

B.Sc., ELECTRONICS & COMMUNICATION

Syllabus

Program Code: UEL

2023 - Onwards



MANNAR THIRUMALAI NAICKER COLLEGE

(AUTONOMOUS)

Re-accredited with “A⁺” Grade by NAAC

PASUMALAI, MADURAI – 625 004

MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS),
MADURAI – 625 004
B.SC ELECTRONICS AND COMMUNICATION CURRICULUM
(For the students admitted from the academic year 2023-2024 onwards)

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
FIRST SEMESTER						
Part – I	Tamil / Alternative Course					
23UTAGT11	தமிழ் இலக்கிய வரலாறு - I	6	3	25	75	100
Part – II	English					
23UENGE11	General English - I	6	3	25	75	100
Part - III	Core Courses					
23UELCC11	Electronic Devices	4	4	25	75	100
	Electronic Devices and Circuits Lab	2	-	-	-	-
Part - III	Elective Course					
23UELEC11	Applied Physics	4	4	25	75	100
	Applied Physics Lab	2	-	-	-	-
Part IV	Non Major Elective					
23UELNM11	Troubleshooting and Maintenance of Home Appliances	2	2	25	75	100
Part IV	Foundation Course					
23UELFC11	Fundamentals of Electricity	2	2	25	75	100
Part IV	Skill Enhancement course					
23UELSC11	Electronic Measurements	2	2	25	75	100
Total		30	20	175	525	700
SECOND SEMESTER						
Part – I	Tamil / Alternative Course					
23UTAGT21	தமிழ் இலக்கிய வரலாறு – II	6	3	25	75	100
Part – II	English					
23UENGE21	General English - II	6	3	25	75	100
Part - III	Core Courses					
23UELCC21	Electronic Circuits	4	4	25	75	100
23UELCP21	Electronic Devices and Circuits Lab	2	2	25	75	100
Part - III	Elective Course					
23UMTEA24	Basic Mathematics	4	4	25	75	100
23UELEP21	Applied Physics Lab	2	2	25	75	100
Part IV	Non Major Elective					
23UELNM21	Fundamentals of Computing	2	2	25	75	100
Part IV	Skill Enhancement course					
23UELSC21	Satellite Communication	2	2	25	75	100
23UELSC22	Cellular Phones	2	2	25	75	100
Total		30	24	225	675	900

*** During the first semester all the students will study 2 hours each for 23UELCP21 (Electronic Devices and Circuit Lab) and 23UELEP21 (Applied Physics Lab) for which the marks with due credits will be awarded in the second semester.**

Course Code	Title of the Course	Hrs	Credits	Maximum Marks		
				Int	Ext	Total
THIRD SEMESTER						
Part – I	Tamil / Alternative course					
23UTAGT31	தமிழக வரலாறும் பண்பாடும்	6	3	25	75	100
Part – II	English					
23UENGE31	General English - III	6	3	25	75	100
Part - III	Core courses					
23UELCC31	Digital Electronics	4	4	25	75	100
23UELCP31	Digital Electronics Lab	4	4	25	75	100
Part - III	Allied courses					
23UCSAC31	Programming in C & C++	4	4	25	75	100
23UCSAP31	Computer Programming C & C++ Lab	2	1	25	75	100
Part - IV	Skill Based courses					
23UELSC31	Electronic Equipments and Servicing	1	1	25	75	100
23UELSC32	Antenna and Wave Propagation	2	1	25	75	100
Part - IV	Mandatory course					
23UEVSG41	Environmental Studies	1	-	-	-	-
Total		30	21	200	600	800
FOURTH SEMESTER						
Part – I	Tamil / Alternative course					
23UTAGT41	தமிழும் அறிவியலும்	6	3	25	75	100
Part – II	English					
23UENGE41	General English - IV	6	3	25	75	100
Part - III	Core courses					
23UELCC41	Linear Integrated Circuits	5	5	25	75	100
23UELCP41	Linear Integrated Circuits Lab	4	4	25	75	100
Part - III	Allied course					
23UMTAC44	Numerical Methods	4	4	25	75	100
Part - IV	Skill Based courses					
23UELSC41	Fiber Optic Communication Systems	2	2	25	75	100
23UELSC42	Television Systems	2	2	25	75	100
Part - IV	Mandatory course					
23UEVSG41	Environmental Studies	1	2	25	75	100
Total		30	25	200	600	800

Course Code	Title of the Course	Hrs	Credi ts	Maximum Marks		
				Int	Ext	Total
FIFTH SEMESTER						
Part – III	Core courses					
23UELCC51	Microprocessor and Microcontroller	6	4	25	75	100
23UELCP51	Microprocessor and Microcontroller Programming Lab	4	3	25	75	100
23UELCC52	Industrial Automation	4	4	25	75	100
Part – III	Core project					
23UELPR51	Project with Viva - Voce	4	3	25	75	100
Part – III	Elective courses – I					
23UELEC51	Microwave and Radar Systems	5	4	25	75	100
23UELEC52	Internet of Things					
23UELEC53	PCB Design and Fabrication					
Part – III	Elective courses – II					
23UELEC54	Power Electronics	5	4	25	75	100
23UELEC55	VLSI Design					
23UELEC56	Mobile Computing					
Part – IV	Mandatory course					
23UVLEG51	Value Education	2	2	25	75	100
23UELIN51	Internship Report	-	1	25	75	100
Total		30	25	200	600	800
SIXTH SEMESTER						
Part – III	Core courses					
23UELCC61	Analog and Digital Communication Systems	6	5	25	75	100
23UELCP61	Electronic Communications and Measurements Lab	6	4	25	75	100
23UELCC62	Measurement Systems	6	5	25	75	100
Part – III	Elective courses – I					
23UELEC61	Digital Signal Processing	5	4	25	75	100
23UELEC62	Robotics					
23UELEC63	Automotive Electronics					
Part – III	Elective courses – II					
23UELEC64	Control Systems	5	4	25	75	100
23UELEC65	Computer Network					
23UELEC66	Design with PIC Microcontroller					
Part – IV	Skill course					
23UELSC61	Biomedical Instrumentation	2	2	25	75	100
Part – V	Extension activities					
23UNCET61, 23UNSET61, 23UPEET61, 23URRET61, 23UYRET61, 23UHFET61, 23UEOET61 & 23UHRET61	N.C.C, N.S.S, Physical Education, R.R.C, Y.R.C, Health and Fitness Club, ECO Club & Human Rights Club	-	1	25	75	100
Total		30	25	175	525	700
Grand total		180	140	1175	3525	4700

FIFTH SEMESTER



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Microprocessor and Microcontroller			
Course Code	23UELCC51	L	P	C
Category	Core	6	-	4

COURSE OBJECTIVES:

- To enable the students to learn about the microprocessor architecture, the instruction set of 8085 and to develop the programming skills.
- To learn To know various peripheral devices and to interface them with 8085
- To study the architecture, addressing modes and instruction set of 8051.
- To impart knowledge about assembly language programs of 8051.
- To impart knowledge of different types of external interfaces including LCD, Keyboard, stepper motor and sensors.

UNIT - I 8085 ARCHITECTURES 18

Architecture of 8085 -Instruction set – Data Transfer, Arithmetic, Logical, Branching and I/O Instruction, Instruction types- various Addressing Modes. Timing sequence- Instruction cycle- Machine cycle- Halt wait state-. ALP- Mnemonic, Op-code - simple Assembly language program flow chart stack and subroutines- Interrupts.

UNIT - II INTERFACE CONTROLLERS 18

Peripheral device – Programmable peripheral Interface (8255 A) - Programmable Interrupt controller (8259 A) - USART- Serial Communication Interface (8251). Programmable DMA Controller (8257). Interfacing –Analog to Digital Converter- Stepper Motor – Key Board & Display Interface.

UNIT - III 8051 MICROCONTROLLER 18

Intel 8051 microcontroller – Block Diagram, pin out – oscillator and clock – Program Counter and Data pointer, A and B registers, flags and program status word – Internal RAM – the Stack and Stack pointer – special functions registers – Internal ROM – I/O Pins, ports and circuits – External memory. Counters, Timers and Addressing Modes

UNIT - IV 8051 INSTRUCTIONS 18

Data exchanges – Logical operations – Byte level operation – Bit level logical operations – Rotate and swap operations – Arithmetic operations – Jump and call instructions – Interrupts and return.

UNIT - V 8051 PROGRAMMING 18

Assembly Language programming for 8051 Micro controller family – Arithmetic and Logical Programs – Interfacing Keyboard – Interfacing LED, LCD Display – A/D and D/A Interfacing.

Total Lecture Hours	90
----------------------------	-----------

BOOKS FOR STUDY:

- S. Ramesh Gaonkar, “Microprocessor Architecture Programming and applications with 8085/8080A” Wiley Eastern Limited (1986) ---- (Unit I & II)
- Kennath J. Ayala, “8051 Micro controller Architecture, Programming and Applications” Penram International Publishing ---- (Unit III, IV & V)
- Mohamed Ali Maszidi & Janice Gillispie Maszidi, “The 8051 Microcontroller and Embedded System”, Pearson Publishers.

BOOKS FOR REFERENCES:

- Aditya. P. Mathur, —Introduction to Microprocessors”, IIIrd Edition
- Douglas V. Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH, 2012
- Ayala J.K., —The 8051 Microcontroller: Architecture, programming and applications”, Penram International (2005) 3rd edition.

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/108/103/108103157/>
- ❖ <https://www.slideshare.net/>
- ❖ <https://www.tutorialspoint.com/microprocessor/index.htm>
- ❖ <https://lecturenotes.in/subject/22/microprocessor-and-microcontroller-MPMC>

Nature of Course	EMPLOYABILITY			✓	SKILL ORIENTED			ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made				New Course	✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Explain the 8085 microprocessor architecture and its instruction set.	K1 to K4
CO2	Interface the 8085 microprocessor with various peripheral devices.	K1 to K4
CO3	Describe architecture and operation of microcontroller 8051.	K1 to K4
CO4	Foster ability to understand the design concept of interfacing microcontroller with various peripherals	K1 to K4
CO5	Foster ability to understand the role of embedded systems in industry.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	3	3	3	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80
LESSON PLAN:					
UNIT	Microprocessor and Microcontroller			HRS	PEDAGOGY
I	8085 ARCHITECTURES			18	Power point presentation, ICT tools
	Architecture of 8085 -Instruction set – Data Transfer, Arithmetic, Logical, Branching and I/O Instruction, Instruction types- various Addressing Modes. Timing sequence- Instruction cycle- Machine cycle- Halt wait state-. ALP- Mnemonic, Op-code - simple Assembly language program flow chart stack and subroutines- Interrupts.				
II	INTERFACE CONTROLLERS			18	Power point presentation, ICT tools
	Peripheral device – Programmable peripheral Interface (8255 A) - Programmable Interrupt controller (8259 A) - USART- Serial Communication Interface (8251). Programmable DMA Controller (8257). Interfacing –Analog to Digital Converter- Stepper Motor – Key Board & Display Interface.				
III	8051 MICROCONTROLLER			18	Power point presentation, ICT tools
	Intel 8051 microcontroller – Block Diagram, pin out – oscillator and clock – Program Counter and Data pointer, A and B registers, flags and program status word – Internal RAM – the Stack and Stack pointer – special functions registers – Internal ROM – I/O Pins, ports and circuits – External memory. Counters, Timers and Addressing Modes				
IV	8051 INSTRUCTIONS			18	Power point presentation, ICT tools
	Data exchanges – Logical operations – Byte level operation – Bit level logical operations – Rotate and swap operations – Arithmetic operations – Jump and call instructions – Interrupts and return.				

V	8051 PROGRAMMING Assembly Language programming for 8051 Micro controller family – Arithmetic and Logical Programs – Interfacing Keyboard – Interfacing LED, LCD Display – A/D and D/A Interfacing.	18	Power point presentation, ICT tools
----------	--	-----------	--

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Microprocessor and Microcontroller Programming Lab			
Course Code	23UELCP51	L	P	C
Category	Core	-	4	3

COURSE OBJECTIVES:

- To develop the assembly language programming of Microprocessor 8085 and Microcontroller 8051 and to interface it with various peripheral devices
- To develop the assembly language program using data transfer instruction in 8085 & 8051.
- To develop the assembly language program using arithmetic instruction in 8085 & 8051.
- To develop the assembly language program using branch instruction in 8085 & 8051.
- To develop the assembly language program using interfacing instruction in 8085 & 8051.

List of Experiment using 8085 microprocessor

Addition / Subtraction

Multiplication / Division of 8 bit data

Block Data Transfer

Sum of N 8 bit Numbers

Smallest / Largest of N Numbers

To Arrange in Ascending / Descending order

Traffic Light Control Interface

LED Interface

List of Experiment using 8051 microcontroller

Addition / Subtraction of 8 / 16 bit Data

Multiplication / division 8 bit Data

Block Data Transfer

Smallest / Largest of N Numbers

To Arrange in Ascending / Descending Order

Sum of N 8 bit Numbers

1's and 2's Compliment of an Array (8 / 16bit)

Hexadecimal to decimal converter

Wave Form Generation

Stepper Motor Interface

Solid State Relay Interface

LCD Interface

WEB RESOURCES:

- ❖ http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php
- ❖ <http://vlabs.iitkgp.ernet.in/rtes/>
- ❖ **8085 microprocessor and 8051 microcontroller Kit user manual.**

Nature of Course	EMPLOYABILITY			✓	SKILL ORIENTED			ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made			New Course		✓

***Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.**

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Apply the fundamentals of assembly level programming of microprocessor and microcontroller	K1 to K4
CO2	Design and Develop program for real time interface	K1 to K4
CO3	Understand the array arrangement in memory cells	K1 to K4
CO4	Analyze the sensors output and motor control	K1 to K4
CO5	Design and develop embedded c program for input and output interfacing	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	2	3	2	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	2	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG

2 - MEDIUM

1 - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3

WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

Cycle	Microprocessor and Microcontroller Programming Lab	HRS	PEDAGOGY
I	8085 Programs Addition / Subtraction Multiplication / Division of 8 bit data Block Data Transfer Sum of N 8 bit Numbers	12	Practical demonstration
II	Smallest / Largest of N Numbers To Arrange in Ascending / Descending order Traffic Light Control Interface LED Interface	12	Practical demonstration
III	8051 Programs Addition / Subtraction of 8 / 16 bit Data Multiplication / division 8 bit Data Block Data Transfer Smallest / Largest of N Numbers	12	Practical demonstration
IV	To Arrange in Ascending / Descending Order Sum of N 8 bit Numbers 1's and 2's Compliment of an Array (8 / 16bit) Hexadecimal to decimal converter	12	Practical demonstration
V	Wave Form Generation Stepper Motor Interface Solid State Relay Interface LCD Interface	12	Practical demonstration

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)							
Internal	Cos	K Level	Aim and Apparatus	Algorithm and Flow chart	Coding for Assembly language and C language	Debugging and Execution	Result
CI AI	CO1	K1	5				
	CO2	K2		5			
	CO3	K3			5		
	CO4	K3				5	
	CO5	K4					5
Question Pattern CIA		No. of Questions to be asked	2	2	2	2	2
		No. of Questions to be answered	2	2	2	2	2
		Marks for each question	2.5	2.5	2.5	2.5	2.5
		Total Marks for each section	5	5	5	5	5

Distribution of Marks with K Level CIA									
	K Level	Aim and Apparatus	Algorithm and Flow chart	Coding for Assembly language and C language	Debugging and Execution	Result	Total Marks	% of (Marks without choice)	Consolidated %
CIA	K1	5					5	20	20
	K2		5				5	20	20
	K3			5	5		10	40	40
	K4					5	5	20	20
	Marks						25	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA Component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)							
Internal	Cos	K Level	Aim & Apparatus	Algorithm and Flow chart	Coding for Assembly language and C language	Debugging and Execution	Result
CI AI	CO1	K1	15				
	CO2	K2		15			
	CO3	K3			15		
	CO4	K3				15	
	CO5	K4					15
Question Pattern		No. of Questions to be asked	2	2	2	2	2
		No. of Questions to be answered	2	2	2	2	2
		Marks for each question	7.5	7.5	7.5	7.5	7.5
		Total Marks for each section	15	15	15	15	15

Distribution of Marks with K Level								
K Level	Aim & Apparatus	Algorithm and Flow chart	Coding for Assembly language and C language	Debugging and Execution	Result	Total Marks	% of (Marks without choice)	Consolidated %
K1	15					15	20	20
K2		15				15	20	20
K3			15	15		30	40	40
K4					15	15	20	20
Marks						75	100	100



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Industrial Automation			
Course Code	23UELCC52	L	P	C
Category	Core	4	-	4
COURSE OBJECTIVES:				
➤ To understand the concept of programmable logic controllers. ➤ To understand the Basic Language and Programming. ➤ To train the students to learn the Advanced Programming. ➤ To understand the concept of Communication and Networking. ➤ To Understand the Trouble shooting and maintenance of PLCs				
UNIT - I	INTRODUCTION TO PLCs			12
Definition and Applications-Overview of PLCs-Applications in industry -Components of a PLC System-CPU-Memory (RAM, ROM, Flash)-I/O Modules-Power Supply-PLC Standards and Architecture-Digital vs. Analog signals -Sinking/Sourcing concepts- Programming Languages and Basics				
UNIT - II	SCADA SYSTEMS OVERVIEW			12
Introduction to SCADA-SCADA Architecture-SCADA System Components-Communication Protocols-HMI Design & Development-SCADA Networking-Security & Troubleshooting-Applications				
UNIT - III	ADVANCED PLC PROGRAMMING CONCEPTS			12
Timers and Counters-Data Handling and Arithmetic Operations-Move, compare, and arithmetic instructions-Scaling and data conversion-Analog Input/Output Handling-Analog-to-digital conversion (ADC) and scaling-Addressing and data storage (bits, words, registers).				
UNIT - IV	PLC COMMUNICATION AND NETWORKING			12
Communication Protocols-Overview of PLC communication methods-Industrial protocols -HMI Integration-Introduction to Human-Machine Interface (HMI)-Connecting HMI to PLC-Networking PLCs-SCADA systems and integration with PLC				
UNIT - V	TROUBLESHOOTING, MAINTENANCE, AND APPLICATIONS			12
PLC Troubleshooting Techniques-Debugging software errors-Use of diagnostic tools-Safety Considerations-Practical Applications-Sequential process control -Real-world examples (traffic lights, packaging systems)-Future Trends in PLC				
Total Lecture Hours				60

BOOKS FOR STUDY:

- "Programmable Logic Controllers" by Frank D. Petruzella - A comprehensive introduction to PLCs and their programming.
- "PLC Programming for Industrial Automation" by William Bolton - Covers the basics of PLC programming and its applications.
- "Programmable Logic Controllers: An Emphasis on Design and Application" by Thomas D. Davies - Focuses on the design and application aspects of PLC programming.

BOOKS FOR REFERENCES:

- "Advanced PLC Programming" by David A. Nawrocki - Explores advanced PLC programming concepts, including networking and data exchange.
- 2. "PLC Programming: Principles and Applications" by John R. Hackworth - Covers advanced topics, such as PLC-based control systems and programming languages.
- 3. "Programmable Logic Controllers: Hardware and Programming" by Ronald W. Rockwell - Provides in-depth coverage of PLC hardware and programming

WEB RESOURCES:

- ❖ <https://unitronicsplc.com/what-is-plc-programmable-logic-controller/>
- ❖ <https://nptel.ac.in/courses/108105063>
- ❖ https://archive.nptel.ac.in/content/syllabus_pdf/108106022.pdf

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.								

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the concept of programmable logic controllers.	K1 to K4
CO2	Understand the Basic Language and Programming.	K1 to K4
CO3	Learn the Advanced Programming.	K1 to K4
CO4	Understand the concept of Communication and Networking	K1 to K4
CO5	Understand the Trouble shooting and maintenance of PLCs	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	M	M	S	S	S	M	S
CO2	L	M	L	S	M	M	M	S	M	S
CO3	M	S	M	L	S	L	M	S	L	M
CO4	M	M	S	M	L	M	L	S	M	S
CO5	M	M	M	M	S	S	M	S	S	M

S- STRONG		M – MEDIUM			L - LOW	
CO / PO MAPPING:						
COS	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	3	3	1	3	1	
CO 2	2	2	2	3	1	
CO 3	2	2	2	3	2	
CO 4	1	3	1	3	3	
CO 5	2	1	1	3	2	
WEIGHTAGE	10	11	7	15	9	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	66	73	46	100	60	
LESSON PLAN:						
UNIT	Industrial Automation			HRS	PEDAGOGY	
I	INTRODUCTION TO PLCs : Definition and Applications-Overview of PLCs-Applications in industry -Components of a PLC System-CPU-Memory (RAM, ROM, Flash)-I/O Modules-Power Supply-PLC Standards and Architecture-Digital vs. Analog signals -Sinking/Sourcing concepts- Programming Languages and Basics			12	Lecture, Chalk, PPT, ICT	
II	PROGRAMMING LANGUAGES AND BASICS : Introduction to SCADA-SCADA Architecture-SCADA System Components-Communication Protocols-HMI Design & Development-SCADA Networking-Security & Troubleshooting-Applications			12	Lecture, Chalk, PPT, ICT	
III	ADVANCED PLC PROGRAMMING CONCEPTS : Timers and Counters-Data Handling and Arithmetic Operations-Move, compare, and arithmetic instructions-Scaling and data conversion-Analog Input / Output Handling-Analog-to-digital conversion (ADC) and scaling-Addressing and data storage (bits, words, registers).			12	Lecture, Chalk, PPT, ICT	
IV	PLC COMMUNICATION AND NETWORKING : Communication Protocols-Overview of PLC communication methods-Industrial protocols -HMI Integration-Introduction to Human-Machine Interface (HMI)-Connecting HMI to PLC-Networking PLCs-SCADA systems and integration with PLC			12	Lecture, Chalk, PPT, ICT	
V	TROUBLESHOOTING, MAINTENANCE, AND APPLICATIONS : PLC Troubleshooting Techniques-Debugging software errors-Use of diagnostic tools-Safety Considerations-Practical Applications-Sequential process control -Real-world examples (traffic lights, packaging systems)-Future Trends in PLC			12	Lecture, Chalk, PPT, ICT	

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Articulation Mapping - K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2	3.6	7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Project with Viva - Voce			
Course Code	23UELPR51	L	P	C
Category	Core	4	-	3

COURSE OBJECTIVES:

- To provide students for knowledge of Electronics components and soldering techniques and its package information for electronics circuit design.
- Knowledge for the assembling of electronics circuit with components on PCB (Printed Circuit Board) of circuit design.
- Design and development of small electronic project based on hardware and software for electronics systems.
- Design and development of IoT based Industrial Project.
- Design and development of innovative projects using Embedded Systems.

Course Description

The Project is conducted by the following Course Pattern.

Guidelines For Internship:

1. There will be one Faculty guide.
2. Individual Project can be done by student in industry or in person.
3. A Group of two students can be joined to do a project under HoD's and Principals approval
4. The student/students should submit a Project Report (Maximum 30 Pages).
5. The Marks for Project Report will be awarded only on the basis of the Project Report with Viva - Voce.

Internal

Presentation
Submission

25

External

Project Report
Viva Voce

75

Total - 100

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/108/106/108106151/>
- ❖ https://swayam-uat-node1.appspot.com/practice_course1/preview
- ❖ <https://www.mooc-list.com/tags/digital-signal-processing>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made		✓	New Course		
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

COURSE OUTCOMES:										K LEVEL	
After studying this course, the students will be able to:											
CO1	Demonstrate a technical knowledge of their selected project topic									K1 to K4	
CO2	Undertake problem identification, formulation and solution									K1 to K4	
CO3	Design engineering solutions to complex problems utilizing a system approach									K1 to K4	
CO4	Conduct an engineering project									K1 to K4	
CO5	Demonstrate the knowledge, skills and attitudes of a professional electronics students									K1 to K4	
MAPPING WITH PROGRAM OUTCOMES:											
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	
CO1	2	3	3	2	3	2	3	1	2	3	
CO2	2	2	2	3	2	2	3	2	2	1	
CO3	3	3	3	2	2	1	1	3	3	2	
CO4	2	2	2	3	3	3	1	1	2	3	
CO5	2	2	3	3	3	1	2	2	3	3	
3- STRONG			2 – MEDIUM					1 - LOW			
CO / PO MAPPING:											
COS		PSO1		PSO2		PSO3		PSO4		PSO5	
CO 1		3		3		2		2		3	
CO 2		3		3		3		3		1	
CO 3		3		3		2		2		2	
CO 4		2		2		3		3		3	
CO 5		3		3		2		3		3	
WEIGHTAGE		14		14		12		13		12	
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS		93		93		80		86		80	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Microwave and Radar Systems			
Course Code	23UELEC51	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ To impart knowledge on the working principle of microwave tube, microwave solid state device and communication systems. ➤ To gain knowledge on the operation of Microwave tubes and Microwave solid state devices. ➤ To understand the concepts of Microwave Communication Devices. ➤ To understand the concepts of Microwave Communication Systems. ➤ To gain knowledge on Radar Communication systems.				
UNIT – I INTRODUCTION TO MICROWAVES				15
Introduction – Maxwell's Equations – Types of Wave Guides – TE and TM Modes – Propagation of TM Waves in Rectangular Wave Guide – TM Modes in Rectangular Wave Guide.				
UNIT – II MICROWAVE TUBES				15
High Frequency limitation of conventional tubes – Principle of velocity modulation – Klystron amplifiers – Reflex Klystrons – Magnetron oscillators – Travelling wave tubes – Backward oscillators.				
UNIT - III MICROWAVE SOLID STATE DEVICES				15
High Frequency limitations – Microwave transistors – Varactor diode – Parametric amplifier – Tunnel diodes – Theory of negative resistance amplifiers – Gunn effect – Gunn diode oscillators – Avalanche effect IMPATT and TRAPATT diodes – Lasers and Masers.				
UNIT - IV MICROWAVE COMMUNICATION SYSTEMS				15
Micro wave Antennas - Microwave system block diagram – Repeaters – Need for diversity – Frequency and space diversity – Protection switching arrangements – Microwave radio communication- system gain.				
UNIT - V RADAR SYSTEMS				15
Radar range equations – Mono static and bio static radars – CW (Continuous wave) Radar – Frequency modulated CW radar – MTI and pulse Doppler radar – Duplexers – displays- radar antennas.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- Reich J.H., MICROWAVE PRINCIPLES, Van nostrand Reinhold co., 1st edition, 1987.
- George Kennedy, Bernard Davis and S R M Prasanna, Electronic Communication System McGrawhill Education, Sixth Edition

BOOKS FOR REFERENCES:

- Tomasi w. —ADVANCED ELECTRONIC COMMUNICATION SYSTEMS, Prentice Hall International, 1987.
- Liao Y.S., —MICROWAVE DEVICE AND CIRCUITS, Prentice Hall of India, 3rd Edition, 5 th reprint 1992.
- Solink M.I., —INTRODUCTION TO RADAR SYSTEMS, McGraw Hill, 2nd Edition, 1992.

WEB RESOURCES:

- ❖ https://onlinecourses.nptel.ac.in/noc19_ee58/preview
- ❖ <https://nptel.ac.in/courses/108/105/108105154/>
- ❖ <https://www.classcentral.com/course/swayam-microwave-engineering-14199>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		10%	No Changes Made			New Course		
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.									

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the theory of microwave and Radar systems	K1 to K4
CO2	Discuss the working of microwave amplifiers, oscillators and devices.	K1 to K4
CO3	Design and analyze the microwave amplifiers, oscillator and devices.	K1 to K4
CO4	Illustrate the different types of radar systems	K1 to K4
CO5	Evaluate the concepts of Radar transmitter and receiver.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

LESSON PLAN:

UNIT	Microwave and Radar Systems	HRS	PEDAGOGY
I	Introduction to Microwaves: Introduction – Maxwell's Equations – Types of Wave Guides – TE and TM Modes – Propagation of TM Waves in Rectangular Wave Guide – TM Modes in Rectangular Wave Guide	15	Power point presentation, ICT tools
II	Microwave Tubes: High Frequency limitation of conventional tubes – Principle of velocity modulation – Klystron amplifiers – Reflex Klystrons – Magnetron	15	Power point presentation, ICT tools
III	Microwave Solid State Devices: High Frequency limitations – Microwave transistors – Varactor diode – Parametric amplifier – Tunnel diodes – Theory of negative resistance amplifiers – Gunn effect – Gunn diode oscillators – Avalanche effect IMPATT and TRAPATT diodes – Lasers and Masers.	15	Power point presentation, ICT tools
IV	Microwave communication Systems: Micro wave Antennas - Microwave system block diagram – Repeaters – Need for diversity – Frequency and space diversity – Protection switching arrangements – Microwave radio communication- system gain.	15	Power point presentation, ICT tools
V	Radar Systems: Radar range equations – Mono static and bistatic radars – CW (Continuous wave) Radar – Frequency modulated CW radar – MTI and pulse Doppler radar – Duplexers – displays- radar antennas.	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Internet of Things			
Course Code	23UELEC52	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ To enable the students to learn about IoT ➤ To understand the concept of data and device management. ➤ To enable the students to learn about the Programming Fundamentals With C Using Arduino ➤ To understand the interfacing concepts. ➤ To gain knowledge about the applications in IoT				
UNIT - I	IoT Fundamentals			15
Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT – Things in IoT and IoT Protocols.				
UNIT - II	IoT M2M			15
Introduction-IoT/M2M systems - Communication Technologies - Data management, data consolidation and Device management - Ease of Designing and Affordability.				
UNIT - III	PROGRAMMING FUNDAMENTALS WITH C USING ARDUINO IDE			18
Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators – Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.				
UNIT - IV	SENSORS AND ACTUATORS			15
Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino.				
UNIT - V	SENDING SENSOR DATA OVER INTERNET			15
Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform .				
Total Lecture Hours				75

BOOKS FOR STUDY:

- A. ArshdeepBahga, Vijay Madiseti, “*Internet of Things: A Hands-On Approach*”, Orient Blackswan Pvt. Ltd., First edition, 2015
- Boris Adryan, DominikObermaier, Paul Fremantle, —**The Technical Foundations of Iot**”, Artech Houser Publishers, 2017.

BOOKS FOR REFERENCES:

- Michael Margolis, —**Arduino Cookbook**”, O’Reilly, 2011
- Marco Schwartz, —**Internet of Things with ESP8266**”, Packt Publishing, 2016
- D. Charles Bell, “MySQL for the Internet of Things”, Apress, First edition, 2016.

WEB RESOURCES:

- ❖ [https://nptel.ac.in/courses/106/105/106105166/Introduction to IoT Part I – Lecture 1](https://nptel.ac.in/courses/106/105/106105166/Introduction%20to%20IoT%20Part%20I%20-%20Lecture%201)
- ❖ [https://ocw.cs.pub.ro/courses/iot/courses/02Electronics for Internet of Things – Lecture II](https://ocw.cs.pub.ro/courses/iot/courses/02Electronics%20for%20Internet%20of%20Things%20-%20Lecture%20II)
- ❖ [https://nptel.ac.in/courses/106105166/Introduction to Arduino – I – Lecture 22](https://nptel.ac.in/courses/106105166/Introduction%20to%20Arduino%20-%20I%20-%20Lecture%2022)

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change		25%	No Changes Made			New Course		
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.									

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Study the concept of basic IoT	K1 to K4
CO2	Familiarize the principle of connected devices	K1 to K4
CO3	Gain knowledge about embedded devices	K1 to K4
CO4	Analyze different sensor Interface technology	K1 to K4
CO5	Analyze the IoT applications	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	3	3	3	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Internet of things	HRS	PEDAGOGY
I	IoT Fundamentals Introduction to IoT: Evolution of IoT – Definition & Characteristics of IoT - Architecture of IoT – Technologies for IoT – Developing IoT Applications – Applications of IoT – Industrial IoT – Security in IoT - Things in IoT and IoT Protocols.	15	Power point presentation, ICT tools
II	IoT M2M Introduction-IoT/M2m systems - Communication Technologies - Data management, data consolidation and Device management - Ease of Designing and Affordability.	15	Power point presentation, ICT tools
III	Programming Fundamentals With C Using Arduino IDE Arduino IDE – Basic Syntax – Data Types/ Variables/ Constant – Operators –Conditional Statements and Loops – Using Arduino C Library Functions for Serial, delay and other invoking Functions – Strings and Mathematics Library Functions.	15	Power point presentation, ICT tools
IV	Sensors and Actuators Analog and Digital Sensors – Interfacing temperature sensor, ultrasound sensor and infrared (IR) sensor with Arduino – Interfacing LED and Buzzer with Arduino	15	Power point presentation, ICT tools
V	Sending Sensor Data over Internet Introduction to ESP8266 NODEMCU WiFi Module – Programming NODEMCU using Arduino IDE – Using WiFi and NODEMCU to transmit data from temperature sensor to Open Source IoT cloud platform	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Articulation Mapping						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	

**MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)****DEPARTMENT OF ELECTRONICS AND COMMUNICATION****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	PCB Design and Fabrication			
Course Code	23UELEC53	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ To inculcate the knowledge of PCB design ➤ To impart knowledge on various methods of laying out a PCB ➤ To learn how to etch and solder ➤ To understand layout and art work. ➤ To understand the concept so transmission line, crosstalk and thermal issues.				
UNIT – I	TYPES OF PCB			15
Single sided layer – double sided layer – Multilayer – Types of PCB board – Plated through holes technology–Benefits of Surface Mount Technology(SMT)–Limitation of SMT–Surface mount components: Resistors, Capacitor, Inductor, Diode and IC’s.				
UNIT – II	LAYOUT AND ARTWORK			15
Planning – General Rules of Layout – Resistance, Capacitance and Inductance – Conductor Spacing – Supply and Ground Conductors – Component Placing and Mounting – Cooling Requirement and Package Density–Layout Check Basic Artwork Approaches–Artwork Taping Guidelines – General Artwork Rules – Artwork Check and inspection.				
UNIT – III	LAMINATES AND PHOTO PRINTING			15
Manufacture of Copper Clad Laminates–Properties of Laminates–Types of Laminates–Manual Cleaning Process – Basic Printing Process for Double Sided PCB’s – Photo Resists – Wet Film Resists – Coating Process for Wet Film Resists – Exposure and Further Process for Wet Film resists–Dry Film Resists.				
UNIT - IV	ETCHING AND SOLDERING			15
Introduction – Etching Machine – Etchant System - Soldering: Principles of Solder Connection – Solder Joints–Solder Alloys–Soldering Fluxes–Soldering Tools: Soldering–De-soldering Tools and Techniques–Man Soldering–Solder Mask– Safety, Health and Medical Aspects in Soldering Practice.				
UNIT - V	DESIGN RULES AND AUTOMATION			15
Reflection–Crosstalk–Ground and Supply Line Noise–Electromagnetic Interference from Pulse Type EM Fields and Automation–Automated Artwork Drafting–CAD.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- Walter C. Bosshart, —PCB Design and Technology, Tata McGraw Hill Publications, Delhi 1983
- RSK handpur, —Printed Circuit Board by Tata McGraw Hill Education Pvt Ltd., New Delhi

BOOKS FOR REFERENCES:

- S D Mehta, —Electronic Product Design Volume-I SC hand Publications

WEB RESOURCES:

- ❖ <https://www.wikihow.com/Create-Printed-Circuit-Boards>
- ❖ http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/
- ❖ https://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself
- ❖ <https://www.youtube.com/watch?v=mv7Y0A9YeUc>
- ❖ <https://www.youtube.com/watch?v=imQTCW1yWkg>

Nature of Course	EMPLOYABILITY				SKILL ORIENTED			ENTREPRENEURSHIP		✓
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		✓	GLOBAL	
Changes Made in the Course	Percentage of Change				No Changes Made		✓	New Course		
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Classify the board sand layers	K1 to K4
CO2	Design layout and make use of the photo printing and etching techniques	K1 to K4
CO3	Understand basic concepts of transmission line, cross talk and thermal issues	K1 to K4
CO4	Understand the design rules and automation techniques	K1 to K4
CO5	Design (schematic and layout) PCB for analog circuits, digital circuits and Mixed circuits	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	3	3	2	2	2	2	3	2	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 - MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	PCB Design and Fabrication	HRS	PEDAGOGY
I	Types Of PCB Single sided layer – double sided layer – Multilayer – Types of PCB board - Plated through holes technology–Benefits of Surface Mount Technology(SMT)–Limitation of SMT–Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's.	15	Power point presentation, ICT tools
II	Layout And Artwork Planning – General Rules of Layout – Resistance, Capacitance and Inductance – Conductor Spacing – Supply and Ground Conductors – Component Placing and Mounting – Cooling Requirement and Package Density–Layout Check Basic Artwork Approaches–Artwork Taping Guidelines – General Artwork Rules – Artwork Check and inspection.	15	Power point presentation, ICT tools
III	Laminates and Photo Printing Manufacture of Copper Clad Laminates–Properties of Laminates–Types of Laminates–Manual Cleaning Process – Basic Printing Process for Double Sided PCB's – Photo Resists – Wet Film Resists – Coating Process for Wet Film Resists – Exposure and Further Process for Wet Film resists–Dry Film Resists	15	Power point presentation, ICT tools
IV	Etching and Soldering Introduction – Etching Machine – Etchant System - Soldering: Principles of Solder Connection – Solder Joints–Solder Alloys–Soldering Fluxes–Soldering Tools: Soldering–De-soldering Tools and Techniques–Man Soldering–Solder Mask– Safety, Health and Medical Aspects in Soldering Practice.	15	Power point presentation, ICT tools
V	Design Rules And Automation Reflection–Crosstalk–Ground and Supply Line Noise–Electromagnetic Interference from Pulse Type EM Fields and Automation–Automated Artwork Drafting–CAD	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Articulation Mapping						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B				(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C				(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	

**MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)****DEPARTMENT OF ELECTRONICS AND COMMUNICATION****FOR THOSE WHO JOINED IN 2023-2024 AND AFTER**

Course Name	Power Electronics			
Course Code	23UELEC54	L	P	C
Category	Core Elective	5	-	4
COURSE OBJECTIVES:				
➤ To presents the principles and applications of industrial and power electronics ➤ To enable the students to learn and design industrial and power electronic circuits ➤ To develop the circuits designing skills related to the power electronics and understood the concept of industrial electronics ➤ To understand the concept of cyclo converter and chopper ➤ To enable the students to how to utilize the industrial and power electronic circuits				
UNIT - I	THYRISTORS	15		
Introduction– Principles, Construction, Operation and Characteristics of SCR – Two Transistor Model – TRIAC – DIAC – GTO – SCS – SUS – SBS – LASCR – MOSFET – UJT– Relaxation Oscillator – PUT.				
UNIT - II	TURN ON/OFF MECHANISMS	15		
Introduction– Types of Turn on Methods: AC Gate Triggering: Forward Voltage Triggering– Thermal Triggering– Radiation Triggering– DC Gate Triggering: Pulse Triggering – Types of Turn Off Methods: Natural Commutation – Forced Commutation: Self Commutation – Complimentary Commutation – Auxiliary Commutation – External Pulse Commutation—Line Commutation – Thyristor Rating.				
UNIT - III	CONTROLLED RECTIFIERS & INVERTERS	15		
Introduction– Single phase Half Wave Controlled Rectifiers with Resistive Load – HWCR with Inductive Load – HWCR with Free Wheeling Diode – Single phase Full Wave Controlled Rectifiers with Resistive, Inductive Loads–FWCR with Freewheeling Diode-INVERTERS: Single Phase Half & Full Bridge Voltage - UPS.				
UNIT - IV	CYCLO CONVERTERS AND CHOPPERS	15		
Introduction – Single Phase Centre Tapped Step-Up Cyclo Converter – Single Phase Centre Tapped Step-Down Cyclo Converter – Three Phase to Single Phase Cyclo converter—Three Phase To Three Phase Cyclo Converters— Step-up and Step-down Choppers.				
UNIT - V	APPLICATIONS	15		
Introduction –Dielectric Heating – Induction Heating – SMPS – UPS – Static Circuit Breaker – Battery Charger –Emergency Lighting System – Time Delay Control – Static Switches.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- MDSingh, —**Power Electronics**l, 2nd Edition, Tata-McGrawHill, 2007.
- M.Ramamoorthy,—**Thyristor and their Applications**l, 2nd Edition, East West Pvt.Ltd, 1999

BOOKS FOR REFERENCES:

- Harish C Rai, “**Industrial and Power Electronics**” 10th edition, Umesh publications 2002
- Timothy J Maloni, “**Industrial Solid State Electronic Devices and Circuits**” 2nd edition 1986

WEB RESOURCES:

- ❖ <https://www.youtube.com/watch?v=1Auay7ja2oY>
- ❖ <https://www.youtube.com/watch?v=oqnLQVFaqYI>
- ❖ <https://www.youtube.com/watch?v=naxnRkOfh2Q>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change		25%	No Changes Made				New Course		
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Developed the Circuit designing skills power electronics.	K1 to K4
CO2	Understood the concept industrial electronics system design.	K1 to K4
CO3	Acquire knowledge about basic concepts and techniques used in power electronics.	K1 to K4
CO4	Ability to analyze various single phase and three phase power converter circuits and understand their applications.	K1 to K4
CO5	Foster ability to identify basic requirements for power electronics based design application.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG**2 – MEDIUM****1 - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

LESSON PLAN:

UNIT	Power Electronics	HRS	PEDAGOGY
I	Thyrister Introduction– Principles, Construction, Operation and Characteristics of SCR – Two Transistor Model –TRIAC – DIAC – GTO – SCS – SUS – SBS – LASCR – MOSFET – UJT– Relaxation Oscillator – PUT	15	Power point presentation, ICT tools
II	Turn ON/OFF Mechanisms Introduction– Types of Turn on Methods: AC Gate Triggering: Forward Voltage Triggering– Thermal Triggering– Radiation Triggering– DC Gate Triggering: Pulse Triggering – Types of Turn Off Methods: Natural Commutation – Forced Commutation: Self Commutation – Complimentary Commutation – Auxiliary Commutation – External Pulse Commutation—Line Commutation – Thyristor Rating	15	Power point presentation, ICT tools
III	Controlled Rectifiers & Inverters Introduction– Single phase Half Wave Controlled Rectifiers with Resistive Load – HWCR with Inductive Load – HWCR with Free Wheeling Diode – Single phase full wave Controlled RectifierswithResistive,InductiveLoads– FWCRwithFreewheelingDiode–INVERTERS: Single Phase Half & Full Bridge Voltage - UPS	15	Power point presentation, ICT tools
IV	Cyclo Converters and Choppers Introduction – Single Phase Centre Tapped Step-Up Cyclo Converter – Single Phase Centre Tapped Step- Down Cyclo Converter – Three Phase to Single Phase Cyclo converter—Three Phase To Three Phase Cyclo Converters— Step-up and Step-down Choppers	15	Power point presentation, ICT tools
V	Applications Introduction –Dielectric Heating – Induction Heating – SMPS – UPS – Static Circuit Breaker – Battery Charger –Emergency Lighting System – Time Delay Control – Static Switches	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B				(5 x 5 = 25 Marks)
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C				(5 x 8 = 40 Marks)
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	VLSI Design			
Course Code	23UELEC55	L	P	C
Category	Core Elective	5	-	4
COURSE OBJECTIVES: ➤ To provide knowledge on VLSI fabrications. ➤ To understand the electrical properties of MOS Devices. ➤ To understand the design rules for layout diagrams. ➤ To gain knowledge on VLSI physical design and styles. ➤ To gain knowledge to apply test principles.				
UNIT - I VLSI Technology				15
Fabrication sequence – process flow – Testing – Super integration concepts – Integrated Passive components – MOS Resistors and capacitors – Crossovers – NMOS – PMOS – CMOS – BICMOS fabrication processes – comparison.				
UNIT - II Electrical Properties of MOS Devices				15
Drain to source current (I_{ds}) versus Drain to source voltage (V_{ds}) relationships – MOS transistor threshold voltage (V_t) – MOS transistor trans-conductance g_m and output conductance g_{ds} – figure of merit (ω_0) – pass transistor- pull – up to pull – down ratio.				
UNIT - III Design Processes				15
VLSI design flow - stick diagram design rules with examples - Design rules for Layout diagrams of digital circuits– sheet resistance R_s –standard unit of capacitance – Inverter delays – Propagation delays- scaling of MOS circuits – limitations of scaling.				
UNIT - IV VLSI Physical Design And Styles				15
Physical Design: Floor Planning – Placement – Routing – Power Delay Estimation – Clock Routing – Power Routing. VLSI Design Styles: Full Custom – Semi custom – Standard Cells – Gate Arrays – FPGAs – CPLDs.				
UNIT - V Testing Of VLSI Circuits				15
Test Principles-BIST-Test Bench- Combinational Circuit Testing, Sequential Circuit Testing, Test Bench Techniques.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- **Basic VLSI Design, Douglas, 3rd Edition, A. Pucknell, Kamran Eshraghian, PHI, New Delhi, 2011.**
- **Modern VLSI design, Wayne Wolf, 3rd Edition, Pearson Education, New Delhi, 4th impression 2008.**

BOOKS FOR REFERENCES:

- **Introduction to VLSI Circuits and Systems, John .P. Uyemura, John Wiley, Student Edition, New Delhi, Reprint 2006.**
- **Principles of CMOS VLSI Design, N.H.E Weste ,K.Eshraghian, Addison Wesley, 2nd Edition, New Delhi.**
- **Application Specific Integrated Circuits, Michel John Sebastian Smith, Addison Wesley, Indian Edition, 4th Indian Reprint 2001, New Delhi**

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/117/101/117101058/>
- ❖ <https://www.youtube.com/watch?v=9SnR3M3CI4>
- ❖ <https://www.youtube.com/watch?v=Y8FvvzcocT4>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made		✓	New Course		
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Gain the knowledge on fabrication principles.	K1 to K4
CO2	Able to analyze the electrical properties of MOS transistors.	K1 to K4
CO3	Apply the appropriate layout design rule to create a VLSI layout for a design.	K1 to K4
CO4	Understand the physical design steps and gain the knowledge on types of VLSI design styles	K1 to K4
CO5	Gain the knowledge, analyze and apply test principles to evaluate the VLSI designs.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG**2 – MEDIUM****1 - LOW**

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

LESSON PLAN:

UNIT	VLSI Design	HRS	PEDAGOGY
I	VLSI Technology Fabrication sequence – process flow – Testing – Super integration concepts – Integrated Passive components – MOS Resistors and capacitors – Crossovers – NMOS – PMOS – CMOS – BICMOS fabrication processes – comparison.	15	Power point presentation, ICT tools
II	Electrical Properties of MOS Devices Drain to source current (I_{ds}) versus Drain to source voltage (V_{ds}) relationships – MOS transistor threshold voltage (V_t) – MOS transistor trans-conductance g_m and output conductance g_{ds} – figure of merit (ω_0) – pass transistor- pull – up to pull – down ratio.	15	Power point presentation, ICT tools
III	Design Processes VLSI design flow - stick diagram design rules with examples - Design rules for Layout diagrams of digital circuits– sheet resistance R_s – standard unit of capacitance – Inverter delays – Propagation delays- scaling of MOS circuits – limitations of scaling.	15	Power point presentation, ICT tools
IV	VLSI Physical Design And Styles Physical Design: Floor Planning – Placement – Routing – Power Delay Estimation – Clock Routing – Power Routing. VLSI Design Styles: Full Custom – Semi custom – Standard Cells – Gate Arrays – FPGAs –	15	Power point presentation, ICT tools

	CPLDs.		
V	Testing Of VLSI Circuits Test Principles-BIST-Test Bench- Combinational Circuit Testing, Sequential Circuit Testing, Test Bench Techniques	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Mobile Computing			
Course Code	23UELEC56	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ This course will give you an understanding of mobile computer systems. ➤ Particularly in the context of wireless network systems such as 2G/3G/4G mobile telephony. ➤ To gain the knowledge of Data networks, and other wireless networks and infrastructure. ➤ The course emphasizes how to interface hardware to mobile computing devices and programming those devices ➤ To understand the concept of Data and knowledge management.				
UNIT - I	INTRODUCTION			15
Mobile and Wireless Devices – Simplified Reference Model – Need For Mobile Computing – Wireless Transmissions – Multiplexing – Spread Spectrum and Cellular Systems – Medium Access Control – SDMA – FDMA – TDMA –CDMA- Comparison of Access Mechanisms				
UNIT - II	WIRELESS NETWORKS			15
Wireless LAN: Infrared vs. Radio Transmission – Infrastructure Networks- Ad hoc Networks IEEE 802.11– HIPERLAN – Bluetooth- Wireless ATM: Working Group- Services Reference Model – Functions – Radio Access Layer – Handover- Location Management Addressing Mobile Quality of Service- Access Point Control Protocol				
UNIT - III	MOBILE NETWORK LAYER			15
Mobile IP: Goals – Assumptions and Requirement – Entities – IP Packet Delivery- Agent Advertisement and Discovery – Registration – Tunneling and Encapsulation – Optimization – Reverse Tunneling – Ipv6 – DHCP-Ad Hoc Networks				
UNIT - IV	MOBILE TRANSPORT LAYER			15
Traditional TCP- Indirect TCP- Snooping TCP- Mobile TCP - Fast Retransmit/ Fast Recovery- Transmission/Timeout Freezing – Selective Retransmission- Transaction Oriented TCP				
UNIT - V	WAP			15
Architecture – Datagram Protocol- Transport Layer Security- Transaction Protocol- Session Protocol- Application Environment-Wireless Telephony Application				
Total Lecture Hours				75

BOOKS FOR STUDY:

- J.Schiller, Mobile Communication, Addison Wesley, 2000.
- William Stallings, Wireless Communication and Networks, Pearson Education, 2003

BOOKS FOR REFERENCES:

- William C.Y.Lee, Mobile Communication Design Fundamentals, John Wiley, 1993.
- Singhal, WAP-Wireless Application Protocol, Pearson Education, 2003.

WEB RESOURCES:

- ❖ <https://archive.nptel.ac.in/courses/106/105/106105160/>
- ❖ https://www.pvpsiddhartha.ac.in/dep_it/lecture%20notes/MC/unit2.pdf
- ❖ <https://www.geeksforgeeks.org/wireless-application-protocol/>

Nature of Course	EMPLOYABILITY			SKILL ORIENTED			ENTREPRENEURSHIP			✓	
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL		✓	GLOBAL		
Changes Made in the Course	Percentage of Change				No Changes Made				New Course		✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.											

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Gain the knowledge of Mobile environments and communications systems.	K1 to K4
CO2	Able to analyze the Hardware devices and interacting with these devices	K1 to K4
CO3	Gain the knowledge of Mobile operating systems available.	K1 to K4
CO4	Understand the Programming applications on a mobile system	K1 to K4
CO5	Gain the knowledge Data and knowledge management.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG**2 – MEDIUM****1 - LOW****CO / PO MAPPING:**

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3

CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

LESSON PLAN:

UNIT	Mobile Computing	HRS	PEDAGOGY
I	INTRODUCTION Mobile and Wireless Devices – Simplified Reference Model – Need For Mobile Computing – Wireless Transmissions – Multiplexing – Spread Spectrum and Cellular Systems – Medium Access Control – SDMA – FDMA – TDMA –CDMA- Comparison of Access Mechanisms	15	Power point presentation, ICT tools
II	WIRELESS NETWORKS Wireless LAN: Infrared vs. Radio Transmission – Infrastructure Networks- Ad hoc Networks IEEE 802.11– HIPERLAN – Bluetooth- Wireless ATM: Working Group- Services Reference Model – Functions – Radio Access Layer – Handover- Location Management Addressing Mobile Quality of Service- Access Point Control Protocol	15	Power point presentation, ICT tools
III	MOBILE NETWORK LAYER Mobile IP: Goals – Assumptions and Requirement – Entities – IP Packet Delivery- Agent Advertisement and Discovery – Registration – Tunneling and Encapsulation – Optimization – Reverse Tunneling – Ipv6 – DHCP-Ad Hoc Networks	15	Power point presentation, ICT tools
IV	MOBILE TRANSPORT LAYER Traditional TCP- Indirect TCP- Snooping TCP- Mobile TCP - Fast Retransmit/ Fast Recovery-Transmission/Timeout Freezing – Selective Retransmission- Transaction Oriented TCP	15	Power point presentation, ICT tools
V	WAP Architecture – Datagram Protocol- Transport Layer Security- Transaction Protocol- Session Protocol-Application Environment- Wireless Telephony Application	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II

	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Internship			
Course Code	23UELIN51	L	P	C
Category	Summer Internship	-	-	1

Course Description

The students have to attend a 30 hours of Internship of their own choice to be carried out in II year summer vacation.

Guidelines For Internship:

1. The Project is conducted by the following Course Pattern. The internship period should be minimum 30 hours.
2. Each group should produce permission letter as well as the attendance certificate.
3. There will be one Faculty guide.
4. The students should submit an Internship Training Report (Maximum 30 Pages).
5. The Marks for Internship Training will be awarded only on the basis of the Internship Training Report.
6. Prior permission may be obtained from the organization in advance by the students concerned and information shall be passed onto the colleges thus enabling the training supervision by the concerned faculties authorized by the college.
7. Daily postal or electronic reporting should be obtained to ensure coherent and comprehensive training during the training period.
8. A final report [Institutional Training Record – ITR] containing the introduction of the industry, the profile of the company and a valid conclusion indicating the benefits of the training shall be given not exceeding 30 [A4] pages [in a spiral- bound form/pre-printed record designed for this purpose]

Internal

Presentation	}	25
Submission		

External

Project Report	}	75
Viva Voce		

Total **- 100**

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP	
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL
Changes Made in the Course	Percentage of Change		No Changes Made		New Course		✓
* Treat 20 % as each unit (20*5=100%) and calculate the percentage of change for the course.							

COURSE OUTCOMES:	K LEVEL
------------------	---------

After studying this course, the students will be able to:

CO1	Explain the student to the environment and expectations of performance on the part of private/public companies or government entities	K1 to K4
CO2	Able to develop work habits and attitudes necessary for job success. Build a record of work experience	K1 to K4
CO3	Explore career alternatives by Integrating theory and practice and learn to appreciate work and its function in the economy.	K1 to K4
CO4	Expose the student to professional role models by developing communication, interpersonal and other critical skills	K1 to K4
CO5	Examine employer-valued skills such as teamwork, communications and attention to detail.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

SIXTH SEMESTER



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Analog and Digital Communication Systems			
Course Code	23UELCC61	L	P	C
Category	Core	6	-	5
COURSE OBJECTIVES: ➤ To understand the concepts of Wave propagation. ➤ To understand the modulation techniques. ➤ To understand the Amplitude modulation and demodulation ➤ To acquire knowledge on Pulse Modulation ➤ To inculcate the principle of digital modulation				
UNIT - I AMPLITUDE MODULATION TECHNIQUES				18
Amplitude Modulation (AM) Technique- Double Sideband Suppressed Carrier (DSBSC) Techniques- Single Sideband (SSB) Technique- Vestigial Sideband (VSB) Modulation Technique- Generation of AM Signal- Generation of DSBSC Signal-Generation of SSB Signal- Generation of VSB Signal.				
UNIT - II ANGLE MODULATION TECHNIQUES				18
Frequency Modulation- Phase Modulation- Comparison of Frequency Modulation and Phase Modulation- Pre-emphasis and De-emphasis- Stereophonic FM Multiplex System. Generation of Frequency Modulation: FM methods, Direct method, Stabilized Reactance Modulator- (AFC), Indirect Method.				
UNIT - III PULSE MODULATION TECHNIQUES				18
Pulse Amplitude Modulation (PAM)- Pulse Width Modulation (PWM) – Pulse Position Modulation (PPM) Pulse Digital Modulation Techniques: Pulse code Modulation (PCM)- Delta Modulation- Differential Pulse code Modulation (DPCM)- Demodulation of Pulse Analog Modulated Signals.				
UNIT - IV DIGITAL MODULATION TECHNIQUES				18
Basic Digital Modulation Schemes: Amplitude Shift Keying (ASK)- Frequency Shift Keying (FSK)- Phase Shift Keying (PSK). M-Ary Digital Modulation Techniques: M-Ary PSK – M-Ary FSK – M-Ary-QAM.				
UNIT - V WIRELESS COMMUNICATION				18
Cellular concept – The advanced Mobile Phone System – AMPS control System – Cellular Telephone specification and operations with block diagram – Cellular Base Station – Cellular Radio System – Digital cellular system.				
Total Lecture Hours				90

BOOKS FOR STUDY:

- Simon Haykin, **An Introduction to Analog and Digital Communications**, John Wiley and Sons (Asia) Pvt.Ltd, 1989, Singapore.
- K.Sam Shanmugam, **Digital and Analog Communication System**, John Wiley & Sons (Asia) Pvt.Ltd, 1979, Singapore.
- Kennedy Davis, **Electronic Communication Systems**, Tata McGraw Hill Publishing Company Ltd, Fourth Edition, 1999, New Delhi.

BOOKS FOR REFERENCES:

- Martin S.Roden, **Analog and Digital Communication Systems**, Prentice Hall, First Edition, 1985, New Delhi.
- Lathi.B.P, **Modern Digital and Analog Communication Systems**, Oxford University Press, USA, First Edition, 1998.
- Srinivasan K.S. **Analog and Digital Communication** Anuradha Publications, 2nd Edition, 2011.

WEB RESOURCES:

- ❖ https://swayam.gov.in/nd1_noc20_ee16/preview
- ❖ https://swayam.gov.in/nd1_noc19_ee47/preview
- ❖ <https://www.techtarget.com/searchmobilecomputing/definition/wireless>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.								

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	To understand the concept of amplitude modulation techniques.	K1 to K4
CO2	To understand the concept of angle modulation techniques.	K1 to K4
CO3	Demonstrate the stages Pulse modulation techniques.	K1 to K4
CO4	Compare the operation of Digital modulation techniques	K1 to K4
CO5	Understand the wireless communication concepts.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	3	3	3	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 - MEDIUM				1 - LOW			

CO / PO MAPPING:					
COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80
LESSON PLAN:					
UNIT	Analog and Digital Communication Systems			HRS	PEDAGOGY
I	Amplitude Modulation Techniques Amplitude Modulation (AM) Technique- Double Sideband Suppressed Carrier (DSBSC) Techniques-Single Sideband (SSB) Technique- Vestigial Sideband (VSB) Modulation Technique- Generation of AM Signal- Generation of DSBSC Signal-Generation of SSB Signal- Generation of VSB Signal.			18	Power point presentation, ICT tools
II	Angle Modulation Techniques Frequency Modulation- Phase Modulation- Comparison of Frequency Modulation and Phase Modulation-Pre-emphasis and De-emphasis- Stereophonic FM Multiplex System. Generation of Frequency Modulation: FM methods, Direct method, Stabilized Reactance Modulator-(AFC), Indirect Method.			18	Power point presentation, ICT tools
III	Pulse Modulation Techniques Pulse Amplitude Modulation (PAM)- Pulse Width Modulation (PWM) – Pulse Position Modulation (PPM) Pulse Digital Modulation Techniques: Pulse code Modulation (PCM) - Delta Modulation- Differential Pulse code Modulation (DPCM) - Demodulation of Pulse Analog Modulated Signals.			18	Power point presentation, ICT tools
IV	Digital Modulation Techniques Basic Digital Modulation Schemes: Amplitude Shift Keying (ASK) - Frequency Shift Keying (FSK)- Phase Shift Keying (PSK). M-Ary Digital Modulation Techniques: M-Ary PSK – M-Ary FSK – M-Ary-QAM.			18	Power point presentation, ICT tools
V	Wireless Communication			18	Power point

Cellular concept – The advanced Mobile Phone System – AMPS control System – Cellular Telephone specification and operations with block diagram – Cellular Base Station – Cellular Radio System – Digital cellular system.	presentation, ICT tools
---	--------------------------------

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Electronic Communications and Measurements Lab			
Course Code	23UELCP61	L	P	C
Category	Core	-	6	4

COURSE OBJECTIVES:

- To understand the concept of working of Different types of Filter experiments
- To experiment the Analog and Digital modulation and detection techniques
- To study the Characteristics of temperature sensors.
- To study the characteristics of Light sensors.
- To develop and design the sensor based Application experiments

List of Experiment – Electronic Communications

1. Low and High pass active filters.
2. Band pass and Band rejection active filters.
3. Cross over Network.
1. Sampling and reconstruction of signals.
2. Amplitude Modulation and Demodulation.
3. Suppressed Carrier amplitude Modulation.
4. Frequency Modulation and Demodulation.
5. Pulse Amplitude Modulation and Demodulation.
6. Pulse Width Modulation and Demodulation.
7. Pulse Position Modulation and Demodulation.

List of Experiment – Measurements Lab

1. Study of RTD.
2. Study of IC Temperature sensors.
3. Study of Strain gauge and Load cell characteristics.
4. Study of LVDT and Tacho generator characteristics.
5. LDR and Opto-coupler characteristics.
6. Study of Piezo-electric transducers and vibration measurement using Piezo electric transducer.
7. PLL application circuits
8. Study of 4-bit R-2R ladder DAC using Op-amp.
9. Study of ADC
10. Study of UJT relaxation oscillator.

WEB RESOURCES:

- ❖ <https://www.vlab.co.in/ba-ntel-labs-electronics-and-communications>
- ❖ <https://sl-coep.vlabs.ac.in/>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.								

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Design the Filters circuits (Low pass, High pass, Band pass and Band reject)	K1 to K4
CO2	Design the working principles of modulation and demodulation techniques	K1 to K4
CO3	Construct and study the Temperature and Displacement transducers	K1 to K4
CO4	Design the ADC & DAC circuits and study its operation	K1 to K4
CO5	Design PLL and UJT relaxation oscillator	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	2	3	2	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	2	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG**2 – MEDIUM****1 - LOW****CO / PO MAPPING:**

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED	100	93	80	86	80

PERCENTAGE OF COURSE CONTRIBUTIO N TO POS					
LESSON PLAN:					
Cycle	Electronic Communications and Measurements Lab	HRS	PEDAGOGY		
I	Low and High pass active filters. Band pass and Band rejection active filters. Cross over Network. Sampling and reconstruction of signals.	18	Practical demonstration		
II	Amplitude Modulation and Demodulation. Suppressed Carrier amplitude Modulation. Frequency Modulation and Demodulation. Pulse Amplitude Modulation and Demodulation.	18	Practical demonstration		
III	Pulse Width Modulation and Demodulation. Pulse Position Modulation and Demodulation. Study of RTD. Study of IC Temperature sensors.	18	Practical demonstration		
IV	Study of Strain gauge and Load cell characteristics. Study of LVDT and Tacho generator characteristics. LDR and Opto-coupler characteristics. Study of Piezo-electric transducers and vibration measurement using Piezo electric transducer.	18	Practical demonstration		
V	PLL application circuits Study of 4-bit R-2R ladder DAC using Op-amp. Study of ADC Study of UJT relaxation oscillator.	18	Practical demonstration		

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)							
Internal	Cos	K Level	Aim and Apparatus	Circuit diagram	Circuit construction	Readings & Calculation	Result
CIA I	CO1	K1	5				
	CO2	K2		5			
	CO3	K3			5		
	CO4	K3				5	
	CO5	K4					5
Question Pattern CIA		No. of Questions to be asked	2	2	2	2	2
		No. of Questions to be answered	2	2	2	2	2
		Marks for each question	2.5	2.5	2.5	2.5	2.5
		Total Marks for each section	5	5	5	5	5

Distribution of Marks with K Level CIA								
K Level	Aim and Apparatus	Circuit Diagram	Circuit Construction	Readings & Calculation	Result	Total Marks	% of (Marks without choice)	Consolidated %
K1	5					5	20	20
K2		5				5	20	20
K3			5	5		10	40	40
K4					5	5	20	20
Marks						25	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)							
Internal	Cos	K Level	Aim & Apparatus	Circuit diagram	Circuit construction	Readings & Calculation	Result
CIAI	CO1	K1	15				
	CO2	K2		15			
	CO3	K3			15		
	CO4	K3				15	
	CO5	K4					15
Question Pattern		No. of Questions to be asked	2	2	2	2	2
		No. of Questions to be answered	2	2	2	2	2
		Marks for each question	7.5	7.5	7.5	7.5	7.5
		Total Marks for each section	15	15	15	15	15

Distribution of Marks with K Level								
K Level	Aim & Apparatus	Circuit Diagram	Circuit Construction	Readings Calculation	Result	Total Marks	% of (Marks without choice)	Consolidated %
K1	15					15	20	20
K2		15				15	20	20
K3			15	15		30	40	40
K4					15	15	20	20
Marks						75	100	100



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Measurement Systems			
Course Code	23UELCC62	L	P	C
Category	Core	6	-	5
COURSE OBJECTIVES:				
➤ To understand the basic concepts of measurement systems. ➤ To familiarize the students with the knowledge of transducers and it types. ➤ To understand the operation of Displacement and Strain gauges. ➤ To understand the working principles of Pressure and vibration sensors. ➤ To understand the working of flow, force and torque sensors.				
UNIT - I	BASIC CONCEPTS OF MEASUREMENT			18
Generalized measurement system, Basic characteristics of measuring devices, noise, Calibration. Classification of transducers, Dynamic characteristics of Measurement system, Transfer function representation, Zeroth order, First order, Second order systems, Testing of dynamic response.				
UNIT - II	DISPLACEMENT MEASUREMENT			18
Principle of Transduction, LVDT, Potentiometric, Digital Transducers, level measurements. Strain measurement: Factors affecting strain measurements, types of strain gauges – Theory and operation of resistance strain gauges, Types of electrical strain gauges–Gauging techniques and other factors. Strain gauge circuits–Temperature compensation–Applications.				
UNIT - III	PRESSURE MEASUREMENT			18
Diaphragms, Other elastic elements, Transduction methods, Force balance Transducers, Solid state devices, piezoelectric pressure transducer, Vibrating element pressure sensors, Pressure multiplexers, Calibration.				
Flow Measurement: Head-type flow meter, Rota meter, Electromagnetic, Mechanical Anemometer and Ultrasonic. Vortex flow meter - mass flow measurements.				
UNIT - IV	TEMPERATURE MEASUREMENTS			18
Mechanical Resistance type sensors, Platinum resistance thermometers, Thermistors, Thermocouples, Solid-state sensors, Quartz thermometer, Radiation methods, Optical pyrometers, Calibration.				
UNIT - V	FORCE AND TORQUE MEASUREMENT			18
Load cells, Digital Force Transducers, Force-Balance Devices. Hydraulic load cell, Electronic Weight system, Torque measurement.				
Total Lecture Hours				90

BOOKS FOR STUDY:

- Instrumentation Devices and systems. C.S. Rangan, G.R.Sharma and V.S.V.Mani TMH, 23rd reprint 2009.

BOOKS FOR REFERENCES:

- E.Doebelin, Measurement systems, VEdn.TMH 2004.
- Electronic instrumentation A.K.Sawney.

WEB RESOURCES:

- ❖ <https://www.youtube.com/watch?v=1uPTyJxZzyo>
- ❖ <https://www.youtube.com/watch?v=q8UuRkOQ9A0>
- ❖ <https://www.youtube.com/watch?v=nv3GuJArjNU>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change			No Changes Made			New Course	✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.								

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Remembering the concept of basic measurement systems.	K1 to K4
CO2	Understand the measurement principle of displacement and pressure sensors.	K1 to K4
CO3	Identify the concept of temperature measurements.	K1 to K4
CO4	Classify types of flow meters.	K1 to K4
CO5	Evaluate force and torque of sensors and transducers .	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	3	3	3	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG**2 - MEDIUM****1 - LOW****CO / PO MAPPING:**

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1

CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Measurement Systems	HRS	PEDAGOGY
I	BASIC CONCEPTS OF MEASUREMENT Generalized measurement system, Basic characteristics of measuring devices, noise, Calibration. Classification of transducers, Dynamic characteristics of Measurement system, Transfer function representation, Zeroth order, First order, Second order systems, Testing of dynamic response.	18	Power point presentation , ICT tools
II	DISPLACEMENT MEASUREMENT Principle of Transduction, LVDT, Potentiometric, Digital Transducers, level measurements. Strain measurement: Factors affecting strain measurements, types of strain gauges – Theory and operation of resistance strain gauges, Types of electrical strain gauges–Gauging techniques and other factors. Strain gauge circuits–Temperature compensation–Applications.	18	Power point presentation , ICT tools
III	PRESSURE MEASUREMENT Diaphragms, Other elastic elements, Transduction methods, Force balance Transducers, Solid state devices, piezoelectric pressure transducer, Vibrating element pressure sensors, Pressure multiplexers, Calibration. Flow Measurement: Head-type flow meter, Rota meter, Electromagnetic, Mechanical Anemometer and Ultrasonic. Vortex flow meter - mass flow measurements.	18	Power point presentation , ICT tools
IV	TEMPERATURE MEASUREMENTS Mechanical Resistance type sensors, Platinum resistance thermometers,	18	Power point presentation , ICT tools

	Thermistors, Thermocouples, Solid-state sensors, Quartz thermometer, Radiation methods, Optical pyrometers, Calibration.		
V	FORCE AND TORQUE MEASUREMENT Load cells, Digital Force Transducers, Force-Balance Devices. Hydraulic load cell, Electronic Weight system, Torque measurement.	18	Power point presentation , ICT tools

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Digital Signal Processing			
Course Code	23UELEC61	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES: ➤ To understand the concepts of Discrete- time-system and Z-transform ➤ To understand the design of digital filter ➤ To understand the concept of errors in digital system ➤ To understand the concept of realization structure of FIR & IIR filters. ➤ To understand the concept of FFT algorithm				
UNIT - I Z- transform and Discrete Time System				15
Z-transform: Definition of Z transforms – Inverse Z transform – Properties of Z transform. Discrete time system: Introduction – Block diagram representation of discrete time system. Classification of discrete time system – Static versus dynamic system – Time invariant versus time variant system – Linear versus Nonlinear system – Causal versus Non causal systems – Stable versus unstable systems.				
UNIT - II Design of Digital Filter				15
Design of linear phase FIR filter using windows – IIR filter design: -impulse invariant method- bilinear transformation method – Review of design technique for analog low pass filter.				
UNIT - III Realization of Digital Linear Systems				15
Basic Structure for FIR system: Direct form – cascade form Basic Structure for IIR system: Direct form -Cascade form structure- Parallel structure-Ladder structure.				
UNIT - IV DFT and FFT				15
Discrete Fourier transform: Definition and properties. FFT algorithm: Introduction to radix 2 fast Fourier transforms – Decimation in time FFT - Decimation in frequency FFT.				
UNIT - V Finite word Length Effects in Digital Filters				15
Finite word length Effects in digital filters: Types of Number representation-Quantization noise-Truncation and rounding -quantization error -overflow limit cycle oscillation.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- S.Salivahanan. A. Vallavaraj and C.GnanaPriya, **Digital signal and processing**, Tata McGraw-Hill publishing company, New Delhi, First Edition, 2001.
- John G.proakis and D.G.Manolakis,” **Digital signal and processing** “PHI, 1986.
- P. Rameshbabu,”**Digital signal and processing**”, fourth edition SciTech 2007.

BOOKS FOR REFERENCES:

- P. Ramesh Babu, **Digital Signal Processing**, SciTech Publications, Chennai, Fourth Edition 2007.
- Johny R Johnson, **Introduction to Digital Signal Processing**, Pearson Education, New Delhi, 2015.

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/108/106/108106151/>
- ❖ https://swayam-uat-node1.appspot.com/practice_course1/preview
- ❖ <https://www.mooc-list.com/tags/digital-signal-processing>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP			
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change				No Changes Made		✓	New Course		
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand Digital Signal Controllers and their Applications	K1 to K4
CO2	Design digital filters IIR and FIR filters	K1 to K4
CO3	Develop discrete form and cascade form of FIR and ITR system	K1 to K4
CO4	Analyze the concept of FFT and DFT	K1 to K4
CO5	Evaluate finite word length effects in signal processing	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	3	3	2	2	2	2	3	2	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM			1 - LOW				

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Digital Signal Processing	HRS	PEDAGOGY
I	Z-transform: Definition of Z transforms – Inverse Z transform – Properties of Z transform. Discrete time system: Introduction – Block diagram representation of discrete time system. Classification of discrete time system – Static versus dynamic system – Time invariant versus time variant system – Linear versus Nonlinear system – Causal versus Non causal systems – Stable versus unstable systems.	15	Power point presentation, ICT tools
II	Design of digital filter: Design of linear phase FIR filter using windows – IIR filter design: -impulse invariant method- bilinear transformation method – Review of design technique for analog low pass filter.	15	Power point presentation, ICT tools
III	Realization of digital linear system: Basic Structure for FIR system: Direct form – cascade form Basic Structure for IIR system: Direct form -Cascade form structure- Parallel structure-Ladder structure.	15	Power point presentation, ICT tools
IV	Discrete Fourier transform: Definition and properties. FFT algorithm: Introduction to radix 2 fast Fourier transforms – Decimation in time FFT - Decimation in frequency FFT.	15	Power point presentation, ICT tools

V	Finite word length Effects in digital filters: Types of Number representation-Quantization noise- Truncation and rounding - quantization error -overflow limit cycle oscillation.	15	Power point presentation, ICT tools
----------	--	-----------	--

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Robotics			
Course Code	23UELEC62	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES: ➤ To familiarize the students with the fundamental concepts of Robots. ➤ To understand the various types of grippers. ➤ Gain knowledge on types of sensors and actuators used in Robots. ➤ To understand the locomotion of robots. ➤ To understand the application of robots.				
UNIT - I ROBOTICS SYSTEMS AND TYPES				15
Introduction: Automations and Robotics - Robotics Drive System - Robot Anatomy - Work Volume - Control System and Precision of Movement - Serial Robot - Robot Subsystems - Motion Sub Systems - Recognition Sub System: Robot Classification : Coordinate Systems - Actuation Systems - Control Method - Program Method.				
UNIT - II ROBOT END EFFECTORS				15
Introduction: Types of End Effectors - Mechanical Grippers - Other Types of Gripper – Vacuum Cups - Magnetic Gripper - Adhesive Gripper – Hook - Scoops other Miscellaneous Device - Tools as End Effectors - Considerations in Gripper Selections and Design.				
UNIT - III SENSORS IN ROBOTS				15
Sensor Classification - Internal Sensors - External Sensors - Vision System - Sensors in Robotics: Tactile Sensors - Proximity and Range Sensors - Miscellaneous Sensors and Sensor based Systems - Uses of Sensors in Robotics - Actuators in Robotics - Pneumatic Actuators - Hydraulic Actuators - Electric Actuators - DC Motors - AC Motors – Pressed DC Motor – Geared DC Motor.				
UNIT - IV MOBILE ROBOTICS LOCOMOTION				15
Introduction Key Uses for Locomotion - Leg Mobile Robots - Leg Configuration and Assembly - Consideration for Dynamics - Types of Legged Robot Locomotion - One Leg; Two Legs Biped - Four Legs (Quadruped) - Six Legs (Hexapod) - Concept of Wheeled Mobile Robots.				
UNIT - V ROBOTIC APPLICATIONS				15
Industrial Applications: Material Handling - Processing Applications - Arc Welding - Assembly Applications - Inspection Applications - Robotics for Arc Welding - Assembly Applications - Robot Safety - Non Industrial Application of Robotics: Home Sector - Health Sector - Service Sector - Agriculture Farms - Research and Exploration.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- M.P.Groover, Mitchellweiss, Roger.N.Nagel, Nicholas G.Odrey, **Industrial Robotics– Technology, Programming And Application**, McGraw-Hill, 2008.
- Ghosh, —**Control in Robotics and Automation: Sensor Based Integration**, Allied Publishers, Chennai, 1998.

BOOKS FOR REFERENCES:

- Deb. S.R., —**Robotics Technology And Flexible Automation**, John Wiley, USA 1992.
- Klafter R.D., Chimielewski T.A., Negin M., —**Robotic Engineering – An integrated approach**, Prentice Hall of India, New Delhi, 1994

WEB RESOURCES:

- ❖ [https://nptel.ac.in/courses/112/105/112105249/Introduction to Robots](https://nptel.ac.in/courses/112/105/112105249/Introduction%20to%20Robots)
- ❖ [https://nptel.ac.in/courses/112/101/112101098/Robotics and Automation](https://nptel.ac.in/courses/112/101/112101098/Robotics%20and%20Automation)

Nature of Course	EMPLOYABILITY			SKILL ORIENTED			ENTREPRENEURSHIP			✓
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change			25%	No Changes Made				New Course	
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Scribe the working concept and types of Robots	K1 to K4
CO2	Apply the knowledge of types of sensors and actuators	K1 to K4
CO3	Programming Languages for Robot design models	K1 to K4
CO4	Understand the concept of Mobile Robotic Locomotion	K1 to K4
CO5	Study the various applications of Robots	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

LESSON PLAN:

UNIT	Robotics	HRS	PEDAGOGY
I	Robotics Systems and Types Introduction: Automations and Robotics - Robotics Drive System - Robot Anatomy - Work Volume - Control System and Precision of Movement - Serial Robot - Robot Subsystems - Motion Sub Systems - Recognition Sub System: Robot Classification : Coordinate Systems - Actuation Systems - Control Method - Program Method.	15	Power point presentation, ICT tools
II	Robot End Effectors Introduction: Types of End Effectors - Mechanical Grippers - Other Types of Gripper – Vacuum Cups -Magnetic Gripper - Adhesive Gripper – Hook - Scoops other Miscellaneous Device - Tools as End Effectors - Considerations in Gripper Selections and Design	15	Power point presentation, ICT tools
III	Sensors in Robots Sensor Classification - Internal Sensors - External Sensors - Vision System - Sensors in Robotics: Tactile Sensors - Proximity and Range Sensors - Miscellaneous Sensors and Sensor based Systems - Uses of Sensors in Robotics - Actuators in Robotics - Pneumatic Actuators - Hydraulic Actuators - Electric Actuators - DC Motors - AC Motors - Pressed DC Motor – Geared DC Motor.	15	Power point presentation, ICT tools
IV	Mobile Robotics Locomotion Introduction Key Uses for Locomotion - Leg Mobile Robots - Leg	15	Power point presentation, ICT tools

	Configuration and Assembly - Consideration for Dynamics - Types of Legged Robot Locomotion - One Leg; Two Legs Biped - Four Legs (Quadruped) - Six Legs (Hexapod) - Concept of Wheeled Mobile Robots		
V	Robotic Applications Industrial Applications: Material Handling - Processing Applications - Arc Welding - Assembly Applications - Inspection Applications - Robotics for Arc Welding - Assembly Applications - Robot Safety - Non Industrial Application of Robotics: Home Sector - Health Sector - Service Sector - Agriculture Farms - Research and Exploration.	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Automotive Electronics			
Course Code	23UELEC63	L	P	C
Category	Elective	5	-	4

COURSE OBJECTIVES:

- To understand the concepts of Automotive Electronics and its evolution and Trends automotive systems & subsystems overview.
- To understand sensors and sensor monitoring mechanisms aligned to automotive Systems, different signal conditioning techniques, interfacing techniques and actuator
- To understand, design and model various automotive control systems using Model based development technique.
- To gain the knowledge of electronic control of braking and traction.
- To understand the concept of engine management system.

UNIT - I INTRODUCTION

15

Automotive Component, Operation, Electrical Wiring Terminals and Switching, Multiplexed Wiring Systems, Circuit Diagrams and Symbols. Charging Systems and Starting Systems: Charging Systems Principles, Alternations and Charging Circuits, New Developments, Requirements of the Starting System, Basic Starting Circuit

UNIT - II IGNITION SYSTEMS

15

Ignition Fundamental, Electronic Ignition Systems. Programmed Ignition, Distribution Less Ignition, Direct Ignition, Spark Plugs. Electronic Fuel Control: Basics of Combustion, Engine Fuelling and Exhaust Emissions, Electronic Control of Carburetion Petrol Fuel Injection, Diesel Fuel Injection

UNIT - III INSTRUMENTATION SYSTEMS

15

Introduction to Instrumentation Systems, Various Sensors Used for Different Parameters, Sensing Driver Instrumentation Systems, Vehicle Condition Monitoring Trip Computer, Different Types of Visual Display

UNIT - IV ELECTRONIC CONTROL OF BRAKING AND TRACTION

15

Introduction and Description Control Elements and Control Methodology, Electronic Control of Automatic Transmission: Introduction and Description Control Of Gear Shift and Torque Converter Lockup, Electric Power Steering, Electronic Clutch

UNIT - V ENGINE MANAGEMENT SYSTEMS

15

Combined Ignition And Fuel Management Systems, Exhaust Emission Control, Digital Control Techniques, Complete Vehicle Control Systems, Artificial Intelligence and Engine Management, Automotive Microprocessor Uses. Lighting and Security Systems: Vehicles Lighting Circuits, Signalling Circuit, Central Locking and Electric Windows Security Systems, Airbags and Seat Belt Tensioners, Miscellaneous Safety and Comfort Systems

Total Lecture Hours

75

BOOKS FOR STUDY:

- TOM DENTON, Automobile Electrical and Electronic Systems, Edward Arnold pb., 1995.

BOOKS FOR REFERENCES:

- DON KNOWLES, Automotive Electronic and Computer controlled Ignition Systems, Don
 ➤ WILLIAM, T.M., Automotive Mechanics, McGraw Hill Book Co.,
 ➤ WILLIAM, T.M., Automotive Electronic Systems, Heiemann Ltd., London, 1978.
 ➤ Ronald K Jurgen, Automotive Electronics Handbook, McGraw Hill, Inc, 1999.

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/107/103/107103084/>
 ❖ <https://nptel.ac.in/courses/107/106/107106088/>
 ❖ <https://www.youtube.com/watch?v=vJ4EfyGXehg>
 ❖ <https://www.youtube.com/watch?v=BG4N2dBgJrQ>

Nature of Course	EMPLOYABILITY				SKILL ORIENTED				ENTREPRENEURSHIP		✓
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL		✓
Changes Made in the Course	Percentage of Change				No Changes Made				New Course		✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.											

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Obtain an overview of automotive components and subsystems.	K1 to K4
CO2	Interface automotive sensors and actuators with microcontrollers	K1 to K4
CO3	Understand the design cycles, communication protocols and safety systems employed in today's automotive industry.	K1 to K4
CO4	Understand the engine management systems	K1 to K4
CO5	Analyse Engine Management System	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	2	2	2	3	2	2	3	2	2	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	3
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	2	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	14	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	93	93	80	86	80

LESSON PLAN:

UNIT	Automotive Electronics	HRS	PEDAGOGY
I	Introduction Automotive Component, Operation, Electrical Wiring Terminals and Switching, Multiplexed Wiring Systems, Circuit Diagrams and Symbols. Charging Systems and Starting Systems: Charging Systems Principles, Alternations and Charging Circuits, New Developments, Requirements of the Starting System, Basic Starting Circuit	15	Power point presentation, ICT tools
II	Ignition Systems Ignition Fundamental, Electronic Ignition Systems. Programmed Ignition, Distribution Less Ignition, Direct Ignition, Spark Plugs. Electronic Fuel Control: Basics of Combustion, Engine Fuelling and Exhaust Emissions, Electronic Control of Carburetion Petrol Fuel Injection, Diesel Fuel Injection	15	Power point presentation, ICT tools
III	Instrumentation Systems Introduction to Instrumentation Systems, Various Sensors Used for Different Parameters, Sensing Driver Instrumentation Systems, Vehicle Condition Monitoring Trip Computer, Different Types of Visual Display	15	Power point presentation, ICT tools
IV	Electronic Control Of Braking And Traction Introduction and Description Control Elements and Control	15	Power point presentation, ICT tools

	Methodology, Electronic Control of Automatic Transmission: Introduction and Description Control Of Gear Shift and Torque Converter Lockup, Electric Power Steering, Electronic Clutch		
V	Engine Management Systems Combined Ignition And Fuel Management Systems, Exhaust Emission Control, Digital Control Techniques, Complete Vehicle Control Systems, Artificial Intelligence and Engine Management, Automotive Microprocessor Uses. Lighting and Security Systems: Vehicles Lighting Circuits, Signalling Circuit, Central Locking and Electric Windows Security Systems, Airbags and Seat Belt Tensioners, Miscellaneous Safety and Comfort Systems	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Control Systems			
Course Code	23UELEC64	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ To understand the concepts of control system and feedback characteristics. ➤ To understand the concept of time domain performance. ➤ To understand the concept of closed loop industrial systems. ➤ To understand the concept of state space analysis of control system. ➤ To understand the concept of design of control system by state space methods.				
UNIT - I CONTROL SYSTEM AND FEEDBACK CHARACTERISTICS				15
Open loop-closed loop system of feedback on gain stability, sensitivity and noise transfer functions –Block diagrams –Block reduction – signal flow graphs-Mason's gain formula-sensitivity control system to parameter variations-control of disturbance signal feedback systems-simple problems				
UNIT - II TIME DOMAIN PERFORMANCE				15
Zero order, first order and second order systems – Step and ramp response- steady state error-stability of liner time invariant system-necessary conditions for stability Hurwitz stability-Routh's stability criterion-Special cases-Simple problems.				
UNIT - III CLOSED LOOP INDUSTRIAL SYSTEMS				15
Thermistors control of quench oil temperature- proportional mode pressure control system –strip tension controller –edge guide controls for strip recoiler-Automatic weighing system – Carbon dioxide controllers for carbonizing furnace.				
UNIT - IV STATE SPACE ANALYSIS OF CONTROL SYSTEM				15
Introduction to state space representation of systems – solving the time invariant state equations-solution for homogeneous state equations-Laplace transform approach to the solution of non-homogeneous state equation-state transition matrix- solutions of non- homogeneous state equations-Laplace transform approach to the solution of non-homogeneous state equation.				
UNIT - V DESIGN OF CONTROL SYSTEM BY STATE SPACE METHODS				15
Controllability – complete state controllability of continuous time system- Alternate form of the condition for complete controllability – o/p controllability – observability – complete observability of continuous time system – Alternate form of the condition for complete observability – Relationship between controllability, observability-Relationship between reference control system – Adaptive control systems.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- S.N.Verma and B.S. Manke, Automatic control systems, Khanna Publishers, 2002
- Benjamin C. Kuo, Automatic Control systems, John Wiley & Sons, 2002
- J.Nagarath and M.Gopal, Control Systems engineering, New Age International 2009.

BOOKS FOR REFERENCES:

- Industrial solid state electronics, Devices and Circuits Timothy J.Malvino
- Modern Control Engineering – OGATA- Third Edition

WEB RESOURCES:

- ❖ <https://www.scribd.com/doc/312738130/Nagoor-Kani-Control-System-Engineering>
- ❖ <https://pdfcoffee.com/nagoor-kani-control-system-engineering-pdf-free.html>
- ❖ https://www.vssut.ac.in/lecture_notes/lecture1423904331.pdf

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP	
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL	✓	GLOBAL
Changes Made in the Course	Percentage of Change			No Changes Made			New Course
*Treat 20 % as each unit (20*5=100 %) and calculate the percentage of change for the course.							

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the concepts of control systems	K1 to K4
CO2	Analyze the concept of time domain performance.	K1 to K4
CO3	Develop the closed loop industrial systems.	K1 to K4
CO4	Analyze the concept of state space analysis of control system	K1 to K4
CO5	Design of control system by state space methods.	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	3	3	2	2	2	2	3	2	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM			1 - LOW				

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Control Systems	HRS	PEDAGOGY
I	CONTROL SYSTEM AND FEEDBACK CHARACTERISTICS Open loop-closed loop system of feedback on gain stability, sensitivity and noise transfer functions –Block diagrams –Block reduction – signal flow graphs-Mason’s gain formula-sensitivity control system to parameter variations-control of disturbance signal feedback systems-simple problems	15	Power point presentation , ICT tools
II	TIME DOMAIN PERFORMANCE Zero order, first order and second order systems – Step and ramp response- steady state error-stability of liner time invariant system-necessary conditions for stability Hurwitz stability-Routh’s stability criterion-Special cases-Simple problems.	15	Power point presentation , ICT tools
III	CLOSED LOOP INDUSTRIAL SYSTEMS Thermistors control of quench oil temperature- proportional mode pressure control system –strip tension controller –edge guide controls for strip recoiler-Automatic weighing system – Carbon dioxide controllers for carbonizing furnace.	15	Power point presentation , ICT tools
IV	STATE SPACE ANALYSIS OF CONTROL SYSTEM Introduction to state space representation of systems – solving the time invariant state equations-solution for homogeneous state equations-	15	Power point presentation , ICT tools

	Laplace transform approach to the solution of non-homogeneous state equation-state transition matrix- solutions of non- homogeneous state equations-Laplace transform approach to the solution of non-homogeneous state equation.		
V	DESIGN OF CONTROL SYSTEM BY STATE SPACE METHODS: Controllability – complete state controllability of continuous time system- Alternate form of the condition for complete controllability – o/p controllability – observability – complete observability of continuous time system – Alternate form of the condition for complete observability – Relationship between controllability, observability- Relationship between reference control system – Adaptive control systems.	15	Power point presentation , ICT tools

Learning Outcome Based Education & Assessment (LOBE)						
Formative Examination - Blue Print						
Articulation Mapping – K Levels with Course Outcomes (COs)						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A				(10 x 1 = 10 Marks)	
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Computer Network			
Course Code	23UELEC65	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ To learn about the OSI Reference model and transmission media. ➤ To learn about the Data link layer ➤ To learn about the Network Layer ➤ To learn about Transport layer ➤ To learn about Application Layer				
UNIT - I Introduction				15
Uses of computer networks – Network Hardware – Network Software – OSI Reference model – Example Networks – Example data communication services — Network Standardization. Physical Layer : Introduction to Guided Transmission Media, Wireless Transmission				
UNIT - II Data Link Layer				15
Data Link Layer Design Issues –Error Detection and Correction – Elementary Data Link Protocols – Sliding Window Protocols-The Channel Allocation Problem –Multiple Access Protocols – Ethernet – ALOHA, CSMA, Collision free protocols- Ethernet, Token bus, Token ring.				
UNIT - III Network Layer				15
Network layer Design Issues, Routing Algorithms - The Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, Routing for Mobile Hosts. Congestion Control Algorithms, Quality of Service - (Requirements, Techniques for Achieving Good Quality of Service) Internetworking.				
UNIT - IV Transport Layer				15
Introduction — Transport Layer Protocols - The Transport Service, Elements of Transport Protocols. Process to Process Delivery – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.				
UNIT - V Application Layer				15
Introduction – Application layer protocols - TELNET – FTP – TFTP – SNMP – DNS. Electronic Mail, The World Wide Web (Architectural Overview only) Multimedia. Network Devices -Routers, Firewalls, and Access points.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- Computer Networks by Andrew S. Tanenbhum 4th Edition, Prentice Hall of India, 2006.

Unit I: Chap 1-1.1 to 1.5;

Unit II: Chap 2- 2.2 to 2.4, 2.6;

Unit III: Chap 3- 3.1 to 3.4 and Chap 4 - 4.1, 4.2.1 to 4.2.3;

Unit IV: Chap 5 – 5.1, 5.2.2, 5.2.3 and 5.2.6,5.2.7 and Chap 6- 6.1,6.2

- Data Communications and Networks by AchyutS.Godbole, Tata McGraw-Hill, New Delhi.

Unit I: Chap 8-8.1 to 8.10;

Unit V: Chap 19-19.1,19.2, 20.1 to 20.3 ,21.1 to 21.3

BOOKS FOR REFERENCES:

- Computer Networks B.Poorna SCITECH Publications 2017

- Data Communications and Networking, Forouzan, Tata McGraw Hill,2003

WEB RESOURCES:

- ❖ <https://nptel.ac.in/courses/106/105/106105183/>
 ❖ https://onlinecourses.swayam2.ac.in/ugc19_cs10/preview
 ❖ <https://www.mooc-list.com/tags/computer-networking>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED		ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL		NATIONAL		GLOBAL	✓
Changes Made in the Course	Percentage of Change			No Changes Made		✓	New Course	
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.								

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the basics of computer networks and reference models	K1 to K4
CO2	Understand the communication medium of physical layer	K1 to K4
CO3	Develop the knowledge of data link layer and medium access layer	K1 to K4
CO4	Compare all layers in OSI model and TCP/IP	K1 to K4
CO5	Importance of Network usage in recent trend	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	3	3	2	2	2	2	3	2	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG

2 – MEDIUM

1 - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Computer Network	HRS	PEDAGOGY
I	Introduction Uses of computer networks – Network Hardware – Network Software – Reference Models – Example Networks – Example data communication services — Network Standardization.	15	Power point presentation, ICT tools
II	Physical Layer The Physical Layer: Guided Transmission Media –Wireless Transmission-Communication Satellites –Mobile telephone System- Network Topologies.	15	Power point presentation, ICT tools
III	Data Link Layer & Medium Access Layer Data Link Layer Design Issues –Error Detection and Correction – Elementary Data Link Protocols –Sliding Window Protocols-The Channel Allocation Problem –Multiple Access Protocols –ALOHA, CSMA, Collision free protocols- Ethernet, Token bus, Token ring.	15	Power point presentation, ICT tools
IV	Network Layer & Transport Layer The Network Layer: Network Layer Design Issues-Routing Algorithms –Shortest path, Flooding, Hierarchical and Broadcast. The Transport Layer: The Transport Service, Elements of Transport Protocols.	15	Power point presentation, ICT tools
V	Application Layer Network Security -DNS- The Domain Name System –Electronic Mail – Usenet news -The World Wide Web – Multimedia.	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Articulation Mapping						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Design with PIC Microcontroller			
Course Code	23UELEC66	L	P	C
Category	Elective	5	-	4
COURSE OBJECTIVES:				
➤ To study the architecture of PIC microcontroller. ➤ To understand the addressing modes of PIC microcontroller. ➤ To impart knowledge about assembly language programs of PIC microcontroller. ➤ To know various peripheral devices of PIC microcontroller. ➤ To gain knowledge about the interfacing the peripheral devices with PIC microcontroller.				
UNIT - I	CPU ARCHITECTURE AND INSTRUCTION SET			15
Overview – Harvard Architecture and Pipelining- Program memory Considerations- Register File Structure and Addressing Modes- CPU registers- Instruction Set- Simple Operations.				
UNIT - II	LOOP TIME SUBROUTINE, TIMER 2 AND INTERRUPTS			15
Timer 2 use- Interrupt logic- Timer 2 scalar Initialization Interrupt service – Interrupt service routine- Loop time subroutine.				
UNIT - III	EXTERNAL INTERRUPT AND TIMERS			15
RB0/INT External Interrupt input- Timer 0- Compare mode- Timer 1/CCP Programmable Period Scalar- Timer 1 External Event Counter- Timer 1 and Sleep Mode- Pulse Width Modulated Outputs- Port B Change Interrupts.				
UNIT - IV	I/O Port Expansion			15
Synchronous Serial Port Module- Serial Peripheral Interface- Output Port Expansion- Input Port Expansion- LCD Display.				
UNIT - V	I2C BUS FOR PERIPHERAL CHIP ACCESS			15
I2C Bus Operation- I2C Bus Subroutine- DAC output- Temperature sensor-Serial EEPROM.				
Total Lecture Hours				75

BOOKS FOR STUDY:

- John B. Peatman, —Design with PIC Microcontrollers—, Pearson Education Publishing

BOOKS FOR REFERENCES:

- Muhammad Ali Mazidi, Rolin D. McKinlay, and Danny Causey, “The PIC Microcontroller and Embedded systems – Using Assembly and C for PIC18,” Prentice Hall, 2007

WEB RESOURCES:

- ❖ <https://www.youtube.com/watch?v=nLlBssKCN2w>
 ❖ <https://www.youtube.com/watch?v=VEAYB1A9SiA>
 ❖ <https://www.youtube.com/watch?v=aSsnLyKtIAU>

Nature of Course	EMPLOYABILITY		✓	SKILL ORIENTED			ENTREPRENEURSHIP				
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓	
Changes Made in the Course	Percentage of Change				No Changes Made				New Course		✓
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.											

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the evolution in microcontroller technology	K1 to K4
CO2	Describe Harvard architecture model and programming techniques	K1 to K4
CO3	Describe the operation and need for interrupts and timers	K1 to K4
CO4	List out various operators in modelling the design units	K1 to K4
CO5	Apply the concept for I/O port expansion	K1 to K4

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3	2	2	2	3	1	1	3
CO2	3	3	3	2	2	2	3	1	1	1
CO3	3	3	3	2	2	1	1	3	3	2
CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3
3- STRONG			2 – MEDIUM				1 - LOW			

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Design with PIC Microcontroller	HRS	PEDAGOGY
I	CPU Architecture and Instruction Set Overview – Harvard Architecture and Pipelining- Program memory Considerations- Register File Structure and Addressing Modes- CPU registers- Instruction Set- Simple Operations.	15	Power point presentation, ICT tools
II	Loop Time Subroutine, Timer 2 and Interrupts Timer 2 use- Interrupt logic- Timer 2 scalar Initialization Interrupt service – Interrupt service routine- Loop time subroutine.	15	Power point presentation, ICT tools
III	External Interrupt and Timers RB0/INT External Interrupt input- Timer 0- Compare mode- Timer 1/CCP Programmable Period Scalar- Timer 1 External Event Counter- Timer 1 and Sleep Mode- Pulse Width Modulated Outputs- Port B Change Interrupts. Change Interrupts.	15	Power point presentation, ICT tools
IV	I/O Port Expansion Synchronous Serial Port Module- Serial Peripheral Interface- Output Port Expansion- Input Port Expansion- LCD Display.	15	Power point presentation, ICT tools
V	I2C Bus for Peripheral chip Access I2C Bus Operation- I2C Bus Subroutine- DAC output- Temperature sensor-Serial EEPROM.	15	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE)
Formative Examination - Blue Print
Articulation Mapping – K Levels with Course Outcomes (COs)

Articulation Mapping						
Internal	Cos	K Level	Section A		Section B Either or Choice	Section C Either or Choice
			MCQs			
			No. of. Questions	K - Level		
CI	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AI	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
CI	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
AII	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
Question Pattern CIA I & II		No. of Questions to be asked	4		4	4
		No. of Questions to be answered	4		2	2
		Marks for each question	1		5	8
		Total Marks for each section	4		10	16

Distribution of Marks with K Level CIA I & CIA II							
	K Level	Section A (Multiple Choice Questions)	Section B (Either / Or Choice)	Section C (Either / Or Choice)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	2	-	-	2	3.6	7
	K2	2	-	-	2	3.6	
	K3	-	20	32	52	93	93
	K4	-	-	-	-	-	-
	Marks	4	20	32	56	100	100
CIA II	K1	2	-	-	2		7.2
	K2	2	-	-	2	3.6	
	K3	-	10	16	26	46.4	46.4
	K4	-	10	16	26	46.4	46.4
	Marks	4	20	32	56	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)						
S. No	COs	K - Level	Section A (MCQs)		Section B (Either / or Choice) With K - LEVEL	Section C (Either / or Choice) With K - LEVEL
			No. of Questions	K – Level		
1	CO1	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
2	CO2	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
3	CO3	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
4	CO4	K1 – K4	2	K1&K2	2 (K4&K4)	2 (K4&K4)
5	CO5	K1 – K4	2	K1&K2	2 (K3&K3)	2 (K3&K3)
No. of Questions to be Asked			10		10	10
of Questions to be answered			10		5	5
Marks for each question			1		5	8
Total Marks for each section			10		25	40
(Figures in parenthesis denotes, questions should be asked with the given K level)						

Distribution of Marks with K Level						
K Level	Section A (Multiple Choice Questions)	Section B (Either or Choice)	Section C (Either/ or Choice)	Total Marks	% of (Marks without choice)	Consolidated %
K1	5	-	-	5	3.6	7
K2	5	-	-	5	3.6	
K3	-	40	64	104	74.3	74
K4	-	10	16	26	18.5	19
Marks	10	50	80	140	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.						

Summative Examinations - Question Paper – Format

Q. No.	Unit	CO	K-level		
Answer ALL the questions PART – A (10 x 1 = 10 Marks)					
1.	Unit - I	CO1	K1		
				a)	b)
				c)	d)
2.	Unit - I	CO1	K2		
				a)	b)
				c)	d)
3.	Unit - II	CO2	K1		
				a)	b)
				c)	d)
4.	Unit - II	CO2	K2		
				a)	b)
				c)	d)
5.	Unit - III	CO3	K1		
				a)	b)
				c)	d)
6.	Unit - III	CO3	K2		
				a)	b)
				c)	d)
7.	Unit - IV	CO4	K1		
				a)	b)
				c)	d)
8.	Unit - IV	CO4	K2		
				a)	b)
				c)	d)
9.	Unit - V	CO5	K1		
				a)	b)
				c)	d)
10.	Unit - V	CO5	K2		
				a)	b)
				c)	d)

Answer ALL the questions PART – B (5 x 5 = 25 Marks)				
11. a)	Unit - I	CO1	K3	
OR				
11. b)	Unit - I	CO1	K3	
12. a)	Unit - II	CO2	K3	
OR				
12. b)	Unit - II	CO2	K3	
13. a)	Unit - III	CO3	K3	
OR				
13. b)	Unit - III	CO3	K3	
14. a)	Unit - IV	CO4	K4	
OR				
14. b)	Unit - IV	CO4	K4	
15. a)	Unit - V	CO5	K3	
OR				
15. b)	Unit - V	CO5	K3	

Answer ALL the questions PART – C (5 x 8 = 40 Marks)				
16. a)	Unit - I	CO1	K3	
OR				
16. b)	Unit - I	CO1	K3	
17. a)	Unit - II	CO2	K3	
OR				
17. b)	Unit - II	CO2	K3	
18. a)	Unit - III	CO3	K3	
OR				
18. b)	Unit - III	CO3	K3	
19. a)	Unit - IV	CO4	K4	
OR				
19. b)	Unit - IV	CO4	K4	
20. a)	Unit - V	CO5	K3	
OR				
20. b)	Unit - V	CO5	K3	



MANNAR THIRUMALAI NAICKER COLLEGE (AUTONOMOUS)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION

FOR THOSE WHO JOINED IN 2023-2024 AND AFTER

Course Name	Biomedical Instrumentation			
Course Code	23UELSC61	L	P	C
Category	Skill	2	-	2
COURSE OBJECTIVES:				
➤ To understand the basic physiology. ➤ To gain knowledge about different electrodes and transducers used in Biomedical instrumentations. ➤ To understand the concepts of medical instruments, signal conditioners and diagnostic equipments. ➤ To gain knowledge for trouble shooting of medical instruments. ➤ To understand the Physiological Assisting devices.				
UNIT - I BIOPOTENTIALS				06
Introduction-Cellular fluids, Trans membrane potentials, R.M.P cell stimulations action potentials. Physiological transducers, Biosensors, Smart sensors.				
UNIT - II BIOELECTRIC SIGNALS AND ELECTRODES				06
Origin of bioelectric signals –Components of Bio-Medical Instrument System- Recording electrodes -Skin contact – Impedance –Electrodes for ECG –EMG and EEG – Electrical conductivity of electrodes gels creams microelectrodes-amplifiers.				
UNIT - III PATIENTS MONITORING SYSTEMS				06
Block diagram and signal analysis of Phonocardiography – Electroencephalograph – Electromyography – Measurement of heart rate – Measurement of blood pressure – Measurement of temperature – Measurement of respiration rate – Apnoea detectors.				
UNIT - IV THERAPEUTIC EQUIPMENTS				06
Cardiac pace maker- Cardiac defibrillators – Surgical diathermy – Microwave diathermy Ultrasonic therapy unit – Pain relief through electrical stimulation.				
UNIT - V MODERN IMAGING SYSTEMS				06
Computer X ray machine –X ray computed tomography Basic NMR components – Echocardiography – Thermography equipments.				
Total Lecture Hours				30

BOOKS FOR STUDY:

- M.Arumugam, Bio-Medical Instrumentation-1992- Anuradha Agencies.

Unit-I- Chap-1;

Unit-II- Chap-2 & 3;

Unit-III- Chap-4;

Unit-IV- Chap-5 & 6;

Unit-V- Chap-7 to 10.

BOOKS FOR REFERENCES:

- Principles of Medical Electronics and Biomedical Instrumentation-C.RajaRao& S K Guha- 2013- Universities Press.
- L.Cromwell, F.J.Weibell and E.A.Pfeiffer, Bio-Medical Instrumentation and measurements, PHI, 1991.
- R.Khandpur. Handbook of bio-medical instrumentation. TMH. 2nd edition 2003.
- Medical Electronics – Tomsin& Webster.

WEB RESOURCES:

- ❖ <https://www.youtube.com/watch?v=i2mZylgP1Fk>
- ❖ <https://www.youtube.com/watch?v=4ldv98F7Zng>
- ❖ <https://nptel.ac.in/courses/108/105/108105101/>
- ❖ <https://nptel.ac.in/courses/108/105/108105091/>

Nature of Course	EMPLOYABILITY				SKILL ORIENTED		✓	ENTREPRENEURSHIP		
Curriculum Relevance	LOCAL		REGIONAL			NATIONAL			GLOBAL	✓
Changes Made in the Course	Percentage of Change			20	No Changes Made		✓	New Course		
*Treat 20% as each unit (20*5=100%) and calculate the percentage of change for the course.										

COURSE OUTCOMES:**K LEVEL**

After studying this course, the students will be able to:

CO1	Understand the Concept of bio-potential	K1 to K2
CO2	Understand the concept of medical instruments	K1 to K2
CO3	Develop the troubleshooting Skills of medical instruments	K1 to K2
CO4	Understand the concepts of signal conditioners & diagnostic equipment	K1 to K2
CO5	Analyze physiological assist devices	K1 to K2

MAPPING WITH PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	3	2	3	1	2	3
CO2	3	3	2	2	2	2	3	2	1	1
CO3	3	3	3	2	2	1	1	3	3	2

CO4	2	2	2	3	3	3	1	1	2	2
CO5	2	2	3	3	3	1	2	2	3	3

3- STRONG

2 – MEDIUM

1 - LOW

CO / PO MAPPING:

COS	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	3	3	1
CO 3	3	3	2	2	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	3
WEIGHTAGE	13	14	12	13	12
WEIGHTED PERCENTAGE OF COURSE CONTRIBUTION TO POS	100	93	80	86	80

LESSON PLAN:

UNIT	Biomedical Instrumentation	HRS	PEDAGOGY
I	BIOPOTENTIALS Introduction-Cellular fluids, Trans membrane potentials, R.M.P cell stimulations action potentials. Physiological transducers, Biosensors, Smart sensors.	06	Power point presentation, ICT tools
II	BIOELECTRIC SIGNALS AND ELECTRODES Origin of bioelectric signals –Components of Bio-Medical Instrument System- Recording electrodes -Skin contact – Impedance –Electrodes for ECR –EMG and EEG – Electrical conductivity of electrodes jellies creams microelectrodes-amplifiers.	06	Power point presentation, ICT tools
III	PATIENTS MONITORING SYSTEMS Block diagram and signal analysis of Phonocardiography – Electroencephalograph – Electromyography – Measurement of heart rate – Measurement of blood pressure – Measurement of temperature – Measurement of respiration rate – Apnoea detectors.	06	Power point presentation, ICT tools
IV	THERAPEUTIC EQUIPMENTS Cardiac pace maker- Cardiac defibrillators – Surgical diathermy –		Power point presentation, ICT tools

	Microwave diathermy Ultrasonic therapy unit – Pain relief thro“ electrical stimulation.	06	
V	MODERN IMAGING SYSTEMS Computer X ray machine –X ray computed tomography Basic NMR components – Echocardiography – Thermography equipments.	06	Power point presentation, ICT tools

Learning Outcome Based Education & Assessment (LOBE) Formative Examination - Blue Print Articulation Mapping – K Levels with Course Outcomes (COs)				
Internal	Cos	K Level	Section A	
			MCQs	
			No. of. Questions	K - Level
CI	CO1	K1 – K2	25	K1,K2
AI	CO2	K1 – K2	25	K1,K2
CI	CO3	K1 – K2	25	K1,K2
AII	CO4	K1 – K2	25	K1,K2
Question Pattern CIA I & II		No. of Questions to be asked	50	
		No. of Questions to be answered	50	
		Marks for each question	1	
		Total Marks for each section	50	

* Two Formative examinations will be conducted as a part of Continuous Internal Assessment under which, 50 MCQ's will be asked [50X1=50 marks] from any 4 CO's. (Ist Test-2 CO's & IInd Test-2 CO's) in equal weightage

Distribution of Marks with K Level CIA I & CIA II					
	K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidate of %
CIA I	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100
CIA II	K1	30	30	60	100
	K2	20	20	40	
	K3				
	K4				
	Marks	50	50	100	100

K1- Remembering and recalling facts with specific answers

K2- Basic understanding of facts and stating main ideas with general answers

K3- Application oriented- Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

CO5 will be allotted for individual Assignment which carries five marks as part of CIA component.

Summative Examination – Blue Print Articulation Mapping – K Level with Course Outcomes (COs)				
S. No	COs	K - Level	Section A (MCQs)	
			No. of Questions	K – Level
1	CO1	K1-K2	15	K1,K2
2	CO2	K1-K2	15	K1,K2
3	CO3	K1-K2	15	K1,K2
4	CO4	K1-K2	15	K1,K2
5	CO5	K1-K2	15	K1,K2
No. of Questions to be Asked			75	
No. of Questions to be answered			75	
Marks for each question			1	
Total Marks for each section			75	
(Figures in parenthesis denotes, questions should be asked with the given K level)				

In summative examinations, 75 MCQ's will be asked [75X1=75 marks] from all 5 CO's in equal weightage.

Distribution of Marks with K Level				
K Level	Section A (Multiple Choice Questions)	Total Marks	% of (Marks without choice)	Consolidated %
K1	40	40	53	100
K2	35	35	47	
K3				
K4				
Marks		75	100	100
NB: Higher level of performance of the students is to be assessed by attempting higher level of K levels.				