UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN ELECTRONICS AND COMMUNICATION SCIENCE

SYLLABUS WITH EFFECT FROM 2023-2024

129C1A

1.3 CORE COURSE-I : CIRCUIT THEORY

Instr.Hrs.: 5 **Year : I**
Credits : 3 **Semester: I**

COURSE OBJECTIVES

1. To apply circuit theorems to simplify and find solutions to electrical circuits.
2. To solve simple circuits using ohm's law, Kirchhoff's laws and the properties of the elements.
3. To build up basic problem solving skills through organizing available information and applying circuit laws.
4. To Build up strong problem solving skills by effectively formulate a circuit problem into a mathematical problem using circuit laws and theorems.
5. To Simplify circuits using series and parallel equivalents and using Thevenin and Norton equivalents
6. To understand application of resistors capacitors, inductors and transient circuit response.

COURSE OUTCOME

At the end of the course the student should be able to

1. Differentiate between passive and active components
2. Identify different types of inductors and types of cores in transformers.
3. Apply Ohm's Law to calculate voltage, current, and resistance in simple electrical circuits.
4. Define the Superposition Theorem, Thevenin's Theorem and Norton's Theorem.
5. Explain the operation of filters and values in AC signals.
6. Recognize the significance of components in electronic circuits

UNIT I

Resistors : Introduction to linear and non linear components (active and passive) – Types of resistors (wire wound, carbon composition, film type, Cermets') – Resistor color coding – power rating of resistors – Series and Parallel combination of resistors.

Capacitors : Capacitance-Factors controlling capacitance-Types of capacitors: Fixed Capacitors, Variable Capacitors – Non electrolytic and electrolytic capacitors. Voltage rating of capacitors – capacitors in series and parallel – Energy stored in capacitors

UNIT II

Inductors : Inductors (air core, iron core, ferrite core) – comparison of different cores – Inductance of an Inductor – Mutual Inductance – Coefficient of coupling – Variable Inductors – Inductors in Series and Parallel without M – Reactance and Impedance offered by a coil – Q factor

Transformer: working – turns ratio – voltage ratio – current ratio – power in secondary – autotransformers – transformer efficiency – core losses – types of cores.

UNIT III

Ohm's law – Kirchoff's current law – Kirchoff's voltage law – voltage division technique - concepts of series circuit – current division technique – concepts of parallel circuits – internal resistance of sources – method of solving a circuit by Kirchoff's laws – loop analysis – nodal analysis – simple problems

UNIT IV

Network Theorems: Super Position Theorem – Thevenin's Theorem – Norton's Theorem – Thevenin to Norton Conversion (Theorem Statement and Simple problems)

UNIT V

Applications of Basic components: Filters (Low Pass Filter, High Pass Filter using passive components.)

AC signal: RMS value– average value–. AC analysis (Pure resistive, Pure inductive circuit and Pure capacitive circuit)

TEXTBOOKS

1. Sedha R S, A Text book of Applied Electronics, S. Chand & Company Ltd
2. Muthusubramanian R, Salivahanan S, Basic Electrical and Electronics Engineering, Tata McGraw Hill Education Private Ltd.
3. Narayanamoorthi M and Others, Electricity and Magnetism, S. Chand & Company Ltd
4. Murugeshan R, Electricity and Magnetism, S. Chand & Company
5. Subharansu Sekhar Dash et al, Basic Electrical Engineering, 2 Edi, Vijay Nicole Pvt Ltd., 2014
6. Giovanni Saggio, Principles of Analog Electronics, CRC Press

REFERENCE BOOKS

1. Sree Harsha N R, Anupama Prakash and D P Kothari D P, The foundations of Basic Circuit Theory, IOP Publishing
2. Hayt and Kemmerly, Engineering Circuit Analysis, 2nd Edition, McGraw Hill
3. Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of electric circuits, 6th Edition, McGraw Hill
4. Theraja V, Basic Electronics Solid State, S. Chand & Company Ltd
5. Bernard Grob, Basic Electronics, McGraw Hill Book Company

WEBSITES

1. Khan academy. Org
2. NPTEL
3. http://www.electronicsteacher.com
4. http://www.abcofelectronics.com
5. http://www.science-ebooks.com
6. www.ocw.mit.edu
7. www.academic.earth

UNIVERSITY OF MADRAS

B.Sc. DEGREE PROGRAMME IN ELECTRONICS AND COMMUNICATION SCIENCE

SYLLABUS WITH EFFECT FROM 2023-2024

129C1B

1.4 CORE COURSE-II: CORE PRACTICAL-I

Instr.Hrs.: 5 **Year : I**

Credits : 3 **Semester: I**

(Atleast seven experiments should be done for the examination)

1. Study of CRO, Multimeter and other Testing Devises (Study Purpose)
2. Testing of components
3. To verify Ohm's Law using voltmeter and Ammeter
4. Study of Kirchoff's law
5. Resistance in Series and Parallel
6. Capacitors in Series and Parallel
7. Study of Super Position Theorem
8. Verification of Thevenin's Theorem
9. Study of RC Circuit – Series Resonance
10. Study of Current limitation by resistor using LED.
11. Low pass filter using Capacitor

REFERENCE BOOKS

1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill.
2. Sugaraj Samuel R & Horsley Solomon, B.E.S. Practicals.

UNIVERSITY OF MADRAS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION SCIENCE

Syllabus

SEMESTER II

2.3 Core Course CC III

Semester II				
Course Code	2.3 Core Course CC III	T/P	C	H/W
Course Name	Electronic Devices	T	5	5
Objectives:	1. To understand the use of diodes as power supply rectifiers 2. To understand the operation of transistors as switching circuits 3. To understand the fundamentals of operation of the semiconductor electronic devices			
Unit - I	**Semiconductor Basics :** Conductor – Semiconductor – Introduction to Intrinsic and Extrinsic semiconductor – P type and N type semiconductor – PN junction diode – V-I characteristics - Half wave, Full wave & Bridge rectifier – expression for efficiency and ripple factor - Construction of Basic logic gates using Diodes.			
Unit - II	**Special Purpose Diodes:**Zener and Avalanche Break down, Zener diode - V-I characteristics regulated power supply using Zener diode- LED, Photodiode, PIN Diode, Varactor Diode, Tunnel Diode – Principle, Working& Applications.			
Unit – III	**Transistors:**Transistor symbols NPN & PNP – Transistor biasing for active, saturation & cutoff - Operation of a BJT - Characteristics of a transistor in CE, CB & CC modes – Early effect – Punch-through– Transistor testing– Transistor as a switch – - Construction of Basic logic gates using Transistors (qualitative analysis)- Transistor as an amplifier - UJT – Basic construction and working - Characteristics.			
Unit - IV	**Field Effect Transistors :** FET – Construction - Working - Static – Transfer characteristics – Parameters of FET – FET as an amplifier – MOSFET – Enhancement MOSFET – Depletion MOSFET – Construction & Working – Drain characteristics of MOSFET – Comparison of JFET & MOSFET.			
Unit - V	**Power Devices:** Power Transistors- SCR – TRIAC – DIAC and IGBT – Characteristics and working.			
Text Books	1. Theraja B.L., Basic Electronics Solid state, S. Chand & Company Ltd. 2. Reeba Korah et al, Electronic Devices, Vijay Nicole Pvt Ltd, 2014 3. Kishore K Lal, Electronic Devices and Circuits, B S Publications 4. Owen Bishop, Electronics circuits and systems, 4th Edition, Elsevier 5. Godse A.P., Bakshi U.A., , Electronics Devices, 1st edition, Technical Publications, Pune, 2009			

Reference Books	1. Charles Kittel, Introduction to Solid State Physics, 8th edition, 2004 2. Roy Choudary D, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd. 3. Pillai.S O, Solid State Physics, 6th edition, New Age International (P) Limited, 4. Sedha R S, A Textbook of Applied Electronics, S. Chand & Company Ltd. 5. Jacob Millman and Christos C. Halkias, Integrated Electronics, Tata McGraw-Hill 6. Robert L. Boylestad, Louis Nashelsky, Electron Devices and Circuit Theory, 10th Edition, Dorling Kindersley India Pvt. Ltd.
Websites	1. Khan academy.org 2. NPTEL 3. http://www.electronicsteacher.com 4. http://www.science-ebooks.com 5. http://www.abcofelectronics.com 6. www.ocw.mit.edu 7. www.academic.earth
Course Outcome	At the end of the course the student should be able to 1. Recognize the diodes as rectifiers 2. Identify the operation of transistors and as switching circuits 3. Compare the operation of transistors and FETs 4. Describe the fundamental operation of semiconductor electronic devices

2.4 Core Course – CC IV

Semester II				
Course Code	2.4 Core Course – CC IV	T/P	C	H/W
Course Name	Electronic Devices Practical	P	5	5
(At least seven experiments should be done for the examination)				
	1. V-I Characteristics of Junction Diode. 2. Rectifier circuits – Half Wave, Center-tapped Full wave. 3. Bridge Rectifier. 4. V-I Characteristics of Zener Diode. 5. Regulated Power Supply using Zener Diode. 6. Transistor as a switch. 7. Transistor Characteristics of CE Configuration. 8. Logic gates using Diodes.			

	9. Logic gates using Transistor. 10. Characteristics of UJT. 11. Characteristics of JFET 12. Characteristics of SCR 13. Characteristics of TRIAC 14. Rectifier circuits using SCR
Reference Books	1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill. 2. Sugaraj Samuel R & Horsley Solomon, B.E.S. Practicals. 3. Srinivasan M. N., and Others, A text book of practical Physics, Sultan Chand and Sons, New Delhi

2.6 Skill Enhancement Course SEC 2

Semester II				
Course Code	2.6 Skill Enhancement Course SEC 2	T/P	C	H/W
Course Name	Printed Circuit Board Design	P	2	2
(At least seven experiments should be done for the examination)				
Practical	1. Simulation of one rectifier circuit and one clipper/clamper circuit. 2. Simulation of any one transistor biasing circuit. 3. Simulation of CE single/double stage amplifier circuit. 4. Simulation of any one power amplifier circuit. 5. Simulation of any one JFET/MOSFET amplifier circuit. 6. Simulation of any one negative feedback circuit. 7. Simulation of encoder/multiplexer circuit. 8. Simulation of decoder/de multiplexer circuit. 9. Simulation of any one flip-flop circuit using gates. 10. Simulation of any one register/counter circuit. 11. Design of PCB for any one circuit from experiment 1 to 6. 12. Design of PCB for any one circuit from experiment 7 to 10. 13. Plot the sine, cosine, triangle and exponential waveform using SCILAB. 14. Plot sampled sine, cosine, triangle and exponential waveform using SCILAB. 15. Study of Simulink. (Only source and sink available in Simulink library).			
Reference Books	NGspice, LTSpice, MULTISIM, Orcad, Proteus or other open source PCB design tools, SCILAB			
Websites	Website: http://www.scilab.org/ (To download SCILAB open source software) http://www.linear.com/, http://www.expresspcb.com/			

	http://ngspice.sourceforge.net/

2.7 NMC – I* (NaanMudhalvan Course)

Semester II				
Course Code	2.7 NMC – I* (NaanMudhalvan Course)	T/P	C	H/W
Course Name		T	2	2

2.8 Skill Enhancement Course SEC 3

Semester II				
Course Code	2.8 Skill Enhancement Course SEC 3	T/P	C	H/W
Course Name	Soldering Practices	P	2	2
Objectives:	• Introduce basic skills and terminology associated with hand tools, soldering irons, tip care and soldering techniques. • Component recognition, awareness of the existence of value codes and the importance of component polarity. • Develop safe working practices with electricity. To prepare students for Integrated Circuit programming.			
Unit - I	Hand Tools and its uses: Identification, Specification and uses of commonly used tools			
Unit - II	Different types of solder, Soldering materials, their Specification, and the use of flux			
Unit – III	Soldering Theory, Soldering Procedure, Hazards involved in soldering			
Unit - IV	Practice of soldering and de-soldering of different components			
Unit - V	Construction of small circuits using soldering 1. Verification of Ohms law 2. Verification of Kirchhoff's laws			
Reference Books	1. A Hands-On Guide to Making Electrical and Mechanical Connections" by Marc de Vinck. 2. "Soldering for Dummies" by Dirk Reinhardt 1. "Basic Soldering for Electronics Pace Handbook" by David Harris. 2. Principles of Reliable soldering Techniques, R. Sengupta, New Age International Publishers, Second Edition. 3. Electronics, Mechanic and Consumer Practical, Arihant Publications, Latest Edition.			
Websites	1. https://www.youtube.com/watch?v=AL-_RGbyf1s 2. https://learn.sparkfun.com/tutorials/how-to-solder-through-hole-soldering/all#soldering-your-first-component-			

SEMESTER III

3.3 Core Course CC V

Semester III				
Course Code	3.3 Core Course CC V	T/P	C	H/W
Course Name	Analog Electronics	T	5	5
Objectives:	1. To understand the operations and the applications of the various classes of an Amplifier. 2. To familiarize the student with the analysis and design of basic transistor amplifier circuits, feedback amplifiers and multi vibrator circuits. 3. To understand the concepts of Multi Stage Amplifier. 4. To study the operation of Hartley, Colpitts, RC Phase shift, crystal and Wien bridge oscillators. 5. To determine the operating characteristic of Unijunction Transistor Oscillator. 6. To study the characteristics of Operational Amplifier. 7. To study the various applications of Operational amplifier and IC 555.			
Unit - I	**Amplifiers :** General principles of small signal & large signal amplifiers. Classification of Amplifiers – Concept of Multistage Amplifier – RC coupled amplifiers - Working – Frequency response – Transformer coupled amplifiers – working – frequency response (Qualitative Analysis) – Direct coupled amplifier – Working - Emitter Follower.			
Unit - II	**Power Amplifier & Feedback Amplifier:**Classification – Class A, B, C amplifiers class A – single ended amplifier – Transformer coupled amplifier – Cross over distortion (definition) – complementary symmetry class B Push pull amplifier – power dissipation and output power calculations.			
Unit – III	**Feedback:** Basic concepts of feedback – Derivation for transfer gain with feedback - effects of negative feedback on input and output resistances, gain, gain stability, distortion and bandwidth – Types of feedback (Voltage series, Voltage shunt, Current series, Current shunt)			
Unit - IV	**Operational Amplifiers & Timer –** IC Identification – op-amp parameters – frequency response of an op-amp – Differential amplifier – CMRR – Inverting amp – non-inverting amp – voltage follower – IC 555 – pin functions – Internal Architecture.			
Unit - V	**Applications – Opamp:** Summing amplifier – Comparator – Integrator – Differentiator – Square wave generators – Triangular wave generators. **IC 555:** Astable – Monostable – Schmitt trigger.			
Text Books	1. Jocob Millman and Christos C.Halkias, Integrated Electronics, McGraw Hill. 2. Roy Choudary D, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000. 3. Sedha, R.S. A Textbook of Applied Electronics, S. Chand & company			

	Ltd. 4. Ramakant A. Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 1994. 5. G.K.Mithal, Basic Electronic Devices and circuits, 2nd Edition, G.K.Publishers Pvt. Ltd. 1998.
Reference Books	1. Allen Mottershead, Electronic Devices and Circuits-an Introduction - Prentice Hall. 2. Mithal G.K., Electronic Devices and Circuits, Khanna Publishers. 3. Donald L.Schillling, Charles Belove, Discrete and Integrated Electronic Circuits, McGraw Hill. **4.** Jacob Milliman, Micro Electronics, McGraw Hill**.**
Websites	https://archive.nptel.ac.in/courses/108/105/108105158/ https://archive.nptel.ac.in/courses/108/108/108108111/
Course Outcomes	At the end of the course the student should be able to 1. Design and analyze of electronic circuits, 2. Recognize power amplifier circuits, their design and uses in electronics and communication circuits. 3. Know the concept of Multistage and feedback amplifier and their characteristics. 4. Design the different oscillator circuits for various frequencies. 5. Design of circuits using Operational Amplifier and IC 555.

3.4 Core Course – CC VI

Semester III				
Course Code	3.4 Core Course – CC VI	T/P	C	H/W
Course Name	Analog Electronics Practical	P	5	5
(At least five experiments should be done for the examination)				
Practical	1. Single stage R-Coupled Amplifier 2. Emitter Follower 3. FET Amplifier 4. Colpitt's Oscillator 5. Hartley Oscillator 6. R-C Phase Shift Oscillator 7. Relaxation Oscillator 8. IC Regulated Power Supply 9. OPAMP - Inverting and Non Inverting modes, Unity Follower 10. OPAMP – Summing Amplifiers (Inverting and Non Inverting Modes) 11. OPAMP - Integrator and Differentiator 12. OPAMP –Square Wave Generator 13. OPAMP – Sine Wave Generator			

	14. Monostable Multivibrator using IC 555 timer 15. Astable Multivibrator using IC 555 timer 16. Schmitt Trigger using IC 555 timer
Reference Books	1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill. 2. R.Sugaraj Samuel & Horsley Solomon, B.E.S. Practical . 3. Srinivasna M N and Others, A text book of practical Physics, Sultan Chand and Sons, New Delhi

3.5 Elective III

Semester III				
Course Code	3.5 Elective III	T/P	C	H/W
Course Name	(a) Energy Physics	T	3	4
Objectives:	• This course introduces the technology and economics of converting renewable energy sources into Electricity. • To provide basic principles and fundamentals of Physics for the development of renewable energy systems. • To Understand the fundamental principles of Solar Energy, Wind energy, Hydro energy and nuclear energy. • To Understand the effects of technology on society. • To prepare students for careers where Physics principles can be applied to the generation of Electricity and development of Technology.			
Unit - I	**Solar Energy:**Basic Concept of Energy – Physics of renewable energy-Source of Solar Energy - Solar Constant- Air Mass. Solar Photovoltaic Cell- working principle.			
Unit - II	**Solar cells:** Types- Series and Parallel connections, Solar panels-Photovoltaic applications: Battery chargers, domestic lighting, street lighting and water pumping.			
Unit – III	**Wind Energy:**Origin and nature of Winds- Basic principles of wind energy extraction –Wind Turbines and Types -Different electrical machines in wind turbines. Environmental Aspects.			
Unit - IV	**Hydropower energy:** Basic hydro energy conversion and efficiency-Types of hydroelectric power plants, viz. micro, small and large-Hydroelectric power plant working - turbines, types of turbines and their applications in small hydro technologies.			
Unit - V	**Nuclear Energy:** Definition, types, uses, disadvantages - Nuclear Power Reactors working– Generation of Electricity- impact on environment-Nuclear power plants in India.			
Text Books	1. Text book of Renewable energy, S.C. Bhatia and R.K. Gupta, Woodhead Publishing India Pvt. Ltd., 2012 2. Science and technology of Photovoltaics, P. Jayarami Reddy, BS Publications, 2004			

	3. Wind Energy, S.C. Bhatia and Puneet Mangla, Woodhead Publishing India Pvt. Ltd., 2012 4. Nuclear Physics, Dr. S. N. Ghoshal, S. Chand Publishing, 2019
Reference Books	1. Renewable Energy sources and Emerging Technologies, D.P. Kothari, K.C. Singal, Rakesh Ranjan, 3rd edition, PHI Publishers. 2. Renewable Energy and Energy harvesting, Dr. Nilamoni Saikia, Mahaveer Publication, 2022
Websites	• Khan academy.org • NPTEL , www.ocw.mit.edu, • www.academic.earth • http://swayam.gov.in
Course Outcomes	At the end of the course the student should be able to 1. Recognize the diodes as rectifiers 2. Identify the operation of transistors and as switching circuits 3. Compare the operation of transistors and FETs 4. Describe the fundamental operation of semiconductor electronic devices

3.5 Elective III

Semester III				
Course Code	3.5 Elective III	T/P	C	H/W
Course Name	(b) Programming in C	T&P	2+1	3+1
Objectives:	1. To understand the different types of variables and operators in C programming and their use in different types of operations. 2. To understand the decision making and looping structures in C and use it in program implementations. 3. To understand the purpose of functions in C. 4. To understand how data storage and access in arrays in C. 5. To learn file operations and data manipulations using pointers in C.			
Unit - I	C fundamentals Character set – Identifier and keywords – data types – constants – variables – declarations – expressions – statements – arithmetic, unary, relational and logical, Assignment and conditional operators – Library functions			
Unit - II	Data input output functions – Simple C Programs – flow of control – if, if-else, while, do-while, for loop, nested control structures – switch, break and continue, go to statements – comma operator			
Unit – III	Functions – definition – proto-types – passing arguments – recursions, storage classes – automatic, external, static, register variables – multi-file programs			
Unit - IV	Arrays – defining and processing – passing arrays to functions – multi dimension arrays – arrays and string . Structures – user defined data types – passing structures to functions – self referential structures – unions – bit wise operations			

Unit - V	Pointers – declarations – passing pointers to functions – Operation in Pointers – pointer and arrays – arrays of pointers – structures and pointers. Files – creating, processing, opening and closing a data file. ***Practicals*** ***(Atleast six Programs should be done for the examination)*** 1. Addition of N number of data's 2. Factorial of a Number 3. Fibonacci Series 4. Palindrome of a String 5. Temperature Conversion 6. Armstrong of a Number 7. Largest of a Number 8. Smallest of a Number 9. Ascending order 10. Descending order 11. Matrix Addition 12. Matrix Subtraction
Text Books	1. Balaguruswamy E, Programming in ANSI C, TMH Publishing Company Ltd 1995 2. Sasi Kala Rani K, Programming in C, Vijay Nicole Pvt Ltd, 2019 3. Kernighan B W and Ritchie D M, The C Programming Language, 2nd Edition, PHI
Reference Books	4. Schildt H, C The Complete Reference, 4th Edition, TMH Pub. Co. Ltd, New Delhi 5. Gothfried B S, Programming in C, 2nd Edition, TMH Pub. Co. Ltd, New Delhi 6. Kanetkar Y, Let us C, BPB Publication, New Delhi
Websites	https://onlinecourses.nptel.ac.in/noc22_cs40/preview - NPTEL
Course Outcome	At the end of the course the student should be able to 1. Implement programs using Functions, Pointers and Structures in C language 2. Implement files and perform file operations. 3. Perform the execution of programs written in C language. 4. Identify the C code for a given algorithm.

3.6 Skill Enhancement Course SEC - 4

Semester III				
Course Code	3.6 Skill Enhancement Course SEC - 4	T/P	C	H/W
Course Name	Mobile Servicing	T	1	1
Objectives:	1. To understand the concepts of Mobile Servicing			

	2. To know the hardware and software parts of mobile phone 3. To Identify and rectify basic fault 3. To familiarize future scope
Unit - I	Mobile Phones: History of mobile phones-General characteristics of mobile phones- Mobile phones advantages, disadvantages and its applications.
Unit - II	Hardware of Mobile Phone: Mobile Phone chip components Name and Their Function-Function of Diode-Crystal-Transistor (Bipolar & MOSFET)- Function of Transistor - Coupler-Wi-Fi oscillator-.EMI filters-Mobile Phone IC's and their function
Unit – III	Software of Mobile Phone: Mobile operating system-functions of OS-Types of Popular Mobile Operating System- Features of Mobile Operating System- Components of a Mobile Operating System-understanding different software faults-use of different secret code.
Unit - IV	Troubleshooting: Fault finding & troubleshooting- section-wise fault finding and repairing of hardware and software problems-circuit tracing and jumpering- troubleshooting through schematic diagrams.
Unit - V	Future Scope: Cloud Technology - Top Mobile technologies Grouping of applications Services for tablets or smart phones- Safety to be followed in Smart phones- future of phones in 2050.
Text Books	Cell Phone Repair Guide for Beginners Book by HossneMamunMinti press
WEBSITES	1.https://mobiletraininginkathmandunepal.com/mobile-phone-repair-pdf-book-free-download/ 2. https://www.mobilecellphonerepairing.com/mobile-phone-repairing-pdf-book-free-tutorial-guide.html#google_vignette 3. https://www.youtube.com/watch?v=hvX5Wd5PkAo 4. https://www.mobilerepairingonline.com/p/blog-page_15.html 5. https://egyankosh.ac.in/bitstream/123456789/72524/3/Unit-3.pdf
Course Outcome	At the end of the course the student should be able to 1. Knows about the Basic Circuit Board and Assembly and disassembly a mobile cell phone 2. Has understood the concepts of Mobile Communication tools and instruments and its usage 3. Knows about the Basic Circuit Board and Assembly and disassembly a mobile cell phone 4. Can identify different types of mobile cell phones & their components. 5. Knows the scope for Mobile Phone based servicing business.

3.7 NMC – II (NaanMudhalvan Course)/Skill Enhancement Course SEC - 5

Semester III				
Course Code	3.7NMC – II (NaanMudhalvan Course)/Skill Enhancement Course SEC - 5	T/P	C	H/W
Course Name	Trouble Shooting	P	2	2
Practical	1. Demonstrate the use of various hand held tools. 2. Test the performance of different passive electronic components (fixed/variable) 3. Test the performance of active electronic components like general purpose transistor/FET 4. Verify the functionality of TTL and CMOS Digital IC's using IC tester 5. Explore datasheet of minimum any five electronics components and analog/ Digital IC's			
Text Books	1. Modern Electronic Equipment: Trouble- shooting, Repair and Maintenance Khandpur TMH 2006 2. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting R. G. Gupta TMH 2001			
Reference Books	3. Student Reference Manual for Electronic Instrumentation Laboratories David L Terrell Butterworth-Heinemann 4. Electronic Testing and Fault Diagnosis G. C. Loveday, A. H Wheeler Publishing			

SEMESTER IV

4.3 Core Course CC – VII

Semester IV				
Course Code	4.3 Core Course CC – VII	T/P	C	H/W
Course Name	Digital Electronics	T	5	5
Objectives:	1. To understand common forms of number representation in digital electronic circuits and to be able to convert between different representations. 2. To perform decimal, octal, hexadecimal, and binary conversions. 3. To apply Boolean algebra to solve logic functions. 4. To implement simple logical operations using combinational and sequential logic circuits. 5. To identify and differentiate digital electronics applications.			
Unit - I	**Number System and Codes :** Decimal, binary, octal, hex numbers, conversion from one to another – codes, BCD, excess 3, gray codes conversion from one to another – Error detection codes.			
Unit - II	**Boolean Algebra and Theorems :** Basic, Universal logic gates – Boolean Identities - Boolean theorems, De Morgan's Theorem – sum of products, products of sums expressions, simplification by Karnaugh Map method, simplification based on basic Boolean theorems – don't care conditions.			

Unit – III	**Combinational Digital Circuits :** Arithmetic Building blocks, Half & Full Adders and Half & Full Subtractors, BCD adders – multiplexers, De-multiplexers, encoders, decoders – Characteristics for Digital ICs - RTL, DTL, TTL, ECL CMOS (NAND & NOR Gates).
Unit - IV	**Sequential Digital Circuits:**Flip-flops, RS, Clocked SR, JK, D, T, master-slave Flip flop – Conversion of Flip flop - shift registers – ripple counters – synchronous counters and asynchronous counters (4-bit counter). Introduction to VHDL and Verilog for digital logics design.
Unit - V	**DAC:** Accuracy-Resolution- Variable Resistor Network, R-2R ladder Network **ADC:** Accuracy-Resolution-Successive Approximation-Dual Slope.
Text Books	1. Jain R P, Modern digital Electronics, 3rd Edition, TMH, 2003. 2. Sanjay Kumar Suman et al, Digital Principles and System Design, Vijay Nicole Pvt Ltd, 2014 3. Puri, V.K., Digital Electronics, Tata Mc Graw Hill 4. Marris mano M., Computer System Architecture, 2nd Edition, Prentice Hall, 1998 5. Malvino and Leach, Digital Principles and applications, McGraw Hill, 1996 IV Edition 6. Vijayendran V, Introduction to Integrated Electronics, S.Viswanathan Printers and Publishers, 2005
Reference Books	1. Millman J, Micro Electronics, McGraw Hill International Book Company, New Delhi 1990. 2. William H. Gothman, Digital electronics – An int. to theory and practice,2nd Edition, PHL of India, 2007. 3. Morris Mano M, Digital Logic and Computer Design, PHI 2005. 4. Morris Mano M, Digital Design, PHI 2005. 5. Godse A.P, Digital Electronics, Technical Publications.
Websites	1. Khan academy.org 2. NPTEL 3. http://www.electronicsteacher.com 4. http://www.abcofelectronics.com 5. www.ocw.mit.edu
Course Outcome	At the end of the course the student should be able to 1. Identify the structure of various number systems and its application in digital design 2. Analyze various combinational and sequential circuits 3. Analyze how to interface digital circuits with analog components

4.4 Core Course – CC VIII

Semester IV				
Course Code	4.4 Core Course – CC VIII	T/P	C	H/W

Course Name	Digital Electronics Practical	P	5	5
(At least five experiments should be done for the examination)				
Practical	1. Universality of NAND & NOR gates. 2. Verification of Boolean laws using NAND gates (Associative, Commutative & Distributive Laws) 3. Verification of Boolean laws using NOR gates (Associative, Commutative & Distributive Laws) 4. Sum of Products using NAND gates and Product of Sums using NOR Gates. 5. 4-bit binary parallel adder and Subtractor IC 7483 6. Counter using IC 7473 7. Study of RS, D, T and JK Flip-Flops with IC's. 8. Study of Encoder & Decoder. 9. Study of Multiplexer & De-Multiplexer. 10. Half and Full Adder using Simple & NAND Gates. 11. Half and Full Subtractor using Simple & NAND Gates. 12. Study of 7490 BCD Counter – MOD Counters. 13. BCD to Seven segment decoder 7447/7448.			
Reference Books	1. Zbar, Malvino and Miller, Basic Electronics, A Text Lab Manual, Tata McGraw Hill. 2. R.Sugaraj Samuel & Horsley Solomon, B.E.S. Practical.			

4.5 Elective IV

Semester IV				
Course Code	4.5 Elective IV	T/P	C	H/W
Course Name	(a) Applied Physics	T	3	3
Objectives:	1. Physics is a systematic study of the natural world, a discipline that measures reality through application of observation with logic and reason. In order to make use of such a discipline we need certain foundational information. 2. To understand the tools and methods that Physicists use range from balance scales to Laser beam emitters. 3. To understand principles of Physics in Fiber Optical Communication systems. 4. To provide basics and fundamental principles of Nano Science. 5. To prepare students to excel in technical careers based on laws of Physics.			
Unit - I	**LASER PHYSICS:** Introduction- Principle of spontaneous emission and stimulated emission. Population inversion, pumping. Eienstein's A and B coefficients-derivation. Types of Lasers- Ruby Laser, Nd-YAG, Semiconductor Lasers-Applications of lasers.			
Unit - II	Introduction – Principle and structure of optical fibres – Propagation of			

	light through optical fibres – types of optical fibers – Optical fiber communication system (block diagram)
Unit – III	**FIBER OPTICSENSORS:**Introduction and Types ofFiber Optic Sensors – Medical Applications of Optical fibers- Medical Endoscope- Engineering Applications of Optical fibers- Telecommunications- Computer Networks- Advantages
Unit - IV	**NANO PHYSICS:** Introduction- Length scales in Physics- Nanostructures: 1D, 2D and 3D nanostructures (Nano dots, thin films, Nanowires, Nano rods)- Synthesis of Nanostructure Materials (a) Top down and Bottom up approach, Photolithography, Ball milling.
Unit - V	**NANO MATERIALS APPLICATIONS:**(a) Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells).
Text Books	1. Dr. Arumugam M, 2nd edition, 2002 -Engineering Physics, Anuradha Publications. 2. Introduction to Fiber optics, Ajoy Ghatak & K.Thyagarajan, Cambridge University Press, 2017. 3. Basics of Nano Physics, G.P Singh, Anmol Publishers, 2011 4. Nano science and Nano technology, K.K.Choudhury(Narosa)
Reference Books	1. Lasers- Fundamentals and Application, K. Thiagarajan&Ajoy Ghatak, Springer, 2011 2. Fiber-Optic Communication Systems, Agarwal. G.P. - John Wiley& Sons, 3rd Edition, 2002 3. Nano Physics, Dr. R.K. Tripathi, Arjun Publishing House, 2017
Websites	• Khan academy.org • NPTEL , www.ocw.mit.edu, • www.academic.earth • http://swayam.gov.in
Course Outcome	At the end of the course the student should be able to 1. Recognize the principles of Physics behind Lasing action. 2. Explain the working of various types of Laser technology. 3. Understand the structure and transmission of light through Fiber Optics. 4. Categorize the applications of Lasers and Fiber optics in various fields. 5. Identify the fundamental principles of nanotechnology, nanomaterial based sensors and their applications in industry and medical fields.

4.5 Elective IV

Semester IV				
Course Code	4.5 Elective IV	T/P	C	H/W
Course Name	(b) Programming in JAVA	T	3	3
Objectives:	1. To understand the concepts of Object Oriented Programming.			

	2. To learn about the control structures, class with attributes and methods used in Java.
Unit - I	**Introduction to Java**: Features of Java, JDK Environment, Object Oriented Programming Concept Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance,Polymorphism, Difference between C++ and JAVA **Java Programming:** Fundamental Structure of java program, Data types, Variables, Operators,Keywords, Naming Convention, Decision Making (if, switch), Looping (for, while),Type Casting
Unit - II	**Classes and Objects**: Creating Classes and objects, Memory allocation for objects, Constructor,Implementation of Inheritance, Implementation of Polymorphism, Method Overloading, and Method Overriding. Nested and Inner classes
Unit – III	**Arrays, Strings & Graphic Programming:** Arrays, Creating an array, Types of Arrays, String class Methods, String Buffer methods. Abstract Class, Interface and Packages: Modifiers and Access Control, Abstract classes and methods, Interfaces, Packages Concept, Creating user defined packages, The Graphic class. Jav.awt.Graphics,Uses of classJawa.awt.Graphics, Custom painting, Drawing Lines, Drawing Rectangles,Drawing Ellipses and Circles, Drawing Arcs, Drawing Polygons.
Unit - IV	**Inheritance, Packages and Interface:** Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces
Unit - V	**Exception Handling &FileHandling**: Exception types, Using try catch and multiple catch, Nested try, throw, throws and finally, Creating User defined Exceptions. Overview of Different Stream (Byte Stream, Character stream), ReadersandWritersclass,FileClass,FileInputStream,FileOutputStream,InputStreamReaderandOutputStreamWriterclass,Filereaderandwriter class,FileWriter,Buffered Reader class.
Text Books	1. JAVA The complete Reference, Herbert Schildt (2011),Java:, 8th Edition, Tata McGraw-Hill Education, New Delhi. 2. Java in a Nutshell by Benjamin J.Evans & David, Flanagan 7th Edition O′ Reilly Publication 3. Let Us Java, Yashavant Kanetkar – BPB Publications – 6th Edition.
Reference Books	1. Java7 Programming Black Book by Kogent Learning Solutions Inc Dream Tech press 2. Java Fundamentals A comprehensive introduction By Herbert Schildt. Dale Skrien, McGraw Hill Education. 3. Programming with Java A Primer - E.Balaguruswamy Mc Grawbill 4. Core Java Volume-I Fundamentals Horstmann & Cornell, Pearson Education. –Eight Edition 5. Head First Java by Kathy Sierra, Bert Bates, O'Reilly publications

Websites	• Khan academy.org • NPTEL , www.ocw.mit.edu, • www.academic.earth • http://swayam.gov.in
Course Outcome	At the end of the course the student should be able to 1. Knowledge of the structure and model of the Java programming language. 2. Understand the basic principles of creating Java applications with GUI. 3. Demonstrate use of string and String Buffers, Develop multithreaded programs in Java

4.6 Value Education

4.7 NMC – III (NaanMudhalvan Course)/ Skill Enhancement Course SEC - 6

Semester IV				
Course Code	4.7 NMC – III (NaanMudhalvan Course) / Skill Enhancement Course SEC - 6	T/P	C	H/W
Course Name	Programming in C++	T	2	2
Objectives:	1. To introduce the concepts of Object Oriented Programming language. 2. To learn the object-oriented concepts of C++ and Java. 3. To handle exceptions in C++ 4. To learn and program the concepts of Control statements, Classes object, Polymorphism and Inheritance.			
Unit - I	**Principles of Object – Oriented Programming** Introduction to OOPs concepts –characteristics of OOP'S – Features of OOP'S - Introduction to OOPS in Java programming – Basics of Java.			
Unit - II	**Beginning with C++** Structure of C++ program – C++ keywords – Basic Data types – Constants – Variables – Operators - Manipulators			
Unit – III	**Control Statements** Decisions – if, if else, switch – Loops – for, while, do while – Other control statement – break, continue and goto statements.			
Unit - IV	**Classesand object** Class –Creating objects –Accessing Class member – A C++ program with class Constructors - Destructors			
Unit - V	**Polymorphism and Inheritance** Polymorphism - Function Overloading - Operator overloading - Virtual functions– Inheritance.			
Text Books	1. E. Balagurusamy, Object Oriented Programming with C++ , Tata McGraw- Hill Education 2. Robert Lafore, Object – Oriented Programming in C++, Sams Publications.			
Reference Books	1. Ira Pohl, Object oriented Programming using C++, Benjamin/Cummings Publishing Company.			

	2. Herbert Schildt, The Complete Reference C++, 4th Edition, McGraw-Hill Osborne Media
Websites	1. https://www.udemy.com/course/beginning-c-plus-plus-programming/ 2. https://www.udemy.com/course/learn-object-oriented-programming-oops-concepts-in-java/
Course Outcome	**At the end of the course the student should be able to** 1. Implement the Object Oriented concepts using C++ 2. Describe data, variables and operators in C++. 3. Perform exceptions that arise in a C++ program. 4. Describe polymorphism, inheritance and virtual functions in C++.

SEMESTER V

5.1 Core Course CC - IX

Semester V				
Course Code	5.1 Core Course CC - IX	T/P	C	H/W
Course Name	Microprocessor and interfacing	T	4	5
Objectives:	1. To know the microprocessor as a programmable digital system element. 2. To illustrate some basic concepts of microprocessors through the use of assembly language programming. 3. To develop an in-depth understanding of the operation of microprocessors and machine language programming & interfacing techniques. 4. To design simple interfaces to Intel-8085. 5. To Comprehend the various peripheral interface circuits that are necessary for the operation of Intel-8085.			
Unit - I	**Introduction of 8085 Microprocessor:** Architecture of 8085 microprocessor - Pin details of 8085 –Interrupts and its types. **Instruction set of 8085 :** Data transfer-Arithmetic-Logical-Branching-Machine control-Addressing modes			
Unit - II	**Programming Exercises :** Addition and Subtraction(8-bit and 16-bit), Multiplication, Division, Largest, Smallest, Block transfer, Ascending order and Descending order (all 8-bit data), Binary to BCD, BCD to Binary, Binary to ASCII, ASCII to Binary, BCD to ASCII, ASCII to BCD (all 8-bit data)Stack –Subroutine - Time delay using register and register pair.			
Unit – III	**Memory :** Primary memory –Secondary memory-RAM- ROM-EPROM-EEPROM-Interfacing Memory- 2K X 8, 4K X 8 ROM, RAM to 8085, Interfacing an I/O Devices using Memory Mapped I/O and I/O Mapped I/O – Difference between I/O mapped and Memory Mapped I/O.			
Unit - IV	**Timing Diagrams:**Instruction cycle – machine cycle – T-state -Timing diagrams for Op-code Fetch Cycle Memory Read, Memory Write, I/O			

	Read, I/O Write **Peripheral Devices :** Programmable peripheral interface (Intel 8255), programmable Keyboard and Display Interface (Intel 8279)
Unit - V	**Microprocessor Applications:**Analog to Digital Converter (ADC) - Digital to Analog converter (DAC) - Traffic light controller - Temperature controller.
Text Books	1. Ramesh S. Gaonakar, Microprocessor Architecture, Programming and Application with the 8085, Penram International Publishing, Mumbai. 2. Ram, Fundamentals of microprocessors and microcomputers-Dhanpat Rai Publications, New Delhi 3. Vijayendran, Fundamentals of microprocessor-8085, S. Viswanathan publishers, Chennai.
Reference Books	1. Mathur A P, Introduction to Microprocessors, 3rd Edition, Tata McGraw, New Delhi, 1995. 2. Leventhal L A, Microprocessor Organization and Architecture, Prentice Hall India.
Websites	• Khan academy.org • NPTEL , www.ocw.mit.edu, • www.academic.earth • http://swayam.gov.in
Course Outcome	At the end of the course the student should be able to 1. Describe the architecture of 8085 microprocessor 2. Analyze assembly language programs 3. Implement program efficiency using various addressing modes 4. Perform Interfacing of memory & various I/O devices with 8085 microprocessor

5.2 Core Course X

Semester V				
Course Code	5.2 Core Course X	T/P	C	H/W
Course Name	Artificial Intelligence	T	4	5
Objectives:	● To understand the basics of AI and Intelligent Agents ● To learn basics of problem solving using search techniques • To know the logical implications in computational intelligence ● To learn different knowledge representation techniques in AI and tools. • To understand the applications of AI in different domains.			
Unit - I	**Basics of Artificial Intelligence** Introduction of AI - History and foundations of AI - Types of AI - Building AI System, Intelligent Agents, Agents and Environments – Good Behavior: The Concepts of Rationality – The Nature of Environments – The Structure of Agents			
Unit - II	**Problem Solving by Search** Uninformed: Breadth-first search, Depth-first search, Hill-climbing search -			

	Informed (Heuristic) search - A* Search - Adversarial Search and Games, Optimal Decisions in Games, Alpha–Beta Pruning - Constraint satisfaction problems (CSP)
Unit – III	**Knowledge Reasoning & Planning** Logical Agents - Knowledge-Based Agents - Logic - Propositional Logic Agents based on Propositional Logic - First Order Logic – Inference – Classical Planning – Planning in real world
Unit - IV	**Reasoning under Uncertainty** Acting under uncertainty - Probability and Bayes' Theorem, Representing knowledge in uncertain domain – Semantics of Bayesian networks – Exact and approximate inference in Bayesian networks.
Unit - V	**AI Applications** Radar for target detection, Automated ECG Noise Detection and Classification, Traffic prediction and classification, AI in Cognitive Radio Network (CRN).
Text Books	1. "Artificial Intelligence: A Modern Approach (AIMA)", Stuart J. Russell and Peter Norvig, Prentice Hall, 2020 (4th Ed.) 2. "Artificial Intelligence and Machine Learning", Vinod Chandra S. S was published by PHI Learning in 2014.
Reference Books	1. "Artificial Intelligence by Example: Acquire advanced AI, machine learning, and deep learning design skills", Denis Rothman, 2nd Edition Paperback,2020. 2. "Artificial Intelligence and Machine Learning", Iresh A., DhotreanamitraDeshmukh - Nimbalkar, Technical Publications, Pune,2022.
Websites	https://www.udemy.com/courses/search/?src=ukw&q=PYTHON
Course Outcome	Upon completion of the course, students will be able to • Explain the basic concepts of Artificial intelligence • Apply the search techniques to real-time problems. • Apply the reasoning techniques to real world problems. • Infer knowledge in uncertain environments • Apply AI techniques in developing real world applications.

5.3 Core Course XI

Semester V				
Course Code	5.3Core Course XI	T/P	C	H/W
Course Name	Sensor Technology for Artificial Intelligence	T	4	5
Objectives:	● Define sensors and transducers and differentiate between the two ● Explain the principles of resistive, piezoelectric and capacitive sensors			

	and their applications. • To know the logical implications in computational intelligence ● Identify the applications of biomedical and gas sensors. • Explain the integration of AI with sensors for advanced monitoring and data analysis.
Unit - I	Definition and classification of sensors and transducers, Basic sensor principles and characteristics, Sensitivity, range, resolution, and accuracy Overview of sensor technologies: mechanical, thermal, optical, magnetic, chemical, and biological Applications of sensors in various fields: healthcare, automotive, industrial, environmental monitoring
Unit - II	Piezoelectric sensors: principles and applications, Capacitive and resistive sensors: design and operation, Optical sensors: photodiodes, phototransistors, and fiber optic sensors, Thermal sensors: thermocouples, RTDs, and thermistors
Unit – III	Biosensors: principles, types, and applications, Gas sensors: metal oxide semiconductor sensors, electrochemical gas sensors, pH sensors and ion-selective electrodes
Unit - IV	Nanotechnology in sensors: nanowires, nanotubes, and nanomaterials, MEMS and NEMS sensors: design, fabrication, and applications, Smart sensors and self-calibrating sensors, Wearable and flexible sensors, AI Integration of Sensors
Unit - V	Basics of wireless communication technologies: Bluetooth, Zigbee, Wi-Fi, and LoRa, Network topologies and protocols for sensor networks, Applications of wireless sensor networks and IoT in smart cities, agriculture, and healthcare
Text Books	1. "Introduction to Instrumentation and Measurements" by Robert B. Northrop – III Edition, CRC Press. 2. “Handbook of modern sensors physics designs and applications” by Jacob Fraden , Springer
Reference Book	1. “Sensors and Transducers “ by D. Patranabis – 2nd Edition - PHI Learning
Websites	https://www.udemy.com/courses/search/?src=ukw&q=Sensors
Course Outcome	Upon completion of the course, students will be able to • Classify various types of sensors based on their operational principles and applications • Describe the principles of piezoelectric sensors and their applications • Understand the role of nanowires, nanotubes, and nanomaterials in sensor technology • Understand the development and application of wearable and flexible sensors. • Apply wireless sensor networks in smart cities, agriculture, and healthcare.

5.4 Core Course XII

Semester V				
Course Code	5.4 Core Course CC-XII	T/P	C	H/W
Course Name	Microprocessor Practical	P	4	5
(At least Eight Programs should be done for the examination)				
Unit - I	**Microprocessor 8085** 1. Addition 2. Subtraction 3. Multiplication 4. Division 5. Square 6. Largest & Smallest number in the given array. 7. Ascending & Descending order. 8. Binary to ASCII & ASCII to Binary 9. BCD to ASCII & ASCII to BCD. 10. Binary to BCD and BCD to Binary. 11. Block Move **Interfacing with 8085** 1. DAC 2. ADC 3. Traffic light interface 4. Clock Program 5. Flashing LED			
Reference Books	1. Ramesh S. Gaonakar, Microprocessor Architecture, Programming and Application with the 8085, Penram International Publishing, Mumbai. 2. K. Udaya Kumar, B.S. Umashankar, The 8085 Microprocessor Architecture, Programming and Interfacing, Pearson Education India 3.Ajay Wadhwa, Microprocessor 8085: Architecture, Programming, and Interfacing, PHI Learning Pvt. Ltd			

5.5 Elective V

Semester V				
Course Code	5.5 Elective V	T/P	C	H/W
Course Name	(a) Python Programming with Raspberry Pi	T	3	4
Objectives:	❖ Understand the fundamentals of Python language and Programming techniques. ❖ Exposure to functions, File handling and Data structure concepts ❖ Get familiar with the specifications and features of different Raspberry Pi models. ❖ Create embedded and IoT projects using the Raspberry Pi using Python.			

Unit - I	Introduction to Python: PythonIDE / IDLE Installation: Text Editors, Shells-PyCharm IDE -Python Syntax - Keywords, Identifiers and Comments - Variables - Data Types - Numbers - Strings - Lists - Tuples - Sets Dictionaries - Input and Output - Python Operators: Arithmetic, Relational, Assignment, Logical and Bit-wise- Python Control Flow&Decision Making: Conditional: If else and Nested, if else and elif - Looping & Branching - For Loop, While Loop and Nested Loops - Break & Continue Statement – Simple Program.
Unit - II	Function, Arrays and File handling: User-defined Functions - Built-in Functions – Types of Functions - Exception –Python Modules and Maths Module - User Input and output IO – File handling and Exception handling - Python Date and Time - Regular Expressions - Python Arrays - Recursion: Simple programs - Factorial, Sum of n natural numbers, Fibonacci series.
Unit – III	Data structure and Advanced Programming concepts: Stack and operations - Introduction to Queue - Operations on Queue - Introduction to files and types of files - Multithreading -Advanced Programming in Python:Object Oriented - Objects and Classes, Networking – CGI– GUI: Tkinter –Open Source: Introduction to Anaconda Python, MicroPython programming and CPhyton - Python for Data Science: Introduction Spyder.
Unit - IV	Basics of Raspberry Pi Board and OS: Comparison of various Raspberry Pi Models, Pin description, On-board components of Raspberry Pi - Basic operations of the Raspberry Pi -Linux Environment: Introduction, Architecture, File System Popular Linux Commands -LINUX Shell, SHELL Scripting, Introduction to Raspbian Operating System and Booting Up Raspberry Pi – Introduction to Pi Camera, Flask, Guizero and LAMP server.
Unit - V	Programming Raspberry pi with Python and Applications: General Purpose I/O (GPIO) and control using Python - Interfacing Raspberry Pi using Python: LED Blinking, Temperature & Humidity Sensor - PIR, Obstacle detection, Servo control, Buzzer, Photo Detector- Raspberry Pi Camera Module and library - Camera functions: capture images, change settings, capture video, time lapse photosRaspberryApplications:IoT using Raspberry Pi forRobot,automation and web applications.
Text Books	1. "Basic Python Programming for Beginners" by Dr. Marlapalli Krishna & S. Jaya Prakash Dr. Marlapalli Krishna, K. VaradaRajkumar, Paperback, 2021. 2. "Python Programming: A modular Approach" by Sheetal and Naveen Kumar, Pearson,2018. 3. "Core Python Programming" by R. NageswaraRao, 3rd Ed, Dreamtech press - Paperback 2021. 4. "The Official Raspberry Pi Beginners Guide", Gareth Halfacree 5th Ed, Raspberry Pi press, 2023. 5. "Programming Raspberry Pi in 30 Days" by Edgardo Peregrino, BPB

	Publication 2023.
Reference Books	1. "Learn Python Programming" by Fabrizio Romano, Second Edition, Packt Publishing Ltd, Brimingham UK, 2018. 2. "Python: The Complete Reference by Martin C. Brown, McGraw-Hill publication, Paperback. 2018. 3. "Raspberry Pi User Guide" by Eben Upton, Gareth Halfacree, John Wiley & Sons, 2014.
Websites	1. NPTEL: https://onlinecourses.nptel.ac.in/noc24_cs57/preview - The Joy of Computing using Python. 2. NPTEL:https://onlinecourses.nptel.ac.in/noc24_cs45/preview - Programming, Data Structures & Algorithms Using Python. 3. https://www.nielit.gov.in/sites/default/files/Gangtok/IoT_raspberrypi_10th_Jan_2020_R1.pdf. 4. https://www.raspberrypi.com/books-magazines/ 5. https://gnindia.dronacharya.info/EEE/NC-Course-2nd-Year/Downloads/Python-Programming /Books/Python-Programming.pdf 6. NPTEL: https://onlinecourses.nptel.ac.in/noc24_cs54/preview - Python for Data Science. 7. https://www.gcreddy.com/2022/01/python-programming-language-syllabus.html.
Course Outcome	By the end of the course the students are able to ❖ Familiar with basics of Python programming and ability to solve problems ❖ Understand a given Python program and to write Coding for simple solutions. ❖ Fundamentals of Raspberry Pi board and Raspberry Linux OS ❖ Develop Raspberry based basic level applications using Python programming.

5.5 Elective V

Semester V				
Course Code	5.5 Elective V	T/P	C	H/W
Course Name	(b) Industrial Electronics	T	3	4
Objectives:	1. To familiarize students to the principle of operation, design and applications of Thyristor 2. To learn the triggering mechanism and commutation 3. To understand the basic operation of Invertors 4. To know the applications of LASER, Ultrasonics and Radar			
Unit - I	**Thyristors and their Operations:** Principles and operations of SCR – Voltage amplifier gate characteristics of SCR – Characteristics of two			

	transistor models – Thyristor construction – Rectifier circuit using SCR – GTO – Operation and characteristics of DIAC – TRIAC – Silicon Controlled Switch – Silicon Unilateral Switch – Silicon Bilateral Switch – Light activated SCR
Unit - II	**Turn On/Off Mechanism:** Types of turn on methods: AC gate triggering: R triggering – RC triggering – DC gate triggering – Pulse triggering – Types of turn off methods: Natural commutation – Forced Commutation: Self-Commutation – Complimentary commutation – Auxiliary commutation – External pulse commutation – Line commutation – Thyristor rating
Unit – III	**Invertors:** Types of invertors – Single phase bridge inverter – Mc Murray impulse communication inverter – Single phase half bridge voltage source inverter – Single phase full bridge voltage inverter
Unit - IV	**Choppers:** Introduction – Basic chopper classification – Basic chopper operation – Control strategies – Chopper configuration – Thyristor chopper circuits – Jones chopper – Morgan chopper – A.C. chopper – Source filter – Multiphase choppers
Unit - V	**Industrial Applications:** Automatic Street light - Single Phase Inverter - DC Choppers (Step up and Step down) - R and RC Triggering - External Pulse Commutation - DC motor controller and Light Dimmer - Time delay circuit – Application of LASER in industry – Ultrasonic application – Radar application
Text Books	1. Harish C Rai, Power Electronic Devices, Circuits, Systems and Applications, 1st Edition, GacGotia Publication Pvt. Ltd., 1998 2. Ramamourthy, Thyristor and their applications, 2nd Edition, East-West Publishers, 3. Shamir K Datta, Power Electronics and Controllers, 3rd Edition, PHI 4. Singh M D and Khanchandani K B, Power electronics, Tata McGraw
Reference Books	4. Singh M D and Khanchandani K B, Power electronics, Tata McGraw – Hill publishing company Limited 5. Adolph Blicher, Thyristor Physics, Springer-Verlag
Websites	https://www.mdpi.com/journal/electronics/sections/Industrial_Electronics https://www.researchgate.net/publication/259656587_IEEE_Industrial_Electronics
Course Outcome	At the end of the course the student should be able to 1. Explain the principle and application of Thyristor 2. Implement the triggering mechanism in various applications 3. Describe the basic operation of Invertors 4. Analyze the applications of LASER, Ultrasonics and Radar in various fields

5.6 Elective VI

Semester V

Course Code	5.6 Elective VI	T/P	C	H/W
Course Name	(a) Computer Networks	T	3	4
Objectives:	1. To learn the definition and basic terminology of Computer Networks 2. To learn the different types of Computer Networks 3. To know the application of computer networks in different fields 4. To know Multiplexing, transmission media and signals 5. To learn the functioning of OSI model and describe the responsibilities of each layer 6. To know about the individual components and functioning of the internet 7. To learn the hardware components used in the networking			
Unit - I	Introduction to Computer Networks : User of Network – Network structure – The OSI reference model concepts – layers of the OSI model			
Unit - II	The Physical Layer : Different types transmission medium – CODEC – switching techniques – channel allocation methods – ALOHA protocol – LAN protocol (any one) – IEEE standards 802.3 (Ethernet), 802.4 (token ring), 802.5 (token bus)			
Unit – III	The Data Link Layer : Design issues – concept of framing – different methods – error detection and correction (single error correction and cyclic redundancy check)			
Unit - IV	The Network Layer : Design issues – Internal organization of network layer – congestion control algorithm, leaky bucket algorithm and token bucket algorithm – Dijikstra routing algorithm			
Unit - V	Repeaters, bridges, routers and gateways – brief introduction to the transport layer, session layer, presentation layer – basic concepts of internet – WWW			
Text Books	1. Andrew S Tenenbaum, Computer Networks, Prentice Hall of India 2. Stallings W, Data and Computer Communications, Printice Hall of India 3. Behrouz and Forouzan, Introduction to data communications and networking, McGraw Hill			
Reference Books	1.Behrouz and Forouzan, Introduction to data communications and networking, McGraw Hill			
Websites	1. Khan academy.org 2. NPTEL 3. http://wwww.electronicsteacher.com 4. http://www.science-ebooks.com 5. http://www.abcofelectronics.com 6. www.ocw.mit.edu 7. www.academic.earth			
Course Outcome	At the end of the course the student should be able to 1. Explain the OSI Reference Model 2. Analyze the requirements for a given organizational structure and			

	select the most appropriate networking architecture and technologies 3. Describe the functions of Physical, Data Link, Network layers in OSI model 4. Define the transport, session and presentation layers

5.6 Elective VI

Semester V				
Course Code	5.6 Elective VI	T/P	C	H/W
Course Name	(b) Industrial Internet of Things (IIoT)	T	3	4
Objectives:	1. To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application. 2. Knowledge for the design and analysis of Industry 4.0Systems for Electronics Engineering students.			
Unit - I	**Introduction to Industrial IoT (IIoT) Systems:** The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.			
Unit - II	**Implementation systems for IIoT:** Sensors and Actuators for Industrial Processes, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Interoperability in Smart Automation, Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems. **Case Study:**IIoT application development with Embedded PC based development boards.			
Unit – III	**IIoT Data Monitoring & Control:** IoT Gate way, IoT Edge Systems and It's Programming, Cloud computing, Real Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology. **Case Study:**Automotive Applications, Home Automation, Smart Cards.			
Unit - IV	**Cyber Physical Systems:** Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis **Case Study:** Smart Metering, e-Health Body Area Networks, City Automation.			
Unit - V	**Industrial IoT- Applications:** Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management. **Case Study:** Plant Automation, Real life examples of IIoT in Manufacturing Sector.			
Text Books	1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist Publications: Apress 2. The Concept Industry 4.0. An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.			

Reference Books	1. The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications 2. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3. 3. Five thoughts from the Father of the Internet of Things; by Phil Wainwright - Kevin Ashton 4. Dr.OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers. 5. "PIC Microcontroller and Embedded Systems: Using assembly and C for PIC 18" by MAZIDI PEARSON 2008.
Websites	1. https://www.udemy.com/course/plc-to-aws-iot-and-aws-ec2-in-iiot/
Course Outcome	At the end of this course, students will be able to: 1. Knowledge of theory and practice related to IndustrialIoT Systems. 2. Ability to identify, formulate and solve problems by using Industrial IoT. 3. Ability to implement real field problem by gained knowledge of Industrial applications with IoT capability.

5.7 NMC – IV (NaanMudhalvan Course) / Skill Enhancement Course SEC 7

Semester V				
Course Code	5.7 NMC – IV (NaanMudhalvan Course) /Skill Enhancement Course SEC 7	T/P	C	H/W
Course Name	MAT Lab	P	2	2
Objectives:	1. To learn features of MATLAB as a programming tool. 2. To promote new teaching model that will help to develop programming skills and technique to solve mathematical problems. 3. To understand MATLAB graphic feature and its applications. 4. To use MATLAB as a simulation tool.			
Unit - I	**Introduction to MATLAB:** The MATLAB Environment - MATLAB Basics – Variables, Numbers, Operators, Expressions, Input and output - Vectors, Arrays – Matrices.			
Unit - II	**MATLAB Functions:**Built-in Functions - User defined Functions.			
Unit – III	**Graphics with MATLAB:** Files and File Management – Import and Export – Basic 2D, 3D plots – Graphic handling.			
Unit - IV	**Programming with MATLAB:**Conditional Statements, Loops – MATLAB Programs – Programming and Debugging – Applications of MATLAB Programming.			
Unit - V	**Mathematical Computing with MATLAB:**Algebraic equations – Basic Symbolic Calculus and Differential equations – Numerical Techniques and Transforms.			
Reference Books	1. "A Guide to MATLAB - for Beginners and Experienced Users", 2nd			

	Ed., Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg, Cambridge University Press, (2006). 1. "Essentials of MATLAB Programming", 2nd Ed., Stephen J. Chapman, Cengage Learning, (2009). 2. "MATLAB Demystified", David McMahon, the McGraw-Hill Companies, (2007). 3. "MATLAB® for Engineers", 3rd Ed., Holly Moore, Pearson Education, Inc., (2012). 4. "Engineering computation with MATLAB", 2nd Ed., David M. Smith, Pearson Education, Inc., (2010).

5.8 Summer Internship /Industrial Training

SEMESTER VI

6.1 Core CourseXIII

Semester VI				
Course Code	6.1 Core Course CC XIII	T/P	C	H/W
Course Name	Real Time Embedded Systems	T	4	6
Objectives:	1. To familiarize with different types of microcontroller 2. To know 8051 microcontroller in detail 3. To familiarize with Arduino as IDE, programming language & platform. 4. To provide knowledge of Arduino boards and basic components. 5. Develop skills to design and implement various smart system application.			
Unit - I	**Introduction to Microcontroller:** Features of 8051 - Comparison of Microcontroller &Microprocessor – 8051Architecture – Block diagram – 8051 Pin details - Memory Organization– Counter and Timers –Serial Communication – Interrupts.			
Unit - II	**8051 Instruction Sets:** Addressing Modes – Data Transfer Instructions – ArithmeticInstructions – Logical Instructions – Branching Instructions - Bit level Instructions			
Unit – III	**Programming Exercise (8 Bit):** Addition – Subtraction – Multiplication – Division - Data Transfer - Largest/Smallest Number – Ascending/Descending Order-Basic Time Delay.			
Unit - IV	**Introduction to Embedded Systems**: Block Diagram-Von Neumann and Harvard Architecture –Introduction to CISC and RISC -Components of Embedded System- Types of Embedded Systems - Advantages and Applications of Embedded Systems - Introduction to Embedded C – Difference between C and Embedded C. - Introduction to ARDUINO-Types of Arduinos Boards-Architecture and Pin configuration.			
Unit - V	**Arduino IDE Setup and Installation:**Program structure- Data Types-Variables and Constants-Operators-Control Statements-Arrays-Library			

	Functions. Programming in Arduino: Analog and Digital value read-Temperature and Humidity Sensor - Ultrasonic Sensors-Flame sensors--Light Sensitive sensor. Arduino Output Displays-Serial monitor and plotter, LED blink, Seven Segment Display, LCD Display-Stepper Motor.
Text Books	1. Kenneth J Ayala, The 8051 Microcontroller: Architecture, Programming and Applications, West Publishing company 2. Mazidi E. and Mazidi, F, The 8051 Microcontroller and Embedded systems, 2nd Edition - Prentice – Hall of India (2004) 3. Jack Ganssle and others, Embedded Hardware, Elsevier Inc
Reference Books	4. M. Schmidt, Arduino: a quick-start guide. Dallas: The Pragmatic Bookshelf, 2015. 5. AdithJagadishBoloor, Arduino by Example. Birmingham: Packt Publishing Limited, 2015. 6. M. McRoberts, Beginning Arduino. Berkeley, CA: Apress, 2013.
Websites	https://archive.nptel.ac.in/courses/106/105/106105229/ https://www.udemy.com/course/become-an-embedded-system-engineer-30-days-challenge-embedded-system/
Course Outcome	**At the end of the course the student should be able to** 1. Describe the architecture of 8051 microcontroller 2. Describe the operation of microcontroller 3. Implement the machine language programming 4. Explain Arduino environment and its applications 5. Implement circuits using Arduino

6.2 Core Course XIV

Semester VI				
Course Code	6.2 Core Course – CC XIV	T/P	C	H/W
Course Name	Embedded Systems Practical	P	4	6
(At least twelve experiments should be done for the examination)				
Practical	**Microcontroller** 1. Addition 2. Subtraction 3. Multiplication 4. Division 5. Largest Number 6. Smallest Number 7. Block Transfer 8. Ascending Order 9. Descending Order **Interfacing with Arduino** 10. Blinking of an LED			

	11. Seven Segment Display 12. LCD 13. IR Sensor 14. Gas Sensor 15. Stepper motor 16. Temperature and Humidity Sensor 17. Ultrasonic sensors
Reference Books	https://www.udemy.com/course/arduino-sbs-17gs/ https://onlinecourses.swayam2.ac.in/aic20_sp04/preview

6.3 Core Course XV – Project

6.4 Elective VII

Semester VI				
Course Code	6.4 Elective VII	T/P	C	H/W
Course Name	(a) Medical Electronics	T	3	5
Objectives:	1. To enable the students to learn about bio-potentials and medical instruments 2. To enable students to know various instruments used for diagnostics and treatment. 3. To introduce an fundamentals of transducers as applicable to physiology 4. To explore the human body parameter measurements setups			
Unit - I	**Basic Physiology :** Cells and their Structures - Transport of Ions through Cell Membrane - Resting and Excited State Transmembrane Potential - Action Potential - Propagation of Bioelectric Potential – Piezo electric and Ultrasonic Transducers.			
Unit - II	**Bio-potential Recording:** Basic Electrode Theory - Micro electrodes, skin electrodes, needle electrodes – pH electrode – Blood gas electrode. ECG - EEG - EMG - ERG - different lead systems - their waveforms.			
Unit – III	**Measurement of Biological Parameters & Treatment :** Measurement of heart beat rate - measurement of temperature - Sphygmomanometer - – Blood Gas analysers, pH meter - blood flow meters EM and plesthsmographic technique – Applications of LASER in Medicine			
Unit - IV	**Diagnostic Equipments& Biotelemetry :** X-ray Imaging - Radio Fluoroscopy - Image Intensifiers - Angiography - Endoscopy – Diathermy – Shortwave, microwave & Ultrasonic Diathermy. BIOTELEMETRY AND PATIENT SAFETY: Need for Biotelemetry - Elements of Telemetry System – Applications of Telemetry in Patient care.			
Unit - V	**Physiological assist Devices:** Need for Pacemakers - Pacemaker Parameters and Circuits - Different Modes of Operation - DC Defibrillator - Ventilators - Dialysis – Hemodialysis -. **Computer Applications:** Computerized Axial Tomography (CAT) Scanner - MRI –			

	Ultrasonography - Computer Based Patient Monitoring System.
Text Books	1. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, 4th Edition, Pearson Education Asia, New Delhi, 2001 2. Leslie Cromwell, Fred J. Webell, Erich A. Pfeffer, Bio-medical Instrumentation and Measurements, Prentice Hall of India, New Delhi, 1990 3. Arumugam. M, Biomedical Instrumentation, Anuradha Agencies Publishers, Chennai, 1992
Reference Books	1. Khandpur, Handbook on Biomedical Instrumentation, Tata McGraw Hill Company, New Delhi, 1989 2. John G Webster, Ed., Medical Instrumentation Application and Design, 3rd Edition, John Wiley & Sons, Singapore, 1999
Websites	https://onlinecourses.nptel.ac.in/noc22_bt56/preview https://www.shiksha.com/online-courses/medical-electronics-certification
Course Outcome	At the end of the course the student should be able to 1. Describe the origin of biopotentials and explain the role of biopotential electrodes; 2. Design and operate biopotential amplifiers 3. Describe common biomedical signals and distinguish characteristic features 4. Measure biomedical information 5. Demonstrate the position of biomedical instrumentation in modern hospital care 6. Explain the Physiological assist devices and Computer Applications.

6.4 Elective VII

Semester VI				
Course Code	6.4 Elective VII	T/P	C	H/W
Course Name	(b) Machine Learning And Data Science	T	3	5
Objectives:	1. To understand the basics of Machine learning and Data science 2. To learn basics of machine learning techniques 3. To aware about Python libraries for ML and Data analysis 4. To learn applications of ML and data analytics for electronic applications.			
Unit - I	**Basics of Machine Learning and Deep learning** Machine Learning (ML) - Fundamentals and learning system - Forms of Learning - Math for ML: Probability theory and linear Algebra - Introduction to Big Data, Deep learning and Natural language processing			

	(NLP).
Unit - II	**Machine Learning Techniques** **Supervised Learning:** Regression and classification algorithms - Learning Decision Trees - Naive Bayes model - **Unsupervised Learning:** Clustering and types - Hard and soft clustering & four types of clustering algorithms - Advice for applying ML - ML System Design.
Unit – III	**Machine Learning – Knowledge and Applications in Electronics** **Knowledge in Learning:** Logical Formulation of Learning, Knowledge in Learning, Logic Programming, Reinforcement learning, statistical learning. **Applications** – Case studies: Deep Learning Automated ECG Noise Detection and Classification, Application of ML in Cognitive Radio Network (CRN).
Unit - IV	**Fundamentals of Data Science** Data Science Fundamentals, Roles & Responsibilities of a Data Scientist – Data Science process Introduction to Python libraries - Understanding Python & data structure - Python for ML.
Unit - V	**Data analytics and Applications in Electronics** Python for Data Science, Data Visualisation in Python, Data Analysis in Excel, Analytics Problem Solving, Python libraries for Computer vision, Robotics and Autonomous vehicle Introduction to Cloud in ML: open-source frameworks Scikit Learn &PyTorch - Introduction to Git &GitHub.
Text Books	1. Data Science and Machine Learning using Python by DrReemaThareja (Author),2022 ISBN-13-978-9355322142, McGraw Hill publication. 2. Data Science and Machine Learning by N. Meenakshi K. E. Rajakumari S. HariharaSitaraman (Author), Notion Press, 2021, ISBN-13-978-1638069911.
Reference Books	1. Data Analytics using Python Paperback by BhartiMotwani (Author), 2020,ISBN-13-978-8126502950,WILEY PUBLICATIONS
Websites	1. https://archive.nptel.ac.in/courses/106/106/106106139/ 2. https://www.ibm.com/topics/natural-language-processing 3. https://www.geeksforgeeks.org/data-science-fundamentals/ 4. https://www.run.ai/guides/machine-learning-in-the-cloud
Course Outcome	•Explain the basic concepts of ML, DL and Data science •Apply the learning techniques and python libraries for ML. •Apply python for ML by developing electronics applications.

6.5 Elective VIII

Semester VI				
Course Code	6.5 Elective VIII	T/P	C	H/W
Course Name	(a) Artificial Intelligence for Robotics	T	3	5

Objectives:	1. To understand the fundamental concepts, types of robots. 2. To impart fundamental theory of various components, parts of robots and electronic controls for robotics 3. To develop skills in design and programming robots using Arduino. 4. To be aware of the basic concept of AI in Robotics and applications.
Unit - I	**Basic Theory of Robotics and Parts:** History of Robotics - Definition and Basics of Robotics - Laws and knowledge base of Robotics -**Types:** Industrial Robot - Fixed, Mobile Robots, Autonomous and Unmanned Robot - Manipulators - pitch, yaw, joints, speed of motion and payload - Sensors – End effectors - Motors and Grippers for Robots.
Unit - II	**Electronic control, Programming and Applications for Robots** Introduction to Robot Programming Languages - VAL programming and commands for simple program -**Robot design using Arduino:** Line followers - Obstacle avoidance - pick and place robot - Bluetooth & IoT based design.
Unit – III	**Basics of AI in Robotics:** The Role of Robotics in Artificial Intelligence, benefits of AI in Robotics: Enhanced capabilities, Increased Efficiency and Productivity, Safety applications in Robotics – ABS, Air bag system, Advanced Driver Assistance System (ADAS)
Unit - IV	**AI in Computer Vision:** Object Recognition, Visual serving, AI algorithms process camera and sensor data to map surroundings, identify obstacles, and plan safe and efficient paths for robots to navigate.
Unit - V	**Applications of Artificial Intelligence in Robotics:** Autonomous vehicle, AI- driven medical advances and applications in healthcare.
Text Books	1. P. Jaganathan, Industrial Robotics, 3rd Edition, Lakshmi Publications 2.A.K. Gupta, S.K. Arora, Industrial Automation and Robotics, University of science press, 2013. 3. Mark Torvalds, Arduino Programming: Step-by-step guide to mastering Arduino hardware and software, 2nd Edition, 2018. 4. Artificial Intelligence for Robotics by Francis X. Govers,2018,Packt Publishing, ISBN: 9781788835442.
Reference Books	1. Thomas R. Kurfess, Robotics and Automation Hand book, CRC Press, 2005. 2. Artificial Intelligence and Roboticsby Huimin Lu, Springer,2021.
Websites	1. https://www.arduino.cc. 2. https://www.openrobotics.org 3. https://www.instructables.com/id/Simple-Smart-Robot-Using-arduino/. 4. https://onlinedegrees.sandiego.edu/application-of-ai-in-robotics/. 5. https://www.ai-startups.org/books/robotics/ 6. https://www.geeksforgeeks.org/artificial-intelligence-in-robotics/
Course Outcome	At the end of the course the student should be able to 1. Explain concepts, types and various components of robots 2. Describe the basics of AI for robotics 3. Recognize programming knowledge to build up applications in robots.

	4.Aware of AI in robotics applications like computer vision and autonomous vehicle.

6.5 Elective VIII

Semester VI				
Course Code	6.5 Elective VIII	T/P	C	H/W
Course Name	(b) Electronic Instrumentation	T	3	5
Objectives:	1. To introduce the basic concepts related to the operation of Electrical and Electronics Measurement Instruments 2. To study the basics of design of analog and digital circuits used in electronic instrumentation 3. To understand basic electronic instrument terminology 4. To understand the proper application of electronic instruments			
Unit - I	**DC indicating Instruments:** PMMC Galvanometer (D' Arsonal Movement) – Principle, Construction and Working — Conversion of Galvanometer into Ammeter, Voltmeter and Ohmmeter (Series and Shunt Types) – Multimeter – Loading Effect. **AC indicating Instruments:** Electrodynamometer – Principle, Construction and Working – Merits and Demerits – Rectifier Type Instruments – Watt-hour Meter.			
Unit - II	**DC Bridges:** Wheatstone bridge – Determination of resistance – KelvinDoubleBridge - Determination of resistance. **AC Bridges:** Maxwell's Bridge – Determination of Self-Inductance – Wien's Bridge – Determination of Frequency – Schering's Bridge – Determination of Capacitance			
Unit – III	**Oscilloscopes:** Block Diagram – Deflection Sensitivity – Electrostatic Deflection – Electrostatic Focusing – CRT Screen – Measurement of Waveform frequency, Phase difference and Time Intervals – Sampling Oscilloscope – Storage Oscilloscopes (Introduction).			
Unit - IV	Instrumentation Amplifiers and Signal Analyzer: Instrumentation amplifier – Electronic Voltmeter –Digital Voltmeter– Block Diagram of Function Generator – Wave analyzer – Fundamentals of Spectrum Analyzer.			
Unit - V	**Transducers and Display Devices:** Strain Gauge – Unbonded Strain Gauge – LVDT – Resistance Thermometer – Thermocouple – Photoelectric Transducer – Seven Segment Display – LCD.			
Text Books	1.W.D. Cooper & A. D. Helfrick, Electronic Instrumentation and Measurement Techniques, Prentice Hall of India. 2. A.K. Sawhney, A course in Electrical and Electronic Measurements and Instrumentation, DhanpatRai and Sons.			
Reference Books	3. P. B. Zbar, Electronic Instruments & Measurements, McGraw Hill International. 4. Dominic Savio et al, Electronics and Instrumentation, Vijay Nicole Pvt			

	Ltd, 2016 5. J.B. Gupta, A course in Electronic and Electrical Measurements', S.K. Kataria& sons, Delhi, 2013.
Websites	
Course Outcome	At the end of the course the student should be able to 1. Categorize DC and AC indicating instruments 2. Recognize various AC and DC bridges 3. Recognize the basic features of oscilloscope and different types of oscilloscopes 4. Identify the complete knowledge of various electronics instruments/transducers to measure the physical quantities in the field of science and technology.

6.6 Extension Activity

6.7 NMC – V (NaanMudhalvan Course)/ Professional CompetencySkill

Semester VI				
Course Code	6.7 NMC – V (NaanMudhalvan Course)/ Professional Competency Skill	T/P	C	H/W
Course Name	PLC Programming Lab	P	2	2
(At least Seven experiments should be done for the examination) Any embedded based simulation tool may also be used				
Unit - I	1. Study of PLC Symbols 2. Study of Various Logic Execution in Ladder Diagram. 3. Writing of Ladder Logic for Different Statements. 4. Ladder Diagram Development for Different Types of Logic Gates using Suitable Software 5. PLC Input - Output Wiring Methods 6. Operating Simple Loads using Relays, Switches and Pushbuttons 7. Different Applications of Push Buttons 8. Programming the PLC Via Ladder logic 9. Working of Different Types of Timers 10. Study & Implement ; ON delay timer in PLC 11. Study & implement ; OFF delay timer in PLC 12. Working Of Different Types of Counters 13. Study & Implementation of Up Counter in PLC Programming. 14. Study & Implementation of Down Counter in PLC Programming. 15. Interlocking 16. Sequencer 17. Sequential Operation of On/Off of A Set of Lights 18. Forward And Reverse Direction Control of Motors 19. Latching and Unlatching of motor 20. Prepare the Physical and Programmed Ladder Diagram for the Control			

	Problem shown below & Implement the same. 21. PLC Programming for Bottle Filling Plant. 22. Procedure for Producing a Ladder Logic Diagram for Car Parking Simulation 23. Position Control for Satellite Dish DC Motors 24. Starting Three Phase Induction Motors Via Star-Delta Starter 25. Automatic Indication of Water Tank Level 26. Traffic Lights Indication
Reference Books	1. "Industrial Automation Using PLC SCADA & DCS" by R.G. Jamkar, Global Education Ltd. 2."Industrial Automation with SCADA: Concepts, Communications and Security, by K S Manoj,3rd edition, Laxmi Publications Pvt Ltd, 2007. 3. "BASIC PLC PROGRAMMING FOR BEGINNERS", Mitsubishi Electric GX Works2" by Williams Robertson Mitsubishi Electric Programming Series I 2020
Websites	1. https://www.udemy.com/course/plc-programming-from-scratch