Kuvempu University, Shankargatta, Shivamogga

Course: B. Sc.

Subject: ELECTRONICS

Semester: V

Paper 5.1: Embedded Controllers

Course Code		Course Title	Embedded Controllers
Course Credits	03	Hour of Teaching/week	04
Total Contact Hours	64	Formative Assessment Marks	20
Exam Marks	80	Exam Duration	3 Hours

UNIT I **16Hrs**

Introduction to Microprocessors and Microcontrollers: Microprocessor Architecture Harvard and Von-Neumann Architecture, CISC and RISC processors. Comparison of microprocessor with microcontroller. Microcontrollers and embedded processors. Embedded Systems Design Parameters of Embedded Systems, Embedded Software Development Tools: Integrated Development Environment (IDE). Editor, Assemblers, Compilers, linker, loader, Instruction Set Simulator (ISS) Debugging Tools and Techniques, Emulators.

UNIT II **16Hrs**

Overview of the PIC microcontroller: family, Architecture and features of PIC18F458, Memory organization, Data memory organization, EEPROM, flash memory, Special Function Registers, Program Counter, Configuration registers, Stack memory, Interrupts, I/O ports, Timers, USART, Capture/Compare/PWM (CCP) Modules, MSSP Serial Port, CAN module, ADC, Special features of the CPU, Oscillator sources. Clock source switching, Instruction set. Watchdog Timer.

PIC 18 Interrupts: Steps during the execution of an interrupt, ISR, Sources of Interrupts in PIC18F, Enabling and Disabling an Interrupt

UNIT III **16Hrs**

PIC Programming in C: Code Space Limitations, C language over ASM for embedded system, C Functions and Variables, Data types in C, structure of C program for PIC18F, time delays using loop program and Example, PORT I/O Programming in C, bit addressable I/O programming, Logic operations in C , Programing timer/counter.

PIC18F Addressing Modes: Immediate addressing mode, Direct addressing mode, Register indirect addressing mode and Indexed ROM addressing mode

Instruction set and Assembly Language Programming of PIC 18: Instruction set overview, Arithmetic, Logical and Rotate Instructions Assembly Language Program Structure, Template for Writing Assembly Programs, Writing Programs to Perform Arithmetic Computations, Logical Instructions, Program Loop to Create Time Delays.

UNIT IV **16 Hrs**

Hardware interfacing and Microcontroller: Introduction to Communication Protocols – RS 232, I2C, USB, USART, SPI, CAN, and IrDA. Program ROM allocation, Data RAM allocation, I/O Programming, Timer programming, Automatic Stack operations, Programmer access to the Stack, serial port programming, interrupt programming, generation of PWM signal PWM Motor Control with CCP.

Interfacing: PIC18F458: Switch LED, Seven segment LED, keyboard, LCD External ADC, DAC interfacing, stepper motor, DC motor interfacing, real time clock(RTC) and Series ADC, erasing and writing , flash and EEPROM, memories for data storage. Sensor interfacing and signal conditioning standard.

References:

1. Muhammedali Maizidi and Janice Gillespie and Rollin D,"8051 microcontroller and embedded system using assembly and C, First edition Pearson 2006
2. Tim Wilmshurst, "Designin embedded systems with PIC Microcontrollers: Principles and applicatons, First edition Elsevier, 2007
3. Muhammedali Maizidi, Rollin D, Mckinlay, "PIC microcontroller and embedded systems using assembly and C for PIC18, First edition Pearson 2008
4. John Pickman, Design with PIC microcontroller", First edition Prentice hall 1997

B.Sc. V Semester Syllabus: 2026-27

Paper 5.2: Advanced Communication

Course Code		Course Title	Advanced Communication
Course Credits	03	Hour of Teaching/week	04
Total Contact Hours	64	Formative Assessment Marks	20
Exam Marks	80	Exam Duration	3 Hours

Unit 1: Digital Communication **16Hrs**

Definition of signal and classification, Block diagram of digital transmission and reception, Comparison of analog and digital communication, advantages of digital communication. Definition of information capacity, entropy, bit rate, baud rate and bandwidth of digital data. Shannon's theaorem, Shannon's Heartley theorem, amount of information, sampling process and sample and hold circuit. Sampling theorem, types of pulse modulation-PAM, PWM and PPM (Introduction and generation using Transistors).

Unit 2: Digital Modulation Techniques and Multiplexing **16Hrs**

Definition and types of Digital Modulation Techniques.
PCM- Introduction, block diagram of PCM transmitter and receiver. Digital modulation techniques-binary generation and detection (coherent and non-coherent) of binary ASK, FSK, PSK and QPSK. Multiplexing- Introduction, need and different types; FDM-Introduction, block diagram, advantages and disadvantages. TDM- Introduction, block diagram, advantages and disadvantages, Comparison between FDM and TDM

Unit 3: Optical Fiber Communication: **16Hrs**

Need of Fiber Optic Communication, fundamentals, nature of light, basic optical laws and definitions, optical fiber types, rays and modes, signal degradation in optical fibers.
Optical fiber losses-types, advantage and disadvantages of optical fiber communications, applications of optical fiber communications. Optical sources and detectors: Characteristics features and types-LEDs, Laser diodes: Structures and working principle, fundamental receiver operations, Avalanche photo diode, PIN Diode-Structures and working Principle. Block diagram of Optical fiber communication system.

Unit 4: Satellite Communication and Mobile Communication: **16Hrs**

Satellite Communication: Introduction, need, Geosynchronous satellite orbits, geostationary satellite advantages of geostationary satellite. Satellite visibility, transponders(C-Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink

Mobile Communication: Basic concept of mobile communication, frequency bands used in mobile communication, concept of cell sectoring and cell splitting, SIM number, IMEI number, need for data encryption, architecture (block diagram) of mobile communication network, idea of GSM, CDMA, TDMA and FDMA technologies, simplified block diagram of mobile phone handset, 2G,3G and 4G, 5G concepts(qualitative only)

References:

1. Kennedy and Davis, "Electronic communication systems", 4th Edition, TATA McGraw Hill.
2. D Roddy and J Collen "Electronic Communication", 4th Edition PHI 2008.
3. Gerd Keiser, "Optical fiber Communication", 2nd Edition McGraw Hill.
4. Gorden L Stuber, "Principles of Mobile communication", 2nd Edition, Kluwer Academic Publishers.

Practicals

1. Interfacing of (a) LEDs to read switch status. If switch is on, turn on LED otherwise turn off LED (b) to blink an LED with different delay
2. To interface seven segment LED display and program to implement countdown/up decimal digit 9 to 0
3. LCD (2X16) interfacing
4. Interfacing of stepper motor and rotating stepper motor by N steps clockwise/ anti clockwise with speed control.
5. Generate square, saw tooth, triangular and staircase waveform using DAC interface.
6. Display of 4-digit decimal number using multiplex seven segment display interface.
7. Sample and hold circuit.
8. Pulse width Modulation (PWM)
9. Pulse amplitude Modulation (PAM)
10. Pulse position modulation (PPM)
11. Amplitude shift key (ASK)
12. Frequency shift key (FSK)
13. Phase shift key (PSK)
14. Numerical Aperture of OFC.
15. Study of bending losses of optical fiber.
16. Microcontroller based Programs/Interfacing (Addition, Subtraction, Multiplication etc)

Note: Minimum 8 experiments to be conducted

B.Sc. VI Semester Syllabus: 2026-27

Paper 6.1: Signals and Systems and Introduction to Artificial Intelligence

Course Code		Course Title	Signals and Systems and Introduction to Artificial Intelligence
Course Credits	03	Hour of Teaching/week	04
Total Contact Hours	64	Formative Assessment Marks	20
Exam Marks	80	Exam Duration	3 Hours

Content		Hours
UNIT – 1	**SIGNALS AND SYSTEMS**	
Introduction to continuous-time and discrete-time signals: Understanding signals, some real-world examples of signals and systems. Mathematical and graphical representation of signals, classification of signals: 1-D and 2-D, continuous and discrete, periodic and non-periodic, symmetries (even-odd) etc., related problems to enhance understanding of different signal types, elementary signals – unit impulse, unit step exponential and sinusoidal signals. Introduction to continuous-time and discrete-time systems, examples of systems, interconnections of systems, Properties of systems: Linear, Non-linear, time variance-invariance, casual-non causal, memory-systems, memory-less systems, feed-back in systems, stability, inverse systems.		**16**
UNIT-2	**OPERATIONS ON SIGNALS**	
Operations on signals: Amplitude scaling, shifting, folding, time scaling, addition of two signals etc., time-domain representation of systems, linear time-invariant systems, Convolution integral and convolution sum, impulse and step response of systems, differential equation representation of LTI systems, properties and stability of LTI systems, solving differential equations.		**16**
UNIT -3	**ARTIFICIAL INTELLIGENCE**	
Artificial Intelligence: goals of AI, advantages and disadvantages of AI, applications of AI, programming without and with AI, History of AI, composition of intelligence: types of intelligence. **Machine learning:** Difference between machine learning and traditional programming features of machine learning, introduction to data in machine learning, types and different forms of data, applications of machine learning differences between AI and ML. **AI-Agents:** Structure of agent, types of agents-Simple Reflex, Model-Based Reflex, Goal-Based, Utility-based, learning agent.		**16**
UNIT - 4	**PROBLEM SOLVING AND SEARCH ALGORITHM**	
Problem solving in AI: Important terms used in problem solving, types of problems in AI: Ignorable problems, recoverable problems, irrecoverable problems, steps for problem solving in AI: Diagram, explanation of each stage. Search algorithms in AI: terminologies, properties of search algorithms. **Types of search algorithms:** Uninformed search, Breadth-first search, Depth-first search, Depth-limited search, Bidirectional search. Informed search: Best-first Search, A* Search Algorithm.		**16**

Reference Books:

1. Alan V Oppenheim, Alan S. Willsky Nawab, “Signals and Systems”, Pearson edition Asia/PHI, 2nd Edition, 2002.
2. Simon Haykin and Barry Van Veen, “Signals & Systems”, Wiley, 2nd Edition, 2021.
3. Ganesh Rao and Satish Tunga, “Signals and Systems”, Pearson/Sanguine Technical Publishers, 2004
4. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig
5. Artificial Intelligence: Foundations of Computational Agents by David L Poole and Alan.
6. Fundamentals of Artificial Intelligence and Machine learning (Pb) by Pradhan Manaswini, DPS Publishing House, 2019.

B.Sc. VI Semester Syllabus: 2026-27

Paper 6.2: VLSI and Robotics

Course Code		Course Title	VLSI and Robotics
Course Credits	03	Hour of Teaching/week	04
Total Contact Hours	64	Formative Assessment Marks	20
Exam Marks	80	Exam Duration	3 Hours

UNIT – I **16 hrs**

MOS Transistor Theory: n MOS / p MOS transistor, threshold voltage equation, body effect, MOS device design equation, sub threshold region, Channel length modulation. Mobility variation, Tunneling, punch through, hot electron effect MOS models, small signal AC Characteristics, CMOS inverter, βn / βp ratio, noise margin, static load MOS inverters, differential inverter, tristate inverter, BiCMOS inverter.

UNIT-II **16 hrs**

CMOS Process Technology: Semiconductor Technology overview, basic CMOS technology, p well / n well / twin well process. Current CMOS enhancement (oxide isolation, LDD, refractory gate, multilayer inter connect), Circuit elements, resistor, capacitor, interconnects, MOS mask layer, stick diagram, design rules and layout, symbolic diagram, mask feints, scaling of MOS circuits. Basics of Digital CMOS Design: Combinational MOS Logic Circuits-Introduction, CMOS logic circuits with a MOS load, CMOS logic circuits, complex logic circuits, CMOS full adder, Transmission Gate. Sequential MOS logic Circuits – Introduction, Behavior of bi-stable elements, SR latch Circuit, clocked latch and Flip Flop Circuits, CMOS D latch and edge triggered Flip Flop.

UNIT III **16 Hrs**

Robot Design and Kinematic: Introduction to Robotics: Definition, evolution, components, and classification of robots. Robot Structure: Links, joints, degrees of freedom (DOF), robot configurations – Cartesian, SCARA, articulated, cylindrical, spherical.
Forward Kinematics: Transformation matrices, Denavit-Hartenberg (DH) parameters, examples for 2-DOF and 3-DOF manipulators. Inverse Kinematics: Analytical solutions for simple manipulators, geometric and algebraic approaches, multiple solutions and redundancy.
Robot Workspace: Joint space vs task space, reachability analysis.
Homogeneous Transformation Matrix: Composition of transformations, rotation and translation.
Robot Anatomy Design Considerations: Payload, accuracy, repeatability, and stiffness (introductory design perspectives).

UNIT IV: **16 Hrs**

Sensors and Actuators – Construction, Working & Interfacing: Sensors – Construction, Operation & Interfacing: Proximity & Distance Sensors: IR sensor (reflective), Ultrasonic sensor (HC-SR04): Echo-pulse principle, Light & Motion Detection: LDR: Light sensitivity and voltage divider principle, PIR sensor: Pyroelectric effect and human motion detection. Environmental Sensors: LM35 (Temperature), DHT11 (Temp + Humidity), MQ gas sensors, Position & Orientation: Hall Effect sensor: Magnetic field detection, Accelerometer (ADXL345): 3-axis motion sensing, Sensor Interfacing: Pull-up/down resistors, signal conditioning, ADC basics, denounce circuits
Actuators – Types, Construction & Drivers: DC motors: Working, speed control using PWM, Servo motors: Feedback control and pulse width control, Stepper motors: Construction, unipolar/bipolar control, Solenoids and Relays: Solenoids and Relays.

References:

1. Basic VLSI design, 3rd edition, Douglas A Pucknell, Kamran Eshraghian, PHI
2. Introduction to VLSI circuits and systems, John P Uyemura, John Wiley.
3. Principals of CMOS VLSI design, 3rd edition, Neil H E Weste and David Harris, Addison Wesley 2004
4. CMOS digital integrated circuits, Analysis and Design, 3rd edition, Sung-Ho(Steve) Kang and Yusuf Leblebici, McGraw Hill, 2002.
5. Saeed B. Niku, Introduction to Robotics: Analysis, Control, Applications, Wiley.
6. John J Craig, Introduction to Robotics: Mechanics and Control, Pearson.

B.Sc. IV Semester Skill Enhancement Course Syllabus: 2026-27

Paper: Domestic wiring skills and Consumer Electronics

Course Code		Course Title	Domestic wiring skills and Consumer Electronics
Course Credits	02	Hour of Teaching/week	02
Total Contact Hours	32	Formative Assessment Marks	10
Exam Marks	40	Exam Duration	2 Hours

UNIT-I **16Hrs**

Electrical wiring - Definition, Electrical components-resistors, capacitors, -inductors, transformers, switches, dc voltage and current, ac voltage and current (Definition, types, symbols and functions).**Wires and cables**-types. general rules for wiring, requirements of electrical installation.

Electrical connections: Basic circuits (series and parallel connections). Socket outlet wiring, single bulb controlled by one-way switch, multiple bulb controlled by one-way switch, junction box wiring diagram. Electrical switch board wiring (with 3pin socket, 2pin socket along with fuse and indicators). Electrical wiring diagram for bulb and fan with individual switches. Electrical panel wiring diagram. Single bedroom electrical wiring diagram.

Electrical safety measures: Measures and procedures, earthing system: concept of earthing, requirement of earthing, types of earthing (rod, pipe and plate earthing), earthing of electrical installation and checking of earthing system.

UNIT -II Consumer Electronics **16Hrs**

Audio Systems: PA system, Microphones, Amplifier, Loudspeakers, Radio Receivers, AM/FM, Audio Recording, and reproduction, Cassettes, CD and MP3. TV and Video Systems: Television standards, BW/Colour, CRT/HDTV, video system, VCR/VCD/DVD players, MP4, players, set top box, CATV and Dish TV, LCD, Plasma and LED
TV, Projectors: DLP, Home Theatres, Remote controls.

Reference Books

1. Electric wiring, Sateesh Kumar, Ane Books pvt ltd
2. Complete book to Electrical wiring, Eleanor G Young.
3. PCB Design and Layout Fundamentals, Christopher T. Robertson, 3rd Edition, Newnes (Elsevier).
4. High-Speed Digital Design: A Handbook of Black Magic by Howard Johnson & Martin Graham, 2nd Edition, Prentice Hall
5. R.P.Bali, Consumer Electronics, Pearson Education (2008)
6. R.G. Gupta, Audio and Video systems, Tata McGraw Hill (2004)

B.Sc. V Semester Skill Enhancement Course Syllabus: 2026-27

Paper: Internet of Things

Course Code		Course Title	Internet of Things (IoT)
Course Credits	02	Hour of Teaching/week	02
Total Contact Hours	32	Formative Assessment Marks	10
Exam Marks	40	Exam Duration	2 Hours

Unit I: Fundamentals of Internet of Things 16 Hrs

Fundamentals of IoT: Introduction, History of IoT, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Communication technologies used in IoT -Wi-Fi, Bluetooth, Zigbee, GSM, and LPWAN basics. Networking fundamentals-IPv4, IPv6, MQTT, and HTTP protocols are introduced. Basic cloud computing concepts and IoT platforms. An introduction to commonly used development boards-Arduino and Raspberry Pi (simple interfacing concepts).

Unit II: IoT System Design, Applications and Security 16 Hrs

IoT system design and real-world implementation. IoT data acquisition, data processing, cloud storage, and visualization techniques. IoT analytics basics, middleware, and application layer protocols such as MQTT and CoAP. IoT security challenges (authentication, encryption, data privacy, and cyber threats).

Practical applications - smart home automation, environmental monitoring, smart agriculture systems, wearable devices, and industrial IoT (IIoT). Energy efficiency in IoT devices, edge computing basics, and integration of IoT with emerging technologies- AI and Big Data. future trends and societal impact of IoT.

Reference Books

1. *Internet of Things: A Hands-On Approach* by Arshdeep Bahga & Vijay Madisetti 1st Edition,Universities Press
2. *Internet of Things: Principles and Paradigms, by* Rajkumar Buyya & Amir Vahid Dastjerdi, 1st Edition, Morgan Kaufmann

B.Sc. VI Semester Skill Enanhancement Course Syllabus: 2026-27

Title: Electronic Public system and E-Waste Management

Course Code		Course Title	**Electronic Public system and E-Waste Management**
Course Credits	**02**	Hour of Teaching/week	**02**
Total Contact Hours	**32**	Formative Assessment Marks	**10**
Exam Marks	**40**	Exam Duration	**2 Hours**

Unit I: Electronic Public Systems 16 Hrs

The concept and importance of electronic public systems used in governance, banking, security, and communication. Overview of embedded systems and microcontroller-based public utility devices. The structure, components, and working principles of **CCTV surveillance systems** (analog and IP-based), including camera types, DVR/NVR, storage systems, networking basics, and maintenance. The architecture and operation of **Automated Teller Machines (ATMs)**, including card reader mechanisms, PIN verification, currency dispensing units, sensors, embedded controllers, and security features. The functioning and design of **Electronic Voting Machines (EVMs)** and **Voter Verifiable Paper Audit Trail (VVPAT)** systems used by the Election Commission of India, covering control unit, ballot unit, VVPAT printer mechanism, and security safeguards. M**obile phone technology**, basic block diagram, processor, memory, display, battery, SIM technology, and evolution from 2G to 5G. applications, reliability, data security, and societal impact of public electronic systems.

Unit II: E-Waste Management 16 Hrs

Electronic waste (e-waste) definition, classification, sources, and global trends. hazardous materials present in electronic devices (lead, mercury, cadmium, lithium batteries) and their environmental and health impacts. International regulations such as the Basel Convention and national e-waste management rules, Extended Producer Responsibility (EPR). Collection, segregation, storage, transportation, dismantling, and recycling techniques for electronic waste, e-waste generated from public electronic systems such as CCTV units, ATMs, EVMs, VVPAT systems, and mobile phones material recovery techniques (mechanical separation, precious metal extraction), battery disposal, data destruction methods, and reverse logistics.

Reference Books

1. *E-Waste Management: From Waste to Resource, by* Klaus Hieronymi, Ramzy Kahhat, and Eric Williams. 1st Edition, Routledge publications.
2. *Solid and Hazardous Waste Management,* M.N. Rao & Razia Sultana 2nd Edition BS publications

SEMESTER VI (PROJECT WORK)

Course Code		Course Title	PROJECT WORK
Course Credits	**02**	Hour of Teaching/week	**04**
Total Contact Hours		Formative Assessment Marks	**10**
Exam Marks	**40**	Exam Duration	**3 Hours**

Guidelines:

1. The project is of 4 Hours per week for one semester duration.
2. The synopsis approval will be given by the project Guides.
3. The project work should be a group of not more than FOUR members.
4. The project labs will focus on survey, planning, designing, coding and testing of the project.

Scheme of Valuation for Project

Internal Assessment for Project

Assessment type	**Marks**
Internal, Attendance, Documentation	05
Development work, Report	05
TOTAL MARKS	**10**

Final Assessment for Project Work

Assessment Type	**Marks**
Write up regarding Project	05
Presentation (PPT or Seminar)	15
Demonstration	10
Viva Voce	10
TOTAL MARKS	**40**

Kuvempu University, Shankargatta, Shivamogga
Subject: Electronics(UG)

Skill Enhancement Course(SEC) question paper pattern 4th, 5th and 6th semester

Time:2 hours Max Marks:40

Section A

Answer all questions: 5X2=10

1.
2.
3.
4.
5.

Section B

Answer any SIX of the Following: 6X5=30

6.
7.
8.
9.
10.
11.
12.
13.