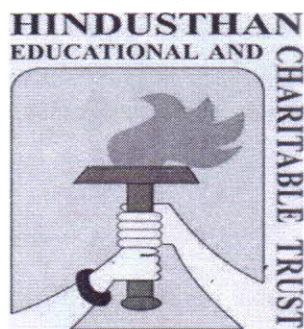


**LEARNING OUTCOMES–BASED CURRICULUM  
FRAMEWORK (LOCF)**

**in the**

**POST GRADUATE PROGRAMME  
M.Sc., ELECTRONICS AND COMMUNICATION SYSTEMS**

**FOR THE STUDENTS ADMITTED FROM THE  
ACADEMIC YEAR 2021 - 2022 AND ONWARDS**



**HICAS**

**HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)**

**(Affiliated to Bharathiar University and Accredited by NAAC)**

**COIMBATORE-641028**

**TAMILNADU, INDIA.**

Phone: 0422-4440555

Website: [www.hindusthan.net/hicas/](http://www.hindusthan.net/hicas/)

## **INTRODUCTION**

The students pursuing Electronics and Communication Systems course would develop in-depth understanding of various aspects of the subject. The working principles, design guidelines and experimental skills associated with different design methodologies for digital and embedded systems, communication electronics and control systems and various applications of electronic devices, circuits and systems are among such important aspects.

## **PREAMBLE**

Learning Outcome Based Curriculum Framework for Master of Science (M.Sc.) in Electronics and Communication Systems is a post graduation course. The credit system implemented through this curriculum, would allow students to develop a strong footing in the fundamentals and specialize in the disciplines of his/her liking and abilities.

## **VISION**

To provide world class education to the students to face global challenges and to inculcate the latest trends in technological advancement. To cater the needs of the environmental and ethical values in the mind of students to become good citizens and entrepreneurs.

## **MISSION**

The Mission of the college is to pursue a philosophy of perpetual acquisition of knowledge. The important policy is to provide value-based education and to bring out the hidden potentials in students that equip them to approach life with optimism.

## **PROGRAMME EDUCATIONAL OBJECTIVES (PEO)**

- PEO 1:** Have a successful career in electronics academia / industries / entrepreneurs.
- PEO 2:** Critically analyze existing literature in an area of specialization.
- PEO 3:** Ethically develop innovative and research-oriented methodologies to solve the problems identified.
- PEO 4:** Be receptive to new technologies and attain professional competence through lifelong learning such as advanced degrees, publications and other professional activities.
- PEO 5:** Communicate effectively and manage resources skillfully as members and leaders of the profession.

### **PROGRAMME OUTCOME (PO)**

**PO1: DISCIPLINARY KNOWLEDGE :** Utilize the basic knowledge in mathematics, science and technology in Electronics and Communication field.

**PO2: PROBLEM SOLVING AND ANALYSING:** Identify, formulate and solve complex problems to achieve demonstrated conclusions using mathematical principles and science in Electronics and Communication field.

**PO3: ENVIRONMENT SUSTAINABILITY AND ETHICS:** Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns.

**PO4: MODERN TOOL USAGE:** Construct, choose and apply the techniques, resources and modern tools required for Electronics and Communication systems applications.

**PO5: CO-OPERATIVE TEAM WORK & COMMUNICATIVE SKILLS:** Communicate the electronic activities to technical society for documentation and presentation.

**PO6: SELF DIRECTED / LIFE LONG LEARNING:** Demonstrate resourcefulness for contemporary issues and lifelong learning. Interpret the data pertaining to Electronics and Communication problems and arrive at valid conclusions.

**PO7: ENHANCING RESEARCH CULTURE:** Apply research-based knowledge to design and conduct experiments, analyze, synthesizes.

### **PROGRAMME SPECIFIC OUTCOME (PSO)**

**PSO1:** Apply the fundamental concepts of electronics and communication systems to design a variety of components and systems for technology applications.

**PSO2:** Select and apply cutting-edge hardware and software tools to solve complex Electronics and Communication systems problems.

**PSO3:** Adapt the emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing/novel problems.

**PSO4:** Realize the fact that the knowledge and techniques learnt in this course has direct implication for the betterment of society and its sustainability.

**PSO5:** Analyze the functional characteristics of various concepts such as signal processing, image processing, communication, networking, embedded systems, VLSI and control system.

**HINDUSTHAN COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),  
COIMBATORE-641028**

**SCHEME OF EXAMINATIONS - CBCS & LOCF PATTERN**

*(For the Students admitted from the Academic year 2021-2022 and Onwards)*

**PG PROGRAMME**

**Programme: M.Sc.,**

**Branch: Electronics and Communication Systems**

Course Code	Course Type	Course Title	Credit points	Lecture Hours/Week		Exam Duration (hours)	MAX. MARKS		
				Theory	Practical		I.E.	E.E	Total
<b>Semester – I</b>									
21ELP01	DSC	Digital and Network Communication	4	5	-	3	40	60	100
21ELP02	DSC	Microwave and RADAR Navigation System	4	5	-	3	40	60	100
21ELP03	DSC	8051 Microcontroller with C Programming	4	5	-	3	40	60	100
21ELP04	DSC	Power Electronics	4	4	-	3	40	60	100
21ELP05	DSC	Practical I - Digital Communication Systems	3	-	5	5	50	50	100
21ELP06	DSC	Practical II - 8051 Microcontroller and its Applications	3	-	5	5	50	50	100
21ELP07	SEC	Internship / Institutional Training / Mini-Project	2	-	-	-	100	-	100
21ELPE01	AEE	Open Elective – I	2	3	-	3	100	-	100
21ELPV01	ACC	VAC – I	1*	2	-	2	50	-	50**
21ELPJ01	SEC	Aptitude / Placement Training	Grade *	2	-	2	50	-	50**
-	SEC	SDR – Student Development Record	Assessment will be done in the end of III – rd semester						
<b>Total</b>			<b>26</b>	<b>26</b>	<b>10</b>	<b>-</b>	<b>460</b>	<b>340</b>	<b>800</b>
<b>Semester – II</b>									
21ELP08	DSC	Optical Fiber Communication	4	5	-	3	40	60	100
21ELP09	DSC	MEMS and Control Systems	4	5	-	3	40	60	100
21ELP10	DSC	Embedded Systems and RTOS	4	5	-	3	40	60	100
21ELP11	DSC	Digital System Design using VHDL	4	4	-	3	40	60	100
21ELP12	DSC	Practical III - Optical and Microwave Communication	3	-	5	5	50	50	100
21ELP13	DSC	Practical IV - Embedded System and RTOS	3	-	5	5	50	50	100
21ELP14	SEC	Internship / Institutional Training / Mini-Project / Extension Activity	2	-	-	-	100	-	100
21ELPE02	AEE	Open Elective – II	2	3	-	3	100	-	100
21ELPV02	ACC	VAC – II	1*	2	-	2	50	-	50**
21ELPJ02	SEC	Online Courses	Grade *	-	-	-	-	-	C/NC

21ELPJ03	SEC	Aptitude / Placement Training	Grade *	2	-	2	50	-	50**
		<b>Total</b>	<b>26</b>	<b>26</b>	<b>10</b>	<b>-</b>	<b>460</b>	<b>340</b>	<b>800</b>
<b>Semester - III</b>									
21ELP15	DSC	Mobile Communication	4	5	-	3	40	60	100
21ELP16	DSC	Digital Signal Processing	4	4	-	3	40	60	100
21ELP17	DSC	Modern VLSI Design	4	4	-	3	40	60	100
21ELP18	DSE	Elective – I / <b>DSE-I</b>	3	3	-	3	40	60	100
21ELP19	DSE	Elective – II / <b>DSE-II</b>	3	3	-	3	40	60	100
21ELP20	DSC	Digital Signal Processing - Practical V	3	-	5	5	50	50	100
21ELP21	DSC	VLSI Design - Practical VI	3	-	5	5	50	50	100
21ELP22	SEC	Internship / Institutional Training / Mini-Project / Extension Activity	2	-	-	-	100	-	100
21ELPE03	AEE	Open Elective - III	2	3	-	3	100	-	100
21ELPV03	ACC	VAC – III	1*	2	-	2	50	-	50**
21ELPJ04	SEC	Online Courses	Grade *	-	-	-	-	-	C/NC
21ELPJ05	SEC	Aptitude / Placement Training	Grade *	2	-	2	50	-	50**
21ELPJ06	SEC	SDR – Student Development Record	2*	-	-	-	-	-	-
		<b>Total</b>	<b>28</b>	<b>26</b>	<b>10</b>	<b>-</b>	<b>500</b>	<b>400</b>	<b>900</b>
<b>Semester - IV</b>									
21ELP23	DSE	Elective - III / <b>DSE-III</b>	3	5	-	3	40	60	100
21ELP24	DSE	Elective - IV / <b>DSE-IV</b>	3	5	-	3	40	60	100
21ELP25	DSC	Self-Study Course	3	-	-	3	40	60	100
21ELP26	SEC	Project Work /Student Research	5	-	-	-	50	150	200
		<b>Total</b>	<b>14</b>	<b>10</b>	<b>-</b>	<b>-</b>	<b>170</b>	<b>330</b>	<b>500</b>
<b>Grand Total</b>									

- denotes Extra credits which are not added with total credits.
- \*\*denotes Extra marks which are not added with total marks.
- VAC-Value Added Course(Extra Credit Courses)
- \*Grades depends on the marks obtained
- † C-Completed/ NC- Not Completed

Range of Marks	Equivalent remarks
80 and above	Exemplary
70–79	Very good
60–69	Good
50–59	Fair
Below 50	Not Satisfactory=Not completed

- Part IV& V not included in total marks and CGPA calculation.
- I.E-Internal Exam
- E.E-External Exam
- J-Job Oriented Course
- E-Open Elective Papers

#### PASSING MINIMUM

- Passing Minimum for UG 40% and for PG 50 %
- For UG : 35 % (25 marks) in EE and 40 % in Total Marks
- For PG 50 % (30 marks) in EE and 50 % in Total Marks

## Abstract for Scheme of Examination

(For the students admitted during the academic year 2021 - 2022 and onwards)

Course	Papers	Credit	Total Credits	Marks	Total Marks
<i>Core /DSC</i>	11	4	44	100	1100
<i>Self-Study Course /DSC</i>	1	3	3	100	100
<i>Electives/DSE</i>	4	3	12	100	400
<i>Practical/ DSC</i>	6	3	18	100	600
<i>Project/ SEC</i>	1	5	5	200	200
<i>Internship/Institutional Training/Mini-Project / Extension Activity</i>	3	2	6	100	300
<i>Open Electives /AEE</i>	3	2	6	100	300
<i>Job Oriented Course / Value Added Course</i>	3	1*	3*	50	150**
<i>Skill Based/ Placement/Aptitude SEC</i>	3	Grade*	Grade*	50	150**
<i>Online Courses / SEC</i>	2	Grade*	Grade*	-	-
<i>SDR - SEC</i>	1	2*	2*	-	-
<b>Total</b>			94 (5 Extra Credits)		3000 (300**)

<b>List of Open Elective Papers</b>	
<b>Open Electives</b>	Yoga for Human Excellence Human Health & Hygiene Indian Culture and Heritage Indian Constitution and Political System Consumer Awareness and Protection Professional Ethics and Human Values Human Rights, Women's Rights & Gender Equality Disaster Management Green Farming Corporate Relations start a Business? Research Methodology and IPR General Studies for Competitive Examinations IIT JAM Examination (for Science only) CUCET Examination
<b>VAC Papers</b>	-
<b>Courses offered by the Departments to other Programmes</b>	-


Note: VAC / JOC courses can be added along with the above open electives.

<b>List of Elective Papers/ DSE</b> <b>(Can choose any one of the paper as electives)</b>		
	<b>Course Code</b>	<b>Title</b>
<b>Electives/ DSE-I</b>	21ELP18A	Wireless Sensor Networks
	21ELP18B	Real Time System Design
<b>Electives/ DSE-II</b>	21ELP19A	ARM Core Processor
	21ELP19B	Virtual Instrumentation
<b>Electives/ DSE-III</b>	21ELP23A	Introduction to Robotics
	21ELP23B	Digital Circuits
<b>Electives/ DSE-IV</b>	21ELP24A	Introduction to Wireless and Cellular Communications
	21ELP24B	Design for Internet of Things

  
**Syllabus Coordinator**

  
**Academic Council – Member Secretary**

**Co-ordinator**  
**Academic Audit Cell**  
**Hindusthan College of Arts & Science,**  
**Coimbatore-641 028.**

  
**HOS of the Department**  
**Department of Electronics**  
**Hindusthan College of Arts & Science**  
**Coimbatore-641 028**  
**PRINCIPAL**

**PRINCIPAL**  
**Hindusthan College of Arts and Science**  
**Hindusthan Gardens, Behind Nava India**  
**Coimbatore - 641 028.**



### Regulations

1. Internship / Institutional Training / **Mini-Project** is related to the discipline can be permitted to complete during the end of I and III semesters for minimum seven days each and permitted to submit a report.

Internship / Institutional Training	Not more than seven days
Mini project	Depends on the departments

2. Project work is considered as a special course involving application of knowledge in problem solving / analyzing /exploring a real-life situation. A Project work may be given in lieu of a discipline specific elective paper.
3. To fix the practical marks for PG programme for Internal assessment and External assessment as 50 marks I.E. and 50 marks E.E and to modify the component for Internal assessment as Test-1 = 20, Test-2 = 20 and Observation and concept application = 10.
4. To modify the Internal and External Assessment marks FOR THEORY as 40 and 60 for all the post graduate programme for the Academic year 2021-2022 and onwards. Subsequently, the Internal component is to be modified as Test -1 = 10, Model = 10 and other component = 20. The Components for internal assessment can be of 5 marks for each 4 components out of 10 components (**10 Components can be fixed by the concern boar chairman**) selected by the each subject in-charges for their respective courses.
5. To incorporate Online courses as a non-credit skill enhancement course for the III and IV th semesters and Grades will be assessed based on the certificates produced by the students. It is compulsory to produce one Online course certificate for each semester to avail grades for the students. (2 certificates in any of the online platform is mandatory)
6. **Two Elective courses DSE- III & DSE- IV are the subjects which are to be related with NPTEL courses.**

#### **FAST TRACK SYSTEM:**

The Students have the options of taking two subjects of the fourth semester of M.Sc Electronics and Communication Systems programme through NPTEL / Swayam portal from the list given or offered by NPTEL and approved by the department for which credit transfer is permitted. The students should inform the department prior to the registration of the course and get due approval for the same. If the student completes these courses before the start of the fourth semester, the student can be considered for a fast track programme, and do the projects work alone during the fourth semester apart from the self study paper. Once the student submits the successful course completion credentials as required by the college for the NPTEL/SWAYAM online courses, then the credit transfer will be considered for qualifying the degree.

7. **If the students who are all completed the NPTEL courses before semester -III, they can avail exemption from appearing exams of DSE- III & DSE- IV in Fast track scheme.**
8. SDR – Student Development Report to be received by the department from the students till end of the **Third** semester. (Evidences of Curricular activities and Co-curricular activities)

### PG/MCA Scheme of Evaluation (Internal & External Components)

(For the students admitted during the academic year 2021-2022 and onwards)

#### 1. Internal Marks

Components	Marks
Test	10
Model Exam	10
Internal Assessment components	20 #
<b>TOTAL</b>	<b>40</b>

#### # List of components for Internal Assessment

S.No	Components
1	Multiple choice questions
2	Quiz
3	Video teach
4	UT – Unannounced test
5	Co-operative or Collaborative Learning
6	Mini Project/Assignment
7	Case study
8	Seminar

(Any four components from the above list with five marks each will be calculated .4x5=20 marks)

#### 2. a) Components for Practical I.E.

Components	Marks
Test -I	20
Test - II	20
Application*	10
<b>Total</b>	<b>50</b>

#### b) Components for Practical E.E.

Components	Marks
Experiments	40
Record	5
Viva	5
<b>Total</b>	<b>50</b>

#### 3. Institutional/ Industrial Training, Mini Project and Major Project Work

Internships/Industrial Training (I.E)		Major Project Work		
Component	Marks	Component	Marks	Total Marks
Work diary	25	I.E a)Attendance	20	50
Report	50	b)Review	30	
Viva-voce	25			
<b>Total</b>	<b>100</b>	E.E* a) Final report	120	150
		b)Viva-voce	30	
			<b>Total</b>	<b>200</b>

\*Evaluation of report and conduct of viva voce will be done jointly by Internal and External Examiners

#### 4. Value Added Courses / Aptitude/Placement courses:

Components	Marks
Two Test (each 1 hour) of 25 marks each QP is objective pattern (25x1=25)	50
<b>Total</b>	<b>50</b>

**5. Guidelines for Open Elective**

No of Activities	Marks
Two Tests (each 3 hours) of 50 marks each [5 out of 8 descriptive type questions 5 x 10 = 50 Marks]	100

**Guidelines:**

1. The passing minimum for these items should be 50%
2. If the candidate fails to secure 50% passing minimum, he / she may have to reappear for the same in the Subsequent semesters
3. Item No's:4 is to be treated as 100% Internals and evaluation through online.
4. Item No.2: \* - Application should be from the relevant practical subject other than the listed programmes. It must be enclosed in the practical record.

*For all PG/MBA/MCA Programmes (2021-2022 Regulations)*  
**QUESTION PAPER PATTERN FOR CIA EXAM**

Reg.No:----- Q.P.CODE:  
HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)  
PG/MBA/MCA DEGREE CIA EXAMINATIONS -----20-----  
(-----Semester)  
BRANCH: -----  
Subject Name: -----

Time: Two Hours

Maximum: 50 Marks

**Section-A (3 x 4=12 Marks)**

Answer ALL Questions

ALL questions carry EQUAL Marks

(Q.No: 1 to 3 Either Or type)

**Section-B (2 x 12=24 Marks)**

Answer any TWO Questions out of THREE Questions

ALL questions carry EQUAL Marks

(Q.No: 4 to 6)

**Section-C (1 x 14=14 Marks)**

(Compulsory Question: It should be a Case study/Application oriented/Critical analysis  
from any of the units)

(Q.No: 7)

**QUESTION PAPER PATTERN FOR MODEL / END SEMESTER EXAM**

Reg.No:----- Q.P.CODE:  
HINDUSTHAN COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)  
PG/MBA/MCA DEGREE MODEL EXAMINATIONS -----20-----  
(-----Semester)  
BRANCH: -----  
Subject Name: -----

Time: Three Hours

Maximum: 60 Marks

**SECTION - A (5x4=20 marks)**

Answer ALL Questions

ALL Questions carry EQUAL Marks

(Q.No 1 to 5 Either Or type)

(One question from each Unit)

**SECTION - B (3x10=30 Marks)**

Answer any THREE Questions Out of FIVE Questions

ALL Questions carry EQUAL Marks

(Q.No 6 to 10)

(One question from each Unit)

**SECTION - C (1x10=10Marks)**

(Compulsory Question: It should be a Case study/Application oriented/Critical analysis  
from any of the units)

(Q.No: 11)

<b>Course Code:</b>	21ELP01	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>Digital and Network Communication</b>						<b>Semester:</b>	<b>I</b>
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>5</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>4</b>

### COURSE OBJECTIVE

1. Students can able to understand the building blocks of digital communication system.
2. Able to understand the network architecture and protocols.
3. Students can get exposure and implement on various modulation schemes.
4. Can able to analyze different types of protocols used in network architecture.
5. Can able to evaluate transmission techniques in communication related jobs.

### COURSE OUTCOME

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Remember the performance of PAM, PCM and DM in a digital communication	K1
CO2	Understand the different types of digital modulation schemes for implementing digital radio	K2
CO3	Apply the concept of analog and digital transmission techniques.	K3
CO4	Analyze different types Network Architecture and Protocols	K4
CO5	Evaluate the working of LAN and ISDN	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELP01	<b>Digital and Network Communication</b>	<b>Sem: I</b>
<b>Unit No.</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	<b>Signal Digitization</b> Sampling Theorem – Pulse Amplitude Modulation – Pulse Position Modulation – Pulse Width Modulation – Pulse Code Modulation – Quantization: Quantization Noise – Delta Modulation: Adaptive Delta Modulation – Signal Power – Signal to Quantization Noise Ratio – PCM and DM Voice Signal Comparison – Time Division Multiplexing – CCITT.	<b>13</b>

II	<b>Digital Radio</b> Digital Radio Block Diagram – Digital Modulation: Amplitude Shift Keying – Frequency Shift Keying – Phase Shift Keying – Binary Phase Shift Keying – Quadrature Phase Shift Keying – Quadrature Amplitude Modulation – Digital Demodulation: Coherent Demodulation – Coherent Detection – FSK Demodulator – MFSK Receivers– BPSK Demodulator – QPSK Demodulation – QAM Demodulation.	13
III	<b>Data Communication</b> Introduction – Basic Terms and Concepts – Line Configurations – Topology – Transmission Media – MODEM: Standard and Types – Analog and Digital transmission: Encoding and Modulating – Channel Capacity – Base Band and Broad Band – Transmission Impairments – Multiplexing: FDM – TDM – Error Detection and Control: CRC.	13
IV	<b>Network Architecture and Protocols</b> Layered Architecture – OSI model – Functions of Layers – Data Link Control Protocols – ARQ – Stop and Wait – Sliding Window – Go back N and Selective Repeat – Asynchronous Protocol: X Modem – Y Modem– Kermit – Synchronous Protocol: BSC– SDLC – HDLC– TCP/IP Model – SMTP – HTTP – FTP.	13
V	<b>LAN and ISDN</b> LAN: Standard, Protocol – IEEE 802 Standards: ETHERNET – LLC – MAC – CSMA/CD – Token Ring – Token Bus – FDDI –ALOHA– SONET – ISDN: IDN – Channels – User Interfaces – ISDN Layers – Broad Band ISDN – Frame Relay – ATM: Concept and Architecture – ISDN Protocol– Physical Layer Protocol – D-channel Data Link Layer – Layer 3 Protocols– Network Signaling Systems: SS7 Protocol.	13

*Distribution of marks: Problems 40%, Theory 60%*

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOKS

1. Harold Kolimbris, "Digital Communication Systems with Satellite and Fiber Optics Applications", Pearson Education, Third Indian Reprint, 2004. (Unit –I&II)
2. Behrouz. A.Forouzan, "Data Communication and Networking", Tata McGraw Hill, fourth Edition, 2000. (Unit – III, IV and V)

#### REFERENCE BOOKS

1. John G. Proakis, "Digital Communications", McGraw–Hill Higher Education, fourth edition.
2. Ulysess Black, "Data Communications and Distributed Networks", third edition.
3. Sanjay Sharma, "Communication Systems", S.K. Kataria & Sons, first edition.
4. Michael A. Miller, Data & Network Communication, Delmar Cengage Learning, first edition.

## WEB RESOURCES

Web Link: <https://nptel.ac.in/courses/106/105/106105082/>  
<https://nptel.ac.in/courses/117/101/117101051/>



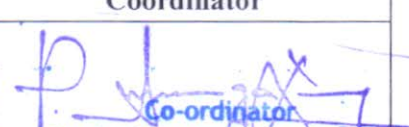
## MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	M	S	S	M	M	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	M

S-Strong, M- Medium

## ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Dr. R. PREMA Name & Signature of the Staff	 Dr. K. THANCAVEL Name & Signature	 Co-ordinator Curriculum Development Cell Name & Signature Hindusthan College of Arts & Science Coimbatore-641 028.

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028



<b>Course Code:</b>	<b>21ELP02</b>	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>Microwave and RADAR Navigation System</b>						<b>Semester:</b>	<b>I</b>
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>5</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>4</b>

### COURSE OBJECTIVES

1. To enable the students to learn the operations of wave equation.
2. To get deep knowledge in Microwave Devices and Circuits.
3. To get thorough knowledge about uses of microwave amplifiers and oscillators.
4. Can get exposure on wave guides and microwave antennas.
5. To enable the students to know more about RADAR systems.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Remember and recognize Maxwell's Equations	K1
CO2	Understand the working of various microwave devices	K2
CO3	Classify the working of microwave amplifiers and oscillators	K2 & K3
CO4	Analyze the performance of wave guides and various antennas	K4
CO5	Evaluate the working of RADAR system and its applications	K5

**K1- Remember, K2- Understand, K3- Interpret, K4- Analyse, K5- Evaluate**

10/01/2021  
 150  
 ,sonar P and to  
 150 148

## SYLLABUS

21ELP02	Microwave and RADAR Navigation System	Sem: I
Unit No.	Topics	Hours
I	<b>EM Wave Theory</b> Introduction to Microwaves: History – Region and Band Designations– Advantages – Applications – Maxwell’s Equations: Ampere’s Law – Faraday’s Law – Gauss Law–Wave Equations – TEM/TE/TM/HE Wave Definitions –Transmission Lines - Two wire parallel transmission lines – Voltage and current relationship on transmission lines.	13
II	<b>Microwave Devices</b> Classification of Solid-State Microwave Devices – Varactor Diodes – PIN Diode–Schottky Barrier Diode (SBD) – Tunnel Diode –Gunn Diode – IMPATT Diode–TRAPATT Diode–BARITT Diodes – Quantum Electronic Devices.	13
III	<b>Microwave Amplifiers and Oscillators</b> Klystrons: Two Cavity Klystron Amplifier–Multicavity Klystron– Reflex Klystron–Traveling Wave Tube (TWT): Construction– Operation– Backward Wave Oscillator – Magnetrons: Cavity Magnetron Operation– Sustained Oscillations in Magnetron– Applications.	13
IV	<b>Waveguides and Microwave Antennas</b> Types of Waveguides– Propagation of Waves in Rectangular Waveguides– TE and TM Modes–Propagation of TM Waves in Rectangular Waveguide– TM Modes in Rectangular Waveguides. <b>Horn Antenna:</b> Sectoral E & H–plane Horn– Pyramidal Horn and Conical Horn – Parabolic Reflector: Feed for Parabolic Reflector – Lens Antenna – Slot Antenna – Micro Strip Antenna: Operation – Methods of Analysis – Polarization – Dual frequency.	13
V	<b>RADAR</b> Block Diagram – Classification: Doppler – Pulsed – Free Space RADAR Range Equation – Maximum Unambiguous Range –RADAR Receivers – Modulators – RADAR Displays: Plan Position Indicator (PPI) – Doppler Effect – CW Doppler RADAR – Moving Target Indicator (MTI) RADAR– Frequency Modulated CW RADAR – Radio Navigational Aids: Long Range Navigational Aid (LORAN).	13

*Distribution of marks: Problems 40%, Theory 60%*

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

## TEXT BOOKS

1. Dr. Kulkarni. M, “Microwave and Radar Engineering”, Umesh Publications, Fifth Revised Edition, 2015. (Unit –I to V)
2. Prasad K. D, “Antenna and Wave Propagation”, Sathya Prakashan Publication, Third Edition, Reprint, 2004.

## REFERENCE BOOKS

1. Merrill I. Skolnik, "Introduction to RADAR Systems", Tata McGraw-Hill, Third Edition, Fifth Reprint, 2002.
2. David M. Pozar. "Microwave Engineering", Wiley Publications, fourth edition.
3. Merrill I. Skolnik, "Introduction to Radar Systems", McGraw Hill Book Company, Second edition.

## WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/103/108103141/>  
<https://nptel.ac.in/courses/108/105/108105154/>


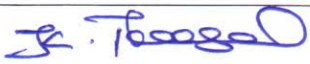
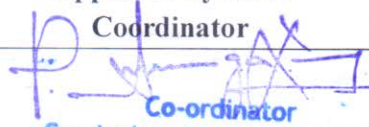
**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	M	S	M
CO5	M	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>MAHITHA MOHAN</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature Head of the Department	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028.

Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

<b>Course Code:</b>	<b>21ELP03</b>	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>8051 Microcontroller with C Programming</b>						<b>Semester:</b>	<b>I</b>
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>5</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>4</b>

### COURSE OBJECTIVES

1. To enable the Students to learn the architecture and instruction sets.
2. To express the concepts of programming and Interfacing concepts of 8051 Microcontroller.
3. To understand the assembly and C language programs.
4. Able to use interrupts and serial communication concepts.
5. Can evaluate the programming concepts for real time applications.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Recall the fundamentals of microprocessors and architecture of 8051	K1
CO2	Understand the assembly and C language programs of 8051	K2
CO3	Compute the function of interrupts and serial communication in real world applications	K3
CO4	Analyze different types of external interfaces including LEDES, LCD, Keypad, Matrix, Switches & Seven segment display.	K4
CO5	Evaluate programming concepts of real time applications	K3 & K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

<b>21ELP03</b>	<b>8051 Microcontroller with C Programming</b>	<b>Sem:I</b>
<b>Unit No.</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	<b>Overview of 8051</b> Introduction to Computing – Microprocessor and Microcontrollers – Microcontrollers and Embedded Processors – Overview of 8051 Family – 8051 Architecture – Timers – Registers and Memory Organizations.	<b>13</b>
<b>II</b>	<b>8051 Assembly Language Programming</b> Inside the 8051 – Pin Out – Instruction Set: Addressing Modes – Data Transfer Instruction – Logical Instruction– Arithmetic Instructions – Jump and Call Instructions –Bit Oriented Instructions – Flags and Stack.	<b>13</b>

III	<b>Programming with C</b> Data Types – Time Delay Programming – I/O Programming – Logic Operations – Arithmetic Operations – Timer Programming – Counter Programming.	13
IV	<b>8051 Interrupts &amp; Peripherals</b> 8051 Interrupts – Programming External Hardware Interrupts – 8051 Serial Communication Programming – Programming with Serial Communication Interrupts – Peripheral and Interrupt Programming in C.	13
V	<b>Real World Applications and Case Studies</b> LCD Interfacing – Keyboard Interfacing – Parallel and Serial ADC Interfacing – DAC Interfacing – Sensor Interfacing and Signal Conditioning – RTC Interfacing – Relays and Opto-Isolator Interfacing – Stepper Motor Interfacing – DC Motor Interfacing and PWM.	13

Distribution of marks: Problems 40%, Theory 60%

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOK

1. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C" by PHI, 2<sup>nd</sup> Edition, 2006. (Unit –I to V)

#### REFERENCE BOOKS

1. Kenneth J. Ayala, "The 8051 Microcontroller", Delmar Cengage Learning, 3<sup>rd</sup> Edition, 2004.
2. Subrata Ghoshal, 8051 Microcontroller: Internals, Instructions, Programming and Interfacing, Pearson Education, second edition, 2014.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/105/108105102/><https://nptel.ac.in/courses/117/104/117104072/>


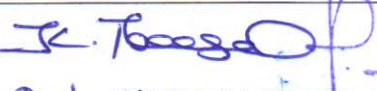

#### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S
CO3	S	S	M	S	S	M	S
CO4	M	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Mrs. S. SATHYA DEEBA Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science Name & Signature

**Head of the Department**  
Department of Electronics  
Hindusthan College of Arts & Science  
Coimbatore-641 028.

<b>Course Code:</b>	<b>21ELP04</b>	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>Power Electronics</b>						<b>Semester:</b>	<b>I</b>
<b>Hrs/Week:</b>	<b>4</b>	<b>L</b>	<b>4</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>4</b>

### COURSE OBJECTIVES

1. To impart the knowledge of different types of Power Semiconductor Devices
2. To get exposure on switching characteristics and applications.
3. To enable the students to work with static switches and voltage controllers.
4. Can able to design inverters and power supplies and become an entrepreneur.
5. Able to get thorough knowledge about regulators.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Enumerate the fundamental concepts of power electronic devices such as SCR, TRIAC, and Power MOSFET etc.	K1
CO2	Explain the working of controlled rectifiers and regulators.	K2
CO3	Demonstrate the working of static switches and voltage controllers	K3
CO4	Ability to characterize inverters and power supplies for industrial needs.	K4
CO5	Predict the design concept of UPS, battery charger, emergency lighting system etc.,	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELP04	Power Electronics	Sem: I
Unit No.	Topics	Hours
I	<b>Power Electronic Devices</b> Introduction – Power Semiconductor Devices: Power Diodes – Power Transistors: Power MOSFET – Insulated Gate Bipolar Transistor (IGBT) – Thyristors: SCR, TRIAC – Other Power Electronic Devices: SIT– MCT– PUT–SCS–SUS–GTO–SITH.	11



<b>II</b>	<b>Controlled Rectifiers</b> Controlled Rectifiers: Phase Controlled Converter – Single–Phase Semi Converter – Single–Phase Series Converter – DC Choppers: Step Down Operation: Step Down with RL Load –Step Up Operation – Switch Mode Regulator: Buck Regulator – Boost Regulator – Buck–Boost Regulator – CUK Regulator.	<b>11</b>
<b>III</b>	<b>Static Switches &amp; AC Voltage Controllers</b> AC Switches : Single Phase –Three Phase – Three Phase Reversing Switches – AC Switches for Bus Transfer – DC Switches– Solid State Relays – AC Voltage Controller: ON–OFF Control –Phase Control – Single Phase Bidirectional Controllers: Resistive Loads – Inductive Loads– Cyclo Converters: Single Phase Cyclo Converters.	<b>10</b>
<b>IV</b>	<b>Inverters</b> Single Phase Bridge Inverters – Three Phase Inverters – Voltage Control: Single PWM –Multiple PWM –Sinusoidal PWM – Phase Displacement Control – 60–Degree PWM – Third–Harmonic PWM.	<b>10</b>
<b>V</b>	<b>Power Supplies</b> DC Power Supplies: Switched Mode – Resonant – Bidirectional – AC Power Supplies: Switched Mode – Resonant – Bidirectional – UPS – Static Circuit Breakers – Battery Charger – Emergency Lighting System.	<b>10</b>

*Distribution of marks: Problems 60%, Theory 40%*

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOK

1. Rashid .M.H, "Power Electronics – Circuits, Devices and Applications", Third Edition, Prentice Hall, 2018. (Unit –I to V)

#### REFERENCE BOOKS

1. Dr.Bimbhra.P.S, "Power Electronics", Khanna Publishers, Fifth Edition, 2014.
2. V. Jagannathan, Power Electronics: Devices and Circuits, PHI Publications, Second Edition, 2013.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/105/108105066/>  
<https://nptel.ac.in/courses/108/102/108102145/>



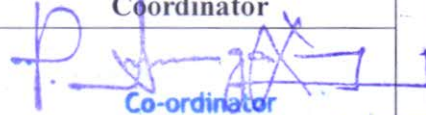
**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>Dr. K. THANGAVEL</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028.

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

<b>Course Code:</b>	<b>21ELP05</b>	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>Practical I: Digital Communication Systems</b>						<b>Semester:</b>	<b>I</b>
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>-</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>5</b>	<b>Credits:</b>	<b>3</b>

### COURSE OBJECTIVES

1. To impart the knowledge on implementation of baseband modulation techniques.
2. To enable the students to work on various modulation technologies.
3. Can able to design different types of modulation process.
4. Able to get thorough knowledge about delta modulation and demodulation techniques.
5. Get exposure on designing of quadrature modulation and demodulation schemes ✓

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Understand the implementation of baseband modulation techniques	K1
CO2	Apply the PCM and DM concept to design digital communication system	K2
CO3	Analyze the working of various pulse modulation schemes	K3
CO4	Design various digital modulators and demodulators for implementing digital communication	K4
CO5	Evaluate the output characteristics of quadrature modulation and demodulation process.	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

<b>21ELP05</b>	<b>Practical I: Digital Communication Systems</b>	<b>Sem:I</b>
<b>Experiment No.</b>	<b>Topics (Any 10 Experiments)</b>	
1	PAM Generation and Detection	
2	PWM Generation and Detection	
3	PPM Generation and Detection	
4	Frequency Sampling	

5	Pulse Code Modulation and Demodulation
6	Linear Pulse Code Modulation and Demodulation
7	ASK Generation and Detection
8	FSK Generation and Detection
9	PSK Generation and Detection
10	QPSK Generation and Detection
11	DPSK Generation and Detection
12	BPSK Generation and Detection
13	QAM Generation and Detection
14	Delta Modulation and Demodulation
15	Adaptive Delta Modulation and Demodulation

**Teaching methods:** < Practical Demonstration >

#### TEXT BOOK

1. Harold Kolimberis, "Digital Communication Systems with Satellite and Fiber Optics Applications", Pearson Education, Third Indian Reprint, 2004.

#### REFERENCE BOOK

1. John G. Proakis, "Digital Communications", McGraw-Hill Higher Education, fourth Edition, 2000.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/104/108104098/>  
<https://nptel.ac.in/courses/117/101/117101051/>

Computer-Aided Design  
 Department of Arts & Science  
 Government College of Engineering  
 Tirunelveli



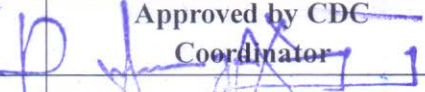
**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Dr. R. PREMA Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028 Name & Signature

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

<b>Course Code:</b>	<b>21ELP06</b>	<b>Course Title</b>					<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>	
		<b>Practical II: 8051 Microcontroller and its Applications</b>					<b>Semester:</b>	<b>I</b>	
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>-</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>5</b>	<b>Credits:</b>	<b>3</b>

### COURSE OBJECTIVES

1. To impart the outline of the practical skills for developing own ALP.
2. To understand C program for real world applications using 8051 microcontrollers.
3. Can able to design various embedded system products.
4. Able to distinguish between various code converters.
5. Get exposure to interpret the designing of programs based on real time applications.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Remember and apply basic programming concepts of 8051 $\mu$ C	K1
CO2	Understand the data transfer operation through serial and parallel ports	K2
CO3	Analyze the ADC & DAC interfacing with 8051 $\mu$ C	K3
CO4	Examine various embedded system products to solve realtime problems using 8051 $\mu$ C	K4
CO5	Justify the programming concepts of Traffic light and water level controller	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELP06	Practical II: 8051 Microcontroller and its Applications	Sem:I
Experiment No.	Topics (Any 10 Experiments)	
1	Arithmetic and Logic Operations	
2	Data Transfer with Parallel Port	
3	PWM Generation	
4	Solid State Relay Interface using Interrupt	
5	Interfacing Matrix Keypad	

6	Seven Segment Display Interface
7	LCD Interface
8	Data Transfer with Parallel Port
9	DAC Interface
10	ADC Interface
11	Stepper Motor Interface
12	Serial Communication Interface
13	Digital Clock
14	Traffic Light Controller
15	Water Level Controller

**Teaching methods:** < Practical Demonstration >

#### TEXT BOOK

1. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C" by PHI, 2<sup>nd</sup> Edition, 2006.

#### REFERENCE BOOK

1. Kenneth J. Ayala, "The 8051 Microcontroller", Delmar Cengage Learning, 3<sup>rd</sup> Edition, 2004.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/106/108/106108100/>  
<https://nptel.ac.in/courses/108/105/108105102/>

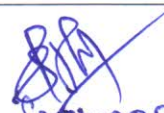
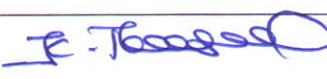
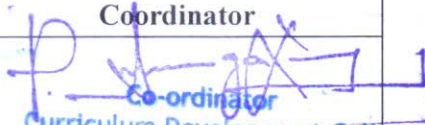
**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>Mrs. S. SATHYA DEEPA</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028. Name & Signature

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028



<b>Course Code:</b>	<b>21ELP08</b>	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>Optical Fiber Communication</b>						<b>Semester:</b>	<b>II</b>
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>5</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>4</b>

### COURSE OBJECTIVES

1. To facilitate the knowledge about Optical Fiber Fabrication,
2. To understand the characteristics of Optical Sources & detectors
3. To determine the signal distortion and bending loss of signals.
4. To impart knowledge on Optical sources and detectors.
5. To get strong knowledge in Optical Networks and applications.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Enumerate the fabrication process of optical fibers	K1
CO2	Classify the types of optical fibers	K2
CO3	Apply the characteristics of single mode fibers	K3
CO4	Analyze the function of various light sources and detectors	K4
CO5	Evaluate the performance of optical fibers in SONET, CATV and SDH etc.	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

<b>21ELP08</b>	<b>Optical Fiber Communication</b>	<b>Sem: II</b>
<b>Unit No.</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	<b>Optical Fiber Fabrication</b> Motivation for Light Wave Communications – Optical Spectral Bands – Nature of Light – Basic Optical Laws – Fiber Materials – Fiber Fabrication: Classification – Chemical Vapor Deposition – Multi- Element Glasses – Phasil System – Comparisons of Various Fabrication Processes – Drawing and Coating – Double Crucible Method – Rod-In Tube Method – Mechanical Properties.	<b>13</b>

<b>II</b>	<b>Optical Fibers and their Properties</b> Basic Structure of Optical Fiber –Conditions for Total Internal Reflection– Principles of light propagation – Types of fibers: Step Index & Graded Index fibers – Modes of Propagation: Single and Multimode– Calculation of Acceptance Angle –Numerical Aperture –Advantages and Application.	<b>13</b>
<b>III</b>	<b>Signal Degradation</b> Attenuation – Absorption – Scattering & Bending losses – Core & Cladding losses – Signal distortion in Fibers – Modal Delay – Factors contributing to dispersion – Group delay – Material & Waveguide dispersion – Signal distortion in Single Mode Fibers – Polarization mode dispersion – Characteristics of single mode fiber – Cut-off wavelength – Mode – Field Diameter – Single mode fiber bending loss – Dispersion power penalty – Total dispersion delay – Maximum transmission rate – Dispersion shifted fiber.	<b>13</b>
<b>IV</b>	<b>Light Sources and Photo Detectors</b> Light Sources: LED –Fiber LED Coupling –LASERS –Operation types– Spatial Emission– Current v/s output characteristics. Photo Detectors: Characteristics – Photo Emissive Type –Photo Conductive –Photo Voltaic Devices –PIN Photo diode –Avalanche Photo Diode.	<b>13</b>
<b>V</b>	<b>Optical Networks &amp; Applications</b> Wave Length Division Multiplexing – Dense WDM – Digital Subscriber Line Technology – SONET/SDH: SONET Network Layers –Frame Format– SONET Multiplexing – SONET Topologies – SDH – Community Antenna Television (CATV) –Special Applications: Digital Video Transmission Using Optical Fibers networks receiver – High performance receiver–Design of fiber optic receiver– Fiber based MODEMS.	<b>13</b>

*Distribution of marks: Problems 40%, Theory 60%*

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOKS

1. Gerd Keiser, "Optical Fiber Communications", Tata McGraw Hill Publications, Fifth Edition, 2017. (Unit-I to IV)
2. Subir Kumar Sarkar, "Optical Fibres and Fibre Optic Communication Systems" S. Chand & Comp. (Unit-V)

#### REFERENCE BOOKS

1. Robert J Schoenbeck "Electronic Communications Modulation and Transmission", PHI, 1999.
2. Optical Fiber Communications: Principles and Practice, Pearson Education, Third Edition, 2010.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/104/108104113/>

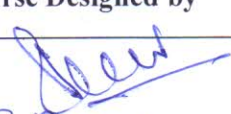
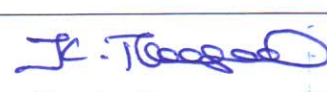
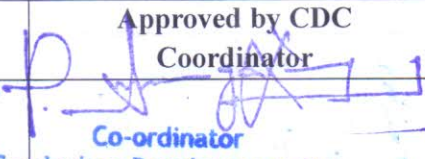
**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	M	S	M	S	S	M	S
CO4	S	M	S	M	M	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>Dr. R. PREMA</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 Co-ordinator <b>Curriculum Development Cell</b> <b>Hindusthan College of Arts &amp; Science,</b> <b>Coimbatore-641 028.</b> Name & Signature

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

Course Code:	21ELP09	Course Title						Batch:	2021-2022 & Onwards
		MEMS and Control Systems						Semester:	II
Hrs/Week:	5	L	5	T	-	P	-	Credits:	4

### COURSE OBJECTIVES

1. To learn the concept of MEMS and micro systems.
2. To impart knowledge on Control systems and thermal systems.
3. To correlate and apply the same in open and closed loop systems.
4. To differentiate time and frequency domain responses.
5. Evaluate the working characteristics of PID controllers.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Recall the concepts of MEMS and Microsystems	K1
CO2	Understand the fundamentals of control systems	K2
CO3	Apply the concept of control system in electrical and thermal systems	K3
CO4	Analyze the time and frequency-domain responses of first and second-order systems	K4
CO5	Evaluate the stability analysis of controlsystems and controllers.	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate

### SYLLABUS

21ELP09	MEMS and Control Systems	Sem: II
Unit No.	Topics	Hours
I	<b>Overview of MEMS &amp; Micro System</b> MEMS & Micro systems - typical MEMS & Micro system products – Evaluation of Micro fabrication – Microsystems and Microelectronics – The Multidisciplinary nature of Micro Systems design and Manufacture – Micro Systems and miniaturization – applications of Micro Systems in Automotive industry – applications of Microsystems in other industries.	13

II	<b>Working Principles of Microsystems</b> Micro sensors – Micro actuation using Thermal Forces – Actuation Using shape memory Alloys – Actuation Using Piezoelectric crystals – Actuation using Electrostatic forces – MEMS with Micro Actuators – Micro Accelerometers – Micro Fluidics.	13
III	<b>Concepts of Control Systems</b> Introduction to control systems-Human elements in control systems- block diagram fundamentals- open loop control system-closed loop control systems- Linear and Nonlinear Systems- Effect of feedback on Overall gain, Stability, Sensitivity and Noise-Physical system representation: Electrical Systems and thermal system.	13
IV	<b>Block Diagrams, Signal Flow Graphs and Time Response Analysis</b> Introduction to Block Diagrams-Block diagram reduction-Signal flow graph-Signal flow graph algebra-construction of signal flow graph from block diagram- Mason's gain formula-Time Response Analysis of First and second order systems-Steady state error.	13
V	<b>Stability Analysis, Compensation and Controllers</b> Stability Analysis of Control System: Bode plot- Routh Hurwitz criterion-Root Locus-Nyquist Criterion-Principles of P-PI-PD-PID Controllers-Cascade and feedback compensation, lag, lead, lag-lead Compensation.	13

*Distribution of marks: Problems 40%, Theory 60%*

**Teaching methods:** Power Point Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOKS

1. Tai Ran Hsu – MEMS & Micro systems Design and Manufacture – Tata McGraw Hill. (Unit I,II&III)
2. A. NagoorKani, "Control Systems", RBA Publications. (Unit IV & V)

#### REFERENCE BOOKS

1. Katsuhiko Ogata "Modern Control Engineering". Pearson Education Asia, Fourth edition, 2002.
2. Benjamin C.Kuo "Automatic Control Systems", PHI, 1995.
3. S.N. Verma, "Automatic Control Systems", Khanna Publishers.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/117/105/117105082/>  
<https://nptel.ac.in/courses/108/101/108101037/>


**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	M	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	M	S	M	S	M	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>MAHITHA MOHAN</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 Co-ordinator Name & Signature Curriculum Development Cell

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

Hindusthan College of Arts & Science,  
 Coimbatore-641 028.

<b>Course Code:</b>	<b>21ELP10</b>	<b>Course Title</b>					<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>	
		<b>Embedded Systems and RTOS</b>					<b>Semester:</b>	<b>II</b>	
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>5</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>4</b>

### COURSE OBJECTIVE

1. To enable the students to recall the basics of RTOS
2. To become familiar with PIC microcontroller in embedded systems.
3. To get thorough knowledge on peripheral devices of PIC microcontrollers.
4. To understand architecture of embedded systems and services.
5. To know more about real time operating systems and applications.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Understand the fundamentals of Embedded system	K1
CO2	Ability to get the knowledge in RTOS	K2
CO3	Apply the functions of RTOS through case studies	K3
CO4	Examine System Design using PIC Microcontrollers	K4
CO5	Evaluate real time operating system functions	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELP10	Embedded Systems and RTOS	Sem: II
Unit No.	Topics	Hours
<b>I</b>	<b>Embedded Systems</b> Definition and Classification – Overview of Embedded Controllers – Exemplary High Performance Processors – CISC and RISC Architecture– Hardware Unit in an Embedded System– Software Embedded into a System – Exemplary Applications – Embedded Systems on a Chip in VLSI circuit.	<b>13</b>
<b>II</b>	<b>PIC 16F877 Architecture and Instruction Set</b> Device Overview – Architecture – Memory Organization – Status Register– Option Register – INTCON Register – PCON Register – I/O Ports– Data EEPROM– Instruction Set: Byte Oriented Operations – Bit Oriented Operations– Literal and Control Operations.	<b>13</b>

<b>III</b>	<b>PIC Peripheral Features</b> TIMER0 Module – TIMER1 Module – TIMER2 Module – Capture/ Compare/ PWM Modules – I <sup>2</sup> C transmission and reception – USART – ADC Module – Special features of the CPU : Oscillator Selection – Power on Reset – Power up Timer – Oscillator Startup Timer – Brownout Reset- Interrupts – Watchdog Timer –SLEEP.	<b>13</b>
<b>IV</b>	<b>Embedded Software Architecture &amp; Operating System Services</b> Round Robin – Round Robin with Interrupts – Function Queue Scheduling Architecture– Real Time Operating Systems (RTOS) – Tasks and Data – Semaphores and Shared Data– Message Queues, Mail Box and Pipes – Timer Function – Events – Memory Management.	<b>13</b>
<b>V</b>	<b>Real Time Operating Systems</b> Study of Micro C/OS-II – Vx Works – Other Popular RTOS – RTOS System Level Functions – Task Service Functions – Time Delay Functions – Memory Allocation Related Functions – Semaphore Related Functions – Mailbox Related Functions – Queue Related Functions – Case Studies of Programming with RTOS: Case Definition, Multiple Tasks and their Functions – Creating a list of Tasks, Functions and IPCs – Exemplary Coding Steps.	<b>13</b>

*Distribution of marks: Problems 20%, Theory 80%*

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOKS

1. Rajkamal, *Embedded Systems Architecture, Programming and Design*, TATA McGraw-Hill, Second Edition, 2008. (Unit-I, II, III)
2. David E. Simon, "An Embedded Software Primer", Addison Wesley, Ninth Impression, 2011. (Unit IV & V)

#### REFERENCE BOOKS

1. Shibu KV, "Introduction to Embedded System" Tata McGraw Hill, 2010.
2. Micro C OS II Reference Manual, Salvo User Manual & VX works Programmers Manual.
3. Martin.P.Bates, "Programming 8-bit PIC Microcontrollers in C Interactive Hardware Simulation", Elsevier, Second Edition, 2008.
4. PIC 16f877A DataSheet.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/102/108102045/>  
<https://nptel.ac.in/courses/108/105/108105057/>



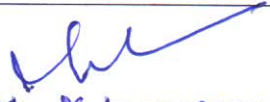


## MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

## ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>Mr. M. KUMARESAN</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 — Co-ordinator <b>Curriculum Development Cell</b> Name & Signature <b>Hindusthan College of Arts &amp; Science,</b>

Head of the Department  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

Coimbatore-641 028.

<b>Course Code:</b>	21ELP11	<b>Course Title</b>						<b>Batch:</b>	2021-2022 & Onwards
		Digital System Design using VHDL						<b>Semester:</b>	
<b>Hrs/Week:</b>	4	L	4	T	-	P	-	<b>Credits:</b>	4

### COURSE OBJECTIVE

1. To impart the concepts of digital circuit design using VHDL
2. To equip the students to develop new digital systems.
3. To apply the concept of behavioral and structural modeling of VHDL.
4. To enable the students to differentiate the types of PLD's.
5. To get exposure to estimate design examples used in VHDL.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Recall the functionality of digital systems	K1
CO2	Elaborate the synthesise digital modules and circuits for a wide application range	K2
CO3	Classify the specifications of modeling registers and counters	K3
CO4	Differentiate the characteristics of programmable logic devices.	K4
CO5	Evaluate design examples used in VHDL	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate

### SYLLABUS

21ELP11	Digital System Design Using VHDL	Sem: II
Unit No.	Topics	Hours
I	<b>Digital Logic Design</b> Combinational Logic – Boolean Algebra and Algebraic Simplification – Karnaugh Maps –Designing with NAND and NOR Gates – Flip–Flops and Latches – Mealy Sequential Circuit Design – Moore Sequential Circuit Design – Sequential Circuit timing – Tristate Logic and Busses.	11
II	<b>VHDL</b> Computer Aided Design – HDL – VHDL Description of Combinational Circuits – VHDL Modules – Sequential Statements – Modeling of Flip–Flops – Wait Statement and Delays – Data Types and Operators – VHDL Libraries.	11

<b>III</b>	<b>VHDL Modeling</b> Modeling Registers and Counters using VHDL Process Statement – Behavior and Structural Modeling – Variables, Signals and Constants – Arrays – Loops in VHDL – Assert and Report Statement.	<b>10</b>
<b>IV</b>	<b>Programmable Logic Devices</b> Overview of PLD – Simple Programmable Logic Devices – Complex Programmable Logic Devices (CPLD) – Field Programmable Gate Arrays (FPGA).	<b>10</b>
<b>V</b>	<b>Design Examples</b> BCD to Seven Segment Display Decoder– Adders – Traffic Light Controllers – State Graphs for Control Circuits – Score Board and Controller – Synchronization and Denouncing – Multiplier – Keypad Scanner – Binary Divider.	<b>10</b>

*Distribution of marks: Problems 10%, Theory 90%*

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOK

1. Charles H. Roth, Jr. Lizy Kurian John, "Digital System Design Using VHDL" Cengage Learning, First Indian Reprint, 2012. (Unit-I to V)

#### REFERENCE BOOKS

1. Bhaskar.J, "VHDL Primer", PHI, Low price Edition, 2001.
2. Douglas L. Perry, "VHDL Programming by Example" Tata Mc-Graw-Hill, Fourth Edition, 2002.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/117/108/117108040/>  
<https://nptel.ac.in/courses/106/102/106102181/>


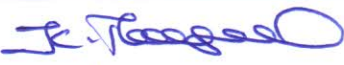

**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	M	M	S	M	S	S	M
CO5	S	S	S	S	M	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>MAHITHA MOHAN</b> Name & Signature of the Staff	 <b>Dr. K. THANCLAVEL</b> Name & Signature	 <b>Co-ordinator</b> Name & Signature

**Head of the Department**  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

**Curriculum Development Cell**  
 Hindusthan College of Arts & Science,  
 Coimbatore-641 028.

Course Code:	21ELP12	Course Title						Batch:	2021-2022 & Onwards
		Practical III: Optical and Microwave Communication						Semester:	II
Hrs/Week:	5	L	-	T	-	P	5	Credits:	3

### COURSE OBJECTIVE

1. To impart the knowledge of establishing optical and microwave communication.
2. To get familiar with bending and coupling losses occur in fibers.
3. To get strong knowledge about characteristics of reflex klystron and gunn diode oscillator.
4. To understand the performance of microwave components.
5. To evaluate the characteristics of microwave devices.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Enumerate the working of analog and digital optical communication system	K1
CO2	Compare the Attenuation, Bending and Coupling Loss of optical fibers	K2
CO3	Demonstrate the characteristics of Reflex Klystron and Gunn Diode Oscillator	K3
CO4	Characterize the performance of various microwave components	K4
CO5	Evaluate the working of microwave devices	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate

### SYLLABUS

21ELP12	Practical III: Optical and Microwave Communication	Sem: II
Experiment No.	Topics (Any 10 Experiments)	
1	Study of Fiber Optic Trainer Kit	
2	Establishment of Analog Fiber Optic Link	
3	Establishment of Digital Fiber Optic Link	
4	Measurement of Attenuation Loss	

5	Measurement of Bending Loss
6	Measurement of Coupling Loss
7	Study of Microwave Components and Instruments
8	Reflex Klystron Characteristics
9	Frequency Measurement of Reflex Klystron
10	VSWR Measurement
11	Attenuator Characteristics
12	Study of Gunn Diode Oscillator
13	Measurement of Unknown Load Impedance
14	Isolator and Circulator Characteristics
15	Horn Antenna Characteristics

**Teaching methods:** < Practical Demonstration >

#### TEXT BOOKS

1. Gerd Keiser, "Optical Fiber Communications", TMH, fourth Edition, 10<sup>th</sup> Reprint, 2011.
2. Dr. Kulkarni. M, "Microwave and Radar Engineering", Umesh Publications, Fifth Revised Edition, 2015. (Unit -I to V)

#### REFERENCE BOOK

1. Subir Kumar Sarkar, "Optical Fibres and Fibre Optic Communication Systems"  
S. Chand & Comp. (Unit-V)

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/104/108104113/>  
<https://nptel.ac.in/courses/108/103/108103141/>


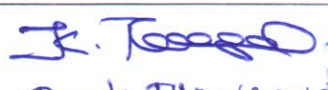

**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>Dr. R. PREMA</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028.

**Head of the Department**  
 Department of Electronics  
 Hindusthan College of Arts & Science  
 Coimbatore-641 028

<b>Course Code:</b>	<b>21ELP13</b>	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>Practical IV: Embedded System and RTOS</b>						<b>Semester:</b>	<b>II</b>
<b>Hrs/Week:</b>	<b>5</b>	<b>L</b>	<b>-</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>5</b>	<b>Credits:</b>	<b>3</b>

### COURSE OBJECTIVE

1. To impart the knowledge of developing own embedded systems for various applications.
2. To understand the interfacing concept of various peripherals.
3. To know the design concepts on seven segment display.
4. To get familiar with DAC and ADC converters.
5. Can able to program with stepper motor and other interfacing concepts.

### COURSE OUTCOMES (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Recall and apply basic programming concepts	K1
CO2	Understand the interfacing concept of various peripherals with embedded microcontroller	K2
CO3	Analyze the data transfer information through serial and parallel ports	K3
CO4	Create various real world applications of Embedded Systems	K4
CO5	Evaluate stepper motor and traffic light control	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

<b>21ELP13</b>	<b>Practical IV: Embedded System and RTOS</b>	<b>Sem: II</b>
<b>Experiment No.</b>	<b>Topics (Any 10 Experiments) (Using PIC 16F84A IC/ PIC 16F877 Kit/ RTOS Kit)</b>	
1	Delay Generation using Timer	
2	PWM Generation	
3	LED Interfacing and Object Counter	



4	Interfacing Solid State Relay
5	Interfacing Seven Segment Display
6	LCD Interface
7	DAC Interface
8	Internal ADC Programming
9	External Event Counter using Timer-1
10	Programming using interrupts
11	Serial Port Interfacing Using RS232
12	Water Level Controller
13	Stepper Motor Interface
14	RTOS Multi tasking
15	Temperature Monitoring and Control

**Teaching methods:** < Practical Demonstaration >

#### TEXT BOOK

1. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems Using Assembly and C" by PHI, 2<sup>nd</sup> Edition, 2006.

#### REFERENCE BOOK

1. Kenneth J. Ayala, "The 8051 Microcontroller", Delmar Cengage Learning, 3<sup>rd</sup> Edition, 2004.

#### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/106/108/106108100/>  
<https://nptel.ac.in/courses/108/105/108105102/>

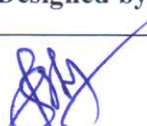


**MAPPING WITH PROGRAM OUTCOMES**

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	S	S	M
CO5	S	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal and External assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>Mrs. S. SATHYADEEPA</b> Name & Signature of the Staff	 <b>Dr. K. THANGAVEL</b> Name & Signature	 <b>Co-ordinator</b> Curriculum Development Cell Name & Signature Hindusthan College of Arts & Science, Coimbatore-641 028.

**Head of the Department**  
 Department of Electronics  
**Hindusthan College of Arts & Science**  
 Coimbatore-641 028

<b>Course Code:</b>	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
								<b>Semester:</b>	
<b>Hrs/Week:</b>	<b>2</b>	<b>L</b>	<b>2</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>1</b>

### COURSE OBJECTIVES

1. To impart the knowledge of different Electronic Test Instruments
2. To understand the working of various signal sources to the students.
3. To get strong knowledge on working of digital meters.
4. Can able to study the characteristics of oscilloscope.
5. Can get familiar to interpret the working of recorders.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Remember fundamentals of analog DC and AC type meters	K1
CO2	Understand the working of signal sources and digital meters	K2
CO3	Demonstrate the working of Oscilloscopes and Digital meters	K3
CO4	Examine to design new electronic test instruments for industrial needs	K4
CO5	Evaluate the functions of Digital meters and recorders	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: Electronic Test Instruments	Sem: I / II / III
Unit No.	Topics	Hours
<b>I</b>	<b>Analog Meters</b> <b>DC Meters:</b> Voltmeter – Ammeter. <b>AC Meters:</b> Voltmeter– Ammeter. Analog Mutimeter.	<b>6</b>
<b>II</b>	<b>Signal Sources</b> Audio Frequency Generator – Function Generator – Wave Analyser – Spectrum Analyser.	<b>5</b>
<b>III</b>	<b>Oscilloscopes</b> <b>General Purpose Oscilloscope</b> – CRT – Single and Dual Trace – Storage Oscilloscope – Digital CRO.	<b>5</b>

IV	<b>Digital Meters</b> Digital Multimeter – Digital Frequency Meter – Measurement of Time – Digital Tachometer – Digital pH Meter.	5
V	<b>Recorders</b> X-Y Recorder – Magnetic Recorder – Digital Data Recording – Digital Memory Waveform Recorder.	5

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

### TEXT BOOKS

1. Albert D. Herlfrick & William D. Cooper, "Modern electronic Instrumentation & Measurement Techniques" Prentice Hall of India, 2002. (Unit –I to III).
2. H S Kalsi, "Electronic Instrumentation" Tata McGraw-Hill, Second Edition, 2006. (Unit-IV & V)

### REFERENCE BOOKS

1. Joseph, J.Carr, "Elements of Electronic Instrumentation & Measurements" III edition, Pearson Education, 2003.
2. Sawhney A.K, "A Course in Electrical and Electronic Measurements and Instrumentation" Dhanpat Rai & Co. 2015.

### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/105/108105153/>  
[https://swayam.gov.in/nd1\\_noc19\\_ee44/preview](https://swayam.gov.in/nd1_noc19_ee44/preview)




### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	M	M	S	M	M	S	M
CO5	M	S	S	S	S	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Dr. K. THANGAVEL Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Curriculum Development Cell Name & Signature Hindusthan College of Arts & Science, Coimbatore-641 028.

**Head of the Department**  
Department of Electronics  
Hindusthan College of Arts & Science  
Coimbatore-641 028

<b>Course Code:</b>	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>VAC: Verilog HDL</b>						<b>Semester:</b>	<b>I / II / III</b>
<b>Hrs/Week:</b>	<b>2</b>	<b>L</b>	<b>2</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>1</b>

### COURSE OBJECTIVES

1. To impart the concepts of digital circuit design using Verilog.
2. To equip the students to develop new digital systems.
3. To determine various operators used in verilog.
4. To diagnose the additional features used in verilog.
5. To enable the students to design and interpret various digital systems.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Understand the functionality of digital systems	K1
CO2	Analyze and synthesize digital modules and circuits for a wide application range	K2
CO3	Interpret the special features of Verilog HDL	K3
CO4	Design and implement simple digital systems using Verilog	K4
CO5	Evaluate the modeling features and examples of sequential logic	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	<b>VAC: Verilog HDL</b>	<b>Sem: I / II / III</b>
<b>Unit No.</b>	<b>Topics</b>	<b>Hours</b>
<b>I</b>	Basics: Synthesis – Design Process – Logic Value System – Verilog Constructs To Gates: Continuous Assignment Statement – Procedural Assignment Statement.	<b>6</b>
<b>II</b>	Always – If – Case – Loop Statements – Functions – Tasks – Verilog Data Types – Nets – Register – Variables – Constants – Array Of Nets Or Registers.	<b>5</b>
<b>III</b>	Verilog Operators – Arithmetic – Bitwise – Reduction – Logical – Relational – Shift Conditional – Concatenation – Expressions And Operands – Operator Precedence.	<b>5</b>

IV	Additional Features of Verilog – Arrays of Primitives and Modules – Hierarchical Dereferencing – Parameters Substitution – Procedural Continuous – Intra Assignments – In Determinant Assignments and Race Condition – Wait Statements – Fork Join Statements.	5
V	Modeling Examples – Modeling Combinational Logic – Modeling sequential logic – modeling a memory – writing Boolean equations – Modeling a counter.	5

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOK

1. J.Bhasker, “ Verilog HDL Synthesis, A Practical Primer” , BS Publication, 1<sup>st</sup> Indian Edition, 2008. (Unit-I to V)

#### REFERENCE BOOKS

1. Micheal D. Ciletti, “Advanced Digital Design With The Verilog HDL”, PHI Publications, Indian reprint, 2014.

2. Morris Mano, “Digital Design with Verilog HDL”, Pearson Education, Fifth Edition, 2016.

#### WEB RESOURCES

Web Link: <https://nptel.ac.in/courses/106/105/106105165/>  
<https://nptel.ac.in/courses/106/105/106105083/>




#### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	M	S
CO4	S	M	S	M	M	S	M
CO5	M	S	S	S	M	S	S

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Dr. R. PREMA Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Name & Signature

Curriculum Development Cell  
Hindusthan College of Arts & Science,  
Coimbatore-641 028.

Head of the Department  
Department of Electronics  
Hindusthan College of Arts & Science  
Coimbatore-641 028



Course Code:	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	Course Title						Batch:	2021-2022 & Onwards
		VAC: Bioelectronics						Semester:	I / II / III
Hrs/Week:	2	L	2	T	-	P	-	Credits:	1

### COURSE OBJECTIVES

1. To impart the fundamentals of Bioelectronics
2. To get strong knowledge about electrical properties of Bio-Medical Instrumentation.
3. To enable the students to determine the features of bio nano machines.
4. To analyze about the energy conservation scheme.
5. To estimate the importance of medical applications of bio-electronics.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Understand the principles of Bioelectronics	K1
CO2	Interpret the features of bio nano machines	K2
CO3	Apply energy conservation scheme in bioelectricity generation	K3
CO4	Analyze the cellular components of human body	K4
CO5	Evaluation of various bioelectronics equipments	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: Bioelectronics	Sem: I / II / III
Unit No.	Topics	Hours
I	Overview of bioelectronics - the interactions between electronics and biomedical science -The fundamental properties of ions in the solution	6
II	The electrical properties of cellular components: lipid bilayer and membrane proteins - Natural nanoconductors: ion channels and pumps	5
III	Energy conversion scheme in the bioelectricity generation of the cell - Single channel recording: measurement and noise	5

IV	Patch clamp amplifier - Electronics of low noise current detection - Biomimetic versions of natural nanoconductors - Functional bionanomachines.	5
V	Medical applications of bioelectronics: ECG – EEG – EMG - Pre-clinical and clinical testing of bioelectronic technology	5

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

### TEXT BOOKS

1. Bertil Hille, "Ion Channels of Excitable Membrane", Sinauer Associates, Inc., 2001.(Unit I-III)
2. Chandran Karunakaran, Kalpana Bhargava, Robson Benjamin, "Biosensors and Bioelectronics" 1<sup>st</sup> Edition, 2009. (Unit I-III)

### REFERENCE BOOKS

1. Wolfgang Hanke and W. R. Schlue, "Planar Lipid Bilayers: Methods and Applications", Academic Press, 2001
2. C.P. Wong, Kyoung-Sik Moon, "Nano Bio-Electronic, Photonic & MEMS Packaging, Springer, 2010.

### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/106/105/106105165/>  
<https://nptel.ac.in/courses/106/105/106105083/>


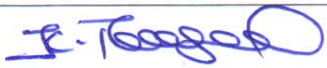
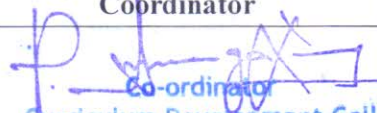
### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S
CO4	M	M	S	S	S	M	M
CO5	S	S	S	S	M	S	M

S-Strong, M- Medium

### ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Cobrdinator
 <b>M.B. S. SATHYADREPA</b> Name & Signature of the Staff	 <b>D.K. THANGAVEL</b> Name & Signature	 Co-ordinator Curriculum Development Cell Hindusthan College of Arts & Science, Coimbatore-641 028.

Head of the Department  
Department of Electronics

Hindusthan College of Arts & Science  
.Coimbatore-641 028

Course Code:	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	Course Title						Batch:	2021-2022 & Onwards
		VAC: Materials Characterization						Semester:	I / II / III
Hrs/Week:	2	L	2	T	-	P	-	Credits:	1

### COURSE OBJECTIVE

1. To recall the fundamentals of Materials Surface.
2. To understand about the morphology and thermal characterization techniques.
3. To classify the working principle of thermal analysis techniques.
4. Can able to explain about microscopy technique to observe microstructure.
5. To enable the students to interpret the surface characterization.

### COURSE OUTCOME (CO)

S. No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Students can recall the importance and classification of Characterization Techniques	K1
CO2	Student can describe the uses of vacuum systems in Material Characterization techniques	K2
CO3	Student can classify the working of Thermal Analysis techniques	K3
CO4	Student can analyze microscopy techniques to observe the microstructure	K4
CO5	Evaluate the diffraction of method used in crystal structure	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: Materials Characterization	Sem: I / II / III
Unit No.	Topics	Hours
I	Introduction to materials and methods – Fundamentals of Materials Characterization – Basic operation – Sample preparation and interpretation of data. Basic failure analysis of materials using different characterization equipment.	6
II	Thermal Analysis techniques: Principle - Working and application of DTA – TGA - TMA - DSC.	5

III	Spectroscopic Techniques for chemical analysis: UV-Visual (UV-VIS) – IR - FTIR - EDS – WDS - X-ray Fluoroscopy (XRF) - Atomic absorption spectrometer (AAS).	5
IV	Diffraction method: Brags Law - X-ray diffraction methods - Determination of crystal structure - lattice parameter - crystallite size - merits and demerits.	5
V	Surface characterization: XPS (ESCA) – UPS - Auger Electron Spectroscopy - Electron Probe Micro Analysis (EPMA) - LEED.	5

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

### TEXT BOOKS

1. F. Weinberg Editor, *Tools & Techniques in Physical Metallurgy, Vol. I & II, Marcel Dekker .(Unit I-III)*
2. John P. Sibilis, *A guide to Material Characterization & Chemical Analysis, VCH Publishers, 1988. .(Unit IV-V)*

### REFERENCE BOOKS

1. J.M. Walls, Editor, *Methods of Surface Analysis : Techniques & Applications, Cambridge University Press, 1990.*
2. B.D. Cullity, *Elements of X-ray diffraction, Addison-Wesley Publishing Company, INC.,*

### WEB RESOURCES

Web Link: <https://www.energy.gov/eere/education/eere-energy-101-video-series>

### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		S	S	S	S	S	S	S
CO2		S	S	S	M	S	S	S
CO3		S	S	M	S	S	S	S
CO4		S	M	S	S	S	S	M
CO5		S	S	S	S	S	S	M

S-Strong, M- Medium

Follows common pattern of Internal Assessment, suggested in the Regulations.

### ASSESSMENT PATTERN (if deviation from common pattern)

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 <b>MAHITHA MOHAN</b> Name & Signature of the Staff	 <b>Dr. K. THANAVEL</b> Name & Signature	 <b>Co-ordinator</b> <b>Curriculum Development Cell</b> <b>Hindusthan College of Arts &amp; Science,</b> <b>Coimbatore-641 028.</b> Name & Signature

<b>Course Code:</b>	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	<b>Course Title</b>						<b>Batch:</b>	<b>2021-2022 &amp; Onwards</b>
		<b>VAC: IoT and its Applications</b>						<b>Semester:</b>	<b>I / II / III</b>
<b>Hrs/Week:</b>	<b>2</b>	<b>L</b>	<b>2</b>	<b>T</b>	<b>-</b>	<b>P</b>	<b>-</b>	<b>Credits:</b>	<b>1</b>

### COURSE OBJECTIVES

1. To impart the concepts of Internet of Things (IoT)
2. To understand the Programming concept used for different devices for new applications.
3. Can able to analyze communication protocols.
4. To enable the students to examine an architecture and implement various applications.
5. Able to evaluate the opinions on IoT applications.

### COURSE OUTCOME (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Enumerate the concept of Internet of Things (IoT)	K1
CO2	Understand the communication protocols used for IoT applications.	K2
CO3	Correlate the most appropriate IoT Devices and Sensors based on Case Studies.	K3
CO4	Diagnose the implementation of various applications	K4
CO5	Evaluate the architecture reference model.	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: IoT and its Applications	Sem: I / II / III
Unit No.	Topics	Hours
<b>I</b>	The Internet of Things Today – Time for Convergence – Towards the IoT Universe – Internet of Things Vision – IoT Strategic Research and Innovation Directions – IoT Applications – Future Internet Technologies – Infrastructure – Networks and Communication.	<b>6</b>
<b>II</b>	M2M Value Chains – IoT Value Chains – An emerging industrial structure for IoT – M2M to IoT – An Architectural Overview – Building an architecture – Main design principles and needed capabilities.	<b>5</b>

<b>III</b>	State of the Art – Introduction State of the art – Architecture Reference Model – Introduction – Reference Model and architecture – IoT reference Model – IoT Reference Architecture – Functional View – Information View – Deployment and Operational View.	<b>5</b>
<b>IV</b>	Introduction IoT applications for industry: Future Factory Concepts –Brownfield IoT – Smart Objects – Smart Applications – IoT for Retailing Industry – Opinions on IoT Application – Home Management – E-Health.	<b>5</b>
<b>V</b>	Overview of Governance – Privacy and Security Issues – Contribution from FP7 Projects – Security – Privacy and Trust in IoT – Data-Platforms for Smart Cities.	<b>5</b>

**Teaching methods:** Power Point Projection through LCD, Assignment, Discussion and Activity.

### TEXT BOOK

1. Vijay Madiseti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1<sup>st</sup> Edition, VPT, 2014. (Unit-I to V)

### REFERENCE BOOKS

1. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1<sup>st</sup> Edition, Apress Publications, 2013.
2. Dhotre I.A, “IoT & its Applications”, Technical Publications, 2021.

### WEB RESOURCES

**Web Link:** <https://github.com/connectIOT/iottoolkit><https://www.arduino.cc/>




### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S
CO4	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 M. M. KUMARESAN Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Name & Signature

Head of the Department  
Department of Electronics  
Hindusthan College of Arts & Science  
Coimbatore-641 028

Curriculum Development Cell  
Hindusthan College of Arts & Science,  
Coimbatore-641 028.

Course Code:	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	Course Title					Batch:	2021-2022 & Onwards	
		VAC: Electric Vehicle Design					Semester:	I / II / III	
Hrs/Week:	2	L	2	1	-	P	-	Credits:	1

### COURSE OBJECTIVE

1. To enhance the student's to remember the proper assembly and design of electric vehicle.
2. Helps to learn and describe different components of vehicle design.
3. To derive the dynamics of vehicle motion
4. Can able to examine hybrid electric vehicle.
5. To get strong knowledge to explain the vector control of AC motors.

### COURSE OUTCOMES (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Remember fundamentals of Vehicle mechanics and Laws of Motion	K1
CO2	Understand the Dynamics of Vehicle Motion	K2
CO3	Analyze the working of DC and AC machines	K3
CO4	Able to examine Hybrid Electric Vehicle for commercial needs	K4
CO5	Evaluate vector control of AC motors	K5

K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: Electric Vehicle Design	Sem: I / II / III
Unit No.	Topics	Hours
I	Electric vehicle system – Components of an Electric vehicle system – Historical perspective of EV system – EV Advantages – EV Market. Vehicle mechanics – Laws of Motion.	6
II	Vehicle Kinetics – Dynamics of Vehicle Motion – Propulsion power – Velocity and Acceleration – Propulsion system design. Energy Source: Battery – Alternative Energy Sources.	5
III	Motor and engine ratings – EV and HEV motor requirements – DC machines – AC machines and their types – PM and SR machines – Switched Reluctance Machines.	5



IV	AC drives – Vector control of AC motors – SR motor drives – Electric Vehicle Drivetrain – EV transmission configurations – Ideal Gear box – EV motor sizing- Aluminium air battery.	5
V	Hybrid Electric Vehicle – Types – Internal combustion engines – Design of an HEV – Hybrid Drivetrains – Rated Vehicle velocity – Initial Acceleration – Maximum velocity – Maximum Gradability.	5

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

### TEXT BOOK

1. Iqbal Husain, "Electric and Hybrid Vehicles Design Fundamentals", CRC Press, 2003. (Unit -I to V).

### REFERENCE BOOKS

1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2003.

### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/108/102/108102121/>  
<https://nptel.ac.in/courses/108/103/108103009/>

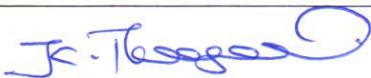
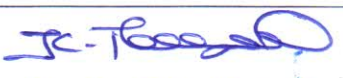
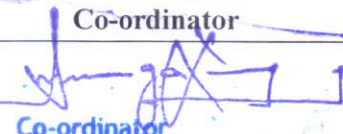
### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S
CO4	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M

S-Strong, M- Medium

### ASSESSMENT PATTERN (if deviation from common pattern)

Follows common pattern of Internal assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Co-ordinator
 Dr. K. THANGAVEL Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Curriculum Development Cell Name & Signature Hindusthan College of Arts & Science, Coimbatore-641 028.

Head of the Department

Department of Electronics

Hindusthan College of Arts & Science  
Coimbatore-641 028

Course Code:	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	Course Title						Batch:	2021-2022 & Onwards
		VAC: Ocean Electronics						Semester:	I / II / III
Hrs/Week:	2	L	2	T	-	P	-	Credits:	1

### COURSE OBJECTIVE

1. To impart the concepts of Ocean Electronics
2. To equip the students to explore the design knowledge on Ocean Electronics.
3. To get familiar with Oceanographic Instruments.
4. To enable the students to learn about under water wireless communication.
5. To get strong knowledge about architecture of oceanographic wireless sensor networks

### COURSE OUTCOMES (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Recall the concept of Remote sensing	K1
CO2	Understand and synthesize the characteristics of sensorsystems	K2
CO3	Classify the features of underwater communication and wireless sensor networks	K3
CO4	Diagnose and implement Oceanographic Instruments	K4
CO5	Evaluate under water mobile communication	K5

**K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate**

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: Ocean Electronics	Sem: I / II / III
Unit No.	Topics	Hours
I	Introduction to Remote Sensing – Remote Sensing Vs SONAR – Applications of Remote Sensing – NADIR Radar System – Microwave Radiometer – Applications of Telemetry	6
II	Introduction to Sensors – Scanner Sensor Systems – Spatial Resolution, pixel size and scale – Marine Observation Satellite Sensors (MOS) – Measurement of Ocean Colour – Surface Currents	5
III	Underwater wireless Communication – Acoustic Communication – Optical Communication – LASER sensor architecture – MEMS approach – Under water mobile communication	5

<b>IV</b>	Oceanographic wireless sensor networks – Common WSN Architecture – General sensor node – Energy Harvesting – Wireless underwater sensor network – Acoustic sensor network	<b>5</b>
<b>V</b>	Oceanographic Instruments – Instruments and measured parameters – Oceanographic Instrumentation – Marine magnetometer – Submersible Incubation Device – Deep Ocean Tsunami Detection Buoy	<b>5</b>

**Teaching methods:** PowerPoint Projection through LCD, Assignment, Discussion and Activity.

### TEXT BOOK

1. S.R. Vijayalakshmi & S. Muruganand, "Ocean Electronics", Overseas India Private Limited, 1<sup>st</sup> Edition. (Unit-I to V)

### REFERENCE BOOKS

1. V.Chander & P.R.S. Pillai, "Ocean Electronics", Allied Publishers Private Limited, 1<sup>st</sup> Edition.
2. Erik Dahlman, "5G: The Next Generation Wireless Access Technology", First Edition, Academic Press, 2018.

### WEB RESOURCES

**Web Link:** <https://nptel.ac.in/courses/114/105/114105002/>  
<https://freevideolectures.com/subject/ocean-engineering/>

### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	S
CO4	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal assessment, suggested in the Regulations.

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Dr. R. PERMA Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Name & Signature

Head of the Department  
Department of Electronics  
Hindusthan College of Arts & Science  
Coimbatore-641 028

Co-ordinator  
Name & Signature  
Hindusthan College of Arts & Science  
Coimbatore-641 028.

Course Code:	21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	Course Title						Batch:	2021-2022 & Onwards
		VAC: Artificial Intelligence using Raspberry Pi						Semester:	I / II / III
Hrs/Week:	2	L	2	T	-	P	-	Credits:	1

### COURSE OBJECTIVE

1. To recall the programming concepts of Artificial Intelligence
2. To get thorough knowledge in understanding of Raspberry Pi.
3. Can able to determine the features of Raspberry Pi
4. To design and implement various applications.
5. Can able to evaluate machine learning algorithm.

### COURSE OUTCOMES (CO)

S.No	COURSE OUTCOME	BLOOMS LEVEL
CO1	Remember the concept of artificial Intelligence	K1
CO2	Describe neural networks used in Raspberry Pi	K2
CO3	Classify the features of Office database used in animal identification	K3
CO4	Design and examine various algorithms used in machine learning	K4
CO5	Evaluate Hopfield network used in realtime applications	K5
<b>K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate</b>		

### SYLLABUS

21ELPV01/ 21ELPV02/ 21ELPV03/ 21ELPV04	VAC: Artificial Intelligence using Raspberry Pi	Sem: I / II / III
Unit No.	Topics	Hours
I	AI Historical Origins -Intelligence - Strong AI vs. Weak AI, Broad AI vs. Narrow AI - Reasoning -AI Categories - AI and Big Data.	6
II	Boolean Algebra -Expert Systems -Raspberry Pi Configuration - Installing Prolog on a Raspberry Pi -Introduction to Fuzzy Logic -Problem Solving - Machine Learning -Neural Networks -Evolutionary Computing.	5

III	Office Database - Animal Identification - tic-tac-toe - Cold or Flu Diagnosis - Expert System with Raspberry Pi GPIO Control : Installing PySWIP - Hardware Setup -Rpi.GPIO Setup - Expert System with LED Control.	5
IV	Machine Learning: -Demo: Color Selection –Algorithm -Roulette Wheel Algorithm -Demo: Autonomous Robot: Autonomous Algorithm -Test Run - Additional Learning.	5
V	Hopfield Network –Demo: Numerical Figure Recognition Demonstration - Autonomous Robot Car Using ANN -Python Control Script for the Obstacle-Avoiding -Robot Car -Light-Seeking Robot.	5

**Teaching methods:** Power Point Projection through LCD, Assignment, Discussion and Activity.

#### TEXT BOOK

1. Beginning Artificial Intelligence with the Raspberry Pi, Authors, Donald J. Norris, Barrington, New Hampshire, USA ISBN-13 (pbk): 978-1-4842-2742-8, Apress. (Unit-I to V)

#### REFERENCE BOOKS

1. Francis X. Govers , “Artificial Intelligence for Robotics: Build intelligent”, First Edition, 2018.
2. Russell, “Artificial Intelligence: A Modern Approach”, Pearson Education, Third Edition, 2015.

#### WEB RESOURCES

**Web Link:** <https://www.raspberrypi.org/raspberrypi-store/>

#### MAPPING WITH PROGRAM OUTCOMES

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	M	M	S	S
CO3	S	S	M	S	S	M	S
CO4	M	M	S	S	S	S	M
CO5	S	S	S	S	S	S	M

S-Strong, M- Medium

**ASSESSMENT PATTERN (if deviation from common pattern)**

Follows common pattern of Internal assessment, suggested in the Regulations

Course Designed by	Verified by HOD	Approved by CDC Coordinator
 Mrs. S. SATHYADEEPA Name & Signature of the Staff	 Dr. K. THANGAVEL Name & Signature	 Co-ordinator Name & Signature

Head of the Department  
Department of Electronics  
Hindusthan College of Arts & Science  
Coimbatore-641 028

Curriculum Development Cell  
Hindusthan College of Arts & Science,  
Coimbatore-641 028.