

S.V. UNIVERSITY 4-YEAR HONOURS DEGREE PROGRAMME

BSc HONOURS DEGREE PHYSICS(Minor) SYLLABUS

(W.E.F. AY-2023-24)

SEMESTER – V

COURSE 5: APPLICATIONS OF ELECTRICITY AND MAGNETISM

(Theory – Credits: 3)

No. of hours per week: :3

Total contact hours: 45

COURSE OBJECTIVES (As per NAAC Model):

1. To enable students to understand the fundamental principles of electricity and magnetism and their practical applications.
2. To promote problem-solving and analytical skills through the application of theoretical concepts to real-world electrical and electronic devices.
3. To develop competencies in identifying and handling various electrical and electronic components.
4. To encourage scientific thinking and innovation through experimental learning and project-based assessments.
5. To foster interest in emerging technologies in electricity and magnetism, including energy-efficient systems, digital modulation, and smart devices.

COURSE LEARNING OUTCOMES (CLOs) (As per NAAC Model):

On successful completion of this course, students will be able to:

CLO Code	Course Learning Outcome (Mapped to Bloom's Level)
CLO 1	Identify and classify passive components such as resistors, inductors, and capacitors, and explain their applications in circuits. (Remembering, Understanding)
CLO 2	Apply Ohm's Law and network theorems to solve basic DC and AC circuit problems. (Applying)
CLO 3	Describe the construction and working principles of AC and DC generators, transformers, and motors. (Understanding)
CLO 4	Analyse amplitude and frequency modulation techniques in communication circuits. (Analysing)
CLO 5	Design and test basic power supply systems and understand troubleshooting techniques. (Creating, Evaluating)
CLO 6	Engage in hands-on experimentation and simulation to strengthen theoretical knowledge. (Applying)
CLO 7	Participate actively in co-curricular and extracurricular activities, demonstrating teamwork, communication, and technical presentation skills. (Applying, Creating)

Course Content (Syllabus):

Unit I: Passive Elements and Applications (9 Hours)

- Resistor: Types, colour coding, combinations (series/parallel), Ohm's Law, limitations
- Inductor: Principle, EMF induction, energy stored, types and combinations
- Capacitor: Principle, types, charging/discharging, colour coding
- Applications:
 - Resistors as heating and fuse elements
 - Inductors in fans, tuning circuits
 - Capacitors in motors, power supplies
 - *Introduction to smart materials such as thermistors, LDRs for sensing applications*

Unit II: Power Sources and DC Network Theorems (9 Hours)

- Power Sources: DC & AC, battery types, rechargeable batteries (Li-ion, Lead-acid), configurations
- Theorems: Thevenin's, Norton's, Maximum Power Transfer
- Applications: Voltage/current sources, SMPS in computers
- *Battery Management Systems (BMS) for Electric Vehicles and Renewable Energy Storage*

Unit III: AC/DC Generators and Transformers (9 Hours)

- AC Generator: Construction, working, types, applications
- DC Generator: Working, types, applications, losses
- Transformer: Construction, EMF equation, OC/SC tests, types (step-up/down), applications
- Motors: Single-phase motor, applications in household devices
- *Energy-efficient motors, integration with Smart Grid Systems, and IoT-enabled motor controls*

Unit IV: Modulation and Communication Circuits (9 Hours)

- Need for modulation, types: Amplitude Modulation (AM), Frequency Modulation (FM).
- Modulation index, waveforms, and power relations **of AM and FM modulations**
- Demodulation techniques: Diode detector **for AM modulation**
- AM/FM transmitters and receivers.
- *Basics of Digital Modulation (ASK, FSK, PSK), Software Defined Radio (SDR)*

Unit V: EM Induction & Power Supplies (9 Hours)

- DC Motor: Construction, operating principle, power calculation
 - Regulated Power Supply: 5V circuit design
 - Transformer design (step-up/down)
 - FM Radio circuit using LCR
 - Battery eliminator troubleshooting
 - Design of simple chargers and SMPS
 - *Wireless charging systems and USB-PD protocols*
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References (Open Access and Free Resources):

1. "Basic Electrical Engineering" by D.P. Kothari and I.J. Nagrath – [Free PDF on NPTEL](#)
2. "All About Circuits" – Open Source E-book [<https://www.allaboutcircuits.com/textbook/>]
3. NPTEL Course on Basic Electrical Circuits – [<https://nptel.ac.in/courses/108106182/>]
4. "Electric Circuits" by James W. Nilsson, Susan Riedel – INFLIBNET [<https://epgp.inflibnet.ac.in/>]
5. "Electrical Machines" by D.P. Kothari and I.J. Nagrath – e-PG Pathshala & NPTEL
6. "Electric Machinery Fundamentals" by Stephen Chapman – MIT OCW [<https://ocw.mit.edu>]
7. NPTEL: Analogue Communication [<https://nptel.ac.in/courses/108102091/>]
8. "Electronic Communication Systems" by George Kennedy – Archive.org Open Access PDF
9. Amrita Virtual Labs: Electrical Machines [<https://vlab.amrita.edu/>]
10. "Practical Electronics for Inventors" by Paul Scherz – [<https://archive.org/>]

COURSE 5: APPLICATIONS OF ELECTRICITY AND MAGNETISM

(Practical)

Number of Credits: 1

Number of hours per week: 2

Total: 30 Hours

PRACTICAL SYLLABUS

PRACTICAL COURSE OBJECTIVES

- To develop hands-on skills related to circuit construction, measurement, troubleshooting, and testing of electrical and magnetic components and devices.
 - To provide practical exposure to real-world electrical applications using standard instruments and components.
 - To promote safety awareness and accuracy in using tools like multimeters, CROs, and soldering kits.
 - To support analytical thinking and design capability through guided experiments and circuit building.
 - To integrate theory with practice for a deeper understanding of electromagnetic and circuit-based systems.
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PRACTICAL LEARNING OUTCOMES (PLOs)

After successful completion of the practical course, students will be able to:

PLO Code	Practical Learning Outcome (Mapped to Bloom's Level)
PLO1	Identify and operate various electrical components and instruments. (<i>Remembering, Applying</i>)
PLO2	Design and assemble simple electrical circuits. (<i>Applying, Creating</i>)
PLO3	Test and troubleshoot electrical circuits and devices using standard procedures. (<i>Analysing, Evaluating</i>)
PLO4	Understand and apply electromagnetic induction principles through practical demonstrations. (<i>Understanding, Applying</i>)
PLO5	Use measuring instruments like multimeters, CRO, and test equipment effectively. (<i>Applying, Evaluating</i>)

LIST OF PRACTICALS

1. Soldering techniques and practice.
 2. Design and construct a 5V DC unregulated power supply.
 3. Construction and voltage measurement of step-down transformer.
 4. Series and parallel combinations of resistors, capacitors, and inductors; measurement and verification.
 5. Use digital and analogue multimeters to measure voltage, current, and frequency (AC/DC).
 6. Test diode and transistor functionality; identify transistor type (PNP/ NPN).
 7. Construct an RLC series circuit and find the resonance frequency using an AC source.
 8. Construct an RLC parallel circuit and find the resonance frequency.
 9. Detect open and short circuits using continuity tests.
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List of Practical References

1. Soldering Techniques and Practice
References: *Laboratory Manual for Introductory Electronics Experiments* by L.K. Maheshwari & M.M.S. Anand; [Soldering is Easy PDF](#); [CSU Soldering Lab Manual](#)
2. Design and Construct a 5V DC Unregulated Power Supply
References: *Electricity-Electronics Fundamentals* by P.B. Zbar et al.; [5V DC Supply Design PDF](#); [DK Pandey Lab Manual](#)
3. Construction and Voltage Measurement of Step-Down Transformer
References: *Basic Electrical and Electronics Engineering* by S.K. Bhattacharya; [Transformer PDF Guide](#); [UNCC Transformer Lab Manual](#)
4. Series and Parallel Combinations of Resistors, Capacitors, and Inductors
References: *Laboratory Manual: Basic Electrical Engineering* by U. Agarwal; [Series-Parallel Circuits Lab PDF](#); [Tinkering Workshop Manual](#)
5. Use Digital and Analogue Multimeters (AC/DC)
References: *Electronic and Electrical Servicing* by I.R. Sinclair & J. Dunton; [Multimeter Basics PDF](#); [AX-7030 User Manual](#)
6. Test Diode and Transistor Functionality; Identify PNP/NPN
References: *Troubleshooting Electronic Equipment* by R.S. Khandpur; [Diode/Transistor Testing Guide](#); [Brown University Lab Manual](#)
7. Construct an RLC Series Circuit and Find the Resonance Frequency
References: *Basic Electrical and Electronics Engineering* by S.K. Bhattacharya; [Iowa RLC Circuit Lab PDF](#); [UNCC RLC Resonance Manual](#)
8. Construct an RLC Parallel Circuit and Find the Resonance Frequency
References: *Electricity-Electronics Fundamentals* by P.B. Zbar et al.; [UoAnbar RLC Lab Manual](#); [NYU RLC Resonance PDF](#)
9. Detect Open and Short Circuits Using Continuity Tests
References: *Electronic and Electrical Servicing* by Sinclair & Dunton; [DK Pandey Lab Manual](#); [AX-7030 User Manual](#)

STUDENT ACTIVITIES (Co-Curricular and Extra-Curricular)

- **Mandatory Activities:**
 - Field visits to local electronics repair shops, motor winding workshops, or university instrumentation labs.
 - Submission of a fieldwork/project report documenting observations and learning (max 10 pages).
 - Minimum 15 hours of guided training by teachers or experts in lab and field.
- **Suggested Co-Curricular Activities:**
 - Technical assignments (component identification, circuit design, safety protocols).
 - Seminars, group discussions, quizzes, and debates on related electrical and electronic topics.
 - Video preparation demonstrating the use of electrical tools and devices.
 - Collection and documentation of technical materials (photos, diagrams) on motors, transformers, etc.
 - Visits to electrical/electronic industries, research labs, or academic centres.
 - guest lectures from industry and academia.
 - *Recent development: Student projects on renewable energy systems, smart appliances, and IoT in electrical devices.*

CONTINUOUS EVALUATION METHODS (As per NAAC Guidelines)

- Unit Tests and Internal Examinations (written and practical).
- Surprise quizzes on recent topics using online platforms like Kahoot!, Quizizz.
- Assignments and project submissions are evaluated on technical content and presentation.
- Lab performance and report evaluation.
- Seminar and presentation assessments.
- Use of SWAYAM and NPTEL quizzes and certification for knowledge validation.
- Peer evaluation and group activity assessments.

USEFUL RESOURCES

- **For Teachers:**
 - NPTEL Video Lectures and e-Books: <https://nptel.ac.in/>
 - INFLIBNET e-PG Pathshala: <https://epgp.inflibnet.ac.in/>
 - SWAYAM Platform Courses: <https://swayam.gov.in/>
 - Amrita Virtual Labs: <https://vlab.amrita.edu/>
- **For Students:**
 - All About Circuits e-book: <https://www.allaboutcircuits.com/textbook/>
 - MIT Open Courseware Electrical Machines: <https://ocw.mit.edu>
 - Free electronics textbooks on Archive.org

- Interactive simulations on PhET: <https://phet.colorado.edu/>
 - Online courses on Coursera and EdX related to electrical engineering basics (free audit mode)
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QUIZ AND SEMINAR TOPICS

- Principles and applications of resistors, capacitors, and inductors.
 - Network theorems and their applications in circuit design.
 - Working and types of electrical machines.
 - Modulation techniques and communication circuits.
 - Recent advancements in electric motors and power supplies.
 - Emerging trends: Renewable energy integration, IoT in electrical devices.
 - Guest lecture topics: Smart grids, energy-efficient appliances, advances in battery technology.
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FIELD VISIT SUGGESTIONS

- Local electronics and motor repair workshops.
 - University research labs in electrical and instrumentation engineering.
 - Nearby electrical manufacturing or power supply companies.
 - Renewable energy plants (solar/wind).
 - Electronics industries focusing on embedded systems and IoT.
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EXTRA READING & RESEARCH PAPER REFERENCES

- Papers on energy-efficient motor design and smart grids in journals like IEEE Xplore, available via ONOS/Open Access.
 - Research on modulation techniques and communication circuits from IEEE Communications Magazine.
 - Articles on battery management and power electronics from Elsevier journals (open access versions).
 - Encourage students to participate in seminars and present papers based on these readings to develop a scientific temper and communication skills.
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SRI VENKATESWARA UNIVERSITY
4-YEAR BSc HONOURS DEGREE EXAMINATION
Physics Minor (W.E.F. AY-2023- 24)
COURSE 5: APPLICATIONS OF ELECTRICITY AND MAGNETISM
MODEL QUESTION PAPER

Time: 3 Hours

(Semester-V)

Max. Marks: 75

Section A

Answer any five of the following. Each question carries 5 marks.

(5 × 5 = 25 marks)

1. Explain the principle of energy storage in inductors and their use in tuning circuits.
2. Compare the characteristics of Li-ion and lead-acid batteries.
3. State and explain Thevenin's Theorem with a suitable example.
4. What are the losses in a DC generator, and how do they affect efficiency?
5. Define modulation index. How does it affect AM wave characteristics?
6. Describe the construction and working of a diode detector for AM demodulation.
7. Explain the construction and principle of a DC motor.
8. Write a short note on thermistors and LDRs in sensing applications.

Section B

Answer all five questions. Each question carries 10 marks.

(5 × 10 = 50 marks)

9. (a) Describe different types of resistors with colour coding. Explain their applications in heating and fuse circuits.

OR

(b) Explain the working of capacitors in motors and power supplies. Add notes on smart passive components.

10. (a) Discuss different types of batteries and their configuration. How is BMS important in Electric Vehicles?

OR

(b) Explain Norton's Theorem with a circuit diagram. Give one practical application.

11. (a) With a neat diagram, explain the construction and working of a single-phase transformer. Derive its EMF equation.

OR

(b) Discuss the working of a single-phase motor. How are energy-efficient motors integrated with smart grids?

12. (a) What is the need for modulation? Compare AM and FM with waveforms and power relations.

OR

(b) Explain any two digital modulation techniques and give an overview of Software Defined Radio (SDR).

13. (a) Design a regulated 5V power supply and explain the role of each component.

OR

(b) Discuss the construction and working of wireless charging systems. Explain USB-PD protocols with examples.

S.V. UNIVERSITY 4-YEAR HONOURS DEGREE PROGRAMME

BSc HONOURS (PHYSICS Minor) DEGREE SYLLABUS

(W.E.F. AY-2023-24)

SEMESTER – V

Course 6: Electronic Instrumentation

(Theory – Credits: 3)

No. of hours per week: 3

Total contact hours: 45

Course Objectives (COs):

This course aims to:

1. Provide foundational knowledge of electronic measuring instruments.
2. Develop a practical understanding of instrument construction and operation.
3. Introduce display systems, transducers, signal processing, and biomedical instrumentation.
4. Emphasise precision, safety, calibration, and troubleshooting in measurements.
5. Equip students with knowledge of real-life applications of instrumentation in various fields.

Course Learning Outcomes (CLOs):

On successful completion of this course, students will be able to:

CLO Code	Course Learning Outcome
CLO1	Identify and describe the components of a basic instrumentation setup
CLO2	Distinguish between analogue and digital measuring instruments
CLO3	Demonstrate the use of CROs, multimeters, and function generators for measurements
CLO4	Explain the working principles of transducers and display devices
CLO5	Understand and interpret the functions of biomedical instruments like the ECG and pulse oximeter

Theory Syllabus (Total: 45 hours)

UNIT–I: Introduction to Instruments (9 hours)

- a) Basics of Measurement:** Accuracy, precision, sensitivity, resolution, range, types of errors, Classification of instruments: Analogue vs Digital, Construction and working: Analogue & Digital Multimeter (block diagram), DC/AC voltmeter, Display systems: $3\frac{1}{2}$ & $4\frac{1}{2}$ digit DMM, specifications and error analysis in resistance, voltage, and current measurements
- b) Mechanical Instruments:** Working principle of Moving Iron (MI) & Permanent Magnet Moving Coil (PMMC) instruments

UNIT–II: Oscilloscopes (9 hours)

- a) Cathode Ray Oscilloscope (CRO):** Block diagram, CRT structure and functioning, major controls
- b) Applications of CRO:** Measurement of voltage (AC/DC), time period, and frequency, Advanced types: Dual trace, Digital Storage Oscilloscope (DSO), Sampling Oscilloscope

UNIT–III: Transducers and Electrical Bridges (9 hours)

- a) Transducers:** Working of LVDT, resistive, capacitive, inductive, piezoelectric transducers
- b) AC/DC Bridge Circuits:** DC Wheatstone Bridge, AC Maxwell's Bridge, Schering Bridge, Frequency measurement: Wien Bridge

UNIT–IV: Data Converters and Display Devices (9 hours)

- a) Data Converters:** DAC: Binary ladder network, ADC: Successive Approximation ADC
- b) Display Devices:** LEDs, Seven Segment Displays (SSD): Construction, CA & CC types, LCDs: Working, applications, and limitations

UNIT–V: Amplifiers, Oscillators & Biomedical Instruments (9 hours)

- a) Signal Processing Circuits:** Classification: Voltage, power, operational amplifiers, RC Coupled amplifier: Frequency response (qualitative), Feedback: Positive and negative, Barkhausen criterion, RC phase shift oscillator
- b) Biomedical Instruments:** Working principles of: (i) ECG machine, (ii) X-Ray & Radiography
(iii) Ultrasound scanner (iv) Ventilator (v) Pulse oximeter

References

1. **H.S. Kalsi** – *Electronic Instrumentation*, McGraw-Hill, ISBN: 9780071070210 [PDF: \[McGraw-Hill eBook\]](#)
2. **Clyde F. Coombs** – *Electronic Instrument Handbook*, McGraw-Hill, ISBN: 9780071440259
3. **Mandeep Singh** – *Introduction to Biomedical Instrumentation*, PHI, ISBN: 9788120342228
4. **W.D. Cooper & A.D. Helfrick** – *Electronic Instrumentation and Measurement Techniques*, PHI, ISBN: 9788120306534

5. **A.K. Sawhney** – *Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai, ISBN: 9788177001006
6. **B.L. Theraja** – *A Textbook of Electrical Technology*, S. Chand, ISBN: 9788121924409
7. **Leslie Cromwell et al.** – *Biomedical Instrumentation and Measurements*, PHI, ISBN: 9788120300044
8. **Kishor K. Lal** – *Electronic Measurements and Instrumentation*, Pearson, ISBN: 9789332535175
9. **A.K. Sahan** – *Electrical and Electronic Measurements*, Dhanpat Rai Publications
10. **Online Resources** – IEEE Xplore, NPTEL, MIT OCW, e-PG Pathshala, Virtual Labs (IITs)

SEMESTER – V

COURSE 6 - ELECTRONIC INSTRUMENTATION (Practical)

Number of Credits: 1

Number of hours per week: 2

Total: 30 Hours

Practical Objectives

This practical component aims to:

1. Provide hands-on experience with electronic measurement and instrumentation systems.
 2. Train students in the operation, calibration, and troubleshooting of basic lab instruments.
 3. Introduce the use of biomedical instruments and display modules in real-world contexts.
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Practical Learning Outcomes

After successful completion of the practical course, students will be able to:

PLO Code	Practical Learning Outcome
PLO1	Operate and calibrate CROs, DMMs, and signal generators.
PLO2	Measure electrical parameters using standard lab equipment.
PLO3	Use display modules like SSDs for numeric and alphabetic output.
PLO4	Perform real-world biomedical measurements like body temperature and blood pressure.
PLO5	Interpret real-time physiological signals using biomedical instruments such as ECG and oximeter.

PRACTICAL SYLLABUS (*Total: 12 Experiments*)

1. DMM usage for voltage, current, and resistance (AC/DC)
2. Measuring AC/DC voltages & frequency using CRO
3. Generate and measure waveforms (sine, square) using a Function Generator
4. Display 0–9 using a seven-segment display
5. LVDT-based displacement measurement

6. Measurement of AC impedance and power factor
 7. Maxwell's bridge for inductance
 8. Temperature measurement with digital thermometer – error estimation
 9. Blood pressure measurement using a sphygmomanometer
 10. SSD display of alphabets (a–h)
 11. Observe ECG machine operation and pattern recognition
 12. Use and analyse data from the Pulse oximeter
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Lab References

1. **J.P. Navani** – *Electronic Measurements and Instrumentation*, S. Chand, ISBN: 9788121939403
2. **A. De Sa** – *Principles of Electronic Instrumentation*, Elsevier, ISBN: 9788126528992
3. **S.P. Bihari et al.** – *Electronic Measurements & Instrumentation*, Vayu Education
4. **Maheshwari** – *Laboratory Manual for Introductory Electronics Experiments*, New Age, ISBN: 9788122430282
5. **Paul B. Zbar et al.** – *Electricity-Electronics Fundamentals*, McGraw Hill, ISBN: 9780028019361
6. Web sources: NPTEL, MIT OCW, Virtual Labs (IIT Bombay), YouTube educational channels

STUDENT ACTIVITY

Mandatory Field/Project Work

Total Duration: 15 Hours (Lab: 10 hours + Field: 5 hours)

1. Teacher-led Training (Lab-based: 10 hours)

This component provides students with hands-on experience under direct faculty supervision to develop familiarity and confidence in handling instrumentation devices. Activities include:

- Demonstrations and guided operation of electronic and biomedical instruments such as CRO, DMM, ECG, SSD, and pulse oximeter.
- Practice sessions to measure electrical parameters like voltage, current, and resistance using analogue and digital multimeters.
- Hands-on testing of signal processing using function generators and oscilloscopes to observe waveforms, measure frequency, and time periods.
- Assembly and testing of simple circuits, e.g., SSD display control or audio amplifier with op-amps.
- Error analysis and calibration exercises to strengthen understanding of real-world measurement deviations and correction techniques.

2. Student Fieldwork (Field-based: 5 hours)

Each student must choose one of the following options and complete a field-based study:

Options:

- Visit to an Electronic Service Centre
 - Objective: Understand real-world troubleshooting and repair of PCB-level components.
 - Observe: Soldering, desoldering, IC replacements, diagnostics of consumer electronics.
- Visit to a Medical Diagnostic Centre
 - Objective: Observe instrumentation in clinical diagnostics (ECG, CT/MRI scan, etc.)
 - Focus: Working of ECG, signal capturing, waveform patterns, patient safety protocols.
- Visit to an Instrumentation Laboratory (in industry or academic institution)
 - Objective: Exposure to industrial-grade sensors, data acquisition systems, transducers, automation instruments.
- Student Deliverable:
 - A 10-page handwritten field report, including:
 - Title of Visit/Project
 - Date, Institution/Industry visited, Resource persons met
 - Detailed technical observations
 - Photos/diagrams (if permitted)
 - Learning outcomes and reflections
 - Conclusion and suggestions

Marks for Field Report: 5 Marks (to be internally assessed by the teacher)

Suggested Co-Curricular Activities:

These activities enhance the understanding of instrumentation through academic engagement, creativity, and self-learning:

1. Invited Talks by Industry Experts
 - Conduct guest lectures from engineers or practitioners in electronics, instrumentation, and healthcare diagnostics.
 - Topics: Automation, IoT in instrumentation, medical electronics, etc.
 2. Seminars and Debates
 - Organise student seminars or group debates on recent innovations in instrumentation, e.g., wearable biomedical devices, smart sensors.
 3. Assignments
 - Topics: Measurement error analysis, electrical safety standards, diagnostic instrumentation layouts, troubleshooting techniques.
 4. DIY Activities (At Home)
 - Example Projects:
 - Make a simple stethoscope using tubes and diaphragms
 - Construct an SSD display control circuit using a 7447 IC and a 7-segment display
 5. Poster Presentations
 - Design educational posters showing internal block diagrams and working principles of biomedical instruments such as ECG, ventilators, pulse oximeters.
 6. Tutorial/Demo Videos Creation
 - Students to record short explainer videos or tutorials on:
 - How to use a CRO
 - Demonstrating a DMM for AC/DC measurements
 - Working principle of ECG or pulse oximeter
 7. Industrial Visits to Process Plants
 - Visit industries like cement, sugar, or chemical plants to observe instrumentation in control rooms, SCADA, and sensor networks.
 8. Attend Webinars/Virtual Workshops
 - Suggested Platforms: ISRO, DRDO, BARC, NI, or startups in electronic healthcare devices.
 - Encourage participation in relevant MOOCs or online certification courses.
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Marks for Field Report: 5

SRI VENKATESWARA UNIVERSITY
4-YEAR BSc HONOURS DEGREE EXAMINATION

(W.E.F. AY-2023- 24)

COURSE 6: ELECTRONIC INSTRUMENTATION

PHYSICS Minor MODEL QUESTION PAPER

Time: 3 Hours

(Semester-V)

Max. Marks: 75

Section A

Answer any five of the following questions. Each question carries 5 marks. (5 × 5 = 25 marks)

1. Define accuracy, precision, sensitivity, and resolution with examples.
2. Explain the construction and working of a PMMC instrument.
3. Describe the basic controls on a CRO and their functions.
4. Write a short note on resistive and piezoelectric transducers.
5. Compare Digital and Analog Multimeters.
6. Explain the working of a seven-segment display with CA and CC configuration.
7. State Barkhausen's criterion. What is its role in oscillator design?
8. Write the working principle of a pulse oximeter.

Section B

Answer all five questions. Each question carries 10 marks. (5 × 10 = 50 marks)

9. (a) Explain the classification of instruments. Describe the construction and working of a digital multimeter with a block diagram.

OR

(b) Discuss in detail the construction and working of MI and PMMC instruments. Mention their advantages and limitations.

10. (a) Draw the block diagram of a CRO and explain the function of each block. Describe CRT structure.

OR

(b) Explain the working of a Digital Storage Oscilloscope (DSO). How can voltage, frequency, and time period be measured using a CRO?

11. (a) Describe the working of LVDT and capacitive transducers. Mention their applications.

OR

(b) Explain the working of the Wheatstone bridge and Maxwell's bridge with neat circuit diagrams.

12. (a) Explain the working of a binary ladder-type DAC and a successive approximation-type ADC.

OR

(b) Discuss the construction and applications of LEDs and LCDs. Compare their advantages and limitations.

13. (a) What are the different types of amplifiers? Explain the frequency response of an RC coupled amplifier.

OR

(b) Describe the working principles of any **three** biomedical instruments from the following:

(i) ECG machine (ii) X-Ray machine (iii) Ultrasound scanner (iv) Ventilator (v) Pulse oximeter