	-	25	75	100
	Total	**28**	**20**	**10**	**350**	**350**	**700**
FOURTH SEMESTER							
47V	Project Work & Viva Voce	10	10	-	100	150	250
-	Elective Practical*	4	-	5	25	75	100
	Total	**14**	**10**	**5**	**150**	**200**	**350**
	Grand Total	**90**	**70**	**35**	**1100**	**1150**	**2250**
ONLINE COURSES							
	SWAYAM-MOOC-Online Course**	**2**	**-**	**-**	**-**	**-**	**50**
		Non-scholastic with Credits					

***ELECTIVE SUBJECTS**

Colleges can choose any one of the Group subjects as Electives

Course Code	Sem.	Title of the Course
GROUP - A		
1EA	I	Web Technology
2EA	II	Relational Data Base Management System
3EA	III	LINUX and Shell Programming
4EP	IV	RDBMS and LINUX Lab
GROUP - B		
1EB	I	Electronic Test Instruments
2EB	II	Analytical Instrumentation
3EB	III	Virtual Instrumentation
4EQ	IV	Instrumentation Lab
GROUP - C		
1EC	I	VLSI Design
2EC	II	Low Power VLSI Design
3EC	III	VLSI Design Using Verilog
4ER	IV	VLSI System Design Lab

**SWAYAM – MOOC – online course shall be of duration at least 4 weeks with at least 2 credits. The course shall be mandatory and shall be completed within third semester (i.e., before the beginning of fourth semester).


First
Semester

Course code		PIC MICROCONTROLLER AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Digital Fundamental and Basics of Microcontroller	Syllabus Version	2021		

Course Objectives:

To understand the Concept of PIC microcontroller Architecture and its Applications

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Learn the Architecture and Instruction set of PIC Microcontroller	K1
2	Acquire the knowledge of Timer and Interrupt Sources	K2
3	Gain the knowledge of different Interface and I/O ports	K2
4	Gain the knowledge about the Special Features of PIC Microcontroller	K3
5	Analyze the techniques of Interfacing between Processor &Peripheral devices related to Industrial Applications	K4 &K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	CPU ARCHITECTURE AND INSTRUCTION SET	11 hours

Overview -Harvard Architecture and Pipelining - Program Memory Considerations - Register File structure and Addressing Modes - CPU Registers - Instruction set.

Unit:2	EXTERNAL INTERRUPTS AND TIMERS	12 hours

Overview -RB0/INT External Interrupt Input - Timer0 - Compare Mode - Capture Mode - Timer1/CCP Programmable Period Scaler - Timer1 External Event Counter - Timer1 and Sleep Mode - Pulse-Width-Modulated Outputs - PORTB-Change Interrupts.

Unit:3	I/O PORTS AND SERIAL PORT INTERFACE	12 hours

Overview –Synchronous Serial Port Module – Serial Peripheral Interface - I^2C Bus Interface – ADC-USART

Unit:4	SPECIAL FEATURES	11 hours

Overview - Configuration Word - Oscillator Configurations - Reset Alternatives – Low-power Operations -Serial Programming – Parallel Slave Port.

Unit:5	INDUSTRIAL APPLICATIONS	12 hours

Introduction – Measurement Applications: Sensing Robot Arm Position - Optical Rotary Shaft Encoders - LVDT - Angular Speed Measurement (RPM Meter) - Digital Thermometer - RTD and Thermocouple Linearization. Automation and Control Applications: Power Controlling Devices - Thyristorised Control - Stepper Motor Drive.

Unit:6	Contemporary Issues	2 hours

Synchronous Serial Port Module

	Total Lecture Hours	60 hours

Text Book(s)	
1	John B.Peatman," Design with PIC Microcontrollers", Pearson Education, Low price Edition, 2009
2	Ajay V Deshmukh, " Microcontrollers: Theory and Applications", Tata McGraw-Hill Educations,2005.
Reference Books	
1	PIC 16F87X Data book, MicrochipTechnlogy Inc, 2001.
2	Tim Wilmshurst " Designing Embedded Systems with PIC Microcontrollers: Principles and Applications ", Newnes, 2006
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/104/117104072/
2	https://www.watelectronics.com/pic-microcontroller-architecture-and-applications/
Course Designed By: Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode	

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	L	M	M	M
CO2	S	M	S	M	S
CO3	S	H	L	M	M
CO4	S	L	S	M	M
CO5	S	S	S	L	M

*S-Strong; M-Medium; L-Low

Course code		LINEAR ICs AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic Understanding of Electronic Circuits	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. To introduce practical applications of linear integrated circuits
2. To introduce the concept of analog multiplier and Phase Locked Loop with applications
3. To study the application of ADC and DAC in real time systems

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the significance and role of the Op-Amp.in the present contemporary world.	K2
2	Select appropriate ICs and circuits for analog system design.	K3
3	Design new analog linear circuit using operational amplifier.	K6
4	Analyze and develop electronic systems using linear ICs.	K4
5	Ability to deploy the data converters in real time scenario.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	OPERATIONAL AMPLIFIER BASICS	11 hours

Ideal Op-Amps.-Practical Op-Amps. - Internal structure – Op-Amp. Parameters - DC performance - AC performance - Interpretation of data sheets – General Op-Amp. – IC 741 Bipolar Op-Amp. – Noise – Open-loop Op-Amp Configuration – Closed-Loop Op-Amp. Configuration – Differential Amplifier – Basic Bridge Amplifier.

Unit:2	APPLICATIONS OF OP-AMP.	11 hours

Comparators – Schmitt Triggers – Linear half-wave rectifiers – Precision rectifiers – Peak Detectors – Sample and Hold Circuits – AC to DC converters – Voltage to Current converter – Current to Voltage converter - Dead-Zone circuits – Clippers – Clampers –Instrumentation amplifier – Integrators-Differentiators – Frequency Doubler – Voltage Divider – Square Rooter – Phase Angel Detector – Pulse Width Modulation.

Unit:3	FILTERS AND WAVEFORM GENERATORS	12 hours

Design of I,II order Low-pass filter - Design of I,II order High-pass filter – Band Pass Filters – Band Reject Filters – Butterworth – Chebyshev –State Variable Filters - Biquad filter - Wein bridge oscillator - Phase shift oscillator – Multivibrators - Triangular wave generators, sawtooth wave generators.

Unit:4	PLL AND TIMER	12 hours

Operating principles - Functional blocks of PLL - stability analysis - Lock and Capture ranges- Applications of PLL - PLL as FM detector - FSK demodulator - AM detector, Frequency translator - Phase shifter - Tracking filter - Signal synchronizer, Frequency Synthesizer. 555 Timer: Functional block diagram - terminals, modes of operation and applications.

Unit:5	**D/A AND A/D CONVERTERS**	**12 hours**

DAC Principles – Weighted-resistor DAC - R-2R Ladder DAC - Current output DAC, MDAC, DAC Specifications - Flash type ADC – Counter type ADC - Continuous type ADC - Successive approximation ADC - Single slope ADC, Dual slope type ADC - ADC Specifications.

Unit:6	**Contemporary Issues**	**2 hours**

PLL Applications

	Total Lecture Hours	**60 hours**

Text Book(s)

1	Salivahanan S, Kanchana Bhaaskaran V S, “Linear Integrated Circuits”, McGraw Hill Education (India) Private Limited, 2015
2	Robert F. Coughlin, Frederick F. Driscoll “Operational amplifiers and Linear Integrated Circuits”, Prentice Hall, 2001.
3	Ramakant A.Gayakwad “Op-Amps and Linear Integrated Circuits”, Pearson, 2017

Reference Books

1	Lal Kishore, “Linear Integrated Circuits”, Pearson, 2012
2	Roy Choudhry “Linear integrated circuits”, New Age International, 1998

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.htm
2	https://nptel.ac.in/courses/108/106/108106068/

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		MICROWAVE AND RADAR NAVIGATION SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basics of wave guides and wave propagation	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. To analysis the microwave circuits and systems
2. Understand the concepts of Microwaves, Microwave transmission modes, Transmission lines, Microwave Amplifiers and Oscillators.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand various microwave system components their properties.	K2
2	Applying microwave devices used to realized amplifiers and oscillators	K3
3	Analyze performance of microwave components from field point of view	K4
4	To understand the basic concepts ,types ,working of radar	K2
5	Correlating RADAR system as microwave application	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO MICROWAVE	12 hours

Introduction – Maxwell's equation – Ampere's law – Faraday's law – Gauss law – Wave equation – TE, TM wave equation – Wave guides – Rectangular wave guides – Propagation of waves in rectangular wave guides – TM and TM modes – Propagation of TM waves in rectangular wave guides – TM modes in rectangular wave guides.

Unit:2	MICROWAVE AMPLIFIERS AND OSCILLATORS	11 hours

Klystrons – Two cavity klystrons – Multicavity klystrons – Reflex klystrons – Power output and frequency characteristics – Efficiency of reflex klystron – Traveling wave tube (TWT) – Applications of TWT – Backward wave oscillator – Magnetron – Cavity magnetron – Sustained oscillation in magnetron – Characteristics and applications of magnetron.

Unit:3	MICROWAVE ANTENNAS	12 hours

Quantitative theory of short dipole antenna – Characteristics of grounded quarter wave and ungrounded half wave antenna – Radiation resistance and radiation pattern – Folded dipole and its application – Broad side and fire array – Loop antenna – Direction finding by Adcock and beeline tossi system – Helical – Rhombic – YAGI antenna – Horn antenna and parabolic reflectors.

Unit:4	PRINCIPLES OF RADAR	12 hours

Introduction – Block diagram of radar – Application of radar – Range equation – Minimum detectable signal – Receiver noise – S/N ratio – Transmitter power – Maximum ambiguous range – System losses - Receiver: Duplexer – Local oscillator – Mixer – Line pulse modulator – Displays – PPI

Unit:5	**FM RADAR AND MTI**	**11 hours**
Doppler effect – CW radar – FM CW radar – multiple frequency CW radar – Moving Target Indicator (MTI) – Non coherent MTI – Pulsed Doppler radar fm altimeter – Tracking – Sequential lobbing – Conical scan – Mono pulse tracking radar		
Unit:6	**Contemporary Issues**	**2 hours**
Wave equation and Radar range equation		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Kulkarni M, "Microwave and Radar Engineering**",** Umesh Publication, 2009
2	Merrill I. Skolnik, "Introduction to radar systems", McGraw Hill, 2001
3	Prasad K.D., **"**Antenna and Propagation**",** Sathya Pradhasan Publications,2003

Reference Book

1	Maini A. K. Microwaves and Radar Principles and Applications, Khanna, 1999

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/108/101/108101112/

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	L	M	M	M
CO2	S	M	S	M	S
CO3	S	H	L	M	M
CO4	S	L	S	M	M
CO5	S	S	S	L	M

*S-Strong; M-Medium; L-Low

Course code		MEMS AND POWER ELECTRONICS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Knowledge on IC fabrication and the Operation of Power electronic Devices	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. To understand the basic concepts of MEMS device and its fabrication technique
2. To analyse the basic functions and design of Power Electronics circuits
3. To implement the use of power electronics in real time applications

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic terms of Micro System and concepts which are needed for Electronic and Communication	K2
2	Understand basic concepts of MEMS device design and it's fabrication methods	K2
3	Apply the Power electronic components used for different Power Electronic Circuits	K3
4	Analyze the problem solving skills and proficiency in Power Electronics circuit analysis.	K4
5	Express the basic working principles of Inverters and power supplies.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	OVERVIEW AND WORKING PRINCIPLES OF MEMS	11 hours

MEMS and Microsystem: Typical MEMS and Microsystems products - Microsystems and Microelectronics -Miniaturization - Applications of Microsystems - Micro sensors - Micro actuation - Micro grippers - Micro motors- Micro accelerometer – Micro fluids

Unit:2	FABRICATION AND MICRO SYSTEM DESIGN	12 hours

Ions and Ionization- Doping - Substrate and wafers - Silicon as a substrate - Silicon compounds- Piezo Resistors - Piezo Crystals – Photolithography - Ion implantation – Diffusion - Oxidation – Chemical vapor deposition – sputtering – deposition by Epitaxy- Physical Vapor Deposition (PVD) - Etching - Surface Micromachining - LIGA process - Microsystems Design Considerations - Use of CAD and tools in Microsystems design -Process design – Design of silicon die for a micro pressure sensor –Computer Aided Design – Micro system packaging – Introduction to intelligence CAD tool for MEMS.

Unit:3	POWER ELECTRONIC DEVICES AND CIRCUITS	12 hours

Review and Operations of SCR, DIAC,TRIAC and IGBT- **Thyristor Commutation:** Natural commutation - Forced commutation - Self commutation - Impulse commutation - Response pulse commutation - External pulse commutation - complementary commutation - **Controlled Rectifiers**: Principle of Phase controlled converter- Single-Phase full converter - Single-phase semi converter - Principle of Three phase half wave converter

Unit:4	AC VOLTAGE CONTROLLERS AND DC CHOPPERS	12 hours

AC voltage controllers: Principle of On/Off Control - Principle of Phase Control - Single Phase Bi-Directional Controllers with Resistive and Inductive Loads - Cyclo-Converters - Single Phase Cyclo-Converters - **DC Choppers:** Principles of Step-down Operation -Step down with RL load- Principle of Step-up Operation - **Switch mode regulators:** Buck Regulator - Boost Regulator - Buck Boost Regulator - CUK Regulator

Unit:5	**INVERTERS AND STATIC SWITCHES**	**11 hours**

Inverters: Principle of Operation - Single Phase Bridge Inverter - Three-Phase Inverter -PWM Voltage Control Power Supplies – Introduction to applications of power electronics in automotive system - **Power supplies:** DC Power Supplies -Switched Mode Power Supplies (SMPS) - UPS - AC Power Supplies: Switched mode AC power supply - Resonant AC Power supply - Bi-Directional AC Power supply - **AC and DC static switches**: Introduction - Single phase AC switches - Three phase AC switches - Three phase reversing switches - DC switches Static circuit breaker - AC and DC solid state relays

Unit:6	**Contemporary Issues**	**2 hours**

Microsystems Design Considerations and Use of CAD tools in Microsystems design

	Total Lecture Hours	**60 hours**

Text Book(s)

1	Tai-Ran-Hsu, “MEMS & Micro Systems Design and Manufacture”, Tata McGraw Hill Education Private Limited, 2002.
2	Muhammed Rashid, “Power Electronics, Circuits, devices and Applications”, Prentice Hall Edition, Third Edition, 2004
3	P.S.Bimbra, “Power Electronics”, Khanna Publishers, Fourth Edition, 2011.

Reference Book(s)

1	James. J.Allen, “ Micro Electro Mechanical System Design” Taylor & Francis Group, 2005
2	Sen “Power Electronics” –Mc GrawHill International, 1989.
3	Jaganathan.V, “Power Electronics Devices and Circuits”, PHI Learning Pvt. Ltd, 2011.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

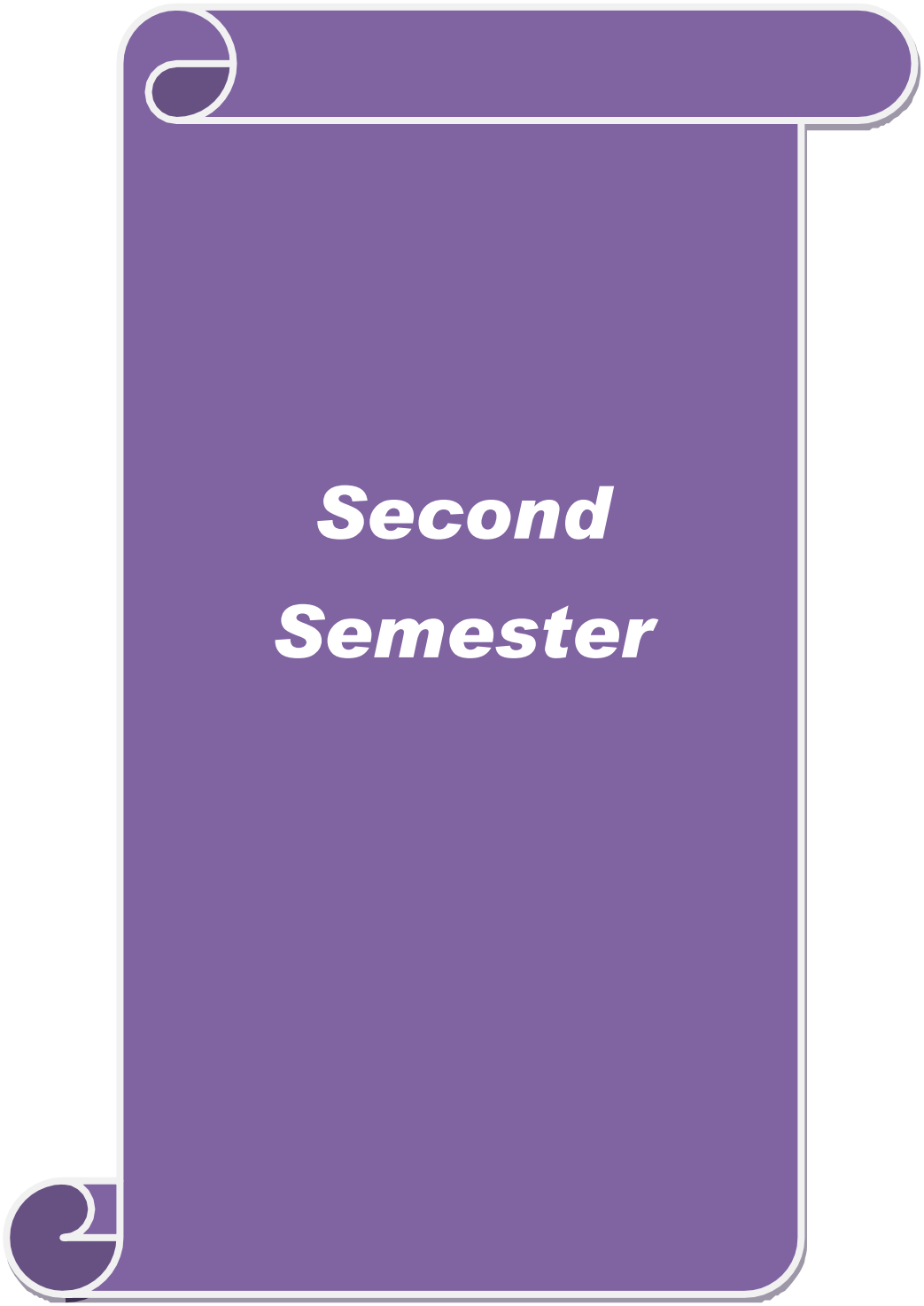
1	http://nptel.ac.in/courses/117105082
2	https://nptel.ac.in/courses/108/108/108108113/
3	https://nptel.ac.in/courses/108/102/108102145/

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	M	S	M	S
CO2	S	S	M	S	S
CO3	S	S	M	S	S
CO4	S	M	S	M	S
CO5	S	M	S	M	S

*S-Strong; M-Medium; L-Low


Second
Semester

Course code		RASPBERRY PI WITH PYTHON PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge in Electronics and Computer programming	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. Learn the basic concepts of Python and use of various data structures and functions.
2. Understand the various components of ARM Cortex – A Series.
3. Provide the necessary knowledge of the Raspberry Pi to design and develop practical applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the core programming constructs of Python.	K2
2	Express proficiency in the handling of functions in Python.	K2
3	Understand the ARM processor design philosophy, architecture and its families.	K2
4	Articulate the functions and features of ARM Cortex A-Series Processors.	K3
5	Analyze and design the Raspberry Pi using Python for peripheral interfacing.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO PYTHON	11 hours

Getting started with Python - Comments - Python Identifiers – Keywords - Variables – Standard data types – Operators – Statement and Expression – String operations – Boolean Expressions – Control statements – Iteration statement – Input from keyboard

Unit:2	FUNCTIONS IN PYTHON	11 hours

Built-in Functions - Composition of Functions - User Defined Functions - Parameters and Arguments - Function Calls - The return Statement - Python Recursive Function - The Anonymous Functions - Writing Python Scripts

Unit:3	INTRODUCTION TO ARM PROCESSOR	12 hours

The RISC Design Philosophy - The ARM Design Philosophy -Embedded System Hardware - Embedded System Software - Registers -Current Program Status Register - Pipeline - Exceptions, Interrupts, and the Vector Table - Core Extensions - Architecture Revisions - ARM Processor Families

Unit:4	ARM CORTEX – A SERIES	12 hours

ARM Cortex processors categories, ARMv8-A Architecture and Processors, Exception levels - Execution states, Changing Exception levels: ARMv7 processor modes - ARMv7 privilege levels, Caches: A basic cache arrangement - Cache terminology, Memory management: The memory management unit - Virtual and physical memory, big. LITTLE Technology: Structure of a big. LITTLE system, Software execution models in big. LITTLE

Unit:5	RASPBERY PI	12 hours
Introduction to Raspberry Pi - Installation of NOOBS on SD Card - Installation of Raspbian on SD Card - Terminal Commands - Installation of Libraries on Raspberry Pi - Getting the Static IP Address of Raspberry Pi - Run a Program on Raspberry Pi - Installing the Remote Desktop Server - Pi Camera - Face Recognition Using Raspberry Pi - Installation of I2C Driver on Raspberry Pi - Serial Peripheral Interface with Raspberry Pi - Programming a Raspberry Pi - Play with LED and Raspberry Pi - Reading the Digital Input - Reading an Edge - Triggered Input		
Unit:6	**Contemporary Issues**	**2 hours**
Installation of NOOBS on SD Card and Installation of Raspbian on SD Card		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Balagurusamy E, “Introduction to Computing and Problem Solving Using Python”, McGraw Hill Education (India) Private Limited, 2016
2	Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM System Developer’s Guide Designing and Optimizing System Software”, Morgan Kaufmann Publishers is an imprint of Elsevier, 2004
3	ARM® Cortex®-A Series, Programmer’s Guide for ARMv8-A, Version 1.0, ARM, 2015
4	Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, "Internet of Things with Raspberry Pi and Arduino", CRC Press, 2019

Reference Books

1	Rashi Gupta, “MakingUse ofPython”, Wiley Publishing, Inc., First Edition, 2002
2	Wolfram Donat, “Learn Raspberry Pi Programming with Python”, Apress, 2018

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.tutorialspoint.com/python/index.htm
2	https://pythonprogramming.net/introduction-raspberry-pi-tutorials/
3	https://learn.sparkfun.com/tutorials/python-programming-tutorial-getting-started-with-the-raspberry-pi/all

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DIGITAL SIGNAL PROCESSING	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge in Signals and System	Syllabus		2021-	

Course Objectives:

The main objectives of this course are to:

1. To introduce signals, systems, time and frequency domain concepts, and DSP techniques
2. To acquire the knowledge of design, implementation, analysis and comparison of digital filters for processing of discrete time signals.
3. To program DSP Processor for various applications

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understanding the fundamentals of discrete time signals and systems	K2
2	Know the computational algorithms and properties of the DFT in DSP system design	K1
3	Evaluate design problems related to frequency selective processing and design FIR/IIR filters	K5
4	Create a knowledge about Programmable digital signal processor	K6
5	Familiar with programming environment used to develop TMS320C54XX processor applications.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	BASICS OF SIGNALS AND SYSTEMS	10 hours

Introduction to Signals - System and Signal processing - Classification of Signals - representation of signals - Standard discrete time signals - Classification of Discrete time signals -Operation on signals - Classification of Discrete time systems - Interconnection of systems - Convolution and correlation - Sampling and quantization.

Unit:2	COMPUTATION OF DISCRETE FOURIER TRANSFORMS	13 hours

Introduction - Direct evaluation of DFT - Fast Fourier transform (FFT) - Decimation-in-time algorithm (DIT) - Radix-2 DIT-FFT algorithm steps - Decimation-in-frequency algorithm (DIF) - Radix-2 DIF-FFT algorithm steps - Differences and similarities of DIT and DIF algorithm - IDFT using FFT algorithm.

Unit:3	SYSTEM STRUCTURES AND FILTERS DESIGN	13 hours

Introduction: Block diagram and signal flow graph representation, **IIR system**: Direct, Canonic, Cascade and Parallel form, **FIR system**: Direct, Canonic, Cascade and Lattice structure. **IIR Filters:** Impulse invariant technique, Bilinear transformations. **FIR Filters:** Windowing method using Kaiser Window, Frequency sampling method.

Unit:4	DIGITAL SIGNAL PROCESSOR	10 hours

Multiplier and multiplier accumulator (MAC) -Bus structure & memory access scheme – Multipleaccess memory- Multiported memory - VLIW architecture – Pipelining - Special addressing modes in P-DSP's -On Chip Peripherals

Unit:5	**TMS320C5X PROCESSOR PROGRAMMING AND APPLICATIONS**	**12 hours**
TMS 320C5x Architecture: CALU - ARAU - PLU – Program control - Status registers- Assembly language syntax – Instruction set - Addressing modes - Applications		
Unit:6	**Contemporary Issues**	**2 hours**
TMS 320C5416 Architecture - Instruction set – Applications		
	Total Lecture hours	**60 hours**

Text Book(s)

1	P. Ramesh babu, "Digital Signal Processing**"**, SciTech Publication, 2011
2	B.Venkataramani and M.Bhaskar, "Digital Signal Processors-Architecture, Programming and Applications''**,** Tata McGraw Hill,2004
3	TMS 320C5X - Users guide, Texas instruments,1998

Reference Books

1	Salivaghan,Vallavaraj, "Digital Signal Processing", Tata McGraw Hill,2003
2	John G.Proakis, Dimitris G. Manolakis, D.Sharma**, "**Digital Signal Processing Principles, Algorithms, and Applications**"**, Pearson Education, 2014.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.my-mooc.com/en/mooc/dsp/
2	https://swayam.gov.in/nd1_noc19_ee50/preview
3	https://nptel.ac.in/courses/117/102/117102060/
4	https://www.ti.com/lit/ug/spru056d/spru056d.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	M
CO2	M	M	S	M	S
CO3	S	S	M	S	S
CO4	M	S	M	S	S
CO5	S	M	S	M	M

*S-Strong; M-Medium; L-Low

Course code		VHDL PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge in Hardware Description Programming Language with Simulation Software's	Syllabus Version		2021-	

Course Objectives:

The main Objectives of this course are to:

1. To analyze logic processes and implement logical operations using combinational logic circuits.
2. To understand concepts of modeling techniques and features of VHDL.
3. Learn hardware description language (HDL) for the specification, simulation, synthesis and implementation of digital logic systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Discriminate between combinatorial and sequential circuits	K2
2	Define and describe digital design flows for system design and recognize in different approaches.	K3
3	Understanding the Synthesis and Simulation Process of Code	K4
4	Building Simulation Module as per System Specification	K4
5	Understand Programming using FPGA/CPLD concept	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	INTRODUCTION AND BASIC CONCEPTS OF VHDL	11 hours

History of VHDL – Capabilities of VHDL – Hardware Abstraction – Basic Terminology – Entity Declaration – Architecture Body Declaration – Basic Language Elements – Identifiers – Data Objects – Data Types – Operators.

UNIT: 2	BEHAVIOURAL MODELING TECHNIQUES OF VHDL	12 hours

Behavioral Modeling: Entity Declaration – Architecture Declaration – Process Statements – Variable Assignment Statements – Signal Assignment Statement – Wait Statement – If Statement – Case Statement – Null Statement – Loop Statement – Exit Statement – Next Statement – Assertion Statement – Report Statement – Multiple Process – Postponed Process.

UNIT: 3	DATA FLOW AND STRUCTURAL MODELING	12 hours

Data Flow Modeling**:** Concurrent Signal Assignment Statement – Delta Delay Revisited – Multiple Drivers – Conditional Signal Assignment Statement – Selected Signal Assignment Statement – Block Statement – Concurrent Assertion Statement – Value of a Signal.

Structural Modeling**:** Component Declaration – Component Instantiation – Resolving Signal Value – Examples – Half Adder – Full Adder – 4 To 1 Multiplexer – Decoder And Encoders.

UNIT: 4	ADVANCED FEATURES IN VHDL	12 hours
Generics – Configuration Specification – Configuration Declaration – Default Rules and Conversion Functions – Direct Instantiation – Incremental Binding – Subprograms – Subprogram and Operator Overloading – Signatures – Default Value of Parameters – Package Declaration – Package Body – Design File and Libraries – Order of Analysis – Implicit and Explicit Visibilities – Attributes in VHDL.		
UNIT: 5	**DESIGN OF FPGA'S AND CPLD**	**11 hours**
State Machine Chart – Programmable Logic Array – Programmable Logic Array Devices – Altera Max 7000 CPLD's – Xilinx xc 4000 Structures – Xilinx Interconnection – Xilinx Logic – Xilinx 3000 series FPGA's – Altera Complex Programmable Logic Devices – Altera flex 10K series CPLD's.		
UNIT: 6	**Contemporary Issues**	**2 hours**
Design concepts of FPGA'S and CPLD		
	Total Lecture Hours	**60 hours**

Text Book(s)	
1	J. Bhasker, "A VHDL Primer", Prentice Hall PTR, 1999.
2	Charles H. Roth, Jr., Lizy K. John, "Digital Systems Design Using VHDL", Cengage Learning, 2016.
Reference Book(s)	
1	Gaganpreet Kaur, "VHDL: Basics to Programming", Pearson Education India, 2011.
2	Navabi, "VHDL: Modular Design and Synthesis of Cores and Systems", Tata McGraw-Hill Publishing Company Limited, 2008.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc19_cs73/preview
2	https://nptel.ac.in/courses/106/102/106102181/
3	https://nptel.ac.in/content/storage2/courses/117108040/downloads/VHDL.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	M	S
CO3	S	S	M	S	S
CO4	M	S	S	S	S
CO5	S	S	S	M	S

*S-Strong; M-Medium; L-Low

Course code		INTRODUCTION TO INDUSTRY 4.0	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic Mathematics, Programming & Automation knowledge is Essential	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

To know the automated learning techniques.

To study the techniques of knowledge representation.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the representation of knowledge	K2
2	Understand machine learning, AI and RPA techniques in developing real world applications.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Industry 4.0	12 hours

Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.

Unit:2	Machine Learning	12 hours

Machine Learning - Introduction – Definition – Types of Machine Learning –Supervised, Unsupervised, Reinforcement Learning – Algorithms for Machine Learning – Problems solved by Machine Learning - Tools for Machine Learning - Applications areas of Machine Learning.

Unit:3	Artificial Intelligence	12 hours

Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI - environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI

Unit:4	Robotic Process Automation (RPA)	12 hours

Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA – Robots and Softbots – RPA architecture and process methodologies - Industries best suited for RPA - Risks & Challenges with RPA.

Unit:5	Applications and Tools of Industry 4.0	10 hours

Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.

Unit:6	Contemporary Issues	2 hours

Applications of Industrial Automation Systems using Machine Learning & Artificial Intelligence

	Total Lecture Hours	60 hours

Text Book(s)	
1	P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0, 2020
Reference Books	
1	Stuart J. Russell, Peter Norvig, "Artificial Intelligence - A Modern Approach", Third Edition, Pearson Publishers, 2015
2	S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, Wiley-India, 2007
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105195/
2	https://nptel.ac.in/courses/106/106/106106139/
3	https://nptel.ac.in/courses/106/105/106105077/
4	https://nptel.ac.in/courses/112/101/112101098/
Course Designed By: Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode	

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		GENERAL ELECTRONICS LAB	L	T	P	C
Core/Elective/Supportive		Core	0	0	5	4
Pre-requisite		Basic Concepts in Electronics	Syllabus Version	2021-22		

Course Objectives:

The main objectives of this course are to:

1. To inculcate experimental skills to test basic of Linear ICs and Power Electronics
2. To learn circuits using OPAMP, PLL and Timer ICs

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Design Oscillators and Filters using op-amp.	K6
2	Analyze circuits using PLL, OPAMP and timer ICs	K4
3	Analyze power amplifier circuits	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

	List of Experiments (Any 20 Experiments)	150 Hrs.

1. Op-Amp Characteristics.
2. V to I & I to V Convertors.
3. Half Wave Rectifier and Full Wave Rectifier Using Op-Amps.
4. Integrator and Differentiator Using Op-Amps.
5. Design of Low Pass and High Pass Filters.
6. Design of Band Pass, Band Reject & Notch Filters.
7. Instrumentation Amplifier
8. Triangular & Saw Tooth Wave Generators using Op-Amps.
9. Square Wave Generator & Schmitt Trigger Using Op-Amps.
10. Hartley & Colpitts Oscillator using Op-Amps.
11. Phase Shift and Wein Bridge Oscillator using Op-Amps.
12. Astable and Monostable Multi-Vibrators using 555.
13. Voltage Controlled Oscillator using 566.
14. Any Two Applications using Ic565
15. Function Generator using 8038.
16. Dual Power Supply using 78xx and 79xx
17. Adjustable Positive and Negative Voltage Regulator using LM 317 & LM337
18. Low and High Voltage Regulator using LM 723
19. AC Power Control using Thyristors.
20. Switching Circuits For TRIAC.

21. Thyristor Chopper.
22. Single Phase Invertor (20W)
23. Power Amplifier Using LM 380.
24. Different Triggering Circuits for Thyristor.
25. Study a Firing Circuit Suitable for Single Phase Half Controlled Convertor.
26. Single Phase Half Controlled Bridge Convertor with Two Thyristors & Two Diodes.
27. Single Phase Fully Controlled Bridge Convertor using Four Thyristors.
28. Pspice Simulation of DC to DC Step Down Chopper.

	Total Practical Hours	**150 hours**

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		PIC MICROCONTROLLER & RASPBERRY PI WITH PYTHON PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Core	0	0	5	4
Pre-requisite		Basic Concepts in Electronics	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. Provide the knowledge of PIC microcontroller and Raspberry Pi based system design
2. Interfaces different motors and create Automation system
3. Design the system that interact with environment and communicate over the internet

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Design PIC microcontroller and Rapberry Pi based system	K6
2	Interface microcontroller-based system to real world	K4
3	Acquire the knowledge, techniques and skill to integrate hardware and software	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

	List of Experiments (Any 10 Experiments)	75 hours

PIC Microcontroller

1. Addition and Subtraction of Two 8-bit Numbers
2. Multiplication and Division of Two 8-bit numbers
3. Largest Number in an Array
4. Ascending Order of an Array
5. 4-bit Binary Counter
6. Flashing of LED
7. Seven Segment Display Interface
8. LCD Interface
9. DC Motor Direction Controller
10. Stepper Motor Interface
11. Servo Motor Control using PWM
12. Data Transfer using USART
13. SPI Communication

	List of Experiments (Any 10 Experiments)	75 hours

Raspberry Pi with Python Programming

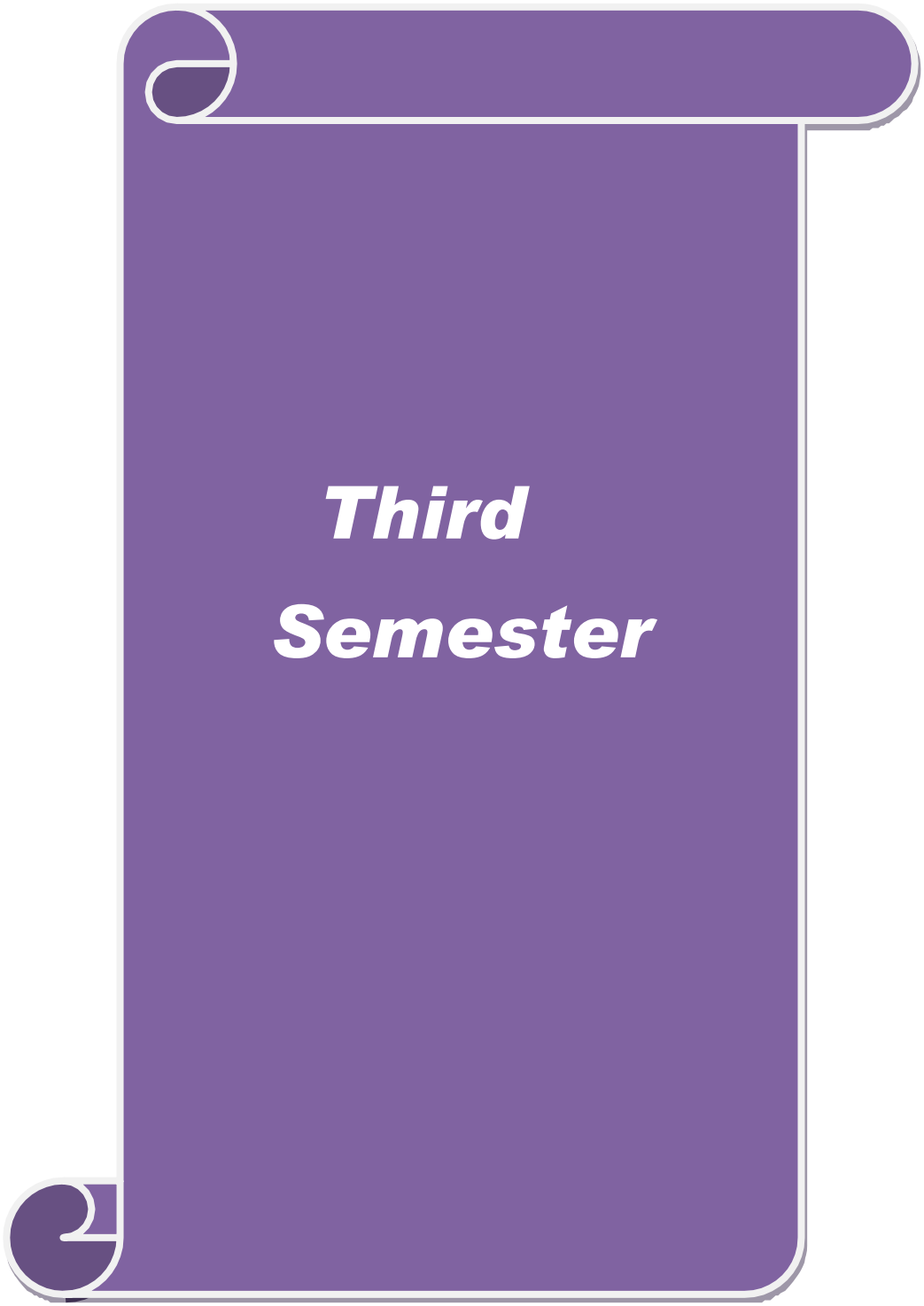
1. Addition and Subtraction of Two 8-bit Numbers
2. Multiplication and Division of Two 8-bit numbers
3. Largest Number in an Array
4. Ascending Order of an Array
5. 4-bit Binary Counter
6. Flashing of LED
7. Seven Segment Display Interface
8. PIR sensor interface
9. Interfacing DC Motor
10. Stepper Motor Interface
11. Pulse Width Modulation
12. Interfacing of Relay
13. Remote-controlling of Electronic Device through Web Interface

	Total Practical Hours	**150 hours**

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	S	S	S	S
CO3	S	M	S	M	M

*S-Strong; M-Medium; L-Low


Third
Semester

Course code		INTERNET OF THINGS WITH ARDUINO	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge in Electronics and Computer programming	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. Learn the basic principles of various smart sensors and apply it in IoT applications
2. Train the students to build IoT systems using sensors, single board computers and open source IoT platforms.
3. Make the students to apply IoT data for real time applications in various domain in secured manner.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts on sensing devices, actuation, processing and communications	K2
2	Implement the Sensors based system using Arduino	K3
3	Understand the key technologies, protocols and standards in Internet of Things.	K2
4	Apply the wireless technologies for IoT using ESP8266	K3
5	Illustrate the applications of IoT in real time scenario	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	SENSORS AND ACTUATORS	11 hours

Sensors Classification - Working Principle of Sensors - Criteria to Choose a Sensor - Generation of Sensors - Resistance sensor – Voltage sensor – Current sensor - PIR Proximity sensor - Barometric pressure sensor – Gyroscope - DC motor - Servo motor- Stepper motor

Unit:2	ARDUINO	12 hours

Introduction to Ardunio – Arduino family of boards with Pin description – Installation of Arduino IDE – Basic Commands for Arduino – LCD Commands – Serial Communication Commands – Interface LED with Arduino – Interface LCD with Arduino - Interface PIR sensor with Arduino – Interface LDR with Arduino – Interface with Bluetooth module.

Unit:3	INTRODUCTION TO IoT	11 hours

Characteristics of IoT – Design Principles of IoT – IoT Architecture and Protocols – IoT Levels - IoT vs M2M - Design Methodology - Challenges in IoT Design – IoT system management - IoT Cloud platforms: Temboo; SensorCloud; ThingWorx; ThingSpeak; Blynk; Cayenne from myDevices

Unit:4	DATA OVER IoT	12 hours

ESP8266 module: Hardware requirements - Installing the Arduino IDE for the ESP8266 - Connecting your module to your Wi-Fi network - Controlling an LED - Reading data from a GPIO pin - Reading data from a digital sensor - Configuring the ESP8266 module and controlling an LED - Controlling the LED from a cloud dashboard - Controlling the lamp from

anywhere in the world – Monitoring temperature and Humidity using DHT11		
Unit:5	**SMART USE OF IoT**	**12 hours**
Smart Home - Wearables – Connected Cars – Industrial IoT Applications – Smart Cities – IoT in Agriculture – IoT Applications in Retail – Energy Engagement – IoT in Healthcare.		
Unit:6	**Contemporary Issues**	**2 hours**
Interfacing with ARDUINO		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, and Mahendra Swain, "Internet of things with Raspberry pi and Arduino", CRC Press Taylor & Francis Group 2020.
2	Volker Ziemann, A Hands-On Course in Sensors Using the Arduino and Raspberry Pi, CRC Press, Taylor & Francis Group, 2018
3	Marco Schwartz, Internet of Things with ESP8266, Packt Publishing, 2016
4	Mohammad Ali Jabraeil Jamali, Bahareh Bahrami, Arash Heidari, Parisa Allahverdizadeh, Farhad Norouzi, Towards the Internet of Things Architectures, Security, and Applications, Springer Nature Switzerland AG, 2020

Reference Books

1	Ashwin Pajankar, Arduino Made Simple, BPB Publications, First Edition, 2018
2	Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, CRC Press, Taylor & Francis Group, 2017

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.arduino.cc/en/IoT/HomePage
2	https://swayam.gov.in/nd2_arp19_ap52/preview
3	https://opensource.com/article/17/12/how-build-custom-iot-hardware-arduino

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		DIGITAL IMAGE PROCESSING	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Familiarity with mathematics and digital signal processing	Syllabus Version		2021-	

Course Objectives:

The main objectives of this course are to:

1. Introduce the fundamental concepts and techniques in digital image processing and their applications.
2. Emphasize on the Image Transforms, Image Enhancement, Restoration and Compression, Image segmentations and Image Analysis.
3. Improve the students ability to use mathematical tools required for the design and development of image processing algorithms to solve image processing problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the general terminology, basic concepts of digital image processing	K2
2	Develop various types of image transformation algorithms and image spatial filtering algorithms	K3
3	Apply 2D image processing transforms and their properties for various image processing problems in frequency domain	K3
4	Estimate various image compression, image encoding and image representation methods and algorithm requirements for practical image processing applications.	K5
5	Design and Develop procedure for solving image processing problems.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	DIGITAL IMAGE FUNDAMENTALS	12 hours

Introduction to Digital Image Processing – The Origins of Digital Image Processing – Fields that use digital image processing – Fundamental steps in digital image processing; Components of an image processing system – Structure of the Human eye – Image formation in the eye – Brightness adaptation and discrimination – Simultaneous contrast – Image sensing and Acquisition – Concepts in Sampling and Quantization – Representing Digital images – Spatial and Intensity resolution – Neighbors of pixel – Adjacency – Connectivity – Regions – Boundaries – Distance measures.

Unit:2	IMAGE ENHANCEMENT	12 hours

Spatial domain methods – Frequency domain methods – Enhancement by point processing – Intensity transformations – Image Negatives – Contrast stretching – Thresholding – Intensity level slicing – Bit plane slicing – Histogram processing; Histogram equalization – Spatial Filtering – Smoothing Spatial filters: Low pass filtering – Median filtering – Sharpening Spatial Filters: High pass filtering – Derivative filters.

Unit:3	IMAGE TRANSFORMS	12 hours

Introduction – Fourier transform – 2D Discrete Fourier Transform – Properties of 2-D DFT and IDFT: Separability, Shift, Periodicity, Convolution, Correlation, Scaling, Conjugate symmetry, Orthogonality, Rotation – Other Image Transforms – Discrete Cosine Transform – Walsh transform – Hadamard transform –Comparison of different image transforms.

Unit:4	**IMAGE COMPRESSION**	**11 hours**
Image Compression Fundamentals – Redundancies – Objective and subjective fidelity criteria – Image Compression models – General image compression system – Huffman Coding – Run length coding – Bit plane coding – Transform coding – Predictive coding – Lossless predictive coding - Lossy predictive coding – Delta modulation coding – DPCM coding.		
Unit:5	**IMAGE SEGMENTATION AND REPRESENTATION**	**11 hours**
Edge based segmentation – Region based segmentation – Point, Line, and Edge detection: Detection of isolated points – Line detection – Gradient operators – Segmentation by Region growing and by Region splitting and Merging – Edge linking and Boundary detection – Feature extraction – Boundary preprocessing – Boundary representation – Chain codes – Shape numbers.		
Unit:6	**Contemporary Issues**	**2 hours**
Various Image transformation techniques		
	Total Lecture Hours	**60 hours**

Text Book(s)	
1	Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson, 2018.
2	S. Jayaraman, S. Esakkirajan and T. Veerakumar, “Digital Image Processing”, Tata McGraw Hill, New Delhi, 2010.
Reference Books	
1	Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice-Hall of India Private Limited, New Delhi, 2006.
2	Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins., Digital Image Processing Using MATLAB, 3rd edition, Gatesmark Publishing, 2020
3	S. Annadurai, R.Shanmugalakshmi, “Fundamentals of Image Processing” Pearson education, 2007
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc20_ee75/
2	https://swayam.gov.in/nd1_noc20_ee83/
3	http://www.imageprocessingplace.com/

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	L	L	L	L
CO2	S	M	L	L	L
CO3	S	M	L	M	M
CO4	M	S	S	S	M
CO5	M	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code		PC HARDWARE AND TROUBLESHOOTING	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge in Computer Hardware and Troubleshooting Techniques	Syllabus Version		2021-	

Course Objectives:

The main Objectives of this course are to:

1. Learn concept & structure of Computer Hardware & Networking Components
2. Identify the existing configuration of the computers & peripherals.
3. Learn PC maintenance, Upgrading and Troubleshooting skills

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand basic concept & structure of Computer Hardware & Networking Components.	K2
2	Familiarize themselves with PC memory devices and Peripherals such as RAM, ROM, HDD, SSD, Mouse, Keyboard, Monitor devices.	K2
3	Know about motherboard I/O interfacing ports such as SATA, PATA, IDE, USB, VGA, HDMI and others will be familiar to the students.	K2
4	Familiarize themselves with the various tools available in Windows or provided by third-party companies that helps in PC troubleshooting and maintenance.	K4
5	Apply their knowledge about computer peripherals to identify/rectify problems on board.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	INTRODUCTION TO PC HARDWARE AND NETWORK DEVICES	11 hours

History and Generations of the computer – Components of IBM PC – CPU – Motherboard & Form Factors – Intel & AMD Processors (32 & 64 bit) – BIOS Setup - SMPS & UPS – Power Connectors – Hub & Switches – Routers – Modem – Fiber Optic Devices – Cables and Connector Types.

UNIT: 2	MEMORY DEVICES	12 hours

Memory types – RAM – ROM – Floppy Disk Drive (FDD) – Optical Disk Drive (ODD) – Hard Disk Drive (HDD) – Solid State Drive (SSD) – USB Drives – External Flash Memory Device – Physical & Logical Formatting.

UNIT: 3	PERIPHERALS	12 hours

Keyboard, Mouse (wire & wireless) – Monitors (CRT,LCD,LED) – Printers – Scanners – Webcams – Speakers and Audio Devices – Sound and Graphics Cards – Joystick – Touchpad & Touch Screen – LCD, LED Projectors – Smart Devices – WiFi LAN Card – Plotters.

UNIT: 4	I/O PORTS AND INTERFACING	11 hours

PS/2 Port – Serial & Parallel Ports – USB Ports – VGA Port – DVI Port – HDMI Port – Audio & Mic Jack – Ethernet Port – SCSI Interface – IDE/PATA Interface – SATA Interface – PCI Slot – PCI Express Slot.

UNIT: 5	**TROUBLESHOOTING**	**12 hours**
Troubleshooting Procedures – General Hardware Problems – Basic Software Problems – Motherboard Problems – HDD failure Testing – SMPS problems – Keyboard / Mouse Problems – Monitor Problems – Speeding up a Slow Computer – IPv4 and IPv6 configuration & Network Problems.		
UNIT: 6	**Contemporary Issues**	**2 hours**
Networking and Interfacing with PC		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	B. Govindarajulu "IBM PC AND CLONES", Tata McGraw-Hill Publishing Company Limited, 2008.
2	K.L.James, "COMPUTER HARDWARE: Installation, Interfacing, Troubleshooting and Maintenance", PHI Learning Private Limited, 2013.

Reference Book(s)

1	N. Mathivanan "MICROPROCESSORS, PC HARDWARE AND INTERFACING", PHI Learning Private Limited (2003).
2	Michael W. Graves "A+ GUIDE TO PC HARDWARE MAINTENANCE AND REPAIR", Thomson Delmar Learning (2004).
3	Peter Norton "INSIDE THE IBM PC AND PS/2", PHI Publishers, 4th Edition (1991).
4	Stephen J Bigelow "TROUBLESHOOTING MAINTAINING AND REPAIRING PC's", Tata McGraw-Hill Publishing Company Limited; 2nd Edition (2000).

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd2_cec20_cs11/preview
2	https://www.ibm.com/support/home
3	https://urbanareas.net/info/training/computer-repair

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	M	S	S	S	S
CO3	S	M	S	S	M
CO4	S	S	S	S	S
CO5	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		NANO ELECTRONICS AND TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge in Nano Science and Characterization Techniques	Syllabus Version		2021-	

Course Objectives:

The main Objectives of this course are to:

1. To introduce the students to Nano Electronics, Nano Devices, and Nano Materials.
2. To identify characterization Techniques behind Nano Electronics.
3. To describe the principle and the Applications of Nano Electronic Devices

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Learn about the background on Nanoscience and Technology	K2
2	Explain the importance of reduction in materials dimensionality, and its relationship with materials properties	K2
3	Understanding the principles and various Characterization Techniques	K2
4	Apply the students the essential role of Nanoscience and Systems	K3
5	Apply their learned knowledge to develop Nano Devices and Applications	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	INTRODUCTION AND CLASSIFICATION	11 hours

Classification of Nanostructures – Nanoscale Architecture – Effects of the Nanometre Length Scale – Changes to the System Total Energy – System Structures – Vacancies in Nanocrystals – Effect of Nanoscale Dimensions on Various Properties – Structural, Thermal, Chemical, Mechanical, Magnetic, Optical and Electronic Properties – Effect of Nanoscale Dimensions on Biological Systems.

UNIT: 2	NANOMATERIALS PREPARATION METHODS	12 hours

Fabrication Methods – Top Down Processes – Milling, Lithographics, Machining Process – Bottom up Process – Vapour Phase Deposition Methods – Plasma-Assisted Deposition Process – Liquid Phase Methods – Colloidal and SolGel Methods – Methods for Templating the Growth of Nanomaterials – Ordering of Nanosystems – Self-Assembly and Self-Organization – Preparation, Safety and Storage Issues.

UNIT: 3	CHARACTERIZATION TECHNIQUES	12 hours

General Classification of Characterization Methods – Analytical and Imaging Techniques – Microscopy Techniques – Electron Microscopy – Scanning Electron Microscopy – Transmission Electron Microscopy – FESEM – Scanning Tunneling Microscopy – Atomic Force Microscopy – X Ray Diffraction – Absorption Spectroscopy – Photo-Luminescence – Raman Spectroscopy.

UNIT: 4	NANO ELECTRONICS AND INTEGRATED SYSTEMS	11 hours
Basics of Nano Electronics – Single Electron Transistor – Quantum Computation – Tools of Micro Nano Fabrication – Nanolithography – Quantum Electronic Devices – MEMS – NEMS – Dynamics of NEMS – Limits of Integrated Electronics.		
UNIT: 5	**NANODEVICES AND APPLICATIONS**	**12 hours**
Nano Magnetic Materials – Particulate Nano magnets – Geometrical Nano magnets – Magneto Resistance – Probing Nano magnetic Materials – Nano magnetism in Technology – Carbon Nanotubes – Fabrication – Applications – Organic FET – Organic LED's – Organic Photovoltaics – Injection Lasers – Quantum Cascade Lasers – Optical Memories – Electronic Applications.		
UNIT: 6	**Contemporary Issues**	**2 hours**
General Classification of Characterization Methods		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Kelsall Robert W, Ian Hamley, Mark Geoghegan, "Nanoscale Science and Technology", Wiley Eastern, 2004.
2	C.P. Poole, F.J.Owens, "Introduction to Nanotechnology", John Wiley & Sons, 2003.
3	Michael Kohler, Wolfgang, Fritzsche, "Nanotechnology: Introduction to Nanostructuring Techniques", John Wiley & Sons, 2008.

Reference Book(s)

1	Mark Ratner, Danial Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea, Pearson (2003).
2	Jan Korvink & Andreas Greiner, "Semiconductors for Micro and Nanotechnology – An Introduction for Engineers", Weinheim Cambridge: Wiley-VCH, 2001.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd1_noc19_mm21/preview
2	http://home.iitk.ac.in/~kbalani/doc/Nanostructures_and_Nanomaterials.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY

Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	S	M	M	S
CO3	S	S	S	S	M
CO4	S	M	S	S	S
CO5	S	M	S	M	S

*S-Strong; M-Medium; L-Low

Course code		PC HARDWARE AND VHDL PROGRAMMING LAB	L	T	P	C
Core/Elective/Supportive		Core Practical	0	0	5	4
Pre-requisite		Computer Hardware Troubleshooting and VHDL Simulation Software's	Syllabus Version		2021-	

Course Objectives:

The main Objectives of this course are to:

1. Acquire skills in installing different subsystem and troubleshooting techniques (Power supply, Video display unit, C.P.U., Printer, Plotter, Graphic monitor, Disc drives etc.).
2. Provides the necessary knowledge and skills regarding working construction, interfacing and networking aspects of computer peripherals
3. Learn knowledge about digital circuit design by VHDL programming

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Troubleshoot common problems related to internal components such as motherboards, RAM, CPU, and power with appropriate tools	K5
2	Identify and analyze the problems in Computer systems, software installation and Networking related rectification	K4
3	Design and simulate list of combinational and sequential digital circuits using simulation software's - VHDL language	K3
4	Analyze, design and develop a system/component/ process for the required needs under the realistic constraints	K4
5	Design the digital systems through VHDL programming	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

	List of Experiments (Any 6 Experiments)	40 hours

PC HARDWARE

1. Configuration of CMOS / BIOS Setup
2. Assembling and Disassembling of Desktop PC
3. Installation of Operating Systems [OS] using Bootable CD/DVD
4. Install Multiple Operating Systems (Windows & Linux) in One Computer using Bootable USB Drive
5. Installation of Driver, Application & Security Software's
6. HDD Formatting & Partitioning using Various Methods
7. Connect Computers with Peer-to-Peer Network using Wi Fi configuration
8. Sharing Folders & Remote Desktop connection using Crimped Network Cables
9. Installation and Configuration of Network Printer / Scanner
10. Smart Device Interfacing with PC (wired & wireless)
11. Speed Control of DC Motor using PC
12. Interfacing with Serial, Parallel and USB ports

	List of Experiments (Any 6 Experiments)	35 hours

VHDL PROGRAMMING

1. Simple Logic Gates
2. Half Adder and Full Adder
3. Half Subtractor and Full Subtractor
4. Encoder and Decoder
5. Multiplexer and Demultiplexer
6. Solving Boolean Equations
7. Flip - Flops
8. Digital Counters
9. Shift Registers and Ring Counter
10. 4 bit and 8 bit Multiplier
11. Arithmetic and Logic Unit
12. Implementation of Simple Programs in CPLD or FPGA kit

	Total Practical Hours	**75 hours**

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	M	S

*S-Strong; M-Medium; L-Low

Course code		DSP AND DIP LABORATORY	L	T	P	C
Core/Elective/Supportive		Core	0	0	5	4
Pre-requisite		Basic knowledge in digital signal processing techniques	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. Design and apply digital signal processing techniques to design discrete time systems and digital filter
2. Compile and solve the digital signal processing problems using MAT lab.
3. Interpret to analyze the importance of various transformation techniques in signal processing

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Enumerate the basic concepts of signals and systems and their interconnections in a simple and easy-to-understand manner using MATLAB	K4
2	Design FIR and IIR filters	K6
3	Process images using techniques of smoothing, sharpening, histogram processing, and filtering	K5

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create

	List of Experiments (Any 6 Experiments)	40 hours

USING Digital Signal Processor

1. Study of Addressing Modes of DSP using simple examples
2. Arithmetic Operations
3. DFT Computations
4. FFT Computations
5. Convolution of Two Discrete Signals
6. Correlation of Two Discrete Signals
7. Waveform Generation
8. Solving Differential Equations
9. Solving Z-Transform
10. Voice Storing & Retrieval
11. FIR Filter Design
12. IIR Filter Design

	List of Experiments (Any 6 Experiments)	35 hours

SIMULATION USING MATLAB

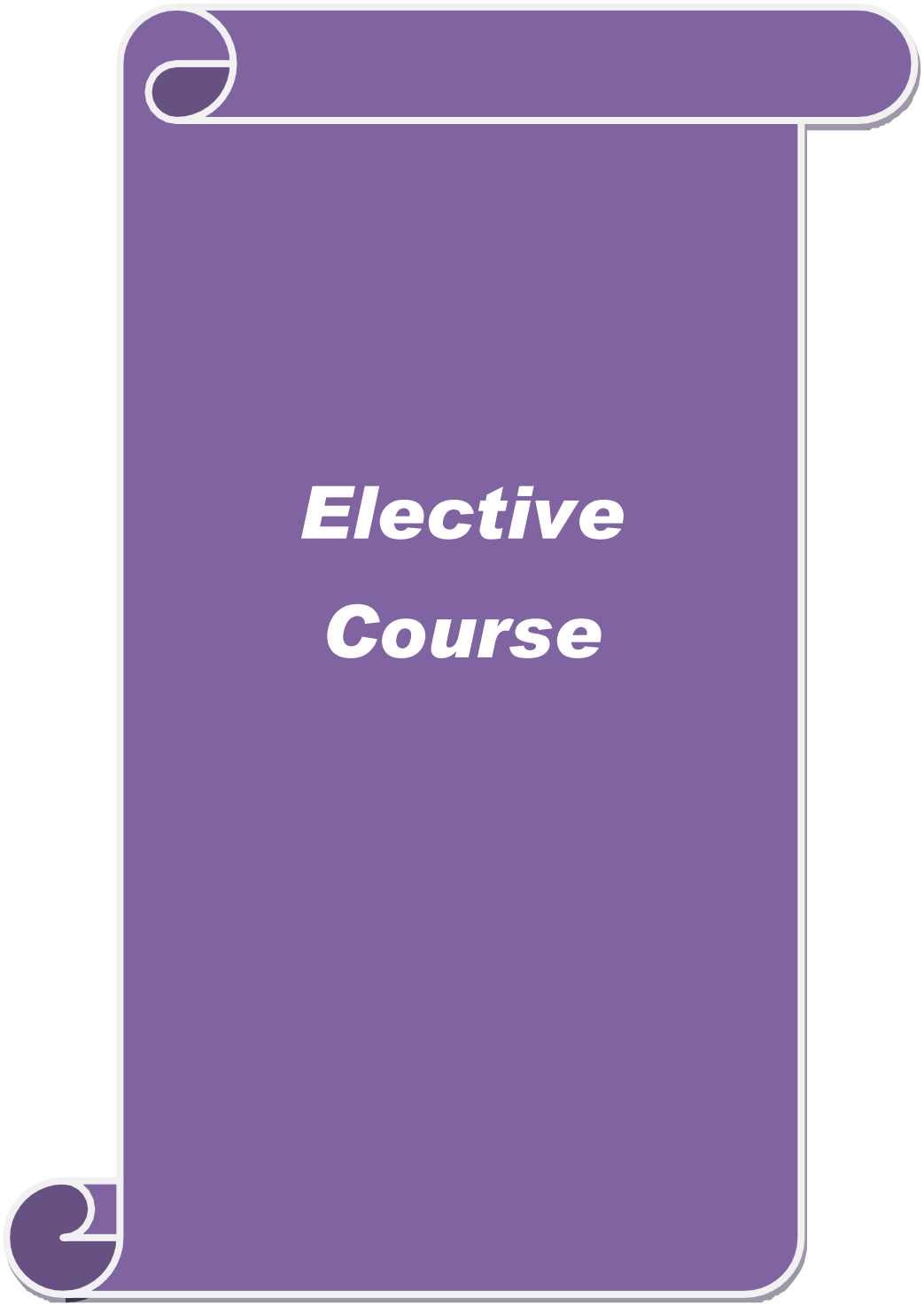
1. Generation of signals
2. Amplitude Modulation & FFT response
3. Impulse, Step, Exponential & Ramp functions
4. Frequency Sampling method
5. Design of FIR filter
6. Design of IIR filter
7. Image Sampling – Zooming & Shrinking operations
8. Basic Gray Level Transformations: Image negative, Power law and Log transforms
9. 2-D Discrete Fourier Transform and Walsh Transform
10. Image Contrast Enhancement by Histogram equalization technique
11. Spatial Image Filtering: Low pass and High pass filtering

	Total Practical Hours	**75 hours**

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	S
CO2	S	S	M	M	S
CO3	S	S	S	S	S

*S-Strong; M-Medium; L-Low


Elective
Course

Course code		WEB TECHNOLOGY	L	T	P	C
Core/Elective/Supportive		Semester I : Elective - Group-A	4	0	0	4
Pre-requisite		Basic knowledge in Computer programming	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. To enable the students to learn the basics of internetworking.
2. To learn the concept of web pages.
3. To know about the internet security systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Apply the concept of networking method in various applications.	K3
2	Demonstrate the internetworking standard, its architecture, advantages and limitations.	K4
3	Design and development of web-pages and web-applications	K5
4	Create knowledge on web pages and protocols.	K6
5	Programming web pages with JavaScript /DOM	K1

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	**10 hours**

Internetworking concepts – Devices: Repeaters – Bridges – Routers – Gateways – Internet topology Internal Architecture of an ISP – IP Address – Basics of TCP – Features of TCP – UDP.

Unit:2	**12 hours**

DNS – Email – FTP – HTTP – TELNET- Electronic commerce and Web technology– Aspects – Types – E-procurement models – Solutions – Supply chain management – Customer Relationship Management – Features Required for enabling e-commerce – Tiers – Concepts of a Tier

Unit:3	**12 hours**

Web page – Static Web pages – Dynamic Web pages – DHTML – CGI – Basics of ASP technology – Active Web pages - User Sessions: Sessions and session Management – Maintaining state information - Transaction Management: Transaction Processing monitors – object Request Brokers – Component transaction – monitor – Enterprise Java Beans.

Unit:4	**12 hours**

Security issues: Basic concepts – cryptography – Digital signature – Digital certificates – Security Socket Layer (SSL) – Credit card Processing Models – Secure Electronic Transaction –

3D Secure Protocol – Electronic money. Electronic Data Interchange: Overview of EDI – Data Exchange Standards – EDI Architecture – EDI and the Internet		
Unit:5		**12 hours**
Extensible Markup Language (XML) – Basics of XML – XML Parsers – Need for a standard– Limitations of Mobile Devices – WAP Architecture – WAP stack – Object Technology.		
Unit:6	**Contemporary Issues**	**2 hours**
Knowledge of framework and platforms- security-performance		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Achyat. S. Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill Pub. Co, Delhi, 2006.

Reference Books

1	Ellote Rusty Harold, "Java Network Programming", O'Reilly Publications, 1997.
2	Jason Hunter, William Crawford, "Java Servlet Programming", O'Reilly Publications, 1998.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd2_ugc19_lb05/preview
2	https://nptel.ac.in/courses/106/105/106105084/
3	https://www.scss.tcd.ie/owen.conlan/CS7062/1_Web_Technologies_Handout.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	M	S	M	M
CO2	M	S	M	S	S
CO3	S	M	M	S	M
CO4	M	S	S	S	M
CO5	S	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code		RELATIONAL DATA BASE MANAGEMENTSYSTEM	L	T	P	C
Core/Elective/Supportive		Semester II : Elective - Group-A	4	0	0	4
Pre-requisite		Basic knowledge in Computer programming	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. To Define basic foundational terms of Database.
2. To Compare relational model with the Structured Query Language (SQL) and also known the constraints and controversies associated with relational database model.
3. To identify the major types of relational management systems and to understand the applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate the basics of query evaluation and apply query optimization techniques.	K2
2	Utilize the knowledge of basics of SQL and construct queries using SQL	K1
3	Apply relational database theory, and be able to write relational algebra expressions for queries	K3
4	Work successfully on a team by design and development of a database application system as part of a team	K4
5	Use commercial relational database system (Oracle) by writing Queries using SQL and to compare the basic database storage structures and access techniques: file and page organizations, indexing methods including B -tree, and hashing.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION	12 hours

Purpose of Database systems- View of Data-Data Models-Database Languages-Transaction Management-Storage Management Database Administrator- Database Users-System Structure. ENTITY Relationship Model: Basic concepts-keys-Entity Relationship Diagram, Weak Entity sets, E-R Features. Data Modeling and Normalization: Data Modeling – Dependency – Database Design – Normal forms – Dependency Diagrams - Denormalization– Another Example of Normalization.

Unit:2	ORACLE TABLES	11 hours

DDL: Naming Rules and conventions – Data Types – Constraints – Creating Oracle Table-Displaying Table Information – Altering an Existing Table – Dropping, Renaming, and Truncating Table.

Unit:3	WORKING WITH TABLE: DATA MANAGEMENT AND RETRIEVAL	12 hours

DML – adding a new Row/Record – Customized Prompts – Updating and Deleting an Existing Rows/Records -restricting Data with WHERE clause –Sorting – **Functions and**

Grouping: Built-in functions –Grouping Data.		
Unit:4	**MULTIPLE TABLES**	**12 hours**
Join & Set operators- Join-set operators. **Sub queries:** Sub query-EXIST and NOT EXIST operators. **PL/SQL: A Programming Language:** Block Structure –Comments – Data Types – Variable Declaration – Assignment operation – Bind variables – Substitution Variables – Printing – Arithmetic Operators.		
Unit:5	**CONTROL STRUCTURES AND EMBEDDED SQL**	**11 hours**
Control Structures – Nested Blocks – SQ L in PL/SQL – Data Manipulation in PLSQL. **PL/SQL Cursors and Exceptions:** Cursors-Type of Cursors-Cursors Variables-Exceptions. Triggers.		
Unit:6	**Contemporary Issues**	**2 hours**
Increasing data volumes- Decentralized data management- Data security		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Abraham Silberschatz, Henry F.Korth,S.Sudharson, ”Database Concepts”, Tata McGraw Hill International Edition, 1997.

Reference Books

1	Alexis Leon and Mathews Leon, “Database Management Systems”, Vikas Publishing, 2008
2	Ramez Elmasri, Shamkant Navathe, “Fundamentals of Database Systems”, Pearson, 2016.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/content/storage2/courses/106106095/pdf/1_Introduction.pdf
2	https://swayam.gov.in/nd2_nou19_lb03/preview
3	https://cs.stanford.edu/people/widom/DB-mooc.html

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	S	M
CO2	M	S	M	M	M
CO3	M	S	S	M	S
CO4	S	M	M	S	S
CO5	M	S	S	M	M

*S-Strong; M-Medium; L-Low

Course code		LINUX AND SHELL PROGRAMMING	L	T	P	C
Core/Elective/Supportive		Semester III : Elective - Group-A	4	0	0	4
Pre-requisite		Basic knowledge in Computer Programming	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. To familiarize students with the Linux environment
2. To learn the fundamentals of shell scripting/programming
3. To familiarize students with basic Linux administration

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic commands of Linux operating system and can write shell scripts	K2
2	Write shell scripts to automate various tasks	K1
3	Master the basics of Linux administration	K4
4	Identify and use UNIX/Linux utilities to create and manage simple file processing operations, organize directory structures with appropriate security, and develop shell scripts to perform more complex tasks.	K6
5	Monitor system performance and network activities.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	WELCOME TO LINUX	11 hours

Overview of LINUX-Additional Features in LINUX .**The LINUX Operating System:** Logging In-Working with the shell..

Unit:2	LINUX SYSTEM START UP & SHUTDOWN	12 hours

Introduction Brief outline of X86 LINUX booting process. **System Logging:** Logging – Accounting-Available Graphical Tools.

Unit:3	FILE FILTERS	12 hours

File Related Commands-Introduction to Piping – Some other means of joining commands-awk commands.

Unit:4	SHELL PROGRAMMING	12 hours

Introduction-programming constructors. **The Shell:** Command line-Standard Inputs & Standard output-Filename Generation/pathname expansion.

Unit:5	THE VIM EDITOR	11 hours

Introduction to Vim features-Command Mode: Moving the cursor-Deleting & changing text -Input mode. **Computing C & C++ Programs under LINUX:** Introduction to C

Compiler-Computing a Multi source C Program-How main is executed on LINUX-Compiling single source C++ Program.		
Unit:6	**Contemporary Issues**	**2 hours**
Computing C & C++ Programs under LINUX		
	Total Lecture Hours	**60 hours**

Text Book(s)	
1	Mark G. Sobell , " A Practical Guide to LINUX Commands, Editors and shell programming", Pearson, 2013
2	N.B. Venkateswarlu," Introduction to LINUX: Installation and Programming " , BS Publications, 2008

Reference Books	
1	Mr. David Tansley, "Linux And Unix Shell Programming**",** Addison Wesley, 2000.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/106/117106113/
2	https://swayam.gov.in/nd2_aic20_sp05/preview
3	http://index-of.es/OS/Venkateswarlu%20N.Introducing%20Linux.Installation%20and%20Programming .BSP.%5BENG,601p.,2008%5D.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	M	M	M	S	M
CO2	M	S	M	M	S
CO3	S	M	M	S	M
CO4	S	S	M	M	S
CO5	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		RDBMS AND LINUX LAB	L	T	P	C
Core/Elective/Supportive		Semester IV: Elective - Group-A	0	0	5	4
Pre-requisite		Basic knowledge in Computer programming	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations and describe the basics of SQL and construct queries using SQL.
3. To emphasize the importance of normalization in databases, and to facilitate students in Database design.
4. To understand and make effective use of Linux utilities and shell scripting language to solve problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Apply the basic concepts of Database Systems and Applications	K3
2	Use the basics of SQL and construct queries using SQL in database creation and interaction	K1
3	Understand the basic commands of Linux operating system and can write shell scripts knowledge and students will be able to create file systems and directories and operate them understand.	K2
4	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.	K5
5	Analyze and Select storage and recovery techniques of database system.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

	List of Experiments (Any 6 Experiments)	40 hours

RDBMS

1. Creating Tables and writing simple Queries using
   a) Comparison Operators, b) Logical Operators, c) Set Operators, d) Sorting and Grouping
2. Creation of Reports using Columnformat
3. Writing Queries using built in functions
4. Updating and altering tables using SQL.
5. Creation of Students Information table and write PL/SQLBlock find the Total, Average marks and Results.
6. Write a PL/SQL block to prepare the Electricity Bill.
7. Splitting the table: Write a PL/SQL block to split the students information table into two,

one with the Passed and other failed.

8. Joining the Tables-Write a PL/SQL Block to join two tables, First table contain Roll Number, Name, Total and Second Table contains the Roll. No and Address.
9. Create a Database Trigger to check the data validity of Record.
10. Recursive Functions write a Recursive Function to find
    a) Factorial of N
    b) Fibonacci Series with N terms.
11. Write a Recursive function to create as sequence of Roll No's using sequence.
12. Write a Database Trigger to implement the Master Detail Relationship.
13. Front and tools.
14. High level programming language extension
15. Menu Design.
16. Data definition, Manipulation of base tables and views.

	List of Experiments (Any 6 Experiments)	**35 hours**

LINUX

1. Write a Shell script to Wish the User according to Present Time. (i.e GOOD MORNING, GOOD AFTERNOON etc)
2. Write a shell program to print the sum of all digits
3. Write a shell program which informs as soon as a specified user whose name is given along the command line is logged into the system
4. Write a shell program to print the following series
    i. 2 2
    ii. 3 3 3
    iii. 4 4 4 4
    iv. 5 5 5 5 5
    v. 6 6 6 6 6 6
5. Write a shell program which takes a source file name & directories names as command line arguments & print the message.
6. Write a shell script which removes empty files from PWD & changes other file time stamps to current time
7. Write a shell program which reads a digit & prints its BCD code
8. Write a shell program which reads a filename along the command line & prints frequency of the occurrence of words

9. Write shell script to see current date time username & current directories. 10. Write script to determine whether given file exist or not, file name is supplied as command line argument, also check for sufficient number of command line argument.		
	Total Practical Hours	**75 hours**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://www.nrcmec.org/pdf/Manuals/CSE/student/4-1%20lp16-17.pdf
2	http://www.becbapatla.ac.in/uploads/BCE1571460572746.pdf
3	http://www.cmrec.ac.in/downloads/academic2017-18/cse/lab/iv/lp.PDF

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	M	S	M	M	S
CO2	S	M	S	S	M
CO3	M	S	M	S	S
CO4	S	S	M	S	M
CO5	S	M	S	M	S

*S-Strong; M-Medium; L-Low

Course code		ELECTRONIC TEST INSTRUMENTS	L	T	P	C
Core/Elective/Supportive		Semester I: Elective - Group-B	4	0	0	4
Pre-requisite		Basic knowledge in Electronics and instrumentation	Syllabus Version	2021-22		

Course Objectives:

The main objectives of this course are to:

1. To introduce students to monitor, analyze and control any physical system.
2. To understand students how different types of meters work and their construction
3. To provide a student a knowledge to design and create novel products and solutions for real life problems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand operation of different instruments.	K2
2	Describe different terminology related to measurements	K1
3	Indentify the principles of various types of transducers and sensors.	K3
4	Employ appropriate instruments to measure given sets of parameters, and practice the construction of testing and measuring set up for electronic systems.	K5
5	Measurement of R,L,C ,Voltage, Current, Power factor , Power, Energy	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	ANALOG METERS	10 hours

D.C,A.C voltmeters, ammeters, multimeter, power meter, Q-meter, true RMS meter, vector impedance meter, vector voltmeter, component measuringinstrument.

Unit:2	SIGNAL SOURCES	12 hours

Sine wave generator- Frequency synthesized sine wave generator- Sweep frequency generator, pulse and square wave generator-Function generator- Wave analyzer- Applications- Harmonic distortion analyzer- Spectrum analyzer- Applications- Audio Frequency generator- Noise generator.

Unit:3	OSCILLOSCOPES	12 hours

General purpose oscilloscope-Screens for CRT -Vertical & horizontal deflection systems- Time base operation, triggers – sweep control, z axis input – Delay line-Multiple trace-Dual beam & dual trace-Probes-Oscilloscope techniques-special oscilloscopes-Storage oscilloscope-sampling oscilloscope-digital CRO.

Unit:4	DIGITAL INSTRUMENTS	12 hours

Digital method for measuring frequency, period, phase difference, pulse width, time interval, total count-Digital voltmeter-Types-Automatic polarity indication, automatic ranging, and auto zeroing-DMM-Microprocessor based DMM-DPM-swept – spectrum analyzer-network analyzer- discharge analyzer- logic probes-logic analyzer.

Unit:5	DISPLAY AND RECORDING DEVICES	12 hours
Bar graph display-Segmental and dot matrix display-X-Y recorders, magnetic tape recorders- Digital recording-Data loggers-Interference and screening-Electrostatic and electromagnetic interference & earth loops.		
Unit:6	**Contemporary Issues**	**2 hours**
Sensors and Transducers- LVDT- Piezoelectric Transducers		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Albert D.Herlfrick & William D.Cooper, "Modern Electronic Instrumentation & Measurement Techniques" Prentice Hall of India,2002.
2	A.J.Bouwens,'Digital Instrumentation" Tata Mc Graw Hill, 1997.
3	RobertA.Witte,'Electronic Test Instruments, Theory and applications' Prentice Hall, 1993.

Reference Books

1	B.M.Oliver and J.M.Cage, "Electronic Measurements & Instrumentation", McGraw Hill International Edition, 1975.
2	Joseph, J.Carr, "Elements of Electronic Instrumentation & Measurements", Pearson, 2003.
3	C.S.Rangan, G.R.sarma, V.S.V.Mani," Instrumentation Devices & systems" Tata Mc Graw Hill, 2002.
4	D.A.Bell, "Electronic Instrumentation and Measurements", Prentice Hall of India, 2002.
5	Rajendra Prasad, "Electronic Measurements and Instrumentation", Khanna Publishers, 2003
6	B.R.Gupta, "Electronics and Instrumentation", S.Chand Co. (P)Ltd., Delhi, 1999.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/108/105/108105153/
2	https://swayam.gov.in/nd1_noc19_ee44/preview
3	https://eladiaqu.firebaseapp.com/aa995/electronic-test-instruments-analog-and-digital-measurements-2nd-edition-by-robert-a-witte-0130668303.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	M
CO2	S	M	S	L	M
CO3	M	S	M	M	S
CO4	M	M	S	M	L
CO5	S	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code		ANALYTICAL INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Semester II: Elective - Group-B	4	0	0	4
Pre-requisite		Basic knowledge in Electronics and instrumentation	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. To apply the principles and theory of instrument analysis.
2. To teach the student the correct operation of instruments.
3. To introduce the student to the techniques of troubleshooting instruments in the laboratory.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the effects of different constituent in a process outcome and analysis the performance of various on-line or off-line instruments. 3. 4. 5.. 6.	K2
2	Apply the knowledge of chromatography to Separates the constituents from a complex mixture.	K3
3	Describe and differentiate between online and offline process and Identifies suitable instruments for analysis gaseous, liquid or solid substance.	K4
4	Decide the dominate frequency characterize the substance from spectrum analysis	K5
5	Perform experimental analysis for different offline test like humidity, moisture, dissolve oxygen etc.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	COLORIMETRY AND SPECTROPHOTOMETRY	11 hours

Special methods of analysis- Beer-Lambert law-colorimeters - UV-ViS spectrophotometers-Single and double beam instruments-Sources and detectors-IR Spectrophotometers-Types-Attenuated total reflectance flame photometers- Atomic absorption spectrophotometers-sources and detectors-FTIR spectrophotometers-Flame emission photometers.

Unit:2	CHROMOTOGRAPHY	12 hours

Different techniques- Gas chromatography- Detectors- Liquid chromatographs-Applications - High pressure liquid chromatographs-Applications.

Unit:3	INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS	12 hours

Types of gas analyzers-Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation-dust and smoke measurements.

Unit:4	PH METERS AND DISSOLVE COMPONENT ANALYZERS	12 hours

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer- sodium analyzer-silicon analyzer.

Unit:5	**RADIO CHEMICAL AND MAGNETIC RESONANCE TECHNIQUES**	**11hours**

Nuclear radiations – Detectors - GM Counter - Proportional counter - Solid state detector - Gamma cameras - X-ray spectroscopy - Detectors- Diffractometers -Absorption meters - Detectors NMR-Basic principles-NMR spectrometer-Applications.

Unit:6	**Contemporary Issues**	**2 hours**

Mass spectrometers - Different types - Applications

	Total Lecture Hours	**60 hours**

Text Book(s)

1	R.S.Khandpur, ”Handbook of Analytical Instruments ”Tata Mc-Graw Hill publishing Co. Ltd.2003.
2	H.H.Willard, L.L.Merrit, J.A.Dean, F.A.Settle,”Instrumental methods of analysis” CBS publishing & distribution, 1995.

Reference Books

1	Robert D.Braun, ”Introduction to Instrumental Analysis” Mc Graw Hill, Singapore,1987
2	G.W.Ewing,”Instrumental Methods of Analysis” Mc Graw Hill 1992.
3	DA Skoog and D.M.West,”Prinicples of Instrumental Analysis” Harper and Row publishers,1974.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.my-mooc.com/en/mooc/analyticalchem/
2	https://swayam.gov.in/nd2_cec20_bt22/preview
3	https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/IC0309%20Analytical%20Instumentation.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	M	S	M	S	M
CO2	S	M	S	L	M
CO3	M	S	M	M	S
CO4	M	M	S	M	L
CO5	S	M	M	S	M

*S-Strong; M-Medium; L-Low

Course code		VIRTUAL INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Semester III: Elective - Group-B	4	0	0	4
Pre-requisite		Basic knowledge in Electronics and Instrumentation	Syllabus Version	2021-22		

Course Objectives:

The main objectives of this course are to:

1. To provide basic concepts in virtual instruments
2. To know about the programming methods in software used in virtual instrumentation
3. To familiarize the students with the applications of virtual instrumentation

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basics concepts and programming in virtual instrumentation	K2
2	Apply virtual instrumentation tool set for a given problem	K3
3	Describe about virtual instrumentation	K1
4	Get an adequate knowledge application of virtual instrumentation	K2
5	Apply virtual instrumentation concept for a given applications	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION	11 hours

General functional description of a digital instrument - Block diagram of a Virtual Instrument - Physical quantities and Analog interfaces - Hardware and Software - User interfaces - Advantages of Virtual instruments over conventional instruments - Architecture of a Virtual instrument and its relation to the operating system.

Unit:2	SOFTWARE OVERVIEW	12 hours

LabVIEW - Graphical user interfaces - Controls and Indicators - 'G' programming - Labels and Text - Shape, Size and Color - Owned and free labels - Data type, Format, Precision and representation - Data types - Data flow programming - Editing - Debugging and Running a Virtual instrument - Graphical programming palettes and tools - Front panel objects - Functions and Libraries.

Unit:3	PROGRAMMING STRUCTURE	12 hours

FOR loops, WHILE loops, CASE structure, formula nodes, Sequence structures - Arrays and Clusters - Array operations - Bundle - Bundle/Unbundle by name, graphs and charts - String and file I/O - High level and Low level file I/O's - Attribute modes Local and Global variables. **OPERATING SYSTEM AND HARDWARE OVERVIEW:** PC architecture, current trends, Operating system requirements, Drivers – Interface Buses – PCI Bus – Interface cards – specification – Analog and Digital interfaces – Power, Speed and timing considerations.

Unit:4	HARDWARE ASPECTS	12 hours

Installing hardware, Installing drivers - Configuring the hardware - Addressing the hardware in LabVIEW - Digital and Analog I/O function - Data Acquisition - Buffered I/O -

Real time Data Acquisition.		
Unit:5	**LABVIEW APPLICATIONS**	**11 hours**
IMAQ - Motion Control: General Applications - Feedback devices, Motor Drives – Instrument Connectivity - GPIB, Serial Communication - General, GPIB Hardware & Software specifications - PX1 / PC1: Controller and Chassis Configuration and Installation.		
Unit:6	**Contemporary Issues**	**2 hours**
Sequence-Style State Machine, Test Executive-Style State Machine		
	Total Lecture Hours	**60 hours**

Text Book(s)

1	Garry M Johnson, "Lab view Graphical Programming", Tata McGraw Hill, New Delhi, 1996.
2	Robert H.Bishop,"Learning with Lab-View" Prentice Hall,2003.
3	Labview : Basics I & II Manual, National Instruments, 2005.

Reference Books

1	Lisa K Wells, "Labview for Everyone", Prentice Hall of India, New Delhi, 1996.
2	Barry Paron, "Sensor, Transducers and Labview", Prentice Hall, New Delhi, 2000.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.pdfdrive.com/virtual-instrumentation-using-labview-d184554798.html
2	https://wwwusers.ts.infn.it/~rui/univ/Acquisizione_Dati/Lezioni/VIII%20-%20Labview%20-%20Introduction/LabVIEW%20Introduction-SixHour.pdf
3	https://vignan.ac.in/subjectsnew/MT330.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode.

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	M	S
CO2	M	S	M	S	M
CO3	S	M	S	M	S
CO4	S	S	M	S	M
CO5	M	S	M	S	M

*S-Strong; M-Medium; L-Low

Course code		INSTRUMENTATIONLAB	L	T	P	C
Core/Elective/Supportive		Semester IV: Elective - Group-B	0	0	5	4
Pre-requisite		Basic knowledge in Electronic instruments	Syllabus Version	2021-22		

Course Objectives:

The main objectives of this course are to:

1. To learn how to visualize and work on laboratory and multidisciplinary tasks.
2. To demonstrate various Bridges &sensors using simulation and hardware set ups.
3. To Measure Voltage, Current, Power factor, Power, Energy.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate variety of practical electrical circuits and conduct experiments to analyze and interpret data.	K2
2	Identify various measuring equipments/meters and to predict correctly their expected performance through different calibration methods.	K1
3	Differentiate the working principle and use of PMMC and moving iron type instruments.	K4
4	Measure Resistance, Inductance, Capacitance, Frequency, Voltage, Current, Power and Energy.	K3
5	Prepare graphical presentations of laboratory data and computational results, incorporating standard data analysis methods to develop technically sound reports of outcomes	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

	List of Experiments (Any 6 Experiments)	40 hours

1. Simple fault finding of pH meters and Identification different type pHelectrodes.
2. Displacement measurement using LVDT
3. Design of V-F and F-V converter
4. Instrumentation amplifier
5. Study of Strain gauges.
6. Thermocouple Compensation.
7. Thermistor Linearization transmitter design.
8. Pressure Calibration.
9. Signal conditioning circuit for any resistive / pressure transducer.
10. Signal conditioning circuit for optical encoder.

	List of Experiments (Any 6 Experiments)	35 hours

USING LAB VIEW

1. Creating a simple VI to place a Digital Control
2. Navigation and Editing VI to make a Degree C to Degree F Converter
3. Converting VI in to Sub VI
4. Write a programme to count Modulus 32 and display the values in decimal, octal decimal and Binary.
5. Built a VI using while loop that displays random numbers in to three wave form charts. (Strip, scope & Sweep)
6. Data Acquisition using Lab VIEW
7. Development of Temperature Measurement using Lab VIEW
8. Development of Virtual Instrument for Function Generator using LabVIEW
9. Development of Virtual Instrument for Audio Signal Spectrum Analyzer using Lab VIEW.

	Total Practical Hours	**75 hours**

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.mesce.ac.in/pdf/Instrumentation%20Lab.pdf
2	http://www.atri.edu.in/images/pdf/departments/INSTRUMENTATION%20LAB%20manual.pdf
3	https://www.amu.ac.in/emp/studym/99993346.pdf

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	M	M	S	M	S
CO2	S	M	M	M	S
CO3	S	S	M	S	M
CO4	M	M	S	M	S
CO5	M	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		VLSI DESIGN	L	T	P	C
Core/Elective/Supportive		Semester I: Elective - Group-C	4	0	0	4
Pre-requisite		Fundamental knowledge of ICs	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. Study the design and realization of combinational & sequential digital circuits.
2. Architectural and performance tradeoffs involved in designing and realizing the circuits in CMOS.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the concepts of digital building blocks using MOS transistor.	K2
2	Understand the fundamentals of CMOS circuits and its characteristics	K2
3	Analyze the CMOS Delay and power strategies.	K4
4	Design and construct Combinational and Sequential Circuits	K6
5	Design arithmetic building blocks and memory subsystems	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO MOS TRANSISTOR	12 hours

MOS Transistor - CMOS logic- Inverter - Pass Transistor and Transmission gate – Tristates Layout Design Rules - Gate Layouts - Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects - DC Transfer characteristics

Unit:2	DELAY AND POWER	11 hours

Delay: Introduction – Transient Response – RCF Delay Model - Linear Delay Model – **Power**: Introduction – Dynamic Power – Static Power – Energy Delay Optimization – Low Power Architectures

Unit:3	COMBINATIONAL CIRCUIT DESIGN	12 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor circuits - **Circuit Pitfalls**: Threshold Drops - Ratio Failures - Leakage - Charge Sharing - Power Supply Noise - Hot Spots - Minority Carrier Injection - Back-Gate Coupling - Diffusion Input Noise Sensitivity - Process Sensitivity - Domino Noise Budgets

Unit:4	SEQUENTIAL CIRCUIT DESIGN	11 hours

Introduction - Static latches and Registers - Dynamic latches and Registers - Pulse Registers, Sense Amplifier Based Register – Pipelining - Schmitt Trigger - Monostable Sequential Circuits - Astable Circuits.

Unit:5	DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM	12 hours

Arithmetic Building Blocks: Data Paths – Adders – Multipliers – Shifters – ALUs - Power and speed tradeoff's - **Designing Memory and Array structures**: Memory Architectures and Building Blocks - Memory Core - Memory Peripheral Circuitry.

Unit:6	**Contemporary Issues**	**2 hours**
Design of Arithmetic Building Blocks		
	Total Lecture Hours	**60 hours**

Text Book(s)	
1	Neil H. E. Weste, David Money Harris, “CMOS VLSI Design”, Pearson, 2017
2	Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, ‖Digital Integrated Circuits:A Design perspective‖, Second Edition , Pearson , 2016

Reference Books	
1	Wayne Wolf, Modern VLSI Design: System-on-Chip Design, Prentice-Hall, 2002
2	Etienne S, Sonia D Bendhia, “Basics of CMOS Cell Design”, McGraw-Hill, 2007
3	Douglas A. Punknell and Kamran Eshraghian , “Basic VLSI Design” PHI, 2009

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/101/117101058/
2	https://nptel.ac.in/courses/108/107/108107129/

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	M	S	S	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	S	S	S	M
CO5	S	S	S	M	S

*S-Strong; M-Medium; L-Low

Course code		LOW POWER VLSI DESIGN	L	T	P	C
Core/Elective/Supportive		Semester II: Elective - Group-C	4	0	0	4
Pre-requisite		Basic knowledge of VLSI Design	Syllabus Version	2021-22		

Course Objectives:

The main objectives of this course are to:

1. To study the concepts of device behavior and modeling
2. To study the concepts of low voltage, low power logic circuits.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic concept of Low Power Design	K2
2	Capability to recognize advanced issues in VLSI systems	K2
3	Understand CMOS technology and digital CMOS design styles.	K2
4	Analyze the development of Low Power Design	K4
5	Analyze the Low power in Algorithm and Architectural level	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	INTRODUCTION TO LOW POWER DESIGN	11 hours

Need for low power VLSI chips - Sources of power dissipation on Digital Integrated circuits - Emerging Low power approaches - Physics of power dissipation in CMOS devices - Dynamic dissipation in CMOS - Transistor sizing & Gate oxide thickness - Impact of technology Scaling - Technology and Device innovation

Unit:2	SIMULATION POWER ANALYSIS AND PROBABILISTIC POWER ANALYSIS	12 hours

SPICE circuit simulators - Gate level logic simulation - Capacitive power estimation - Static state power - Gate level capacitance estimation - Architecture level analysis - Monte Carlo simulation - Random logic signals - Probability and frequency - Probabilistic power analysis techniques - Signal entropy.

Unit:3	LOW POWER DESIGN	12 hours

Circuit level: Power consumption in circuits - Flip Flops and Latches design - High capacitance nodes - Low power digital cells library - **Logic level**: Gate reorganization - Signal gating - Logic encoding - State machine encoding - Pre computation logic.

Unit:4	LOW POWER ARCHITECTURE AND CLOCK DISTRIBUTION	12 hours

Power and Performance management - switching activity reduction - Parallel architecture with voltage reduction - Flow graph transformation - Low power arithmetic components - Power dissipation in clock distribution - Single driver vs Distributed buffers - Zero skew vs tolerable skew - Chip and package co-design of clock network

Unit:5	ALGORITHM AND ARCHITECTURAL LEVEL METHODOLOGIES	11 hours

Introduction - Design flow - Algorithmic level analysis and optimization - Architectural level estimation and synthesis.		
Unit:6	**Contemporary Issues**	**2 hours**
Chip and package co-design of clock network		
	Total Lecture Hours	**60 hours**

Text Book(s)	
1	Gary Yeap, “Practical Low Power Digital VLSI Design”, Springer, 2012
2	Kaushik Roy and Sharat C. Prasad, “Low-Power CMOS VLSI Circuit Design” ,Wiley-Interscience, 2000
3	Rabaey, M. Pedram, “Low Power Design Methodologies”, Kluwer Academic Publications, 1996.
Reference Books	
1	Dimitrios Soudris, Christian Piguet, Costas Goutis, “Designing CMOS circuits for low power”, Kluwer Academic Publishers,2002.
2	Christian Piguet, “Low-power CMOS circuits: technology, logic design and CAD tools”, CRC Press, Taylor & Francis Group, 2006.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105034/
2	https://nptel.ac.in/courses/117/101/117101004/

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	S	S
CO2	S	S	M	M	S
CO3	S	S	M	S	S
CO4	S	M	M	M	S
CO5	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Course code		VLSI DESIGN USING VERILOG	L	T	P	C
Core/Elective/Supportive		Semester III: Elective - Group-C	4	0	0	4
Pre-requisite		Knowledge of basic Digital electronic circuits	Syllabus Version			

Course Objectives:

The main objectives of this course are to:

1. Study and design digital circuits using Verilog HDL
2. Learn the design of VLSI circuits

2021-

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The ability to code and simulate any digital function in Verilog HDL	K4
2	Model digital systems in verilog HDL at different levels of abstraction	K5
3	Know the simulation techniques and test bench creation.	K2
4	Understand the design flow from simulation to synthesizable version	K2
5	Analyze the process of synthesis and post-synthesis	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	BASICS	11 hours

Synthesis – Design Process – Logic Value System – Logic value system – Bit-widths – Value Holders and Hardware Modeling –Logical operators – Arithmetic operators – Relational operators – Equality operators – Shift operators – Bitwise operators – Concatenation Operator – Operator Precedence

Unit:2	VERILOG CONSTRUCTS TO GATES	11 hours

Conditional Expression - Always Statement - If Statement - Inferring Latches from If Statements - Case Statement: Casez - Casex - Inferring Latches from Cases Statement - Full Case - Parallel Case - Non Constant as Case Item - Loop Statement - Functions - Tasks - Using Values X and Z - The Value x - The Value z

Unit:3	ADDITIONAL FEATURES OF VERILOG	12 hours

Arrays of Primitives - Arrays of Modules - Hierarchical Dereferencing - Parameters Substitution - Procedural Continuous Assignment - Intra Assignment Delay - Indeterminate Assignments and Race Condition – wait Statement – fork join Statement – Named Events – Constructs Supported by Synthesis Tools

Unit:4	MODELING EXAMPLES	12 hours

Modeling Combinational Logic - Modeling sequential logic - Modeling a memory - Writing Boolean equations - Modeling a counter - Modeling a parameterized adder - Modeling a parameterized comparator – Modeling a decoder – Modeling a multiplexer.

Unit:5	MODEL OPTIMIZATIONS AND VERIFICATION	12 hours

Resource Allocation – Common Sub-expressions – Moving Code – Common Factoring – Commutativity and Associativity – Dead-code elimination and Constant folding – Flip-flop and Latch optimizations – Design Size – Using Parentheses – A Test Bench – Delays in Assignment Statements – Unconnected Ports – Missing Latches

Unit:6	**Contemporary Issues**	**2 hours**
Parameters Substitution - Procedural Continuous Assignment		
	Total Lecture Hours	**60 hours**

Text Book(s)	
1	Bhasker J, " Verilog HDL Synthesis, A Practical Primer" , Star Galaxy Publishing, 2018
2	Micheal D. Ciletti, " Advanced Digital Design with the Verilog HDL", Pearson, 2011

Reference Books	
1	Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog", McGraw Hill , 2017
2	Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall, 2003

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105165/
2	https://onlinecourses.nptel.ac.in/noc19_cs72/preview

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	M	S	M	S
CO5	S	S	M	S	S

*S-Strong; M-Medium; L-Low

Course code		VLSI SYSTEM DESIGN LAB	L	T	P	C
Core/Elective/Supportive		Semester IV: Elective - Group-C	0	0	5	4
Pre-requisite		Knowledge of basic Mathematics, Digital Electronic circuits and Programming languages	Syllabus Version		2021-22	

Course Objectives:

The main objectives of this course are to:

1. Design and Test of multiplexers, coders and Test of flip-flops
2. Learn the design of FPGA based design methodology.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Design and test digital logic circuits on FPGA.	K6
2	Design combinational and sequential circuits at circuit level	K6
3	Implement efficient techniques at circuit level for improving power and speed of combinational and sequential circuits	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

	List of Experiments (Any 12 Experiments)	75 hours

1. Synchronous counter
2. Asynchronous counter
3. Clock divider and generator
4. FIFO Design
5. Multiplexer design
6. Encoder
7. Decoder
8. Comparator
9. Latches and flip flops
10. ALU Design
11. Parity generator
12. UART Module
13. SPI module
14. Memory module
15. Sequence detector

	Total Practical Hours	75 hours

Course Designed By:
Dr. D.Sathes Kumar, Department of ECS, Government Arts College, OOTY
Mrs.S.Sangeethavanathi, Department of Electronics, Sri Vasavi College, Erode

Mapping with Programme Outcomes					
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S

*S-Strong; M-Medium; L-Low

Annexure

BHARATHIAR UNIVERSITY : : COIMBATORE 641046
DEPARTMENT OF APPLIED ELECTRONICS

MISSION

- Excellence in education, grounded in ethics and critical thinking, for improvement of life.
- Build a learning ambience to enhance innovations, problem solving skills, leadership qualities, team-spirit and moral responsibilities
- Facilitate industry institution interaction in teaching, learning and consultancy to accomplish the technological needs of the society.
- To promote research culture in the emerging areas of Electronics and interdisciplinary domains

***ELECTIVE SUBJECTS**

Colleges can choose any one of the Group subjects as Electives

Course Code	Sem.	Title of the Course
GROUP - A		
	I	Web Technology
	II	Relational Data Base Management System
	III	LINUX and Shell Programming
	IV	RDBMS and LINUX Lab
GROUP - B		
	I	Electronic Test Instruments
	II	Analytical Instrumentation
	III	Virtual Instrumentation
	IV	Instrumentation Lab
GROUP - C		
	I	VLSI Design
	II	Low Power VLSI Design
	III	VLSI Design Using Verilog
	IV	VLSI System Design Lab