Anekant Education Society's

Tuljaram Chaturchand College of Arts, Science andCommerce, Baramati

Autonomous

S. Y. B. Sc. (Computer Science)

Electronics (Sem. IV)

(2024 Pattern)

(w.e.f. June, 2025)

Semester	Paper Code	Title of Paper	No. of Credits
IV	COS-256-MN(C)	Fundamental of Instrumentation Techniques	2
	COS-257-MN(C)	Instrumentation Practical Lab	2

CBCS Syllabus as per NEP 2020 for S. Y. B.Sc. (Comp. Sci.) (SEM IV) (2024 Pattern)

Name of the Program : B. Sc. (Comp. Sci.)

Program Code : UCSEL

Class : S. Y. B.Sc. (Comp. Sci.)

Semester : IV

Course Type : Minor (Theory)

Course Code : COS-256-MN(C)

Course Title : Fundamental of Instrumentation Techniques

No. of Credits : 02

No. of Teaching Hours : 30

Course Objectives:

1. To understand the basic concepts and need for measurement and instrumentation systems.
2. To study the construction and working principles of various measuring instruments.
3. To learn about digital measuring instruments and their applications.
4. To understand the principles and operation of signal and function generators, CRO, and DSO.
5. To study different types of power supplies and their characteristics.
6. To develop the ability to select and use appropriate measuring instruments for various applications
7. To study different types of electronic instruments.

Course Outcomes:

By the end of the course, students will be able to:

CO1. To the basic concepts, need, and block diagram of measurement and instrumentation systems.

CO2. Identify and differentiate various types of instruments and their static and dynamic **characteristics** such as accuracy, precision, sensitivity, and errors.

CO3. Describe the working principle, construction, and operation of different digital measuring instruments like voltmeter, ammeter, and multimeter.

CO4. Analyze the block diagram, principle, and operation of signal and function generators, CROs, and DSO.
CO5. Examine and compare various types of power supplies (fixed, variable, dual, CVCC, SMPS) based on specifications and operating characteristics.
CO6. Apply knowledge of instrumentation to select and use appropriate measuring devices for practical measurement tasks

CO7: Apply measurement and instrumentation knowledge to select suitable instruments for specific applications.

Topics and Points of Learning:

Unit 1: Basics of Measurement and Instrumentation (10)

Introduction, Block diagram of Instrumentation system, Need of Instrumentation, General Measurement System, Classification of Instruments, Static and Dynamic characteristics of instruments, Measurement of physical parameters, measurement system block diagram,Measurement characteristics like accuracy, precision, sensitivity, linearity, resolution, reliability, repeatability, errors.types of error.

Unit 2: Digital Measuring Instruments (08)

Introduction to digital instruments, Block diagram, principle of operation, Accuracy of digital instruments,Its application ,digital instruments,Construction and working principles of Digital Multimeter, Volt meter, Current meter, multi-meter.

Unit3: Signal sources and Oscilloscope: (12)

Principle, block diagram, working and important specifications of signal and function generators, , single trace CRO, dual channel and dual trace CRO ,Concept of Digital Storage Oscilloscope (DSO).Power Supply: Principle, block diagram, working, important specifications and operating procedures for- Fixed voltage power supply, variable power supply, dual power supply, CVCC supply, SMPS.

Reference Books:

1. Helfrik A. & Copper W., Modern Electronic Instrumentation and measurement
2. Techniques, PHI. 2. Kalsi H. S., Electronic Instrumentation, TMH. 3. Bouwens, Digital Instrumentations, TMH
3. Rashid Muhammad H, Power Electronics, PHI
4. B. S. Sonde, Power Supplies, TMH

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13
CO1	1	1	2	1	1	-	2	1	-	-	2	3	-
CO2	1	-	1	3	-	-	1	-	2	2	2	1	-
CO3	-	1	3	-	-	-	3	2	2	2	-	-	-
CO4	3	-	-	-	-	-	-	3	-	-	3	-	-
CO5	-	-	-	2	3	-	2	-	1	3	-	-	-

Mapping justification:

PO1: Comprehensive Knowledge and Understanding:

CO1: Provides foundational knowledge about measurement principles and the structure of instrumentation systems, forming the conceptual base for further understanding.
CO2: Enhances understanding of how instruments function and perform, developing comprehensive knowledge of measurement characteristics and accuracy.
CO4: Strengthens theoretical and practical understanding of electronic test and measuring instruments essential for engineering applications.

PO2: Practical, Professional, and Procedural Knowledge

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems enables students to develop a strong foundation of professional knowledge. This theoretical understanding forms the basis for practical applications in instrumentation and measurement systems.

CO3: Describing the working principle, construction, and operation of digital measuring instruments like voltmeters, ammeters, and multimeters helps students connect theoretical principles with real-world devices. This enhances their procedural knowledge and professional competence in handling measurement equipment.

CO6: Applying knowledge of instrumentation to select and use appropriate measuring devices for practical measurement tasks demonstrates the students' ability to apply procedural and professional knowledge in real laboratory or field environments. It bridges the gap between conceptual understanding and hands-on implementation.

PO3: Entrepreneurial Mindset and Knowledge:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems builds foundational knowledge that helps students identify potential areas for innovation in designing or improving measurement setups.

CO2: By identifying and differentiating various instruments and their characteristics, students gain the ability to select suitable instruments for different applications — a skill essential for developing cost-effective and efficient solutions in entrepreneurial ventures.

CO3: Learning the working principles and operation of digital measuring instruments (such as voltmeters, ammeters, and multimeters) enhances students' capability to design or improve testing and diagnostic tools, fostering innovation and product development.

CO7: Applying measurement and instrumentation knowledge to select suitable instruments for specific applications encourages creativity, problem-solving, and decision-making — key traits of an entrepreneurial mindset in engineering practice.

PO4: Specialized Skills and Competencies:

: **CO1:**Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems provides students with the specialized technical foundation necessary for working with modern measurement technologies.

CO2: Identifying and differentiating various types of instruments and their static and dynamic characteristics develops analytical and technical skills essential for precise measurement and instrumentation applications.

CO5: Examining and comparing different types of power supplies (fixed, variable, dual, CVCC, SMPS) equips students with hands-on competencies to handle, operate, and troubleshoot electronic equipment — a vital specialized skill in instrumentation and electronics fields.

CO7: Applying measurement and instrumentation knowledge to select suitable instruments for specific applications enhances the students' ability to make informed technical decisions, demonstrating specialized competence in practical and industrial environments.

PO5: Capacity for Application, Problem-Solving, and Analytical Reasoning:

CO1:Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems enables students to logically analyze and interpret system components, fostering analytical and systematic problem-solving skills.

CO5: Examining and comparing various types of power supplies based on specifications and operating characteristics helps students develop the ability to evaluate and select appropriate solutions for specific measurement and testing problems.

CO7: Applying measurement and instrumentation knowledge to select suitable instruments for specific applications demonstrates the students' capacity to apply theoretical understanding to practical challenges, promoting analytical thinking and effective problem-solving in real-world scenarios.

PO7: Research-related Skills

CO1: Understanding the fundamental concepts, need, and block diagram of measurement and instrumentation systems provides a strong theoretical base essential for conducting research and experimentation in the field of measurement science.

CO2: Identifying and differentiating various instruments along with their static and dynamic characteristics enables students to analyze measurement accuracy and errors — a key aspect of research-based investigations and data validation.

CO3: Studying the working principles and operation of digital measuring instruments develops the ability to select suitable instruments and design accurate measurement setups for experimental research.

CO5: Analyzing and comparing different power supplies enhances research-related skills by enabling students to evaluate performance parameters and select optimal configurations for laboratory and experimental applications.

CO7: Applying measurement and instrumentation knowledge to select suitable instruments for specific applications cultivates the ability to design, test, and interpret experimental setups — essential competencies for research and innovation.

PO8: Learning How to Learn Skills:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems encourages continuous learning by helping students build a strong foundation for further exploration of advanced instrumentation technologies.

CO3: Learning the working principles, construction, and operation of various digital measuring instruments such as voltmeters, ammeters, and multimeters promotes self-learning and adaptability to new measurement tools and emerging technologies.

CO4: Analyzing the block diagram, principle, and operation of signal and function generators, CROs, and DSOs develops independent learning and critical thinking skills, enabling students to acquire and apply new technical knowledge throughout their careers.

PO9: Digital and Technological Skills:
CO2:Identifying and differentiating various instruments along with their static and dynamic characteristics helps students understand the functioning and digital integration of modern measuring systems, enhancing their technological proficiency.
CO3:Describing the working principle, construction, and operation of digital measuring instruments such as voltmeters, ammeters, and multimeters develops essential digital skills required for operating and maintaining advanced measurement devices.
CO5:Examining and comparing various types of power supplies based on specifications and characteristics enables students to gain practical experience in handling electronic and digital testing equipment, strengthening their technical competency.
CO6:Applying instrumentation knowledge to select and use appropriate measuring devices for practical tasks builds hands-on technological skills, ensuring readiness to work with modern digital instrumentation systems in real-world environments.
PO10: Multicultural Competence, Inclusive Spirit, and Empathy:
CO2:Understanding and differentiating various types of instruments and their characteristics fosters teamwork and collaboration in diverse laboratory environments, promoting respect for different viewpoints and inclusive problem-solving approaches.

CO3:Learning about the operation and applications of digital measuring instruments encourages cooperative learning and the sharing of ideas among students from varied backgrounds, building empathy and mutual understanding in technical discussions.

CO5:Analyzing and comparing different types of power supplies cultivates collaborative and inclusive learning experiences as students work together to interpret results, appreciate diverse perspectives, and support one another in practical experimentation.

PO11: Value Inculcation and Environmental Awareness:

CO1:Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems helps students recognize the importance of accuracy, ethics, and responsibility in engineering measurements, fostering professional values and integrity.

CO4:Analyzing the block diagram, principle, and operation of signal and function generators, CROs, and DSOs develops awareness of energy-efficient instrumentation practices and encourages the responsible use of electronic resources.

CO7:Applying measurement and instrumentation knowledge to select suitable instruments for specific applications promotes environmentally conscious decision-making by encouraging the use of reliable, efficient, and sustainable measurement techniques.

PO12: Autonomy, Responsibility, and Accountability:

CO1:Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems develops a sense of responsibility in students to apply theoretical knowledge accurately and ethically in practical situations.

CO2:Identifying and differentiating various instruments and their characteristics cultivates accountability in selecting appropriate tools and methods, ensuring reliable and responsible measurement practices.

CO6:Applying instrumentation knowledge to select and use suitable measuring devices for practical tasks encourages independent decision-making, self-reliance, and a professional attitude toward achieving accurate and safe measurement outcomes.

Syllabus for S. Y. B.Sc. (Comp.Sci.) (2024 Pattern)

Name of the Program : B. Sc. (Comp. Sci.)
Program Code : UCSEL
Class : S. Y. B.Sc. (Comp. Sci.)
Semester : IV
Course Type : Minor (Practical)
Course Code : COS-257-MN(C)
Course Title : Instrumentation Practical Lab
No. of Credits : 02
No. of Teaching Hours : 60

Course Objective:

1. To understand the principle and operation of the LM-35 temperature sensor.
2. To understand real-time measurement and control applications.
3. To measure temperature accurately using the sensor.
4. To understand the working principle and internal block diagram of a function generator.
5. To design and test a variable voltage power supply.
6. To study different types of waveforms (sine, square, triangular).
7. To understand measurement accuracy, sensitivity, and calibration.

Course Outcome:

CO1**:** Students will be able to understand and apply the working principles of various sensors, instruments, and measurement systems.

CO2**:** Students will gain practical skills in assembling, testing, and operating measurement and instrumentation circuits.

CO3: Students will be able to measure and analyze electrical and physical parameters accurately.

CO4: Students will develop the ability to interpret experimental data and troubleshoot instrumentation systems.

CO5: Students will understand the applications of different measurement devices in real-world scenarios.

CO6: Students will gain experience in interfacing sensors, instruments, and control systems for practical applications.

CO7: Students will develop problem-solving, analytical, and critical thinking skills relevant to measurement and instrumentation.

List of practicals:

List of Practical (Instrumentation): Group(A)

1.LM-35 based temperature sensing system.

2. Study of Function generator

3. Multi-range voltmeter

4. Variable power supply using IC 317.

5. Study of CVCC.

6. Build and test LDR based light control system.

7. Study of CRO.

8.Study of Fixed voltage regulator supply.

9. Study of SMPS.

10. Study of DSO.

11.Build and test Instrumentation Amplifier.

12. Instrumentation Amplifier for a given gain.

13. Low current Negative power supply using IC 555.

14. Study of Linear Variable Differential Transformer.

15.Temperature measurement and control of using Thermistor.

Group B – Activity (Any two):

1. Seminar/Group Discussion.

2. Internet Browsing

3. Hobby projects.

Mapping of Program Outcomes with Course Outcomes

Weightage: 1=Weak or low relation, 2=Moderate or partial relation, 3=Strong or direct relation

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CO1	1	1	2	1	-	3	2	1	-	-	2	3	1
CO2	1	-	1	3	-	2	1	-	2	2	2	1	-
CO3	-	1	3	-	-	-	3	2	2	2	-	-	2
CO4	3	-	-	-	-	-	-	3	-	-	3	-	-
CO5	-	-	-	2	-	-	2	-	1	3	-	-	-
CO6	-	3	-	-	-	-	-	-	1	-	-	3	2
CO7	2	-	1	1	-	-	2	-	-	-	2	-	-

Mapping justification:

PO2: Practical, Professional, and Procedural Knowledge:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems equips students with the practical knowledge required to approach real-world instrumentation problems professionally.

CO3:Describing the working principles, construction, and operation of digital measuring instruments like voltmeters, ammeters, and multimeters develops procedural knowledge for accurate measurement and experimentation.

CO6:Applying instrumentation knowledge to select and use appropriate measuring devices for practical tasks enhances students' hands-on skills, ensuring they can implement measurement solutions effectively and responsibly in laboratory and field environments.

PO1: Comprehensive Knowledge and Understanding

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems provides students with a strong theoretical foundation, ensuring comprehensive knowledge of system components and their interactions.

CO2: Identifying and differentiating various instruments along with their static and dynamic characteristics enables students to develop an in-depth understanding of measurement principles, accuracy, sensitivity, and error analysis.

CO4: Analyzing the block diagram, principle, and operation of signal and function generators, CROs, and DSOs helps students grasp complex measurement techniques and signal analysis methods, enhancing their overall understanding of instrumentation systems.

CO7: Examining and comparing various types of power supplies (fixed, variable, dual, CVCC, SMPS) allows students to understand practical circuit implementations, performance characteristics, and operational limitations, completing their comprehensive knowledge of instrumentation and measurement setups.

PO3: Entrepreneurial Mindset and Knowledge:

CO1: Understanding the fundamental concepts, need, and block diagram of measurement and instrumentation systems allows students to identify opportunities for innovation in designing or improving measurement setups.

CO2:By identifying and differentiating various instruments and their characteristics, students develop the ability to select efficient and cost-effective solutions — an essential skill for entrepreneurial ventures.

CO3:Learning the working principles and operation of digital measuring instruments (voltmeter, ammeter, multimeter) enhances students' capability to innovate or improve measurement tools and devices.

CO7:Applying measurement and instrumentation knowledge to select suitable instruments for specific applications fosters creative problem-solving, resourcefulness, and decision-making.

PO4: Specialized Skills and Competencies:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems provides students with the specialized technical foundation required for working with modern measurement technologies.

CO2:Identifying and differentiating various types of instruments and their static and dynamic characteristics develops analytical and technical skills essential for precise measurement and instrumentation applications.

CO5:Examining and comparing different types of power supplies (fixed, variable, dual, CVCC, SMPS) equips students with hands-on competencies to operate and troubleshoot electronic instrumentation equipment.

CO7:Applying measurement and instrumentation knowledge to select suitable instruments for specific applications enhances students' ability to make informed technical decisions, demonstrating specialized competence in practical and industrial environments.

PO6: Communication Skills and Collaboration:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems helps students effectively communicate technical ideas and system designs in both written and verbal form.

CO2:Identifying and differentiating various instruments and their static and dynamic characteristics encourages collaboration during laboratory sessions, promoting teamwork, discussion,andcollectiveproblem-solving

PO7: Research-related Skills:

CO1:Understanding the fundamental concepts, need, and block diagram of measurement and instrumentation systems provides a theoretical foundation for conducting research and experimentation in measurement science.

CO2:Identifying and differentiating various instruments and their characteristics enables students to analyze measurement accuracy, errors, and performance parameters — essential for research-based investigations.

CO3:Studying the working principles and operation of digital measuring instruments develops the ability to design accurate experimental setups and select appropriate measurement devices for research purposes.

CO5:Analyzing and comparing different types of power supplies enhances research skills by enabling students to evaluate performance, efficiency, and suitability for experimental setups.

CO7:Applying instrumentation knowledge to select suitable instruments for specific applications cultivates the ability to design, test, and interpret experiments, fostering innovation and research competency.

PO8: Learning How to Learn Skills:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems encourages students to build a strong theoretical foundation and independently explore advanced instrumentation topics.

CO3:Learning the working principles, construction, and operation of digital measuring instruments such as voltmeters, ammeters, and multimeters develops self-learning abilities and adaptability to new measurement tools and technologies.

CO4:Analyzing the block diagram, principle, and operation of signal and function generators, CROs, and DSOs enhances students' critical thinking and independent learning skills, enabling them to acquire and apply new technical knowledge throughout their careers.

PO9: Digital and Technological Skills:

CO2:Identifying and differentiating various instruments along with their static and dynamic characteristics enhances students' understanding of modern digital measurement systems and technological integration.

CO3:Describing the working principle, construction, and operation of digital measuring instruments such as voltmeters, ammeters, and multimeters develops essential digital skills for operating and maintaining advanced instrumentation devices.

CO5:Examining and comparing various types of power supplies (fixed, variable, dual, CVCC, SMPS) equips students with practical experience in handling electronic and digital measurement equipment, strengthening technological competency.

CO6:Applying instrumentation knowledge to select and use appropriate measuring devices for practical tasks builds hands-on digital and technological skills, ensuring readiness to work with modern instrumentation systems in real-world scenarios

PO11: Value Inculcation and Environmental Awareness:

CO1: Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems helps students appreciate the importance of ethics, responsibility, and accuracy in engineering practice.

CO4:Analyzing the block diagram, principle, and operation of signal and function generators, CROs, and DSOs promotes awareness of energy-efficient instrumentation practices and responsible use of resources.

CO7:Applying measurement and instrumentation knowledge to select suitable instruments for specific applications encourages environmentally conscious decision-making and the adoption of sustainable measurement techniques.

PO13: Community Engagement and Service

CO1:Understanding the basic concepts, need, and block diagram of measurement and instrumentation systems enables students to share knowledge and guide communities in basic measurement and monitoring practices.

CO3:Learning the working principles and operation of digital measuring instruments allows students to assist in practical applications that benefit the community, such as local testing and monitoring projects.

CO6:Applying instrumentation knowledge to select and use appropriate measuring devices equips students to contribute to community projects, problem-solving, and hands-on technical support.

CO7:Applying measurement and instrumentation skills for specific applications encourages students to develop solutions for real-world community needs, promoting service-oriented engagement.