SANT GADGE BABA AMRAVATI UNVIERSITY, AMRAVATI

Three Years- Six Semesters Bachelor's Degree Programme

3 Years B.Sc. /4 Year B.Sc. (Hons) & 4 Year B.Sc. (Hons with Research) Programme

Faculty of

Science and Technology

(Science Group)

Subject: **ELECTRONICS**

(Semesters V and VI)

Effective from Academic Year 2026-27

(As per Uniform NEP 2020)

Contents

SANT GADGE BABA AMRAVATI UNVIERSITY, AMRAVATI
FACULTY: Science and Technology
Subject: ELECTRONICS
Teaching and Learning Scheme for the Degree of Bachelor of Science (B.Sc.)
Three Years / Four Years - (Six/ Eight Semesters) Bachelor Degree Programme

Examination, Evaluation and Assessment Scheme

Vertical No.	The Vertical	Mode of Examination & Evaluation Assessment	Theory					Theory (Total)		Practical					Practical (Total)	
			External			Internal				External			Internal			
			Max Marks	Min Marks	Duration (Hrs.)	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Duration (Hrs.)	Max Marks	Min Marks	Max Marks	Min Marks
A	**Major**	External & Internal	**30**	**9**	**2**	**20**	**6**	**50**	**20**	**25**	**10**	**4**	**25**	**10**	**50**	**20**
	IKS Major Specific		**30**	**9**	**2**	**20**	**6**	**50**	**20**	--	--		--	--	--	--
B	**Minor**		**30**	**9**	**2**	**20**	**6**	**50**	**20**	**25**	**10**	**4**	**25**	**10**	**50**	**20**
C	**Generic/ Open ElectVIe**		**30**	**9**	**2**	**20**	**6**	**50**	**20**	--	--		--	--	--	--
D	**VSC**	**Internal**	---	---						--	--		**50**	**20**	**50**	**20**
	SEC	**Internal**	---	---						--	--		**50**	**20**	**50**	**20**
F	**Internship/ Apprenticeship**	Internal	Assessment of these verticals shall be based on various actVIities/practices. It shall be evaluated by gVIing maximum marks of 50 per 2 Credit Course with separate actVIity weightages/levels. A detailed SOP for this assessment process shall be prescribed separately													
	FP/CES															
	CC															

Internal Assessment for Theory/Practical/Laboratory:

All the internal assessments should be conducted on the basis of Continuous Assessment Tests (CAT).

Continuous Assessment Tests (CAT):

For internal assessment, the Continuous Assessment Tests (CAT) shall be conducted as under

i. Three CAT each of 10 Marks (Theory) and 10 Marks (Practical).
   - First on completion of 25% Syllabus of the course or on completion of 25 teaching days,
   - THIRD on completion of 50% Syllabus of the course or on completion of 50 teaching days,
   - Third on completion of 75% Syllabus of the course or on completion of 75 teaching days. .

ii. Each concurrent assessment (CAT-I, II & V) will be mapped to relevant Course Learning Outcome.

iii. Total Performance in CAT (i.e.40 %) shall be based on the best two out of three in CAT examinations

iv. Internal assessment shall be carried out by the respectVIe course teacher by choosing variety of assessment tools/methods such as class test, seminar, case study, field work, mini project work, quiz or any innovatVIe method, which may be deemed to be appropriate for assessing the relevant course outcome.

External Assessment for Practical (Major/ Minor Lab):

- Practical Performance : 20 Marks
- Viva-Voce : 05 Marks
- **Total : 25 Marks**
- Duration of Examination : 04 Hrs.

Internal Assessment for Practical (Major/ Minor Lab):

- Internal Assessment based on CAT : 15 Marks
- Record Book : 10 Marks
- **Total : 25 Marks**

Internal Assessment for Practical (SEC/ VSC Lab):

- Internal Assessment based on CAT : 20 Marks
- Record Book : 10 Marks
- Attendance : 10 Marks
- 10 MCQ/short Question : 10 Marks
- **Total : 50 Marks**
- Duration of End Semester Examination: 04 Hrs.

Evaluation and Assessment for FP/CES:

- Project Report: The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks)
- Oral Presentation: The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks)
- Faculty Evaluation: The faculty mentor will assess the student's performance throughout the project. (20 Marks)
- **Total 50 Marks**

Note: The external assessments of theory courses will be conducted in accordance with the guidelines issued by the SGBA UnVIersity.

SANT GADGE BABA AMRAVATI UNVIERSITY, AMRAVATI
FACULTY: Science and Technology
Subject: ELECTRONICS
Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)
Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme

THIRD YEAR: Level 5.5 - SEMESTER – V (T & L Credit Scheme)

Mode of Teaching	Ver. No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/ Online/ Hybrid	a.	Major	Electronics Theory 8	113231	Measuring Instruments	2	2	16
			Electronics Theory 9	113232	Communication Electronics	2	2	
			Electronics Theory 10	113233	C-Programming	2	2	
			Electronics Lab/Practical-12	113234	Practical based on Theory 113231, 113232 & 113233	2	4	
		Elective	Elective Theory 1	113235	Circuit Design & Simulation	2	2	
			Electronics Lab/Practical-13 A	113236	Practical based on Theory 113235	2	4	
			Elective Theory 2	113237	E-Vehicle Technology	/ 2	/ 2	
			Electronics Lab/Practical-13 B	113238	Practical based on Theory 113237	/ 2	/ 4	
	b.	Minor	Electronics Theory 5	113239	Communication & Microprocessor 8086	2	2	6
			Electronics Lab/Practical-14	113240	Practical based on 113239	2	4	
	c.	Generic/ Open Elective	-	-	-	-	-	-
	d.	VSC	Lab/Practical-15	113241	Advanced Practical on Major Theory T8, T9 and T10	2	4	4
		SEC	Lab/Practical-16	113242	Skill based Practical on Major Theory T8, T9 and T10	2	4	4
	f.	FP/ CES	Project	113243	Field Project / CE Services on Electronics	2	4	8
		CC	Outdoor			2	4	
		TOTAL				**24**	**38**	**38**

Major Theory 8: Measuring Instruments

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113231	Measuring Instruments	2	30	2 Hrs	30

Course Objectives:	• Read, understand, and interpret electrical/electronic circuits through verbal, mathematical and graphical methods. • To give need-based education in Electronics of the highest quality at the undergraduate level. • Use Information Communication Technology to gather knowledge. • Impart skills required to gather information from resources. Equip students in methodology related to electronic circuits, devices and systems.
Course Outcomes:	After completing the course, the student will • Identify electronic components and ICs. • Design system components that meet the requirement of public safety and offer solutions to the societal and environmental concerns. • Apply research-based knowledge to design and conduct experiments. • Construct, choose and apply the techniques, resources and modern electronics tools required for Electronics applications. • Utilize the basic knowledge in Electronics science. • Apply Electronics knowledge in their day-to-day life.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Basic Instrumentation:** Block diagram of generalized instrumentation system, Concept of transducers (Primary and secondary, active and passive, analog and digital). Resistive transducer - potentiometer, Inductive transducer - LVDT, capacitive transducer (by changing distance), measurement of displacement using capacitive transducer (By changing dielectric).	8 Hrs	8 Marks	Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable.
Unit II	**Measurement of Temperature:** Thermocouple, Thermopile, Thermistor, RTD, Total Radiation Pyrometer, IC LM34, IC LM35, Infrared Pyrometer	7 Hrs	7 Marks	
Unit III	**Biomedical Instrumentation:** Introduction, Type of electrode, EEG, EMG, ECG-block diagram and function of each block, X ray machine, instantaneous heart rate meter-systolic and diastolic blood pressure meter, EAR oximeter, pulse Oximeter,	8 Hrs	8 Marks	
Unit IV	**Display, digital Instrument and recorder:** Seven segment, 14 segment, dot matrix, 16x2 LCD display, advantage and disadvantage, Digital instrument: Digital frequency meter, Digital voltmeter (Ramp type), Digital capacitance meter (Block diagram and function of each block)	7 Hrs	7 Marks	

References:	Linear integrated Circuits by Ramakant Gaikwad 2. Principles of Electronics by V. K. Mehta 3. Elements of Electronics by Bagde and Singh

	4. Basic Electronics by B. L. Theraja (S. Chand and Company) 5. Electrical and electronics measurement and Instrumentation by A.K. Sawhney 6. Biomedical instrumentation by R.S.Khandpur
Model questions for theory external examination.	
MCQs for Internal Assessment:	1. Example of Active transducer is ---------- a) Quartz b) cobalt c) Sodium d) None 2. LM34 is used for measurement of temp. in ------ a) Celsius b) Farhenite c) meters d) None 3. LM35 is used for measurement of temp. in ------ a) Celsius b) Farhenite c) meters d) None 4. In LVDT Secondary windings are --------- a) 1 b) 2 c) 3 d) None 5. Thermistors is used for measurement of ------- a) Pressure b) Temperature c) Volume d) weight
One sentence/ short questions	1. Name various types of transducers. 2. Classify the types of transducers. 3. Write concept of Thermistor. 4. Write Concept of 7- Segment display 5. Write the long form of EEG. 6. State applications of thermistor. 7. What is thermocouple? 8. What is DVM?
Long questions	1. Draw the Block diagram of G-I System and Explain. 2. Explain Thermistor and its application. 3. Explain construction and working of LVDT. 4. Draw the block diagram of ECG. and explain every block. 5. Explain construction and working of Thermocouple.

Major Theory 9: Communication Electronics

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113232	Communication Electronics	2	30	2 Hrs	30

Course Objectives:	• To understand the fundamental principles of Electronics Communication. • To study the analog communication system. • To explore the digital communication system. • To examine the optical fibre communication system.
Course Outcomes:	After completing the course, the student will • Understand the fundamental principles of communication systems. • Grasp the concept of analog communication systems. • Recognize the process of converting signals to digital format and the transmission of digital signals in communication systems. • Familiarize one with various telecommunication systems.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Analog Communication**: Need for modulation, Type of Modulation, Amplitude Modulation Frequency Modulation, Phase Modulation (concept, representation, Comparison, modulation index, examples). Difference between AM and FM.	8 Hrs	8 Marks	Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable.
Unit II	**Digital Communication:** Pulse Modulation, PAM, PPM, PWM, Need of Sampling, Digital Modulation, Pulse Code Modulation, PCM Sampling rate, quantization noise, Multiplexing, difference between TDM & FDM.	7 Hrs	7 Marks	
Unit III	**Optical Fibre Communication:** Merits and demerits of OFC, Block diagram of OFC, Types of optical fibre, Total internal reflection, fibre alignment, joint losses.	8 Hrs	8 Marks	
Unit IV	**Telecommunication Systems:** Concept of LAN, WAN, MAN, Network Topology: Ring, Star, and Bus, Block diagram and function of Mobile communication, Internet- 2G, 3G, 4G, 5G.	7 Hrs	7 Marks	

References:	• Frenzel, L.E. (2014). Principles of Electronic communication systems. (3rd ed.). McGrawHill. • Kennedy, G., & Devis, B. (1985). Electronic Communication systems. Tata McGrawHill. • Beasley, J.S., & Miller, G.M. (2007). Modern Electronics Communication. (9th ed.). Pearson. • Roddy, D., & Coolen J. (2008). Electronic Communications. (4th ed.). Pearson Education, India. • Tomasi, W. (2003). Advanced Electronics Communication Systems. (6th ed.). Prentice Hall. • Lathi, B.P. (2017). Modern Digital and Analog Communication Systems. (4th ed.). Oxford University Press.
Model questions for theory external examination.	
MCQs for Internal Assessment:	1. What is the main purpose of modulation in communication systems? a) To increase noise b) To reduce signal strength c) To transmit signals over long distances efficiently d) To store data permanently 2. In Amplitude Modulation (AM), which parameter of the carrier wave is varied? a) Frequency b) Phase c) Amplitude d) Wavelength 3. Which modulation technique provides better noise immunity? a) AM b) FM c) PAM d) PCM 4. Which of the following is a digital modulation technique? a) PAM b) PWM c) PCM d) FM

	5. Which multiplexing technique divides the total time into slots for multiple signals? a) FDM b) TDM c) AM d) FM 6. Optical Fibre communication works on the principle of: a) Diffraction b) Refraction c) Total Internal Reflection d) Interference
One sentence/ short questions	1. Define modulation and explain its need in communication systems. 2. State any three differences between AM and FM. 3. Define modulation index in AM. 4. What is pulse modulation? Name its types? 5. Define Pulse Code Modulation (PCM). 6. What is quantization noise? 7. Differentiate between TDM and FDM. 8. State the merits and demerits of Optical Fibre Communication (OFC). 9. Explain the principle of total internal reflection in optical Fibre. 10. Define LAN, WAN and MAN. 11. Draw and explain any one network topology. 12. Write the block diagram of mobile communication system. 13. Differentiate between 2G, 3G, 4G, and 5G technologies.
Long questions	1. Describe Pulse Code Modulation (PCM) in detail. 2. Explain the concept of multiplexing. Differentiate between TDM and FDM. 3. Draw the block diagram of Optical Fibre Communication (OFC) and explain the function of each block. 4. Explain the principle of Total Internal Reflection in optical Fibre communication. Discuss Fibre alignment, joint losses, couplers, and jointers. 5. Define LAN, WAN, and MAN. Explain various network topologies with advantages and disadvantages. 6. Draw and explain the block diagram of a mobile communication system. 7. Discuss the evolution of mobile communication technologies from 2G to 5G.

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113233	C- Programming	2	30	2 Hrs	30

Course Objectives:	• To strengthen concepts of structured programming in C. • To develop problem-solving skills using advanced features of C language. • To understand memory management and file handling. • To build logic for real-world applications
Course Outcomes:	After completing this course, students will be able to: • Apply advanced C concepts to solve complex problems. • Use pointers effectively for memory manipulation. • Implement file handling techniques. • Develop modular and efficient programs.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Introduction to C Programming:** Types of programming languages, Basic Structure of C Programs, Algorithm, flowcharting, Constants, Variables, and Data Types: Character set, keywords, constants, basic data types, variables: declaration & assigning values. Operators and Expressions: Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators.	8 Hrs	8 Marks	Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable.
Unit II	**Control Statements:** Input/Output functions: printf(), scanf(), Decision making statements: if, if-else, nested if, switch . Looping Statements: while, do-while, for statements, go to, break, continue, nested loops.	7 Hrs	7 Marks	
Unit III	**Arrays and Pointers:** Concept of Arrays, Declaration and initialization of one and two dimensional array. Array operations. Pointers - Definition and need of pointers, Declaration, initialization.	8 Hrs	8 Marks	
Unit IV	**Functions:** Definition and need of functions. Function prototype, categories of function call mechanism: call by value, call by reference. Function arguments and passing, returning values from functions. File operation and functions	7 Hrs	7 Marks	

References:	• Let Us C" – Yashavant Kanetkar. • "Programming in ANSI C" – E. Balagurusamy. • "The C Programming Language" – Dennis Ritchie & Brian Kernighan
Model questions for theory external examination.	
MCQs for Internal Assessment:	1. Which of the following is a high-level programming language? a) Machine Language b) Assembly Language c) C d) Binary Code Answer: c 2. Which of the following is not a basic data type in C? a) int b) float c) char d) string Answer: D 3. Which data type is used to store a single character? a) int b) char c) float d) double Answer: b

	4. Which function is used to display output in C? a) input() b) printf() c) scanf() d) display() Answer: b 5. The goto statement is used to: a) Define function b) Jump to a labelled statement c) Loop execution d) Exit program Answer: b 6. An array is: a) Collection of different data types b) Collection of same data type elements c) A function d) A pointer Answer: b 7. A pointer is: a) A variable storing value b) A variable storing address c) A function d) A keyword Answer: b 8. What is the main purpose of functions? a) Increase code length b) Reduce code repetition c) Slow down execution d) Avoid variables Answer: b
One sentence/ short questions	1. What is a high-level language? 2. What is a variable? 3. Name any two basic data types in C. 4. What is an if statement? 5. What is printf() used for? 6. What is an array? 7. What is a pointer? 8. What is a function in C?
Long questions	1. Explain various basic data types in C. 2. Explain the use of printf() and scanf() with examples. 3. Define an array and explain its types with examples. 4. Define a function and explain its need in programming.

Major Lab/ Practical – 12: Practical on C-Programming, Communication Electronics and Measuring Instruments

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113234	Practical based on C- Programming, Communication Electronics and Measuring Instruments	2	60	4 Hrs	50

Lab/ Practical 12	**Perform minimum 10 experiments, at least one on each of the following aspects.** 1. Write a C program that takes a different data types and display on consol. 2. Write a C program that calculates and prints the sum, difference, product, and quotient (division) of two integers. 3. Write a C program to calculate both the area and circumference of a circle, given its radius. Use a pre-defined constant for π with value 3.14. 4. Calculate simple interest for a loan, given the Principal amount (P), Rate of interest (R), and Time in years (T) as input. 5. Write a C program to read two integer values, A and B, and then swap their contents so that A holds the original value of B, and B holds the original value of A. Use a third, temporary variable. 6. Write a C program swap two integer values, A and B, without using a third temporary variable. 7. Write a C program that prompts the user to enter a single character and prints its corresponding ASCII (American Standard Code for Information Interchange) value. 8. AM generation and detection 9. FM generation and detection 10. Pre emphasis and De-emphasis circuits 11. Multiplexing Techniques (FDM and TDM) 12. Mixer Characteristics 13. Sampling, PAM, PWM, and PPM generation and detection 14. Displacement versus output voltage characteristics of a potentiometric transducer. 15. Characteristics of Strain gauge and Load cell. 16. Characteristics of LVDT, Hall Effect transducer and Photoelectric tachometer. 17. Characteristics of LDR, thermistor and thermocouple. 18. Step response characteristic of RTD and thermocouple. 19. Temperature measurements using RTD with three and four leads. 20. Measurement of Angular displacement using resistive and capacitive transducer.

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

Major Elective Theory 1- Circuit Design and Simulation

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113235	Circuit design and simulation	2	30	2 Hrs	30

Course Objectives:	• Provide the basic concepts, architecture, components, and applications of simulation • Identify and explain the working of various sensors, actuators, and RC component used in systems. • Describe different technologies and protocols used for design and simulation networks. • Develop basic applications using simple hardware concepts. • Understand the importance of simulation and real-life applications in smart home, healthcare, agriculture, and industry. • Explain the characteristics of electrical and electronic measuring instruments. • Illustrate the working principles of transducers, sensors and actuators. • Develop and exemplify basic programming skills in Virtual Instrumentation. • Design and implement a system using sensor and instrumentation configuration. • Demonstrate the skill set using modern tool
Course Outcomes:	After completing the course, the student will • Along with prescribed hours of teaching –learning process, provide opportunity to perform the experiments/ programmes at their own time, at their own pace, at any place as per their convenience and repeat any number of times to understand the concept. • Provide unhindered access to perform whenever the students wish. • Vary different parameters to study the behaviour of the circuit without the risk of damaging equipment/ device or injuring themselves.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Fundamental of Modelling:** Analog: RC network, RC, LC or RLC based electronic circuit, PN junction, transistor amplifier, MOSFET, Digital: AND gate, OR gate, NAND gate, NOR gate, XOR gate and XNOR gate, Op-amps, instrumentation amplifier, IC 555, 556,	7Hrs	7 Marks	Lecture Method for basic concepts, ICT-based Teaching using videos and animations of systems, Group Discussion on applications in daily life. Demonstration Method for sensor and hardware operation, Hands-on Learning using Circuit maker/labview/python/CAD/Scispce/kits, Laboratory Method for simulation based experiments. Interactive Lecture Method for Simulation-Based Learning using IoT simulators/software tools. Project-Based Learning through simple IoT project
Unit II	**Software and Hardware for simulation:** Introduction to Wire, bus, junction, probe, voltage source, current source, and ground etc. used in circuit simulation software. Graphs, analysis, automation design and circuit simulation, Frequency response and AC Analysis of RC, diode, and transistor based electronic circuit.	8Hrs	8 Marks	
Unit III	**Virtual Instrumentation:** Introduction, advantages, data types, graphical system design, modular programming, vis and sub-vis loops, arrays, clusters, plotting data, customizing graphs and charts, case structures, formula nodes, timed structures, data acquisition	8 Hrs	8 Marks	
Unit IV	**Printed circuit Board Design:** Study of Packages of Electronic Components. History of Printed Circuit Boards. Various types of Printed Circuit Boards-Single Sided Boards, Double Sided Plated through Hole Boards, multilayer Boards.PCB Designing Study of-Fault	7 Hrs	7 Marks	

	Finding methods of PCBs, Repairing Techniques. De-soldering techniques, replacement of Component /Solder Pad /Track repairing methods.			development.
References software	1. Multisim (Academic Version or Licensed Version) 2. UltiBoard (Academic Version or Licensed Version) 3. Orcade (Student Version or Licensed Version) 4. Express PCB (Free Version or Licensed Version) 5. Circuit Maker (Free Version or Licensed Version) 6. Tinapro 7. EaglePCB Design Software (Free Version or Licensed Version) (Free Version or Licensed Version) 8. FreePCB (Free Version) Circuit Design Tools 9. List of Software/Learning Websites • www.ni.com (Multisim and Ultiboard - Academic version) • www.cadence.com • www.youtube.com (Orcade - Student version) (PCB Manufacturing Videos) • www.nptel.ac.in • https://www.ti.com/design-resources/design-tools-simulation/analog circuits/overview.html • https://www.analog.com/en/education/education-library/tutorials/analog electronics.html			
References:	1. Basic Electronic Devices and Circuits – M. B. Patil (PHI Learning) 2. Electronic Devices and Circuits – J. B. Gupta (K. K. Gupta, K. K. Gupta & Sons) 3. Design and Simulation of Electrical Machines with MATLAB by L. Ashok Kumar 4. Simulation-Driven Electronics Design by Dr. Poornima Mahesh and Dr. Rajiv Iyer 5. R. S. Khandpur "Printed Circuit Boards: Design, Fabrication, Assembly and Testing" published by McGraw-Hill in 2005			
Model questions for theory external examination.				
MCQs for Internal Assessment:	1. Which software is commonly used for analog and digital circuit simulation? a) Altium Designer b) SPICE c) KiCad d) AutoCAD 2. What does "transient analysis" simulate in circuit simulation tools? a) Frequency response b) DC operating point c) Behaviour over time d) Thermal effects 3. Which type of simulation would help you analyze a filter's cutoff frequency? a) Transient analysis b) AC sweep analysis c) DC analysis d) Monte Carlo analysis 4. What does PCB stand for? a) Printed Circuit Board b) Programmable Circuit Blueprint c) Physical Circuit Base d) Prototype Circuit Builder 5. Which layer of a PCB is typically used for component placement and labelling? a) Signal layer b) Power plane c) Silkscreen layer d) Solder mask layer			
One sentence/ Very short answer questions	1. What is need for a PCB? 2. How do you verify Schematic Symbols or Footprints?? 3. What are the inputs you need to design a PCB? 4. How do you place connectors? 5. How to choose PCB material?			
Short answer questions	1. Define circuit component. 2. List any four applications of simulation. 3. What is the role of circuit designing and simulation? 4. What is a virtual instrument? Give one example. 5. Write the features of virtual instrument.			
Long answer questions	1. Explain the concept of computer-based circuit design and its importance in modern technology. 2. Describe the basic architecture of a virtual simulation platform for circuit and automation design with a neat block diagram. 3. Explain the role of connector and component selection in systems.			

	4. Write in detail about the fabrication of PCB. 5. Explain the working of simulation software and its importance and applications.

Major Elective Lab / Practical 13 A: Practical Based on Circuit Designing and Simulation

Level	Semester	Course	Course Name	Credits	Teaching	Exam	Max Mark

		Code			Hours	Duration	
5.5	V	113236	Practical based on Circuit Designing and simulation	2	60	4 Hrs	50

Lab/ Practical 13 A	Minimum 10 experiments, at least one on each of the following aspects. 1. Simulate Series RL & RC circuit and observe phase difference between waveforms of voltage and current. 2. Simulation and verification of Kirchhoff's Current Law & Kirchhoff's Voltage Law. 3. Simulation of Mesh analysis for a given circuit. 4. Simulation of Nodal analysis for a given circuit. 5. Determination of Z & Y parameters of a given two-port network 6. Simulate and verify Super Positions theorem. 7. Simulation and verification Reciprocity theorem. 8. Simulation and verification Thevenin's and Norton's theorem. 9. Simulation and verification Maximum Power Transfer theorem. 10. Simulation and verification Millman's theorem. 11. Simulation of Series and Parallel Resonance circuit. 12. Mini Project

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination

Major Elective Theory 2: E-Vehicle Technology

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113237	E-Vehicle Technology	2	30	2 Hrs	30

Course Objectives:	• To understand the fundamentals of automotive electronics and basic architecture of Electric Vehicles (EVs). • To study different energy storage systems, battery technologies, and power electronics used in EVs. • To learn the working of electric drive systems, motors, sensors, and vehicle control units in EVs. • To understand vehicle communication, safety systems, and diagnostic techniques in modern automobiles. • To introduce smart vehicle technologies, IoT applications, and future trends in automotive electronics and electric mobility.
Course Outcomes:	**After completing the course, the student will** • Able to learn the basic concepts, architecture, and components of automotive electronics and Electric Vehicles (EVs). • Describe the working and characteristics of batteries, Battery Management Systems (BMS), and power electronic devices used in EVs. • Identify different electric motors, drive systems, sensors, and controllers used in electric vehicles. • Understand vehicle communication systems, safety features, and diagnostic techniques in modern automobiles. • Discuss smart vehicle technologies, IoT applications, and future trends in automotive and electric mobility systems.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Introduction to Automotive Electronics & EV Basics:** Evolution of automotive electronics, Conventional vehicles vs Electric Vehicles (EVs), Types of EVs: Battery Electric Vehicle (BEV), Hybrid Electric Vehicle (HEV), Plug-in Hybrid Electric Vehicle (PHEV), architecture of EV, Battery pack, Electric motor, Controller, Charger, Basics of automotive electrical systems, Wiring harness and connectors, Introduction to standards and safety	7Hrs	7 Marks	The course will use lectures, ICT tools, demonstrations, hands-on activities, and project-based learning to explain EV and automotive electronics concepts. Group discussions, case studies, and industrial exposure will help students understand practical applications and modern automotive technologies.
Unit II	**Energy Storage & Power Electronics in EVs:** Batteries used in EVs: Lithium-ion battery, Lead-acid, Battery parameters: State of Charge (SoC), State of Health (SoH), Battery Management System (BMS): Functions and block diagram, Cell balancing techniques, Power electronics in EV: DC-DC converters, Inverters, Charging systems: AC charging, DC fast charging	8Hrs	8 Marks	
Unit III	**Electric Drive Systems & Control:** Electric motors used in EVs: DC motor, BLDC motor, Induction motor, Motor drive systems and controllers, Regenerative braking system, Sensors used in EVs: Speed, temperature, position sensors, Electronic Control Units, Introduction to vehicle communication	8 Hrs	8 Marks	
Unit IV	**Smart Vehicles, Safety & Future Trends:**	7 Hrs	7 Marks	

	Advanced Driver Assistance Systems, Autonomous vehicle concepts, IoT in automotive electronics, Vehicle diagnostics and fault detection, Safety in EVs:Thermal management, Electrical safety, Environmental impact and sustainability, Future trends: AI in automotive systems, Smart mobility solutions.			
References:	1. Electric and Hybrid Vehicles: Design Fundamentals – Iqbal Husain, CRC Press. 2. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles – Mehrda d Ehsani, Yimin Gao, Sebastian Gay, Ali Emadi, CRC Press. 3. Automotive Electrical and Electronic Systems – Tom Denton, Routledge Publication. 4. Electric Vehicle Technology Explained – Wiley Publication. 5. Understanding Automotive Electronics – Butterworth-Heinemann Publication. 6. Power Electronics – Khanna Publishers. 7. Fundamentals of Electric Vehicles – SAE India Publication. 8. Automobile Electrical and Electronic Systems – McGraw Hill Education.			
Model questions for theory external examination.				
MCQs for Internal Assessment :	1. What does BEV stand for in Electric Vehicles? **A. Battery Electric Vehicle** B. Basic Electric Vehicle C. Battery Engine Vehicle D. Balanced Electric Vehicle 2. Which battery is commonly used in modern Electric Vehicles? A. Dry Cell Battery **B. Lithium-ion Battery** C. Nickel Battery D. Mercury Battery 3. Which device converts DC power into AC power in an EV? **A.** Rectifier B. Transformer **C. Inverter** D. Amplifier 4. What is the function of a regenerative braking system? A. Increase fuel consumption B. Produce engine noise **C. Recover energy during braking** D. Reduce battery voltage 5. Which communication system is commonly used in vehicles for data exchange? **A.** USB **B. CAN Bus** C. HDMI D. VGA			
One sentence/ Very short answer questions	1. What is an Electric Vehicle (EV)? 2. What is the function of a Battery Management System (BMS)? 3. What is the purpose of an inverter in an EV? 4. What is regenerative braking? 5. What is CAN bus in automotive systems?			
Short answer questions	1. Explain the difference between conventional vehicles and Electric Vehicles (EVs). 2. Describe the working and advantages of Lithium-ion batteries used in EVs. 3. Explain the function of a Battery Management System (BMS) in Electric Vehicles. 4. Write a short note on regenerative braking system in EVs. 5. Explain the role of sensors and Electronic Control Units (ECUs) in automotive electronics.			
Long answer questions	1. Explain the architecture of an Electric Vehicle (EV) with a neat block diagram and describe the function of its main components. 2. Discuss different types of Electric Vehicles (BEV, HEV, and PHEV) with their advantages and limitations. 3. Explain the working of Lithium-ion batteries and describe the role of Battery Management System (BMS) in EVs. 4. Describe different electric motors used in EVs and explain the working of regenerative braking system. 5. Explain smart vehicle technologies such as ADAS, IoT in automotive electronics, and future trends in autonomous and AI-based vehicles.			

Major Elective Lab / Practical –13 B: Practical Based on E-Vehicle Technology

Level	Semester	Course	Course Name	Credits	Teaching	Exam	Max Mark

		Code			Hours	Duration	
5.5	V	113238	Practical based on Theory	2	60	4 Hrs	50

Lab/ Practical 13 B	**Minimum ten experiments, at least one on each of the following aspects.** 1. Study of basic components of an Electric Vehicle (EV) using block diagram/model. 2. Identification and testing of automotive electrical components such as wiring harness, connectors, fuse, and relays. 3. Study of 12V automotive electrical system and battery connections. 4. Measurement of battery parameters such as voltage, current, and State of Charge (SoC). 5. Study of Lithium-ion battery characteristics and charging/discharging process. 6. Demonstration and testing of Battery Management System (BMS) functions. 7. Study of DC-DC converter used in Electric Vehicles. 8. Study of inverter operation for DC to AC conversion in EV applications. 9. Study and speed control of DC motor used in electric drive systems. 10. Study of BLDC motor operation and its characteristics. 11. Demonstration of regenerative braking system using motor setup/simulation. 12. Interfacing and testing of sensors used in EVs (temperature, speed, and position sensors). 13. Study of Electronic Control Unit (ECU) and vehicle communication system. 14. Demonstration of CAN bus communication in automotive systems. 15. Study of EV charging methods: AC charging and DC fast charging. 16. Mini project on smart automotive/EV monitoring system using sensors and microcontroller.

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

Minor Theory 5: Communication and Microprocessor 8086

Level	Semester	Course	Course Name	Credits	Teaching	Exam	Max Mark

		Code			Hours	Duration	
5.5	V	113239	Communication and Microprocessor 8086	2	30	2 Hrs	30

Course Objectives:	• To take technical and professional education in electronics and communication engineering • To understand communication principles of Transmitter and Receiver. • Describe the organization and architecture of 8086 microprocessor • Understanding the classification of instructions • Addressing modes of instructions • Realizing the interfacing of memory
Course Outcomes:	**After completing the course, the student will** • Properly understanding of principle of communication engineering • Understanding modulation, demodulation, OFC in communication engineering • Understanding the organization and architecture of 8085 and 8086 microprocessor • Applying the instruction set of 8086 Microprocessor. • Relating the addressing modes used in the instructions • Interfacing the memory and other I/O devices. • Familiarizing the architecture and operation with 8086 microprocessors

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Modulation and Demodulation:** Need for modulation, Types of modulation, AM theory, Frequency spectrum of AM, FM theory, Frequency spectrum of FM, Difference between AM and FM, Block diagram and working of AM and FM transmitter and receiver.	8Hrs	8 Marks	The course will use lectures, ICT tools, demonstrations, hands-on activities, and project-based learning to explain EV and automotive electronics concepts. Group discussions, case studies, and industrial exposure will help students understand practical applications and modern automotive technologies.
Unit II	**Fibre Optic and Digital Communication:** Advantages and disadvantages of OFC, Block diagram of OFC, Types of optical Fibres. Pulse modulation: PAM, PWM, PPM, Sampling theorem, PCM: Bandwidth and quantizing noise, Multiplexing principles: TDM and FDM	7 Hrs	7 Marks	
Unit III	**Architecture of 8086 Microprocessor:** Block diagram, pin diagram and function of 8086 microprocessor, BIU and EU, operating modes of 8086, G.P.R, pointer and index register, segment register etc.	8 Hrs	8 Marks	
Unit IV	**Instructions and Programming of microprocessor 8086**: Data transfer, Arithmetic & Logic Instructions. Addressing mode, Bus cycle, Programs of data transfer, addition, subtraction, division, and multiplication	7 Hrs	7 Marks	

References:	1. A textbook of communication engineering by A.Kumar 2. Electronics and communication by Roddy and Coolean 3. Telecommunication principles circuit and system by S. Rambhadran 4. Modern digital and analog communication system by B.P.Rathi 5. Communication electronics by N.D..Deshpande 6. Microprocessor architecture and programming and application with 8085by Ramesh Gaokar 7. Microprocessor 8085 by B.Ram 8. Microprocessor architecture and application by Dougulus Hall

	9. Intel microprocessor 8086 by Brey:PHI 10. Introduction of microprocessor by A.P.Mathur
Model questions for theory external examination.	
MCQs for Internal Assessment:	**MCQ for internal assessment:** 1) AM stands for ---------- a) Ave rage modulation b) Adapter modulation c) Amplitude modulation d) None 2) There are ---------- sidebands in FM a) 1 b) 2 c) 4 d) Infinite 3) OFC stands for---------- a) Optical fibre cable b) Optical Fibre cable c) Optical frequency cable d) None 4) PWM stands for ---------- a) Position width modulation b) Pulse width modulation c) Pulse wide modulation d) None 5) PPM stands for----- a) Pulse power modulation b) Position position modulation c) Pulse pulse modulation d) Pulse position modulation 6) The intel microprocessor 8086 is a ……. processor a) 8 bit b) 16 bit c) 32 bit d) 4 bit 7) The CF is known as …….. a) carry flag b) B. condition flag c) common flag d) single flag 8) The index register are used to hold …….. a) memory register b) offset address c) segment memory d) offset memory 9) The push source copies a word from source to ……. a) stack b) memory c) register d) destination 10) The 8086 fetches instruction one after another from …….... of memory a) code segment b) IP c) ES d) SS
One sentence/ Very short answer questions	**Short answer Type (2/3 Marks)** 1. What is modulation? 2. What is need of modulation? 3. What is types modulation? 4. Write advantages of OFC? 5. What is PAM? 6. What is TDM? 7. What is microprocessor? 8. Write name of buses used in 8085. 9. What is function of Stack pointer? 10. What is size of address bus of 8086 microprocessor?
Long answer questions	**Long answer Type (4/5 Marks) :** 1. Explain theory of AM. 2. Draw and explain block diagram of AM transmitter. 3. Draw and explain block diagram of OFC. 4. Differentiate between TDM and FDM. 5. Explain PAM and PWM in detail. 6. Draw block diagram of microprocessor 8086and write function of each. 7. Draw pin diagram of microprocessor 8086and write function of each. 8. Explain flag register in 8086 microprocessors. 9. Explain operating modes of 8086 microprocessor 10. Explain addressing modes of 8086 microprocessor

Minor Lab / Practical –14: Practical Based on Communication and Microprocessor 8086

Level	Semester	Course	Course Name	Credits	Teaching	Exam	Max Mark

		Code			Hours	Duration	
5.5	V	113240	Practical based on Communication and Microprocessor 8086	2	60	4 Hrs	50

Lab/ Practical 14	**Perform minimum 10 experiments from the following,** 1. AM generation and detection 2. FM generation and detection 3. Study of AM/ FM radio Receiver. 4. Study of AM/ FM radio Transmitter. 5. Multiplexing Techniques (FDM and TDM) 6. Study of Mixer and its Characteristics 7. Sampling, PAM, PWM, and PPM generation and detection. 8. Write and execute a program using microprocessor 8086 for Addition of two 8-bit numbers. 9. Write and execute a program using microprocessor 8086 for Addition of two16-bit numbers. 10. Write and execute a program using microprocessor 8086 for Subtraction of two 8-bit numbers. 11. Write and execute a program using microprocessor 8086 for Subtraction of two 16-bit numbers. 12. Write and execute a program using microprocessor 8086 for Multiplication of two 8-bit numbers. 13. Write and execute a program using microprocessor 8086 for Division of numbers. 14. Write and execute a program using microprocessor 8086 to perform logical AND operation between two numbers. 15. Write and execute a program using microprocessor 8086 to perform logical OR operation between two numbers.

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination

Vocational Skill Enhancement Course 4: Lab/ Practical 15: Advanced Practical on Major Theory 113231, 113232 and 113233

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113241	VSEC - Advanced applications/ practical on Major Electronics	02	60	4 Hrs.	50

Course Objectives:	To reduce the unemployment by providing self- employment schemes. To make the students skilled person. To reduce the mismatch between the demand and supply of skill man-power. To develop attitudes, knowledge, and skills for entrepreneurship and self-employment.
Course Outcomes:	After successful completion of the course, the students will be able to: Apply their practical knowledge/ hands on training in the workplace. It fulfills the demand of industry. Start business-oriented services.

Lab/ Practical 19	Design minimum Six applications in total, at least 2 from each of the following aspects. 1. Design advanced applications based on Measuring instruments. 2. Design advanced applications based on Communications Electronics. 3. Design advanced applications based on C Programming.

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.
- Mode of Examination: Internal (There is no External Examination)

Skill Enhancement Course (SEC) 3: Lab/ Practical 16: Skill based Practical on Major Theory 113231, 113232 and 113233

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	V	113242	Skill based Practical on Major Theory 113231, 113232 and 113233	02	60	4 Hrs.	50

Course Objectives:	• To develop practical and technical skills through hands-on electronics projects. • To provide knowledge of electronic components, circuit design, and project implementation. • To train students in soldering, PCB fabrication, testing, and troubleshooting techniques. • To introduce students to modern tools and technologies such as sensors, Arduino, and automation systems. • To encourage creativity, innovation, teamwork, and problem-solving abilities through project-based learning.
Course Outcomes:	• Students will be able to identify, test, and use electronic components and instruments effectively. • Students will be able to design, assemble, and troubleshoot basic electronic circuits and projects. • Students will gain practical knowledge of sensor interfacing, Arduino/microcontroller programming, and automation systems. • Students will be able to develop simple project prototypes for real-life applications using modern electronic techniques. • Students will improve technical, teamwork, documentation, and problem-solving skills required for industry and higher studies.

Lab/ Practical 16	Design and develop any one Project/ application from the following aspects. **1. Smart Temperature Display System** Components: LM35 / DHT22, LCD (16x2), Arduino Concepts: ADC, sensor interfacing Extension: Add buzzer for high temperature alert **2. Ultrasonic Distance Measurement System** Components: Ultrasonic sensor, LCD/OLED Concepts: Pulse timing, distance calculation Application: Parking assistant **3. Smart Irrigation System** Components: Soil moisture sensor, relay, pump Concepts: Automation, environmental sensing Working: Water plants only when soil is dry **4. Smart Home Automation System** Components: Relays, sensors, Arduino Control: Mobile/Bluetooth/WiFi Features: Control lights, fan, appliances **5. Industrial Safety Monitoring System** Components: Gas + temperature sensors Concepts: Multi-sensor integration Output: Alarm + automatic shutdown **6. Automated Water Level Controller**

	Components: Water level sensor, relay Concepts: Control systems Working: Automatically turns motor ON/OFF **7. Smart Parking System** Components: IR sensors, display Concepts: Sensor network Display: Available parking slots **8. Any other skill-based applications/ Projects related to Electronics**

Note :

- Students during lab hours shall have to present academic project in the subject Electronics.
- Mode of Examination: Internal (There is no External Examination)

Electronics FP/CES- Project

Electronics FP/CES- Project (113243)

Field Project / CE Services in Electronics: Phase-III	
Credits: 02	**Workload (Hrs./Week): 04**
Course Objectives:	1. To provide hands-on experience in applying theoretical Electronics knowledge to real-world challenges through field-based projects or community engagement (CE) services. 2. To train students in identifying, problems encountered in Electronics and related fieldwork or community service activities. 3. To encourage students to integrate Electronics and field Electronics concepts with interdisciplinary knowledge, technology, and societal needs. 4. To develop students' abilities to document, present, and communicate their field-based or community engagement work effectively to diverse audiences. 5. To instill a sense of responsibility and service by involving students in projects that address community issues related to science and technology.
Course Outcomes:	1. Students will be able to apply Electronics related analytical techniques to investigate and solve real-world problems in field settings. 2. Students will demonstrate proficiency in using experimental tools, instruments, and data analysis methods relevant to their field project or CE service. 3. Students will be able to design, plan, and execute a field Electronics project or community service activity from inception to completion, including documentation and reporting. 4. Students will effectively communicate their project findings and outcomes through written reports, presentations, or community engagement events. 5. Students will demonstrate an understanding of the ethical, environmental, and societal impacts of their work, showing a commitment to responsible scientific practice and community well beings.
Guidelines/SOP for Selection and Implementation of Field Projects / CE Services	
1. Project Selection and Planning	• **Faculty Guidance:** Students will be assigned a faculty mentor to guide their project, providing expertise and resources. • **Project Topic:** The project topic should be relevant to Electronics and align with the student's interests and the available resources. • **Literature Review:** Students are expected to conduct a thorough literature review to understand existing knowledge and identify research gaps. • **Data Collection and Analysis:** Projects often involve experiments, field sampling, simulations, or data analysis from existing sources, depending on the topic. • Project Timeline: The total time allocation for the student to carry out field project is 60 hours. • The students shall have to carry the same project done in Semester III & IV and submit the complete project report in form of thesis containing conclusion, future

	scope (with hardware) etc.
2. Data Analysis and Interpretation	• **Statistical Methods**: Students will learn and apply appropriate statistical methods to analyze data. • **Interpretation of Results:** Data should be interpreted within the context of the project, highlighting significant findings and limitations.
3. Report Writing and Presentation	• **Report Format**: A structured report format is usually followed, including an abstract, introduction, methodology, results, discussion, and conclusion. • **Data Presentation**: Data should be presented clearly and accurately using tables, graphs, and figures. • **Oral Presentation:** Students will be required to present their findings to peers and faculty.
4. CE Services (Community Engagement)	• **Community Needs**: Projects may focus on addressing specific community needs or challenges relevant to Electronics. • **Collaboration:** Students can collaborate with local organizations to implement their projects. • **Impact Assessment**: The impact of the project on the community should be evaluated**.**
5. Evaluation and Assessment	• **Project Report:** The final report will be assessed based on its content, organization, and the quality of the research. (20 Marks) • **Oral Presentation:** The presentation will be evaluated on clarity, engagement, and the ability to answer questions. (10 Marks) • **Faculty Evaluation:** The faculty mentor will assess the student's performance throughout the project. (20 Marks) • **Total 50 Marks**
Examples of Field Projects/CE Services in Electronics	• **Environmental Electronics**: Studying the local ecosystems and developing renewable energy solutions. • **Community Outreach:** Organizing Safety measures and awareness workshops or engaging in scientific literacy initiatives. • **Research Project:** Study related to the subject that contribute to the advancement of knowledge and the well-being of living things.

Note: The extended portion of the Field Project/CE Services in Electronics from Phase-I may be carried forward as Field Project/CE Services in Electronics: Phase-II in the fourth semester, subject to the approval of the assigned faculty mentor.

Teaching and Learning Scheme: for the Degree of Bachelor of Electronics (B.Sc.)
Three Years / Four Years- (Six / Eight Semesters) Bachelor's Degree Programme

THIRD YEAR: Level 5.5 - SEMESTER – VI (T & L Credit Scheme)

Mode of Teaching	Ver. No	The Vertical	Type of Course	Course Code	Course Name	Credits	Workload (Hrs/Week)	Vertical Workload (Hrs/Week)
Classroom Teaching / Lab Work (Practical)/ Outdoor / Field/ Online/ Hybrid	a.	Major	Electronics Theory 11	113244	Microcontroller 8051	2	2	16
			Electronics Theory 12	113245	Sensors and Actuators	2	2	
			Electronics Theory 13	113246	Arduino Programming	2	2	
			Electronics Lab/Practical-17	113247	Practical based on Theory 113244, 113245 & 113246	2	4	
		Elective	Elective Theory 3	113248	Introduction to Internet of Things	2	2	
			Electronics Lab/Practical-18 A	113249	Practical based on Theory 113248	2	4	
			Elective Theory 4	113250	Python Programming	/ 2	/ 2	
			Electronics Lab/Practical-18 B	113251	Practical based on Theory 113250	/ 2	/ 4	
	b.	Minor	Electronics Theory 6	113252	Microcontroller & Sensors	2	2	6
			Electronics Lab/Practical-19	113253	Practical based on Minor Theory 113252	2	4	
	c.	Generic/ Open Elective	-	-	-	-	-	-
	d.	VSC	Lab/Practical-20	113254	Advanced Practical on Major 113244, 113245 & 113246	2	4	4
	f.	Internship	On Job Training	113255	Internship/ OJT	120 Hours	4	8
		CC	Outdoor			2	4	
		TOTAL				**20**	**38**	**38**

Major Theory 11: Microcontroller 8051

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113244	Microcontroller 8051	2	30	2 Hrs	30

Course Objectives:	• To introduce the fundamentals of microcontrollers and distinguish them from microprocessors. • To understand the architecture and internal organization of the microcontroller 8051. • To study key components such as registers memory, timers, and interrupts. • To learn the 8051 instruction sets and develops assembly language programs. • To understand serial communication and interfacing techniques with external devices.
Course Outcomes:	**After completing the course, the student will able to** • Explain the basic concepts and architecture of the microcontroller 8051. • Identify and use various registers, memory types, and architectural components. • Apply different addressing modes and execute instruction sets effectively. • Develop assembly language programs for data transfer, arithmetic, and logical operations. • Implement serial communication and interface the 8051 with peripherals like ADC, 8255, and LEDs.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Microcontroller 8051 Architecture:** Microcontroller Introduction, Difference between Microprocessor and Microcontroller, features, block diagram of microcontroller, Pin Configuration, CPU, registers: A, B, PC, and DPTR.	8 Hrs	8 Marks	Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable.
Unit II	**Registers, Timers and Interrupts:** SFR, PSW, Internal RAM, Stack & SP, counter & timers: TCON & TMOD, Interrupts: IP & IE.	7 Hrs	7 Marks	
Unit III	**Instruction set and Programming:** Addressing modes, Instruction set: Data transfer, arithmetic, logical operation, JUMP, Loop and CALL instructions. Assembly language programming: simple data transfer, arithmetic, logical and single bit.	8 Hrs	8 Marks	
Unit IV	**Communication & Interfacing:** Basics of serial and parallel communication, Transmission Modes, SBUF register, SCON and PCON registers, interfacing to ADC 0804, interfacing to the 8255, interfacing to LED and power reduction mode.	7 Hrs	7 Marks	

References:

1. The 8051 Microcontroller architecture, Programming & Applications- Kenneth J.Ayala (Penram international)
2. The 8051 Microcontroller and Embedded Systems.- M. A. Mazadi, J. C. Mazadi (Pearson Education, Asia)
3. Microprocessor, microcontroller & applications- U. S. Shah (TechMax Publication Pune).
4. Programming and Customizing the 8051 Microcontroller- Mike Predko (TMH, New Delhi)
5. Advanced Digital Electronics, Microprocessor and 8051 Microcontroller by Y. B. Gandole, D. S. Dhote and S. P. Yawale. G.C. publisher, Nagpur

Model questions for theory external examination.

MCQs for Internal Assessment:	1. The 8051 is a: a) Microprocessor **b) Microcontroller** c) Memory device d) I/O device 2. The Program Counter (PC) is used to: a) Store data **b) Store address of next instruction** c) Perform arithmetic d) Control I/O 3. Which register is used for serial data transfer in 8051? a) A b) B **c) SBUF** d) DPTR 4. Which of the following is bit-addressable register? a) A register b) DPTR **c) PSW** d) PC 5. The 8051 has how many I/O ports? a) 2 b) 3 **c) 4** d) 5 6. Which instruction is used for addition? a) MOV **b) ADD** c) ANL d) ORL 7. SCON register is used in: a) Timer control **b) Serial communication** c) Interrupt control d) Memory access 8. TMOD register is related to: a) Interrupts b) Serial communication **c) Timers** d) I/O ports 9. Which mode reduces power consumption in 8051? a) Active mode **b) Idle mode** c) Run mode d) Execute mode 10. ADC0804 is used for: a) Digital to Analog conversion **b) Analog to Digital conversion** c) Memory storage d) Communication
One sentence/ short answer questions	1. Differentiate between a microprocessor and a microcontroller. 2. Draw the block diagram of the microcontroller 8051. 3. Explain the function of the Program Counter and Data Pointer register. 4. What is the PSW register? Explain its any two flags? 5. Explain the features of microcontroller 8051. 6. Explain TMOD/ TCON registers used in timers. 7. What are interrupts? Explain IE/ IP registers. 8. Write short notes on data transfer and arithmetic instructions. 9. Describe the function of SBUF and SCON registers.
Long answer questions	1. Explain the architecture of the microcontroller 8051with a neat block diagram. 2. Describe the internal organization of RAM in Microcontroller 8051. 3. Explain the function of PSW, SP, and DPTR registers in detail. 4. Describe different addressing modes of 8051 with examples. 5. Explain the 8051 instruction set in details with suitable examples. 6. Write an assembly language program for data transfer, arithmetic, and logical operations. 7. Explain transmission modes in details. 8. Describe interfacing of 8051 with ADC0804 with diagram and working. 9. Explain interfacing of 8051 with 8255 programmable peripheral interface. 10. Describe LED interfacing with 8051 and write a sample program. 11. Explain power reduction modes in 8051 in details.

Major Theory 12: Sensors & Actuators

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113245	Sensors & Actuators	2	30	2 Hrs	30

Course Objectives:	To provide a fundamental understanding of the physics and operating principles of various sensors and actuators. To familiarize students with the actuators and power electronic circuits required to translate electronic signals into mechanical motion. To develop skills in designing signal conditioning circuits (amplifiers, filters, and bridges) for real-world sensor data. • To introduce students to digital interfacing and data acquisition systems used in modern industrial and IoT applications.
Course Outcomes:	**After completing the course, the student will** Identify and classify sensors based on their output characteristics and measurement range. Analyze the performance of sensors by calculating parameters like sensitivity, linearity, and resolution. Design and implement Wheatstone bridge and Instrumentation Amplifier circuits for low-level signal extraction. Select appropriate actuators (Stepper, Servo, or DC motors) for specific automation tasks. • Interface analog sensors with digital systems using ADCs.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Fundamentals of Sensor:** Definition and importance of sensors, Role of sensors in electronics and automation, Difference between sensor and transducer, Classification of sensors: Active and Passive sensors, Analog and Digital sensors, Characteristics**:** Accuracy, Precision, Resolution, Sensitivity, Hysteresis and Linearity.	7 Hrs	7 Marks	Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable.
Unit II	**Types of Sensors:** Temperature sensor: LM35, Thermistor, Light sensor: LDR, Photodiode, Motion sensor, Pressure and humidity sensors, Ultrasonic sensor and its applications	8 Hrs	8 Marks	
Unit III	**Introduction to Actuators:** Definition and importance of actuators, Difference between sensors and actuators, Classification of actuators: Electrical, Mechanical, Hydraulic, and Pneumatic actuators, Solenoid actuator, motor-based actuator.	8 Hrs	8 Marks	
Unit IV	**Signal Conditioning & Data Acquisitions:** Signal conditioning: Definition, need and importance, Basic signal conditioning operations: Amplification, filtering, isolation, and attenuation. Introduction to Data Acquisition Systems, Block diagram and working of DAQ system, Computer based data acquisition systems	7 Hrs	7 Marks	

References:	1. Sensors and Transducers by D. Patranabis. 2. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney 3. Instrumentation: Devices and Systems by C.S. Rangan, G.R. Sarma, and V.S.V. Mani 4. Transducers and Instrumentation by D.V. S. Murty

	5. Basic Electrical Engineering by D.P. Kothari 6. Electronic Instrumentation by H.S. Kalsi 7. Transducer Engineering by S. Renganathan 8. Linear Integrated Circuits by D. Roy Choudhury
Model questions for theory external examination.	
MCQs for Internal Assessment:	1. Which of the following is an example of a Passive Transducer? A) Thermocouple B) Photovoltaic cell **C) LDR** D) Piezoelectric crystal 2. The ability of a sensor to provide the same output for the same input under constant conditions is called: A) Accuracy **B) Repeatability** C) Sensitivity D) Resolution 3. In an LVDT, the output voltage is zero at the null position because: A) The primary current is zero **B) The induced voltages in the two secondary coils are equal and opposite** C) The core is removed D) The secondary coils are in phase 4. Which temperature sensor is known for having a "Negative Temperature Coefficient" (NTC)? A) RTD (PT100) **B) Thermistor** C) Thermocouple D) LM35 5. Which motor is specifically designed for precise "Step-by-Step" angular displacement? A) AC Induction Motor B) Shunt DC Motor **C) Stepper Motor** D) Universal Motor 6. What is the purpose of a "Flyback Diode" in a relay driving circuit? A) To increase the switching speed **B) To protect the transistor from high-voltage spikes during turn-off** C) To limit the current to the coil D) To rectify AC to DC 7. A Servo Motor uses which of the following to maintain its position? A) High voltage **B) Feedback mechanism** (Potentiometer/Encoder) C) Permanent magnets only D) Hydraulic fluid 8. An Instrumentation Amplifier is characterized by: A) Low Input Impedance and High Gain **B) High CMRR and High Input Impedance** C) Low CMRR and Low Gain D) High Output Impedance 9. For an 8-bit DAC, if the full-scale output is 5V, the resolution is approximately: 11. A) 0.625 V B) 0.050 V **C) 0.019 V** D) 1.25 V
One sentence/ short answer questions	1. Define Sensitivity in sensors. 2. Define Hysteresis in sensors. 3. Differentiates between Active and Passive transducers. 4. State the role of a Flyback Diode in relay circuits. 5. What is the main advantage of an Instrumentation Amplifier over a standard Differential Amplifier?
Long answer questions	1. Explain the construction and working principle of an LVDT. 2. Describe the working of a Stepper Motor and its "steps per revolution" concept. 3. Explain the working principle of a Piezoelectric Sensor. 4. Draw the circuit of a 3-Op-amp Instrumentation Amplifier. Derive the expression for its output voltage. 5. Explain Pulse Width Modulation. Show how it is used to control the speed of a DC motor.

Major Theory 13: Arduino Programming

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113246	Arduino Programming	2	30	2 Hrs	30

Course Objectives:	• To understand the architecture, specifications, and pin configuration of the Arduino UNO. • To learn installation and setup of Arduino IDE and basic Arduino programming concepts. • To perform digital and analog I/O operations using functions like pinMode(), digitalWrite(), and analogRead(). • To interface basic devices such as LEDs, LCD, switches, relay, buzzer, and motors with Arduino. • To study and implement interfacing of various sensors like temperature, humidity, IR, ultrasonic, and rain sensor.
Course Outcomes:	**After completing the course, the student will able to** • Understand and configure the Arduino UNO R3 and its development environment. • Apply Arduino programming concepts for digital and analog input/output operations. • Interface and control basic electronic components such as LEDs, LCDs, switches, and motors. • Demonstrate working of different sensors and acquire real-world data. • Develop simple embedded system applications using Arduino and sensors.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Introduction to Arduino:** Introduction to Arduino UNO, Technical Specifications, Pin configuration, Concept of digital and analog ports, Power to an Arduino, Arduino IDE Installation & setup: Port, board selection, Library installations	8 Hrs	8 Marks	In addition to classroom teaching, demonstration of the Arduino UNO R3 may be effectively integrated with appropriate pedagogical approaches such as Experiential Learning, Collaborative Learning and the use of Simulation Tools like Tinkercad, wherever applicable.
Unit II	**Arduino I/O and Basic Operations:** Arduino Data Types, Functions of pinMode(), digitalWrite(), analogRead(), delay(), HIGH/LOW status of digital pins. Operation of inbuilt and external LED, Blinking and changing intensity of LED.	7 Hrs	7 Marks	
Unit III	**Basic Interfacing and Programming:** Interfacing of Arduino with DC motor, Stepper motor, LED, 16x2 LCD, Switch, Relay, Buzzer.	7 Hrs	7 Marks	
Unit IV	**Sensors Interfacing and Programing:** Basic function & interfacing of Humidity sensor, Temperature sensor, Moisture sensor, Proximity sensor, IR sensor, Ultrasonic sensor, Rain Sensor, Gas sensor.	8 Hrs	8 Marks	

References:	• Programming Arduino, 2nd edition, by Simon Monk, MC GRAW HILL. • Arduino Made simple with interactive projects, by Ashwin Pajankar, BPB publications • Arduino-Based Embedded Systems Interfacing, Simulation, and LabVIEW GUI,1st edition, by Rajesh Singh, CRC Press. • https://docs.arduino.cc/learn/starting-guide/getting-started-arduino/ • https://www.hackerearth.com/blog/arduino-programming-for-beginners
Model questions for theory external examination.	
MCQs for Internal Assessment:	1. Which microcontroller is used in the Arduino Uno board? **A. ATmega328P** B. ATmega2560 C. PIC16F877A D. ESP8266 2. In the Arduino IDE, which function runs only once when the program starts? A. loop() **B. setup()** C. main() D. start() 3. Which Arduino pins are used for analog input? A. Digital pins (0-13) B. PWM pins **C. Analog pins (A0-A5)** D. Power pins

	4. What is the range of values returned by analogRead() in Arduino Uno? A. 0 to 255 B. 0 to 512 **C. 0 to 1023** D. 0 to 4095 5. Which sensor is used to measure distance using sound waves? A. IR Sensor **B. Ultrasonic Sensor** C. Temperature Sensor D. Humidity Sensor 6. Which function is used to create a delay in milliseconds? 12. delayMicroseconds() B. millis() **C. delay()** D. micros()
One sentence/ short answer questions	1. Explain the architecture of the Arduino Uno. 2. What is the role of the Arduino IDE? 3. Explain the working of pinMode() and digitalWrite() functions. 4. What is the difference between delay() and millis()? 5. Explain looping and decision-making techniques in Arduino. 6. Explain the use of the DHT22 sensor.
Long answer questions	1. Explain the features, pin configuration, and architecture of the Arduino Uno. 2. Describe the functions and structure of programs written in the Arduino IDE. 3. Explain digital and analog I/O operations in Arduino with examples. 4. Discuss looping and decision-making techniques used in Arduino programming. 5. Explain time-related functions: delay(), delayMicroseconds(), millis(), and micros(). 6. Describe interfacing of LED and push button with Arduino with working. 7. Explain interfacing of a 16x2 LCD with Arduino. 8. Describe working and interfacing of a DC motor and relay with Arduino. 9. Describe the interfacing and applications of the DHT22 and rain sensor. 10. Explain the working and interfacing of ultrasonic and IR sensors.

Major Lab / Practical 17: Practical on Major Theory 113244, 113245 & 113246

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113247	Electronics Lab 17	2	60	4 Hrs.	50

Course Objectives:	• To understand programming and operations of the Microcontroller 8051. • To study working and applications of sensors like LVDT, thermistor, LDR, photodiode, and ultrasonic sensor. • To measure physical parameters such as temperature, displacement, light, and distance. • To implement basic signal conditioning circuits like low-pass and high-pass filters. • To develop Arduino-based applications using Arduino UNO and Arduino IDE.
Course Outcomes:	• Apply programming concepts of the 8051 Microcontroller for basic operations. • Demonstrate the use of different sensors for real-world measurements. • Analyze and measure physical parameters using appropriate sensors. • Design basic signal conditioning circuits. • Interface sensors and actuators using Arduino UNO.
Lab Practical 17	**Perform minimum 10 experiments at least three on each of the following aspects.** **8051 Microcontroller** 1. Data transfer using 8051 µc 2. Arithmetic using 8051 µc i.e. Addition, subtraction, multiplication, division etc. 3. Logical using 8051 µc **Sensor & Actuators** 4. Displacement measurement using LVDT. 5. Temperature measurement using **NTC thermistor**. 6. Light intensity measurement using LDR sensor. 7. Study of PN junction **photodiode sensor.** 8. Distance measurement using ultrasonic sensor. 9. Implementation of low-pass filters using RC circuit. 10. Implementation of high-pass filters using RC circuit. **Arduino Programming** 11. Installing and setting up Arduino IDE (board & port selection). 12. Writing and uploading first program (Hello World using Serial Monitor). 13. LED ON/OFF using HIGH/LOW logic. 14. LED blinking using digital output (inbuilt LED). 15. Controlling external LED brightness using potentiometer. 16. Interfacing 16x2 LCD display (display text). 17. Interfacing relay module (ON/OFF control of DC motor). 18. Interfacing temperature & humidity sensor (DHT22). 19. Interfacing buzzer (generate tone/beep). 20. Interfacing ultrasonic sensor (distance measurement). 21. Interfacing rain sensor (rain detection system).

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

Major Elective Theory 3: Introduction to Internet of Things

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113248	Introduction to Internet of Things	2	30	2 Hrs	30

Course Objectives:	• Provide the basic concepts, architecture, components, and applications of Internet of Things (IoT). • Identify and explain the working of various sensors, actuators, and microcontrollers used in IoT systems. • Describe different communication technologies and protocols used for data transmission in IoT networks. • Develop basic IoT-based applications using simple hardware and cloud connectivity concepts. • Understand the importance of IoT security, privacy, and real-life applications in smart home, healthcare, agriculture, and industry.
Course Outcomes:	**After completing the course, the student will** • Understand the fundamentals, architecture, characteristics, and applications of Internet of Things (IoT). • Identify and interface various sensors, actuators, and microcontrollers used in IoT systems. • Understands of IoT communication technologies and protocols such as Wi-Fi, Bluetooth, ZigBee, MQTT, and HTTP. • Able to design and implement simple IoT-based projects for real-time monitoring and data acquisition. • Analyze the role of IoT in smart applications and understand basic issues related to IoT security and privacy.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Fundamentals of Internet of Things:** Introduction to Internet of Things (IoT), Evolution of IoT and its importance, Basic components of IoT system, IoT architecture and layers, Characteristics and advantages of IoT, Applications of IoT in daily life (smart home, healthcare, agriculture, industry), Challenges and limitations of IoT	7 Hrs	7 Marks	**Lecture Method for basic concepts, ICT-based Teaching using videos and animations of IoT systems, Group Discussion on IoT applications in daily life.** **Demonstration Method** for sensor and hardware operation, **Hands-on Learning** using Arduino/NodeMCU kits, **Laboratory Method** for sensor interfacing experiments. **Interactive Lecture Method** for protocols and networking basics, **Simulation-Based Learning** using IoT
Unit II	**Sensors, Actuators and Hardware for IoT:** Introduction to sensors and actuators, Types of sensors used in IoT (temperature, humidity, light, motion, gas, etc.), Working principle of common sensors, Microcontrollers used in IoT, Introduction to Arduino / NodeMCU / Raspberry Pi, Interfacing sensors with microcontrollers, Basic data acquisition in IoT systems	8 Hrs	8 Marks	
Unit III	**Communication Technologies in IoT:** Basics of wireless communication for IoT, IoT communication protocols, Wi-Fi, Bluetooth, ZigBee, and LoRa basics, Introduction to Internet protocols (TCP/IP, HTTP, MQTT), Data transmission in IoT systems, Cloud connectivity and data storage basics, Overview of IoT platforms	8 Hrs	8 Marks	

Unit IV	**IoT Applications and Basic Project Development:** IoT system design steps, Smart home automation concept, IoT in healthcare monitoring, IoT in agriculture and environmental monitoring, Data visualization and monitoring using IoT platforms, Introduction to IoT security and privacy, Simple IoT project demonstration (sensor data monitoring)	7 Hrs	7 Marks	simulators/software tools. **Project-Based Learning** through simple IoT project development.
References:	1. Internet of Things: A Hands-On Approach, Universities Press, 2015. 2. The Internet of Things: A Key Applications and Protocols, Wiley Publication, 2012. 3. Building the Internet of Things, Wiley Publication, 2016. 4. Getting Started with the Internet of Things, O'Reilly Media, 2011. 5. Internet of Things: Principles and Paradigms, Morgan Kaufmann, 2016. 6. The Internet of Things: Connecting Objects to the Web, Wiley Publications. 7. Foundational Elements of an IoT Solution, O'Reilly Media. 8. Building the Internet of Things with IPv6 and MIPv6, Wiley Publications. 9. Introduction to IoT, Cambridge University Press. 10. Internet of Things, Oxford University Press India.			
Model questions for theory external examination.				
MCQs for Internal Assessment :	1. What does IoT stand for? A. Internet of Technology **B. Internet of Things** C. Integration of Things D. Internet of Telecommunications 2. Which of the following is an application of IoT? **A. Smart Home** B. Typewriter C. Calculator D. Printer Cable 3. Which device is commonly used as a microcontroller in IoT? **A. Arduino** B. Monitor **C.** Keyboard D. Scanner 4. Which sensor is used to measure temperature? A. Gas Sensor B. Light Sensor **C. Temperature Sensor** D. Motion Sensor 5. Which communication technology is commonly used for short-range wireless communication? **A. Bluetooth** B. HDMI C. VGA D. Humidity Sensor			
One sentence/ Very short answer questions	1. What is Internet of Things (IoT)? 2. What is the function of a sensor in an IoT system? 3. Name any one microcontroller used in IoT. 4. What is Bluetooth used for in IoT? 5. What is the main purpose of IoT in smart agriculture?			
Short answer questions	1. Define Internet of Things (IoT). 2. List any four applications of IoT. 3. What is the role of sensors in an IoT system? 4. What is an actuator? Give one example. 5. Write the features of Arduino board.			
Long answer questions	1. Explain the concept of Internet of Things (IoT) and its importance in modern technology. 2. Describe the basic architecture of an IoT system with a neat block diagram. 3. Explain the role of sensors and actuators in IoT systems. 4. Write in detail about the features and applications of Arduino board in IoT. 5. Explain the working of NodeMCU and its importance in IoT applications.			

Major Elective Lab/ Practical 18A: Practical on Introduction to Internet of Things

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113249	Electronics lab 19A	2	60	4 Hrs	50

Lab Practical 18A	**Minimum any 10 experiments of the following aspects.** 1. **Study of IoT System and Development Boards** Introduction to IoT concept, block diagram of IoT system, and study of development boards such as Arduino / NodeMCU / Raspberry Pi. 2. **Installation of Arduino IDE and Basic Programming** Installation of Arduino IDE software and writing a simple program for LED blinking. 3. **Digital Input and Output Experiment** Interfacing push button switch and LED with Arduino to understand digital input and output operations. 4. **Analog Input Experiment** Interfacing a potentiometer or analog sensor with Arduino and displaying analog values on serial monitor. 5. **Temperature Sensor Interfacing** Interfacing temperature sensor (LM35 / DHT11) with Arduino and displaying temperature values. 6. **Light Sensor Interfacing** Interfacing LDR sensor with Arduino to measure light intensity. 7. **Humidity Sensor Interfacing** Interfacing DHT11/DHT22 sensor to measure humidity and temperature. 8. **Motion Detection System** Interfacing PIR motion sensor with Arduino for motion detection. 9. **IoT Communication using NodeMCU (Wi-Fi Module)** Connecting NodeMCU with Wi-Fi network and sending sensor data to serial monitor. 10. **Sending Sensor Data to Cloud Platform** Uploading sensor data to IoT cloud platform such as ThingSpeak. 11. **IoT Based Smart Device Control** Controlling LED or relay module through internet using NodeMCU. 12. **Mini Project** Development of a simple IoT application such as Smart home lighting system, Temperature monitoring system, Smart irrigation system

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

Major Elective Theory 4: Python Programming

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113250	Python Programming	2	30	2 Hrs	30

Course Objectives:	• Provide the basic concepts, architecture, components, and applications • Identify and explain the working of various component used in systems. • Describe different technologies and protocols • Develop basic applications using simple hardware concepts. • Understand the importance and real-life applications in smart home, healthcare, agriculture, and industry. • Develop and exemplify basic programming skills in Virtual Instrumentation.
Course Outcomes:	**After completing the course, the student will** • Design and implement a system using sensor and instrumentation configuration. Identify, define, state, list, name the various terminologies of Python Programming. • Understand various concepts and blocks of Python Programming. • Apply the concepts of Python Programming to design real time embedded applications. • Demonstrate the skill set using modern tool

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Installation, Data Types and Input/output :** Importance of Python, Installing Python in Windows/Linux, Executing Python programs, Comments in Python, Internal working of Python, **Identifiers, keywords, and indentation**, Python character set, Tokens, the print () function, Assignment of values to variables, Getting User Input: input () function, The eval () function, Python Core Data Types	7 Hrs	7 Marks	Lecture Method for basic concepts, ICT-based Teaching using videos and animations of systems, Group Discussion on applications in daily life. Demonstration Method for sensor and hardware operation, Hands-on Learning using python, Laboratory Method for simulation based experiments. Interactive Lecture Method for Simulation-Based Learning using IoT simulators/software tools. Project-Based Learning through simple IoT project development.
Unit II	**Operators and Control Statements :** Assignment, Logical, Arithmetic; Operator precedence and Associativity, Bitwise operator, the compound assignment operator; Decision statements- Boolean operators, Boolean Expressions and Relational operators, Decision making statements; Loop Control Statements- while loop, range () function, for loop; break statement, continue statement.	8 Hrs	8 Marks	
Unit III	**List, tuple, dictionary in Python** Lists- creating lists, list operations, list manipulation, list functions, Tuple- creating tuple, tuple operations, tuple functions and methods, Dictionary- creating dictionary, dictionary operations, dictionary functions and methods	8 Hrs	8 Marks	
Unit IV	**Functions in Python and Programs for Embedded Applications** Understanding and defining functions in	7 Hrs	7 Marks	

	python, flow of execution in a function call, passing parameters, returning values from functions, scope of variables. Python Libraries, Design of real time IoT applications using different microcontroller and Python Programming. Basic exercises using Python Programming for real time embedded system applications.			

References:

1. Coding Projects in Python, A step by step guide to creating your own Python Projects, DK, Penguin Random House, 1st American Edition, 2017.
2. Learn Python the HardWay, 3rd Edition, Zed A Shaw, Addison-Wesley, 2014
3. Learning Python,5th Edition, O'Reilley,2013
4. Python Programming for Beginners, 2015 Corey Kidd.
5. www.tutorialspoint.com
6. www.python.org
7. https://www.codeacademy.com/learn/learn-python
8. https://www.w3schools.com/python
9. https://www.learnpython.org
10. https://www.geeksforgeeks.org/python-programming-language

Model questions for theory external examination.

MCQs for Internal Assessment :

1. Who developed Python Programming Language?
   a) Wick van Rossum b) Rasmus Lerdorf c) Guido van Rossum d) Niene Stom
2. Is Python case sensitive when dealing with identifiers?
   a) no b) yes c) machine dependent d) none of the mentioned
3. Which of the following is the correct extension of the Python file?
   a) .python b) .pl c) .py d) .p
4. Is Python code compiled or interpreted?
   a) Python code is both compiled and interpreted
   b) Python code is neither compiled nor interpreted
   c) Python code is only compiled d) Python code is only interpreted
5. Which keyword is used for function in Python language?
   a) Function b) def c) Fun d) Define
6. What is the order of precedence in python?
   a) Exponential, Parentheses, Multiplication, Division, Addition, Subtraction
   b) Exponential, Parentheses, Division, Multiplication, Addition, Subtraction
   c) Parentheses, Exponential, Multiplication, Addition, Division, Subtraction
   d) Parentheses, Exponential, Multiplication, Division, Addition, Subtraction

One sentence/ Very short answer questions

1. Define Arithmetic operators.
2. How many arithmetic operations in python ?
3. What is concatenation operator?
4. What is a string?
5. What is slicing in strings?
6. What is interactive mode in python?
7. How script mode is used?

Short answer questions

1. What is the difference between a tuple and a list in Python?
2. How do you handle exceptions in Python?
3. What is a decorator in Python and how do you use it?
4. Explain the difference between local and global variables in Python.
5. How do you define a function in Python?
6. Explain the difference between len() and count() in Python.
7. What is the difference between append() and extend() in a Python list?
8. What is the difference between list() and set() in Python?

	9. How do you perform file I/O operations in Python? 10. How do you define a lambda function in Python? 11. How do you implement a linked list in Python? 12. How do you implement a dictionary in Python? 13. How do you implement a tree in Python?
Long answer questions	1. Write a Short note on Data types in python. 2. Explain precedence and associativity of operators with examples. 3. Explain different operators in python with examples. 4. Define a variable. How to assign values to them? 5. What is the purpose of Indentation in Python? 6. Explain the features of python. 7. What is identifier? And explain Rules to define identifiers in Python? 8. Briefly explain how to read data from the keyboard. 9. Briefly explain the conditional statements available in python. 10. Describe the various control flow statements in python. 11. Explain the Syntax of for loop and the use of range function with an Example.

Major Elective Lab/ Practical 18B: Practical on Python Programming

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113251	Electronics lab 18B	2	60	4 Hrs	50

Lab Practical 18B	**Minimum any ten experiments from the following aspects.** 1. Write a program to demonstrate different number data types in python. 2. Write a program to perform different arithmetic operations on numbers in python 3. Write a program to create, concatenate and print a string and accessing substring from a given string 4. Write a python script to print the current date in following format "Sun May 29 02:26:23 IST 2017" 5. Write a python program to find largest of three numbers 6. Write a python program to convert temperature to and from Celsius to Fahrenheit. 7. Write a program to get a list of the even numbers from a given list of numbers.(use only comprehensions) 8. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples. 9. Conversion from one coordinate system to another coordinate system using Python commands. 10. Calculation of Force, Electric field and Potential at a given point using Python commands. 11. Calculation of ripple factor for a given rectifier: Half-wave/Full-wave/Bridge circuit using Python program. 12. Obtain the characteristics for the given circuit using Maximum power transfer theorem. 13. Calculation of the equivalent circuit parameters and efficiency of a Transformer at different loads using Python commands. 14. Modelling of an electrical circuit using Python program. Apply Nodal analysis and Mesh analysis for a given electrical circuit.

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

Minor Theory 6: Microcontroller and Sensors

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113252	Microcontroller and Sensors	2	30	2 Hrs	30

Course Objectives:	• To introduce the fundamentals of microcontrollers and distinguish them from microprocessors. • To understand the architecture and internal organization of the microcontroller 8051. • To learn the 8051 instruction sets and develops assembly language programs. • To provide a fundamental understanding and operating principles of various sensors. • To familiarize students with the actuators and power electronic circuits required to translate electronic signals into mechanical motion.
Course Outcomes:	**After completing the course, the student will able to** • Explain the basic concepts and architecture of the microcontroller 8051. • Apply different addressing modes and execute instruction sets effectively. • Develop assembly language programs for data transfer, arithmetic, and logical operations. • Identify and classify sensors based on their output characteristics and measurement range. • Analyze the performance of sensors by calculating parameters like sensitivity, linearity, and resolution.

Unit System	Contents	Workload Allotted	Weightage of Marks Allotted	Incorporation of Pedagogies
Unit I	**Microcontroller 8051 Architecture:** Microcontroller Introduction, Difference between Microprocessor and Microcontroller, features, block diagram of microcontroller, Pin Configuration, CPU, registers	8 Hrs	8 Marks	Besides classroom teaching demonstration of components and measuring instruments (physically and/or virtually), wherever applicable.
Unit II	**Instruction set of 8051 and Programming:** Addressing modes, Instruction set: Data transfer, arithmetic, logical operation, JUMP, Loop and CALL instructions. Assembly language programming: simple data transfer, arithmetic, logical and single bit.	7 Hrs	7 Marks	
Unit III	**Fundamentals of Sensing & Sensor Classification:** Active vs. Passive, Analog vs. Digital, and Null vs. Deflection. **Static & Dynamic Char.:** Accuracy, Precision, Resolution, Sensitivity, Hysteresis and Linearity. Strain Gauges, LVDT, Thermistors (NTC), LM35.	8 Hrs	8 Marks	
Unit IV	**Introduction to Sensors:** Photodiodes, Phototransistors, LDRs, and IR sensors. Piezoelectric effect, Ultrasonic Sensor, pH sensors, Gas sensors (MQ series).	7 Hrs	7 Marks	

References:	1. The 8051 Microcontroller architecture, Programming & Applications- Kenneth J.Ayala (Penram international) 2. The Microcontroller and Embedded Systems.- M. A. Mazadi, J. C. Mazadi (Pearson Education, Asia) 3. Sensors and Transducers by D. Patranabis. 4. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney 5. Electronic Instrumentation by H.S. Kalsi

Model questions for theory external examination.	
MCQs for Internal Assessment :	1. The 8051 is a: a) Microprocessor **b) Microcontroller** c) Memory device d) I/O device 2. The Program Counter (PC) is used to: a) Store data **b) Store address of next instruction** c) Perform arithmetic d) Control I/O 3. Which register is used for serial data transfer in 8051? a) A b) B **c) SBUF** d) DPTR 4. Which of the following is bit-addressable register? a) A register b) DPTR **c) PSW** d) PC 5. The 8051 has how many I/O ports? a) 2 b) 3 **c) 4** d) 5 6. Which instruction is used for addition? a) MOV **b) ADD** c) ANL d) ORL 7. Which of the following is an example of a Passive Transducer? a) Thermocouple b) Photovoltaic cell **c) LDR** d) Piezoelectric crystal 8. The ability of a sensor to provide the same output for the same input under constant conditions is called: a) Accuracy **b) Repeatability** c) Sensitivity d) Resolution 9. In an LVDT, the output voltage is zero at the null position because: a) The primary current is zero **b) The induced voltages in the two secondary coils are equal and opposite** c) The core is removed d) The secondary coils are in phase 10. Which temperature sensor is known for having a "Negative Temperature Coefficient" (NTC)? a) RTD (PT100) **b) Thermistor** c) Thermocouple d) LM35
Short answer questions	1. Differentiate between a microprocessor and a microcontroller. 2. Explain the function of the Program Counter and Data Pointer register. 3. What is the PSW register? Explain its any two flags. 4. What are interrupts? Explain IE/IP registers. 5. Write short notes on data transfer and arithmetic instructions. 6. Define Sensitivity in sensors. 7. Define Hysteresis in sensors. 8. Differentiates between Active and Passive transducers.
Long answer questions	1. Explain the architecture of the microcontroller 8051 with a neat block diagram. 2. Describe the internal organization of RAM in Microcontroller 8051. 3. Discuss the timer/counter operation in 8051 with TMOD and TCON registers. 4. Describe different addressing modes of 8051 with examples. 5. Explain the instruction set in details with suitable examples. 6. Write an assembly language program for data transfer, arithmetic, and logical operations 7. Explain the construction and working principle of an LVDT.

Minor Lab / Practical 19: Practical on Minor Theory Microcontroller and Sensors

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113253	Minor Electronics Lab 19	2	60	4 Hrs.	50
Course Objectives:	• To understand programming and operations of the 8051 Microcontroller. • To study working and applications of sensors like LVDT, thermistor, LDR, photodiode, • To measure physical parameters such as temperature, displacement, light, and distance.						
Course Outcomes:	• Apply programming concepts of the 8051 Microcontroller for basic operations. • Demonstrate the use of different sensors for real-world measurements. • Analyze and measure physical parameters using appropriate sensors.						
Lab/ Practical 19	**Minimum 10 experiments at least three on each of the following aspects.** **8051 Microcontroller** 1. Data transfer using 8051 µc 2. Arithmetic using 8051 µc i.e. Addition, subtraction, multiplication, division etc. 3. Logical using 8051 µc **Sensors** 4. Displacement measurement using LVDT. 5. Temperature measurement using NTC thermistor. 6. Light intensity measurement using LDR sensor. 7. Study of PN junction photodiode sensor. 8. Study of IR sensor. 9. Study of pH Sensor. 10. Study of Gas Sensor.						

Note :

- Students during lab hours shall have to perform at least 10 experiments from given group, however students shall have to perform one experiment at the time of examination.

Vocational Skill Enhancement Course 5: Lab/ Practical 20: Advanced applications/ projects on Major Theory 113244, 113245 and 113246

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Exam Duration	Max Mark
5.5	VI	113254	Electronics Lab 20	2	60	4 Hrs.	50
Course Objectives:	• To understand programming and operations of the Microcontroller 8051. • To study working and applications of sensors like LVDT, thermistor, LDR, photodiode, and ultrasonic sensor. • To measure physical parameters such as temperature, displacement, light, and distance. • To implement basic signal conditioning circuits like low-pass and high-pass filters. • To develop Arduino-based applications using Arduino UNO and Arduino IDE.						
Course Outcomes:	• Apply programming concepts of the Microcontroller 8051 for basic operations. • Demonstrate the use of different sensors for real-world measurements. • Analyze and measure physical parameters using appropriate sensors. • Design basic signal conditioning circuits. • Interface sensors and actuators using Arduino UNO.						
Lab/ Practical 20	**Minimum 5 Projects should be constructing from the following aspects.** **1. Smart Temperature Display System** **Components:** LM35 / DHT22, LCD (16x2), Arduino **Concepts:** ADC, sensor interfacing **Extension:** Add buzzer for high temperature alert **2. Ultrasonic Distance Measurement System** **Components:** Ultrasonic sensor, LCD/OLED **Concepts:** Pulse timing, distance calculation **Application:** Parking assistant **3. Smart Irrigation System** **Components:** Soil moisture sensor, relay, pump **Concepts:** Automation, environmental sensing **Working:** Water plants only when soil is dry **4. Smart Home Automation System** **Components:** Relays, sensors, Arduino **Control:** Mobile/Bluetooth/WiFi **Features:** Control lights, fan, appliances **5. Industrial Safety Monitoring System** **Components:** Gas + temperature sensors **Concepts:** Multi-sensor integration **Output:** Alarm + automatic shutdown **6. Automated Water Level Controller** **Components:** Water level sensor, relay **Concepts:** Control systems **Working:** Automatically turns motor ON/OFF **7. Smart Parking System** **Components:** IR sensors, display **Concepts:** Sensor network **Display:** Available parking slots						

Internship/ Apprenticeship corresponding to Major: On Job Training

Level	Semester	Course Code	Course Name	Credits	Teaching Hours	Credits allotment
5.5	VI	113255	Electronics on job training	4	120 Hrs.	When the student provided the Certificate of attendance "On job training" for 120 Hrs. will be given 4 credits and as for the less attendance, proportionally given the credits.
Course Objectives:	• **Industrial Exposure:** To bridge the gap between academic theory and real-world industrial practice. • **Skill Diversification:** To provide hands-on experience with industry-grade tools, software, and machinery that are unavailable in a classroom. • **Professionalism & Ethics:** To inculcate a sense of workplace discipline & ethics and corporate culture. • **Problem-Solving:** To encourage students to apply critical thinking to live technical challenges and troubleshooting. • **Networking:** To help students build a professional network and understand the various career paths within their domain.					
Course Outcomes:	The student will be able to … • Execute standard operating procedures (SOPs) and safety protocols relevant to the industry/ company. • Analyse real-time data or hardware behaviour to identify faults or optimize processes. • Manage time and resources effectively to meet project goals and deliver quality work. • Present technical reports, project documentation, and findings to a professional audience. • Collaborate effectively within a multi-disciplinary team to achieve a common goal. • Adapt to new culture, technological ideas and utilized software specifically provided by the industry/ company.					