

**Savitribai Phule Pune
University
Faculty of Science & Technology**



**Curriculum
For Bachelor of Vocational Electrical
(Engg)
First Year
(Choice Based Credit System) (2020Course)**

(With Effect from AcademicYear2024-25)

B.Voc Electrical First Year Structure for Semester-I												
Course Code	Course Name	Teaching Scheme (Hrs/Wk)		Examination Scheme and Marks						Credits		
		Th	Pra	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
E101	Introduction to Basic Electrical	03		50	50				100	03		03
E102	Fundamental Of Electronics	03		50	50				100	03		03
E103	Electric Wiring	03		50	50				100	03		03
E104	Introduction To Electric Vehicle	03		50	50				100	03		03
E105	Practical Wiring Application		02				50	--	50		1.5	1.5
E106	Basic Electrical Lab		02				50	--	50	--	1.5	1.5
E107	On Job Training		18			100			100		15	15
Total		12	22	200	200	100	100		600	12	18	30
B.Voc Electrical First Year Structure for Semester-II												
Course Code	CourseName	Teaching Scheme (Hrs/Week)		Examination Scheme and Marks						Credits		
		Theory	Prac	ISE	ESE	TW	PR	OR	Total	TH	PR	Total
E201	Electric Vehicle Design	03		50	50				100	03		03
E202	Digital Electronics	03		50	50				100	03		03
E203	Modern tools in Electrical Maintenances	03		50	50				100	03		03
E204	Electrical Cables And Conductors	03		50	50				100	03		03
E205	Electric and Hybrid Vehicles Lab		04				100	--	100		3	3
E206	On Job Training		18			100			100		15	15
Total		12	22	200	200	100	100		600	12	18	30

BACHELOR OF VOCATIONAL IN ELECTRICAL

FIRST YEAR SYLLABUS

Semester - 1

Subject-E101 Introduction to Basic Electrical

Unit 1: Basics of Electricity-

- Definition of voltage, current, and resistance
- Units of different electric quantities
- Relationship between voltage, current, and resistance in circuits

Unit 2: Basic Laws in Electrical-

- Ohms Law
- Coulombs law
- Faraday's laws of Electromagnetic Induction
- Basic terms & units in electric circuits

Unit 3: Electrical Components and Circuits

- Resistors
- Inductors
- Capacitors
- Series circuit
- Parallel circuit

Unit 4: Safety Precautions in Electrical Work

- Electrical Hazards Awareness
- Personal Protective equipments
- Do's and don'ts while working on electrical site

Unit 5: Magnetic Circuits

- Definition of magnetic circuit
- Important terms in magnetic circuit(flux, flux density, MMF, Reluctance etc.)
- Comparison between electric and magnetic Circuits

Subject-E102 Fundamental of Electronics

Unit 1: PN Junctions and Diodes

- Introduction to semiconductor Materials
- Formation of P-N junctions
- Forward and reverse bias operation
- Applications of diodes

Unit 2: Introduction to Electronic components

- Introduction to transistors
- BJT, FET and their applications
- IGBT and their applications

Unit 3: Introduction to PCB

- Introduction to Bread Board
- PCB designing processes
- Applications

Unit 4: Introduction to Electronic Measurement Instruments

- Digital Multimeter
- Digital storage Oscilloscope
- Cathode Ray Oscilloscope

Unit 5: Introduction to Advance Technologies in Electronics

- Introductions & Applications of Microprocessors
- Introductions & Applications Microcontrollers
- Introductions & Applications Arduino Uno

Subject-E103 Electrical Wiring

Unit 1: Residential Wiring Systems

- Importance of safety in electrical work
- Proper use of personal protective equipment (PPE).
- Understanding different wiring systems used in residential settings (e.g., conduit, armored cable, non-metallic sheathed cable).
- Advantages and disadvantages of each wiring system.

Unit 2: Commercial and Industrial Wiring

- Understanding switchgear and distribution panel components.
- Installation and maintenance practices.
- Installation of lighting systems, power outlets, and other commercial electrical devices.
- Three-phase power systems and their applications.

Unit 3: Troubleshooting Common Wiring Issues

- Identifying and resolving common electrical issues.
- Compliance with National Electrical Code (NEC) or local regulations.
- Routine maintenance practices for commercial wiring systems.
- Identifying and resolving common electrical issues.

Unit 4: Wiring Estimation

- Knowledge of various types of electrical cables, wires, conduits, and other materials used in wiring.
- Developing skills in estimating the cost of electrical wiring projects.
- Considering labor, material, and overhead costs in the estimation process.
- Creating project schedules, timelines, and milestones for wiring installations.

Subject –E104 Introduction to Electric Vehicles

Unit 1: Overview of Electric Vehicle technology

- Definition and types of electric vehicles (Battery Electric Vehicles, Plug-in Hybrid Electric Vehicles, Hybrid Electric Vehicles).
- Battery technology: Types of batteries used in EVs (lithium-ion, solid-state, etc.), battery management systems, charging infrastructure.
- Electric motors: Types of electric motors used in EVs (induction motors, permanent magnet motors), motor controllers.
- Power electronics: Inverters, converters, and their role in controlling power flow in EVs.

Unit 2: Charging Systems

- Overview of charging levels (Level 1, Level 2, DC fast charging).
- Charging infrastructure: Charging stations, home charging, public charging, and emerging technologies.
- Battery Management System (BMS)

Unit 3: Electric Vehicles (BE Vs, PHEVs, HEVs)

- Battery Electric Vehicles (BEVs)
- Plug-in Hybrid Electric Vehicles (PHEVs)
- Hybrid Electric Vehicles (HEVs)
- Extended Range Electric Vehicles (EREVs)
- Fuel Cell Electric Vehicles (FCEVs)
- Electric Bicycles (e-bikes)

Unit 4: Components and systems of Electric Vehicles

- Electric Motor, Battery Pack: Power Electronics
- Charging System
- Thermal Management System
- Electric Power Steering (EPS):
- Regenerative Braking System:

Subject –E105 Practical Wiring Applications (Lab)

- 1) Task:** Build a simple electrical circuit using components such as switches, resistors, and LEDs.

Objective: Understanding the fundamentals of circuitry, basic components, and how to create a closed loop.

- 2) Task:** Construct series and parallel circuits with resistors and lights.

Objective: Differentiate between series and parallel connections, and observe the impact on voltage, current, and resistance.

- 3) Task:** Design circuits with different types of switches (toggle, push-button, rotary).

Objective: Learn how switches control the flow of electricity and create open or closed circuits.

- 4) Task:** Simulate wiring for a room with outlets, switches, and lighting.

Objective: Introduce students to residential electrical wiring practices, emphasizing safety and proper installation.

- 5) Task:** Wire a three-way switch circuit for controlling a light from two different locations.

Objective: Understand the principles of three-way switching commonly used in residential and commercial settings.

Subject – E106 Basic Electrical Lab.

- 1) To measure insulation resistance of electrical equipment's/cable using Megger
2. To demonstrate different types of electrical protection equipments such as fuses, MCB, MCCB, ELCB.
3. To measure of earth resistance at substation earthing using fall of potential method with IS 3043 standard.
4. To study of LT and HT electricity bills.
5. To study safety precautions while working on electrical systems, handling of various equipment's such as multimeter, ammeters, voltmeters, wattmeter's, real life resistors, inductors and capacitors
6. To verify KVL and Superposition theorem.
7. To verify Thevenin's theorem in a DC network

Subject – E107 On Job Training

BACHELOR OF VOCATIONAL IN ELECTRICAL

FIRST YEAR SYLLABUS

Semester 2:

Subject-1 Electric Vehicle Design

Unit 1-Principles of Electric Vehicle design

- Electric Propulsion
- Energy Storage
- Regenerative Braking
- Charging Infrastructure

Unit 2 -Vehicle dynamics and aerodynamics for Electric Vehicles

- Weight Distribution:
- Instant Torque:
- Battery Impact on Handling:
- Adaptive Suspension Systems:
- Streamlined Design:
- Underbody Paneling:
- Drag Coefficient:
- Active Aerodynamics:

Unit 3- Battery management systems

- Cell Monitoring:
- Balancing:
- Overvoltage and Undervoltage Protection:
- Temperature Management:
- State of Charge (SOC) Estimation:
- Charge and Discharge Control:
- Fault Detection and Diagnostics:

Unit 4 -Introduction to Electric Vehicle charging infrastructure

- Charging Stations, Smart Charging:
- Charging Network Operators, Charging Connector Standards

- Payment Systems:
- Interoperability:
- Grid Integration:

Subject-2 Digital Electronics

Unit 1 - Number Systems and Binary Codes

- Decimal System: Binary System
- Octal and Hexadecimal Systems:
- Conversion Between Number Systems:
- Place Value and Weighted Notation:
- Binary Coded Decimal (BCD), Gray Code, Excess-3 Code, ASCII Code, Unicode:
- Error Detection and Correction Codes, Hamming Code:

Unit 2 – Digital Components

- Active components, Passive components
- Multiplexers (MUX) and Demultiplexers (DEMUX):
- Arithmetic Logic Unit (ALU):
- Memory Units:
- Programmable Logic Devices (PLDs):
- Digital Multiprocessors:

Unit 3 - Microcontrollers and Embedded Systems

- Microcontrollers typically include a CPU (Central Processing Unit), RAM (Random Access Memory), ROM (Read-Only Memory), I/O (Input/Output) ports, timers, and sometimes peripherals like ADCs (Analog-to-Digital Converters).
- RTOS (Real-Time Operating System)
- Integration, Communication:

Unit 4 - Unit 3 – Digital Signal Processing

- Introduction, Digital vs. Analog Signals:
- Sampling and Quantization:
- Digital Signal:
- Advantages of DSP:
- DSP Operations:

Subject -3 Modern Tools in Electrical Maintenance

Unit 1- Thermal Imaging Cameras

- Principle of Operation, Infrared Spectrum:
- Detection of Temperature Differences:, Resolution:
- Applications: Building Inspections: Detecting insulation issues, water leaks, and HVAC irregularities.
- Electrical Inspections: Identifying overheating components in electrical systems.
- Industrial Maintenance: Monitoring machinery and equipment for abnormal heat patterns.
- Security and Surveillance: Detecting intruders in low-light or no-light conditions.
- Search and Rescue: Locating individuals in darkness or obscured environments.
- Medical Diagnostics: Detecting variations in skin temperature for certain health assessments.

Unit 2- Insulation Resistance Testers

- Introduction ,Purpose, Preventive Maintenance:
- Applications:
- Measurement Accuracy:
- Polarization Index (PI) and Dielectric Absorption Ratio (DAR):

Unit 2- Circuit Breaker Analyzers

- Introduction, Purpose, Operation
- Functional Testing:
- Contact Resistance Measurement:
- Coil Current Analysis:

Unit 3 - Motor Current Signature Analysis (MCSA)

- Principle:
- Operational Behavior:
- Frequency Analysis:
- Harmonics and Sidebands:
- Healthy Motor Baseline:
- Fault Detection:
- Stator Current Analysis:
- Rotor Current Analysis:

Unit 4 – Current Tester

- Purpose, Types of Current Testers
- Clamp Meters, Current Probes , Non-Contact Current Testers:
- Multimeter Functionality:
- Current Range: Accuracy, Display, Safety Features, Auto-Ranging, Hold Function:
- AC and DC Current Measurement:
- Battery Status Indicator:
- Durability and Build Quality:

Subject- 4 Electrical Cables and Conductors

Unit 1 - Types of Electrical Cables (Twisted Pair, Coaxial, Optical Fiber)

- Twisted Pair Cable:, Structure: Types ,Unshielded Twisted Pair (UTP): Shielded Twisted Pair (STP): Applications
- Coaxial Cable:
- Structure: Types:RG-6 and RG-59: RG-11: Applications: Structure: Types:
- Single-Mode Fiber (SMF): Multi-Mode Fiber (MMF): Applications
- Ethernet Cable (Cat5e, Cat6, Cat6a, Cat7):Structure.Types:Cat5e (Category 5e): Cat6 (Category 6): Cat6a (Category 6a): Cat7 (Category 7):.Applications.
- Power Cables, Structure: Types: Unarmored Power Cables: Armored Power Cables: Applications:
- Instrumentation Cables: Structure: Applications: Fire Alarm Cables:Structure:
- Applications:.Audio and Video Cables:Types:
- HDMI Cables: RCA Cables: Applications.

Unit 2 - Properties of Conductors and Insulators

- Electrical Conductivity:,Free Electron Availability
- Low Resistivity, Temperature Dependency:
- Thermal Conductivity: Skin Effect:
- Electrical Resistivity of insulators, Lack of Free Electrons
- High Resistivity, Dielectric Strength:

Unit 3 - Cable Sizing and Selection Criteria

- Current Carrying Capacity (Ampacity):
- Voltage Drop, Derating Factors
- Short Circuit Rating:

- Temperature Rating:
- Installation Method. Overload Protection, Mechanical Protection

Unit 4 -Cable Termination and Jointing Techniques

- Cold Shrink Termination:
- Heat Shrink Termination:
- Push-On (Slip-On) Termination:
- Bolted Type Termination:
- Taped Termination:
- Resin/Potting Compound Termination:
- Stress Cone Termination:
- Oil-Filled Termination:
- Resin/Potting Compound Joint:Heat Shrink Joint, Crimp Connector Join
- Compression Joint, Oil-Filled Joint, Slip-On Joint, Bolted Joint:

Subject -5 Project

Subject –6 On Job Training