Karmaveer Bhaurao Patil University, Satara

Syllabus for
B. Sc. II Instrumentation Science

Under
Faculty of Science and Technology
(As per NEP 2020)

With effect from Academic Year 2025-2026

Syllabus for Bachelor of Science (B. Sc.) Part – II

Instrumentation Science

Preamble:

This syllabus is prepared for second year undergraduate students. At this level, to develop their interest towards Instrumentation techniques in science and also to prepare them for the academic, industrial exposure for global achievements. Introduction of instrumental techniques with the regular exercises will help to enhance analytical thinking of the students. The interdisciplinary approach with vigor and depth is compatible to the syllabi of other universities, at the same time is not rigid for the students at first year of their graduation.

1. TITLE: **Instrumentation science**
2. YEAR OF IMPLEMENTATION: **2025-2026**
3. DURATION: **01 year**
4. PATTERN: **Semester examination**
5. MEDIUM OF INSTRUCTION: **English**

6. STRUCTURE OF COURSE:

As per NEP-2020 (1.0)

Level	Sem.	Subject				OE	SEC	AEC	IKS	Total
		Major		Minor						
		T	P	T	P					
5.0	III	DSC V (2) DSC VI (2)	DSC P (4)	DSC V (2) DSC VI (2)	DSC P (2)	OE III (2)	SEC I (2)	AEC I English	IKS II (2)	22
5.0	IV	DSC VII (2) DSC VIII(2)	DSC P (4)	DSC VII (2) DSC VIII(2)	DSC P (2)	OE IV (2)	SEC II (2)	AEC II English	VEC II (2)	22

7. EVALUATION STRUCTURE:

Theory

Assessment Category	Internal Evaluation				ESE	Total Marks	Credits
	CCE-I	CCE-II	CCE-III	Total			
	10	10	10	20	30	50	2

Practical

Assessment Category	Internal Evaluation	ESE	Total Marks	Credits
	Journal / Viva/Activity			
	20	30	50	2

8. COURSE TITLE

1) Third Semester

Sr. No.	Subject	Theory				Practical		
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	DSC V (Major)	BIST 231	Dynamics of sensors and Transducer	2	2	BISP 233	1	2
2.	DSC VI (Major)	BIST 232	Laboratory Instrumentation	2	2			
3.	DSC V (Minor)	BIST 234	Fundamentals and applications of sensors and transducer	2	2	BISP 236	1	2
4.	DSC VI (Minor)	BIST 235	Instrumentation for Experimental Sciences	2	2			
5.	VSC I	-	Introduction to Scilab	-	-	BISPVSC-I	1	2
5.	OE	-	Artificial Intelligence studies	-	-	BISPOE III	1	2
6.	SEC	-	Design of Power Supply and PCB	-	-	BISPSEC I	1	2
7.	AEC	English		2	2	-		
8.	IKS	BISTIKS II	Contribution of instrumentation science in Indian knowledge	2	2	-		

2) Fourth Semester

Sr. No.	Subject	Theory				Practical		
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	DSC VII (Major)	BIST 241	Advancements in Power Instrumentation	2	2	BISP 243	1	2
2.	DSC VIII (Major)	BIST 242	Electrical instrumentation and motor control	2	2			

3.	DSC VII (Minor)	BIST 244(Minor)	Power System Instrumentation	2	2	BISP 246	1	2
4.	DSC VIII (Minor)	BIST 245	Electrical instrumentation & motor control	2	2			
5.	VSC II	-	Introduction to MATLAB	-	-	BISPVSC-II	1	2
6.	OE	-	Astronomics	-	-	BISPOE IV	1	2
7.	SEC	-	Introduction to Arduino and programming basics	-	-	BISPSEC I	1	2
8.	AEC	English		2	2	-		
9.	VEC	BISTVEC II	Enviournmental awareness for instrumentation	2	2	-		

9. OTHER FEATURES:

A) LIBRARY:

Reference books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENT:

a) Computer, LCD projector, visualizer, smart board

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : DSC (Major V)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 231-Dynamics of Sensors and Transducers

Course Objectives: Students should be able to….

1. understand key factors influencing the selection of transducers, such as environmental conditions, calibration requirements, and aging effects, to optimize their use in specific industrial and technological scenarios.
2. learn the application of sensors and transducers in diverse industries such as automotive, healthcare, manufacturing.
3. know the principles of various transducer technologies such as resistive, capacitive, inductive, and optical transducers.
4. study the working principles and applications of transducers and sensors.

Course Outcomes: After completion of syllabus students will be able to…..

1. identify performance characteristics and evaluate sources of error in measurement.
2. differentiate the roles of sensors and transducer.
3. design advanced instrumentation system for various scientific and industrial applications.
4. describe the analysis of circuit concepts.

Module	Title and Contents	Hrs
Module -1:	**Introduction to sensors and transducers** 1.1 . Definition- Based on Measurement Parameter**:** Temperature, pressure, humidity, light, motion, etc. Based on Signal Output**:** Analog and digital sensors. 1.2. Classification of Sensors: Active vs. Passive Sensors. Contact vs. Non-contact Sensors. 1.3. Characteristics of Sensors**:** Sensitivity, accuracy, precision, resolution, range and linearity Response time and environmental considerations (temperature, humidity)	08
Module -2:	**Applications of sensor** 2.1. Temperature Sensors: Thermocouples, thermistors, RTDs. 2.2 .Pressure Sensors: Piezoelectric and capacitive sensors. 2.3. Light Sensors**:** Photodiodes, phototransistors, LDRs (Light Dependent Resistors). 2.4. Proximity Sensors: Inductive, capacitive and ultrasonic	07
Module -3:	**Introduction to transducers** 3.1 . Definition of transducers 3.2 .Characteristics of transducers sensitivity, accuracy, range, resolution, and linearity , stability, repeatability, and dynamic response. 3.3. Classification of transducers :Active vs. Passive Transducers	07

	3.4 . Primary vs. Secondary Transducers.	
Module -4:	**Transducer applications** 4.1 Resistive Transducers: Strain gauges, thermistors 4.2 Capacitive Transducers: Pressure sensors, displacement sensors. 4.3 Inductive Transducers: LVDTs (Linear Variable Differential Transformers) proximity sensors. 4.4 Piezoelectric Transducers: Used for vibration and acoustic measurements.	08

Reference Books:

1. J. G. Webster. Measurement, Instrumentation, and Sensors Handbook. CRC Press, 1999.
2. J. P. Bentley. Principles of Measurement Systems. Pearson Education, 2005.
3. E. O. Doebelin and D. N. Manik. Measurement Systems: Application and Design. McGraw-Hill, 2007.
4. A. S. Morris and R. Langari. Measurement and Instrumentation: Theory and Application. Academic Press, 2012.
5. D. A. Bell. Electronic Instrumentation and Measurements. Oxford University Press, 2013.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation:20 M	**End Semester Examination:50M**
• Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks (Best of two CCE marks will be considered)	• Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50M into 30 M)

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : DSC (Major VI)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 232-Laboratory Instrumentation

Course Objectives: Students should be able to….

1. study a comprehensive understanding of the working principles, usage, and applications of advanced laboratory instruments such as ultrasonicator, potentiostat and SEM.
2. understand the principles and practical applications of chemical analysis instruments, including conductometers, potentiometers, and spectrophotometers.
3. gain practical experience in operating and calibrating essential electronics instruments such as LCR meters, microprocessors, microcontrollers, and power supplies.
4. learn hands on experience in an instrumentation techniques.

Course Outcomes: After completion of syllabus students will be able to…..

1. perform precise chemical analyses using instruments like conductometers, colorimeters, and spectrophotometers, and interpret the results to draw meaningful conclusions.
2. design electronic laboratory tools such as LCR meters, microcontrollers, and power supplies to complete tasks related to circuit design, testing, and repair.
3. ability to operate and maintain complex laboratory instruments (e.g.ultrasonicator, potentiostat, SEM) with minimal supervision and troubleshoot basic issues.
4. develop advanced instrumentation systems for various scientific and industrial applications.

Module	Title and Contents	Hrs
Module -1:	**Physics laboratory instruments** 1.1. Ultrasonicator, characterization. Applications in cleaning and sample preparation 1.2 .Potentiostat; Electrochemical analysis and material 1.3. Stroboscope 1.4. Silar coating Technique 1.5 **.** Electrospinning matchine	08
Module -2:	**Electronics laboratory instruments** 2.1 .LCR Meter: Measurement of inductance, capacitance, and resistance 2.2 .Power Supplies & UPS: Principles of operation and applications in laboratory setups. 2.3 .Constant current source & constant voltage source: Design, operation, and role in circuit testing	07

Module -3:	**Chemical sciences laboratory instruments** 3.1. Conductometer & Potentiomete : Principles of electrochemical measurements 3.2. Colorimeter: Techniques for concentration analysis of solutions 3.3. Spectro Photometer: Techniques for concentration analysis of solutions. 3.4.IR Spectrometer & UV Spectroscopy: Understanding molecular structures bonding	07
Module -4:	**Life sciences laboratory instruments** 4.1.Incubator: Principles, Construction, Working , Applications. 4.2.PCR : Principles, Construction, Working ,Applications. 4.3. Lab Scale Fermenter Unit 4.4 .Gel documentation: Design, operation, and role, application 4.5. Flame Photometer ,Laminar air flow meter	08

Reference Books:-

1. A. D. Helfrick and W. D. Cooper. Modern Electronic Instrumentation & Measurement Techniques. 2001.
2. M. R. Sharma. Chemical Instrumentation: A Systematic Approach to Instrumental Analysis. 2013.
3. D. A. Skoog, F. J. Holler, and S. R. Crouch. Principles of Instrumental Analysis. Cengage Learning, 2018.
4. H. H. Willard, L. L. Merritt Jr., J. A. Dean, and F. A. Settle Jr. Instrumental Methods of Analysis. Wadsworth Publishing, 1988.
5. A. J. Bard and L. R. Faulkner. Electrochemical Methods: Fundamentals and Applications. Wiley, 2001.

Evaluation Pattern:40:60

Total Marks: 50

Internal Continuous Evaluation: 20 Marks	**End Semester Examination:50 Marks**
• Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks (Best of two CCE marks will be considered)	• Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50M into 30 M)

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Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : DSC (Major P-III)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISP 233 Practical Lab (Practical lab based on BIST 231 and BIST 232

Course Objectives: Students should be able to….

1. study a comprehensive understanding of the working principles, usage and applications of advanced laboratory instruments such as ultrasonicator, potentiostat and SEM.
2. understand the principles and practical applications of chemical analysis instruments, including conductometers, potentiometers, and spectrophotometers.
3. gain practical experience in operating and calibrating essential electronics instruments such as LCR meters, microprocessors, microcontrollers and power supplies.
4. learn hands on experience in an instrumentation techniques.

Course Outcomes: After completion of syllabus students will be able to…..

1. perform precise chemical analyses using instruments like conductometers, colorimeters, and spectrophotometers, and interpret the results to draw meaningful conclusions.
2. design electronic laboratory tools such as LCR meters, microcontrollers, and power supplies to complete tasks related to circuit design, testing, and repair.
3. ability to operate and maintain complex laboratory instruments (e.g.ultrasonicator, potentiostat, SEM) with minimal supervision and troubleshoot basic issues.
4. develop advanced instrumentation systems for various scientific and industrial applications.

Sr. No	List of Experiments	Hrs
1.	Study of Characterization of a Resistive Temperature Detector (RTD)	60
2.	Study of Thermistor Response for Temperature Measurement	
3.	Measurement of Strain using a Strain Gauge and Wheatstone Bridge	
4.	Displacement Measurement using a Linear Variable Differential Transformer (LVDT)	
5.	Study of Piezoelectric Transducer	
6.	Understand Potentiostat function in electrochemical experiments and how to use it effectively.	
7.	Light Intensity Detection using a Light Dependent Resistor (LDR)	
8.	Study of distance Measurement using an Ultrasonic Sensor	
9.	Study of different parts of 3D printer.	

10.	Study of Incubator use for maintaining optimal conditions for cell culture and microbial growth.
11.	Study operating principles, safety precautions, and applications of ultrasonicator in physics experiments.
12.	Silar coating technique: Master the technique for coating samples with thin layers of silicon.
13.	Understand Dimmerstat use in controlling the intensity of light sources.
14.	Learn how to measure inductance, capacitance, and resistance accurately by using LCR meter.
15.	Study of Ph meter calibration and usage in measuring the acidity or alkalinity of solutions.

Reference Books:-

1. C. G. Herbert and R. A. W. Johnstone. Mass Spectrometry Basics. CRC Press, 2002.
2. J. M. Thompson. Mass Spectrometry. Jenny Stanford Publishing, 2018.
3. N. S. Nise. Control Systems Engineering. John Wiley & Sons, 2019.
4. W. Bolton. Programmable Logic Controllers. Newnes (Elsevier), 2015.
5. A. Bahga and V. Madisetti. Internet of Things: A Hands-On Approach. VPT, 2014.

Evaluation Pattern:40:60

Total Marks: 50 M

Internal Continuous Evaluation: (20 M)	**End Semester Examination: (30 M)**
• Journal: 10 M • Students Performance: 05 M • Viva : 05 M	• **Q. 1 = 30 M**

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Board of Studies in Electronics

Programme: B.Sc	**Semester** - IV
Type : Major (DSC VII)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 241-Advancements in Power Instrumentation

Course Objectives: Students should be able to….

1. understanding of the various types of analogue measuring instruments and their uses.
2. familiarise with working principles and application areas of digital measuring instruments.
3. understand the basic concepts associated with waveform generators.
4. learn experience in the use of various special instruments and their capabilities.

Course Outcomes: After completion of syllabus students will be able to…..

1. identify the various types of industrial chemical instruments and their uses
2. describe the common applications and identify the working principles of medical physics instruments
3. differentiate different types of waveform generated by a waveform generator and their characteristics.
4. utilize appropriate instrument setup procedures, techniques and capabilities for Special Instruments.

Module	Title and Contents	Hrs
Module -1:	**Smart and digital measurement systems** 1.1 .Evolution of electrical instruments 1.2 .Advanced oscilloscope functionalities (DSOs). 1.3 .Data Acquisition Systems (DAQ): Architecture, applications, and interfacing with IoT. 1.4.Introduction to smart meters for energy monitoring and analysis	08
Module -2:	**Power instrumentation** 2.1. Power analyzers for measuring active, reactive, and apparent power, along with harmonic analysis. 2.2. Phasor Measurement Units (PMUs): Applications in power grids and fault detection. 2.3. High-voltage testing equipment: Hipot testers and partial discharge analyzers. 2.4. .Energy meters and smart grid-compatible monitoring devices.	08
Module -3:	**Industrial chemistry instruments** 3.1. Uv-Florescence detector 3.2. Photo fluorimeter 3.3. Histometer 3.4. Biochemistry analyser 3.5. Gas chromatography	07

Module -4:	**Biomedical physics instruments** 4.1. X-ray machine**:** Introduction, working principle, diagram, applications 4.2. MRI machine**:** Introduction, working principle, applications 4.3 .CT-Scan machine: Introduction, working principle, advantages 4.4. ECG machine**:** Introduction, construction, working, applications	07

Reference Books:-

1. C. D. Johnson. Process Control Instrumentation Technology. Pearson Education, 2006.
2. R. S. Sirohi and H. C. Radha Krishna. Mechanical Measurements. New Age International, 2004.
3. T. G. Beckwith, R. D. Marangoni, and J. H. Lienhard V. Mechanical Measurements. Pearson Education, 2007.
4. A. S. Morris. Measurement and Instrumentation Principles. Butterworth-Heinemann, 2001.
5. W. Kester, ed. Data Conversion Handbook. Newnes, 2005.

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks • (Best of two CCE marks will be considered)	**End Semester Examination:50M** • Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50M into 30 M)

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Programme: B.Sc.	**Semester** - IV
Type : Major (DSC VIII)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 242 - Electrical Instrumentation and Motor Control

Course Objectives: Students should be able to….

1. understand the working principles of insulation resistance testers and their use in identifying faults in electrical systems.
2. learn the operation and applications of continuity testers and ground resistance testers in ensuring proper electrical grounding.
3. develop skills in using fault location and diagnostic tools, such as clamp meters and thermal cameras, for troubleshooting electrical systems.
4. study the basic concept related to motor control system.

Course Outcomes: After completion of syllabus students will be able to…..

1. identify insulation resistance in electrical systems and interpret the results for detecting potential insulation failures and safety risks.
2. describe use of continuity testers to check for circuit integrity and ground resistance testers to verify safe grounding in electrical systems.
3. design clamp meter for current measurement and thermal cameras for identifying hotspots or faulty components, improving troubleshooting efficiency.
4. utilize appropriate instrument setup procedures, techniques and capabilities for special instruments.

Module	Title and Contents	Hrs
Module -1:	**Fundamentals of electric motors** 1.1 Basic working principle: Electromagnetic induction 1.2 Classification of electric motors: AC Motors DC Motors 1.3 Special Motors (Stepper, Servo) 1.4 Comparison between AC and DC motors 1.5 Applications of electric motors in daily life and industry	07
Module -2:	**Types of electric motors and their working principles** 2.1 DC Motors 2.2 Brushed DC Motor and Brushless DC Motor (BLDC) 2.3 Working, construction, pros & cons 2.4 Applications 2.5 AC Motors	08

	2.6 Single-phase Induction Motor Three-phase Induction Motor 2.7 Synchronous Motor	
Module -3:	**Fundamentals of electrical instruments** 3.1 Introduction to Electrical Instruments: Overview of devices used to measure electrical parameters such as voltage, current, resistance, power, and energy. 3.2 Working Principles: Moving coil and moving iron principles for analog instruments 3.3 Characteristics of Instruments: Accuracy, precision, resolution, range,sensitivity	08
Module -4:	**Applications of electrical instruments** 4.1 Industrial: Monitoring and controlling electrical equipment. 4.2 Power Systems**:** Load analysis, fault detection, and energy auditing. 4.3 Research and Development**:** Testing circuits, characterizing components	07

Reference Books:-

1. C. D. Johnson. Process Control Instrumentation Technology. Pearson Education, 2006.
2. R. S. Sirohi and H. C. Radha Krishna. Mechanical Measurements. New Age International, 2004.
3. T. G. Beckwith, R. D. Marangoni, and J. H. Lienhard V. Mechanical Measurements. Pearson Education, 2007.
4. A. S. Morris. Measurement and Instrumentation Principles. Butterworth-Heinemann, 2001.

W. Kester, ed. Data Conversion Handbook. Newnes, 2005.

Evaluation Pattern: 40 :60

Total Marks: 50

Internal Continuous Evaluation: 20 M	**End Semester Examination:50 M**
• Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks • (Best of two CCE marks will be considered)	• Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50M into 30 M)

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - IV
Type : Major (DSC P-IV)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISP 243 Practical Lab (Practical based on BIST 241 and BIST 242)

Course Objectives: Students should be able to….

1. understand the principles behind laboratory instruments used in physics experiments.
2. study applications of electronic instrumentation in fields such as telecommunications, automation and instrumentation.
3. learn to operate laboratory instruments for chemical measurements, titration and spectroscopic analysis
4. know the importance of maintaining sterile conditions and safety protocols.

Course Outcomes: After completion of syllabus students will be able to…..

1. describe the evolution of measurement tools and how digital instruments provide more accuracy, efficiency, and capabilities compared to their analog counterparts.
2. design a DAQ system that interfaces with IoT devices, allowing real-time data collection, analysis, and monitoring of electrical systems.
3. develop skills to install and configure smart meters for accurate energy consumption monitoring, and use the data for energy efficiency and cost analysis.
4. identify performance characteristics and find sources of error in measurement.

Sr. No	List of Experiments	Hrs
1.	Study the architecture and functioning of DAQ system.	60
2.	Study the role of smart meters in modern energy monitoring systems.	
3.	Understand the transition of electrical instruments from analog to digital.	
4.	Learn how to use power analyzers to measure different types of power.	
5.	Study the principles and techniques of high-voltage testing equipment:Hipot testers.	
6.	Study construction, control speed & direction of a brushed DC motor.	
7.	Fault Detection with Clamp Meters: Identifying Short Circuits and Open Circuits.	
8.	Understand the basic components, working principle, and applications of an X-ray machine.	
9.	Study the working principle of an MRI machine and understand the role of magnetic fields and radio waves.	
10.	Study the working principle of a CT-Scan machine.	
11.	DC Motor Testing: Measuring Voltage, Current, and Speed for Shunt, Series, and Compound Motors.	

12.	AC Motor Testing: Understanding the Operation and Performance of Synchronous and Induction Motors.
13.	Study the working and wiring of a single-phase induction motor.
14.	Operate a BLDC motor using an Electronic Speed Controller (ESC).
15.	DC Motor Testing: Measuring Voltage, Current, and Speed for Shunt, Series and Compound Motors.

Reference Books:-

1. C. G. Herbert, R. A. W. Johnstone, *Mass Spectrometry Basics*, CRC Press, 2002
2. J. M. Thompson, *Mass Spectrometry*, Jenny Stanford Publishing, 2018
3. N. S. Nise, *Control Systems Engineering*, John Wiley & Sons, 2019
4. W. Bolton, *Programmable Logic Controllers*, Newnes (Elsevier), 2015
5. A. Bahga, V. Madisetti, *Internet of Things: A Hands-On Approach*, VPT, 2014

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**End Semester Examination: 30 Marks** **Q. 1 = 30 M**

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Programme: B.Sc	**Semester** - III
Type : DSC (Minor V)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 234-Fundamentals and Applications of Sensors &Transducers

Course Objectives: Students should be able to….

1. understand key factors influencing the selection of transducers, such as environmental conditions, calibration requirements, and aging effects, to optimize their use in specific industrial and technological scenarios.
2. learn the application of sensors and transducers in diverse industries such as automotive, healthcare, manufacturing
3. know the principles of various transducer technologies such as resistive, capacitive, inductive, and optical transducers.
4. study the working principles and applications of transducers and sensors.

Course Outcomes: After completion of syllabus students will be able to…..

1. identify critical factors for selecting appropriate transducers, such as accuracy, environmental suitability, and application-specific requirements, to ensure optimal system performance and reliability.
2. differentiate use of sensors and transducers in real-world applications across various industries such as automotive, healthcare, manufacturing, audio technology, and telecommunications.
3. develop a detailed understanding of the working principles, construction, and applications of different transducers.
4. describe the role of sensor and transducer in circuit.

Module	Title and Contents	Hrs
Module -1:	**Fundamentals of sensors and transducers** 1.1 .Definition- Based on Measurement Parameter**:** Temperature, pressure, humidity, light, motion, etc. Based on Signal Output**:** Analog and digital sensors. 1.2 .Classification of Sensors: Active vs. Passive Sensors. Contact vs. Non-contact Sensors. 1.3.Characteristics of Sensors**:** Sensitivity, accuracy, precision, resolution, range, and linearity Response time and environmental consideration (temperature, humidity).	08
Module -2:	**Applications of sensor** 2.1. Temperature Sensors: Thermocouples, thermistors, RTDs. 2.2 .Pressure Sensors: Piezoelectric and capacitive sensors. 2.3. Light Sensors**:** Photodiodes, phototransistors, LDR (Light Dependent Resstors). 2.4. Proximity Sensors: Inductive, capacitive, and ultrasonic	07
Module -3:	**Types of transducers** 3.1.Definition of transducers 3.2 Characteristics of transducers sensitivity, accuracy, range, resolution, and	08

	linearity .stability, repeatability, and dynamic response. 3.3. Classification of transducers :Active vs. Passive Transducers 3.4 .. Primary vs. Secondary Transducer	
Module -4:	**Transducers applications and selection** 4.1.Resistive Transducers : Strain gauges, thermistors 4.2 Capacitive Transducers : Pressure sensors, displacement sensors. 4.3..Inductive Transducers : LVDTs (Linear Variable Differential Transformers), proximity sensors. 4.4.Piezoelectric Transducers : Used for vibration and acoustic measurements.	07

Reference Books:-

1. D. Patranabis, Sensors and Transducers, PHI Learning, 2003
2. J. Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, Springer, 2010
3. R. Pallas-Areny, J. G. Webster, Sensors and Signal Conditioning, John Wiley & Sons, 2001
4. I. R. Sinclair, Sensors and Transducers, Newnes, 2001
5. J. P. Bentley, Principles of Measurement Systems, Pearson Education, 2005

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20 M	**End Semester Examination:50 M**
• Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks • (Best of two CCE marks will be considered)	• Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50M into 30 M)

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Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : DSC (Minor VI)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 235-Instrumentation for Experimental Sciences

Course Objectives: Students should be able to….

1. study a comprehensive understanding of the working principles, usage, and applications of advanced laboratory instruments such as ultrasonicator, potentiostat and SEM.
2. understand the principles and practical applications of chemical analysis instruments, including conductometers, potentiometers and spectrophotometers.
3. gain practical experience in operating and calibrating essential electronics instruments such as LCR meters, microprocessors, microcontrollers and power supplies.
4. learn hands on experience in an instrumentation techniques.

Course Outcomes: After completion of syllabus students will be able to…..

1. perform precise chemical analyses using instruments like conductometers, colorimeters, and spectrophotometers, and interpret the results to draw meaningful conclusions.
2. design electronic laboratory tools such as LCR meters, microcontrollers, and power supplies to complete tasks related to circuit design, testing, and repair.
3. ability to operate and maintain complex laboratory instruments (e.g.ultrasonicator, potentiostat, SEM) with minimal supervision and troubleshoot basic issues.
4. develop advanced instrumentation systems for various scientific and industrial applications.

Module	Title and Contents	Hrs
Module -1:	**Physics laboratory instruments** 1.1. Ultrasonicator, characterization. Applications in cleaning and sample preparation 1.2 .Potentiostat; Electrochemical analysis and material 1.3. Stroboscope 1.4. Silar coating Technique 1.5 **.** Electrospinning matchine	08
Module -2:	**Electronics laboratory instruments** 2.1.LCR Meter: Measurement of inductance, capacitance, and resistance 2.2. Power Supplies & UPS: Principles of operation and applications in laboratory setups. 2.3. Constant current source & constant voltage source: Design, operation, and role in circuit testing	07
Module -3:	**Chemical sciences laboratory instruments** 3.1. Conductometer & Potentiometer : Principles of electrochemical measurements 3.2. Colorimeter: Techniques for concentration analysis of solutions 3.3. Spectro photometer: Techniques for concentration analysis of solutions.	08

	3.4. IR Spectrometer & UV Spectroscopy : Understanding molecular structures bonding	
Module -4:	**Life sciences laboratory instruments** 4.1. Incubator: Principles, Construction, Working, Applicatiopns. 4.2. PCR Principles, Construction, Working, Applicatiopns. 4.3. Lab Scale Fermenter Unit 4.4. Gel documentation: Design, operation and role, application 4.5. Flame Photometer ,Laminar air flow meter	07

Reference Books:-

1. J. G. Webster, The Measurement, Instrumentation, and Sensors Handbook, CRC Press, 1999
2. A. K. Sawhney, P. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 2015
3. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, CBS Publishers & Distributors, 1986
4. D. A. Skoog, F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, Cengage Learning, 2018
5. R. Boyer, Modern Experimental Biochemistry, Pearson Education, 2000

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20 M	**End Semester Examination:50M**
• Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks (Best of two CCE marks will be considered)	• Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50 M into 30 M)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : DSC (Minor P-III)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISP 236 Practical Lab (Practical lab based on BIST 234 BIST 235)

Course Objectives: Students should be able to….

1. study a comprehensive understanding of the working principles, usage, and applications of advanced laboratory instruments such as ultrasonicator, potentiostat and SEM.
2. understand the principles and practical applications of chemical analysis instruments, including conductometers, potentiometers, and spectrophotometers.
3. gain practical experience in operating and calibrating essential electronics instruments such as LCR meters, microprocessors, microcontrollers, and power supplies.
4. learn hands on experience in an instrumentation techniques.

Course Outcomes: After completion of syllabus students will be able to…..

1. perform precise chemical analyses using instruments like conductometers, colorimeters, and spectrophotometers, and interpret the results to draw meaningful conclusions.
2. design electronic laboratory tools such as LCR meters, microcontrollers, and power supplies to complete tasks related to circuit design, testing, and repair.
3. ability to operate and maintain complex laboratory instruments (e.g.ultrasonicator, potentiostat, SEM) with minimal supervision and troubleshoot basic issues.
4. develop advanced instrumentation systems for various scientific and industrial applications.

Sr. No	List of Experiments	Hrs
1.	Study of Characterization of a Resistive Temperature Detector (RTD)	60
2.	Study of Thermistor Response for Temperature Measurement	
3.	Measurement of Strain using a Strain Gauge and Wheatstone Bridge	
4.	Displacement Measurement using a Linear Variable Differential Transformer (LVDT)	
5.	Study of Piezoelectric Transducer.	
6.	Speed Measurement using an Optical Rotary Encoder.	
7.	Light Intensity Detection using a Light Dependent Resistor (LDR).	
8.	Study of distance Measurement using an Ultrasonic Sensor.	
9.	Study of Ph meter calibration and usage in measuring the acidity or alkalinity of solutions.	
10.	Study of different parts of 3D printer.	
11.	Study operating principles, safety precautions, and applications of ultrasonicator in physics experiments.	
12.	Study operating principles, safety precautions, and applications of ultrasonicator in	

	physics experiments.	
13.	Learn how to measure inductance, capacitance, and resistance accurately by using LCR meter.	
14.	Silar coating technique: Master the technique for coating samples with thin layers of silicon.	
15.	Understand Dimmerstat use in controlling the intensity of light sources.	

Reference Books:-

1. J. G. Webster, The Measurement, Instrumentation, and Sensors Handbook, CRC Press, 1999
2. A. K. Sawhney, P. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co., 2015
3. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, CBS Publishers & Distributors, 1986
4. D. A. Skoog, F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, Cengage Learning, 2018
5. R. Boyer, Modern Experimental Biochemistry, Pearson Education, 2000

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20 M	**End Semester Examination: 30 Marks**
• Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**Q. 1 = 30 M**

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - IV
Type : DSC (Minor VII)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 244-Power System Instrumentation

Course Objectives: Students should be able to…

1. study the construction, working principles, characteristics, and applications of electrical measuring instruments used in power systems.
2. familiarise with working principles and application areas of digital measuring instruments.
3. understand the basic concepts associated with waveform generators.
4. learn experience in the use of various special instruments and their capabilities.

Course Outcomes: After completion of syllabus students will be able to…

1. identify the various types of industrial chemical instruments and their uses.
2. describe the common applications and identify the working principles medical physics instruments.
3. differentiate different types of waveform generated by a waveform generator and their characteristics.
4. utilize appropriate instrument setup procedures, techniques and capabilities for special instrument.

Module	Title and Contents	Hrs
Module -1:	**Smart and digital measurement systems** 1.1 .Evolution of electrical instruments 1.2 Advanced oscilloscope functionalities (DSOs). 1.3 Data Acquisition Systems (DAQ): Architecture, applications and interfacing with IoT. 1.4 Introduction to smart meters for energy monitoring and analysis 1.5 Applications	08
Module -2:	**Power instrumentation** 2.1. Power analyzers for measuring active, reactive, and apparent power, along with harmonic analysis. 2.2. Phasor Measurement Units (PMUs): Applications in power grids and detection. 2.3. High-voltage testing equipment: Hipot testers and partial discharge analyzers. 2.4. Energy meters and smart grid-compatible monitoring devices.	07
Module -3:	**Industrial chemistry instruments** 3.1 .Uv-Florescence detector 3.2. Photo fluorimeter 3.3.Histometer 3.4. Biochemistry analyser 3.5 .Gas chromatography	08

Module -4:	**Biomedical physics instruments** 4.1. X-ray machine**:** Introduction, working principle, diagram, applications 4.2. MRI machine**:** Introduction, working principle, applications 4.3. CT-Scan machine: Introduction, working principle, advantages 4.4. ECG machine**:** Introduction, construction, working, applications	07

Reference Books:-

1. D. A. Bell, Electronic Instrumentation and Measurements, Oxford University Press, 2013
2. J. G. Webster, Measurement, Instrumentation, and Sensors Handbook, CRC Press, 1999
3. D. A. Skoog, F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, Cengage Learning, 2018
4. J. P. Bentley, Principles of Measurement Systems, Pearson Education, 2005
5. J. G. Webster, H. Eren, Measurement, Instrumentation, and Sensors Handbook: Electromagnetic, Optical, Radiation, Chemical, and Biomedical Measurement, CRC Press, 2014

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks (Best of two CCE marks will be considered)	**End Semester Examination: 50 M** • Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50 M into 30 M)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - IV
Type : DSC (Minor VIII)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST 245-Electrical Instrumentation and Motor Control

Course Objectives s: After completion of syllabus students will be able to…

1. identify insulation resistance in electrical systems and interpret the results for detecting potential insulation failures and safety risks.
2. describe use of continuity testers to check for circuit integrity and ground resistance testers to verify safe grounding in electrical systems.
3. design clamp meter for current measurement and thermal cameras for identifying hotspots or faulty components, improving troubleshooting efficiency.
4. utilize appropriate instrument setup procedures, techniques and capabilities for special instruments.

Course Outcomes: Students should be able to…

1. study the working principles of insulation resistance testers and their use in identifying faults in electrical systems.
2. learn the operation and applications of continuity testers and ground resistance testers in ensuring proper electrical grounding.
3. develop skills in using fault location and diagnostic tools, such as clamp meters and thermal cameras, for troubleshooting electrical systems.
4. study the basic concept related to motor control system.

Module -1:	**Fundamentals of electric motors** 1.1 Basic working principle: Electromagnetic induction 1.2 Classification of electric motors: AC Motors DC Motors 1.3 Special Motors (Stepper, Servo) 1.4 Comparison between AC and DC motors 1.5 Applications of electric motors in daily life and industry	08
Module -2:	**Types of electric motors and their working principles** 2.1.DC Motors 2.2 .Brushed DC Motor and Brushless DC Motor (BLDC) 2.3. Working, construction, pros & cons 2.4. Applications 2.5. AC Motors 2.6. Single-phase Induction Motor Three-phase Induction Motor 2.7 .Synchronous Motor	08
Module -3:	**Fundamentals of electrical instruments** 3.1. Introduction to Electrical Instruments: Overview of devices used to measure electrical parameters such as voltage, current, resistance, power, and energy. 3.2. Working Principles: Moving coil and moving iron principles for analog instruments 3.3. Characteristics of Instruments :Accuracy precision, resolution, range, sensitivity	07

Module -4:	**Applications of electrical instruments** 4.1 .Industrial: Monitoring and controlling electrical equipment. 4.2 . Power Systems**:** Load analysis, fault detection, and energy auditing. 4.3 Research and Development**:** Testing circuits, characterizing components	07

Reference Books:-

1. H. H. Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental Methods of Analysis, CBS Publishers & Distributors, 1986
2. D. A. Skoog, F. J. Holler, S. R. Crouch, Principles of Instrumental Analysis, Cengage Learning, 2018
3. R. Boyer, Modern Experimental Biochemistry, Pearson Education, 2000
4. M. R. Welbourne, J. C. Ellis, Nonlinear Measurement and Instrumentation, Wiley, 2001
5. A. E. Azevedo, Electronic Instrument Design, Wiley, 2010

Evaluation Pattern:40:60

Total Marks: 50

Internal Continuous Evaluation: 20 M	**End Semester Examination: 50 M**
• Internal Work -1:CCE I - 10 Marks • Internal Work -2: CCE II -10 Marks • Internal Work -3:CCE III - 10 Marks • Total marks : 20 marks (Best of two CCE marks will be considered)	• Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50 M into 30 M)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc.	**Semester** - IV
Type : DSC (Minor P-IV)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISP 246 Practical Lab (Practical lab based on BIST 244 BIST 245)

Course Objectives: Students should be able to….

1. understand the principles behind laboratory instruments used in physics experiments.
2. study applications of electronic instrumentation in fields such as telecommunications, automation and instrumentation.
3. learn to operate laboratory instruments for chemical measurements, titration and spectroscopic analysis
4. know the importance of maintaining sterile conditions and safety protocols.

Course Outcomes: After completion of syllabus students will be able to…..

1. describe the evolution of measurement tools and how digital instruments provide more accuracy, efficiency, and capabilities compared to their analog counterparts.
2. design a DAQ system that interfaces with IoT devices, allowing real-time data collection, analysis, and monitoring of electrical systems.
3. develop skills to install and configure smart meters for accurate energy consumption monitoring, and use the data for energy efficiency and cost analysis.
4. identify performance characteristics and find sources of error in measurement.

Sr. No	List of the practical	Hrs
1.	Study the architecture and functioning of DAQ system.	60
2.	Study the role of smart meters in modern energy monitoring systems.	
3.	Understand the transition of electrical instruments from analog to digital.	
4.	Learn how to use power analyzers to measure different types of power.	
5.	Study the principles and techniques of high-voltage testing equipment: Hipot testers.	
6.	Study construction, control speed & direction of a brushed DC motor.	
7.	Fault Detection with Clamp Meters: Identifying Short Circuits and Open Circuits.	
8.	To understand the basic components, working principle, and applications of an X-ray machine.	

9.	To study the working principle of an MRI machine and understand the role of magnetic fields and radio waves.	
10.	To study the working principle of a CT-Scan machine.	
11.	DC Motor Testing: Measuring Voltage, Current, and Speed for Shunt, Series, and Compound Motors.	
13.	AC Motor Testing: Understanding the Operation and Performance of Synchronous and Induction Motors.	
14.	Study the working and wiring of a single-phase induction motor.	
15.	Operate a BLDC motor using an Electronic Speed Controller (ESC).	

Reference Books:-

1. H. S. Kalsi, Electronic Instrumentation, McGraw-Hill Education, 2018.
2. U. A. Baksh .AV. Bakshi , Electronic Measurements and Instrumentation, Technical Publication, 2020.
3. N. A. Anderson, Instrumentation for Process Measurement and Control by CRC Press, 4th Edition 2019.
4. M.R. Welbourne & J.C. Ellis, Nonlinear Measurement and Instrumentation, Wiley 2001.

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**End Semester Examination: 30 Marks** **Q. 1 = 30 M**

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : SEC	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISPSEC I Practical Lab (Design of power supply & PCB)

Course Objectives: Students should be able to….

1. learn a circuit capable of maintaining a constant 5V output regardless of variations in input voltage or load current.
2. aware for minimize output voltage ripple and noise to ensure compatibility with sensitive electronic components.
3. understand thermal management to prevent overheating during continuous operation.
4. study basic components used for PCB design.

Course Outcomes: After completion of syllabus students will be able to…..

1. design a power supply delivering a precise and stable 5V output under varying load and input conditions.
2. differentiate low ripple and noise levels, making the supply suitable for powering sensitive microcontrollers and communication devices.
3. describe reliable operation by implementing effective heat dissipation mechanisms, such as heatsinks or thermal shutdown.
4. identify active and passive components used for PCB design.

Sr No	List of the practical	Hrs
1.	**Study of 5-Volt Regulated Power Supply Block Diagram** (Transformer → Rectifier → Filter → Regulator → Load)	60
2.	**Schematic Design of 5V Regulated Power Supply** Using KiCad/Altium/Eagle.	
3.	**Component Selection for 5V Supply** (Diodes, capacitors, regulator IC, fuse, connector, heat sink).	
4.	**Design of Full-Wave Bridge Rectifier Section** Draw circuit and calculate output voltage.	
5.	**Ripple Voltage Calculation for Filter Capacitor** Choose capacitor value for desired ripple.	
6.	**Single-Layer PCB Layout for 5V Supply** Placement and routing of components.	
7.	**PCB Fabrication using UV Photoresist Method** Printing, exposing, developing, etching.	
8.	**PCB Drilling, Cleaning, and Finishing** Drill holes, file edges, apply flux.	
9.	**Through-Hole Component Assembly** Mount diodes, capacitors, regulator, connectors.	

10.	**Heat Sink Installation for Voltage Regulator** Selection, mounting and thermal considerations.	
11.	**Soldering Practice & Flux Cleaning** Proper solder joints, avoid bridging, clean PCB.	
12.	**Continuity and Short-Circuit Test using Multimeter** Check all traces before powering.	
13.	**Testing Unregulated DC Voltage** Measure rectifier output before regulator.	
14.	**Testing Regulated 5-Volt Output** Measure Vout at no-load and full-load conditions.	
15.	**Ripple Measurement using Oscilloscope** Before and after regulator.	

Reference Books:-

1. R. L. Boylestad, L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, 2013
2. D. A. Bell, Electronic Devices and Circuits, Oxford University Press, 2008
3. M. H. Rashid, Electronic Devices and Circuit Theory, Cengage Learning, 2014
4. C. F. Coombs Jr., H. T. Holden, Printed Circuits Handbook, McGraw-Hill, 2008
5. J. H. Davies, The Design of PCB-Based Systems, Cambridge University Press, 2008

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**End Semester Examination: 30 Marks** **Q. 1 = 30 M**

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : VSC-I	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISPVSC I Practical Lab (Introduction to scilab)

Course Objectives: Students should be able to….

1. study the layout, interface components and how to navigate Scilab.
2. understand how to create and manipulate matrices and vectors in Scilab.
3. learn to use Scilab's built-in functions and write basic scripts for automation.
4. create 2D and basic 3D plots for data visualization.

Course Outcomes: After completion of syllabus students will be able to…..

1. ability to use the Scilab interface and console to execute commands.
2. develop and run simple Scilab scripts for mathematical computations.
3. utilize built-in Scilab functions to solve engineering or scientific problems.
4. perform matrix operations and numerical calculations efficiently.

Sr No	List of the practical	Hrs
1.	**Introduction to Scilab** Learn the basic syntax of Scilab, including arithmetic operations.	**60**
2.	**Matrix Operations** Perform matrix operations such as addition, subtraction, multiplication.	
3.	**Plotting Basic Graphs** Create and customize 2D plots like line plots, scatter plots using plotting functions.	
4.	**Solving Linear Equations** Use Scilab to solve systems of linear equations using matrix operations.	
5.	**Graphical Representation of Functions** Plot mathematical functions (e.g., sin, cos, exponential functions).	
6.	**Differential Equations (ODEs)** Solve simple ordinary differential equations (ODEs).	
7.	**Matrix Eigenvalues and Eigenvectors** Calculate the eigenvalues and eigenvectors of a matrix using Scilab's eig() function.	
8.	**Control Systems Analysis** Analyze and simulate the response of transfer functions for system simulation.	
9.	**Simulation of Electrical Circuits** Model simple electrical circuits (e.g., RC, RL) and simulate their time-domain response.	

10.	**Creating and Using Functions in Scilab** Write user-defined functions in Scilab and use them for specific mathematical tasks.	
11.	**Matrix Eigenvalues and Eigenvectors** Calculate the eigenvalues and eigenvectors of a matrix using Scilab's eig() function.	
12.	**Optimization Problems** Solve simple optimization problems built-in optimization functions.	
13.	**Simulating Mechanical Systems** Model and simulate mechanical systems like mass-spring-damper systems and analyze their motion.	
14.	**Solving Nonlinear Equations** Solve nonlinear equations using fsolve() function for root-finding.	
15.	**Random Number Generation** Generate random numbers and perform Monte Carlo simulations for probabilistic problems.	

Reference Books:-

1. C. Gomez, Engineering and Scientific Computing with Scilab, Birkhäuser, 1998
2. M. Baudin, Scilab: A Free Software to Use for Numerical Computation, Scilab Enterprises, 2010
3. S. L. Campbell, J.-P. Chancelier, R. Nikoukhah, Modeling and Simulation in Scilab/Scicos, Springer, 2006
4. S. L. Campbell, J.-P. Chancelier, Scilab: A Free Software to Use for Numerical Computation, Springer, 2012
5. G. E. Urroz, Numerical and Statistical Methods with Scilab for Engineers and Scientists, CreateSpace Independent Publishing Platform, 2013

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20 M	**End Semester Examination: 30 Marks**
• Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**Q. 1 = 30 M**

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - IV
Type : SEC	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISPSECP II Practical Lab (Introduction to Arduino and Programming Basics)

Course Objectives: Students should be able to…

1. understand the fundamentals of Arduino hardware and components.
2. learn the basics of C/C++ programming used in Arduino.
3. interface basic sensors and actuators with Arduino.
4. set up the Arduino development environment (IDE).

Course Outcomes: After completion of syllabus students will be able to…..

1. connect and control simple hardware components through Arduino.
2. demonstrate a basic understanding of how embedded systems work.
3. study troubleshoot simple programs using Arduino C/C++ syntax.
4. set up and operate an Arduino board using the Arduino IDE.

Sr No	List of the practical	Hrs
1.	**Introduction to Arduino IDE** Installing IDE, exploring interface, compiling first program.	**60**
2.	**Blink LED Program** Using `digitalWrite()` and delay.	
3.	**Use of Digital Input Pins** Read push button state using `digitalRead()`.	
4.	**Blink LED Without Delay** Use of `millis()` for non-blocking code.	
5.	**Serial Communication Basics** Print messages to Serial Monitor using Serial.begin() and Serial.println().	
6.	**Using Buzzer with Arduino** Generate tones using `tone()` function.	
7.	**Interfacing RGB LED** Change colors using PWM signals.	
8.	**Temperature Sensor (LM35) Interfacing** Read analog values and convert to temperature.	
9.	**Ultrasonic Sensor (HC-SR04) Interfacing** Measure distance using trigger and echo pins.	
10.	**Servo Motor Control** Use `Servo.h` library to rotate servo to desired angles.	

11.	**DC Motor Control using Transistor/Motor Driver** Control motor speed using PWM.	
12.	**Relay Module Interfacing** Switch AC/DC loads (lamp or motor) via Arduino.	
13.	**Servo Motor Control** Use `Servo.h` library to rotate servo to desired angles.	
14.	**LDR (Light Sensor) Interfacing** Control LED brightness based on light intensity.	
15.	**Interfacing 16x2 LCD (I2C or Parallel)** Display sensor readings or messages.	

Reference Books:

1. Y. Misra, Programming and Interfacing with Arduino, 2022
2. M. Margolis, B. Jepson, N. R. Weldin, Arduino Cookbook, 2020
3. M. Geddes, Arduino Project Handbook: 25 Practical Projects to Get You Started, 2016
4. S. Saini, M. Kaur, Arduino Solutions Handbook, 2022
5. R. Barnwal, Arduino Programming Projects, 2023

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**End Semester Examination: 30 Marks** **Q. 1 = 30 M**

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - IV
Type : VSC-II	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BISPVSC II Practical Lab (Introduction to MATLAB)

Course Objectives: Students should be able to….

1. perform mathematical and matrix operations using MATLAB commands and built-in functions.
2. develop MATLAB programs using scripts, functions, conditional statements, and loops
3. solve linear equations, numerical problems, and basic differential equations using MATLAB.
4. create 2D and basic 3D plots for data visualization.

Course Outcomes: After completion of syllabus students will be able to…..

1. ability to use the MATLAB interface and console to execute commands.
2. develop and run simple MATLAB scripts for mathematical computations.
3. utilize built-in MATLAB functions to solve engineering or scientific problems.
4. perform matrix operations and numerical calculations efficiently.

Sr No	List of the practical	Hrs
1.	Write a MATLAB program to perform some basic operation on matrices such as addition, subtraction, multiplication.	**60**
2.	To write a “MATLAB” Program to generate various signals and sequences, such as unit impulse, unit step, unit ramp, sinusoidal, square, sawtooth, triangular, sinc signals.	
3.	Performs operations on signals and sequences such as addition, multiplication, scaling, shifting, folding, computation of energy and average power.	
4.	Finding even and odd part of the signal and sequence and also findreal and imaginary parts	
5.	Fit a polynomial or nonlinear curve to experimental data using MATLAB's curve fitting toolbox.	
6.	Find the output with linear convolution operation Using MATLAB Software.	
7.	Study on Matrix Bitwise operations, Relational Operations and Logical Operations.	
8.	Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.	

9.	Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.	
10.	Locating the Zeros and Poles and plotting the Pole-Zero maps in S-plane and Z-Plane for the given transfer function.	
11.	Find the values of x,y,z of the equations x+y+z=3, x+2y+3z=4, x+4y+9z=6.	
12.	Find the derivative of (x+2)(x^2+3).	
13.	Calculate the area enclosed between the x-axis, and the curve y = x3 -2x+5 and the ordinates x = 1 and x = 2	
14.	Model power system components like transformers, generators, and transmission lines, and simulate their behavior under various conditions.	
15.	Interface MATLAB with hardware for real-time data acquisition (e.g., temperature sensors).	

Reference Books:

1. MathWorks, MATLAB: An Introduction with Applications, The MathWorks, Inc., 2024
2. A. Gilat, MATLAB: An Introduction with Applications, Wiley, 2023
3. S. T. Karris, Signals and Systems: With MATLAB Computing and Simulink Modeling, Orchard Publications, 2018
4. L. F. Chaparro, Signals and Systems Using MATLAB, Academic Press, 2019
5. W. Y. Yang, W. Cao, T.-S. Chung, J. Morris, Applied Numerical Methods Using MATLAB, Wiley, 2005

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 M • Journal: 10 M • Students Performance: 05 M • Viva : 05 M	**End Semester Examination: 30 Marks** **Q. 1 = 30 M**

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science

Yashawantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc	**Semester** - III
Type : BISTIKS	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: Contribution of Instrumentation science in Indian knowledge

Course Objectives: Students should be able to….

1. understanding Traditional Knowledge Systems.
2. exploring the Importance of Protection and Value of Traditional Knowledge.
3. provide Highlighting Contributions in Instrumentation.
4. examining Future Technological Prospects of instrumentation in innovative applications.

Course Outcomes: After completion of syllabus students will be able to….

1. explain and Appreciate the Role of Traditional Knowledge
2. analyze Protection Mechanisms of traditional knowledge and its value in the global economy, along with understanding the role of government in its preservation.
3. recognize Contributions of Indian scientists in an instrumentation and their impact on modern technologies
4. evaluate the impact of emerging technologies, understand their applications, and foresee the potential innovations in the instrumentation sector.

Module	Title and Contents	Hrs
Module -1:	**Introduction to Traditional Knowledge** 1.1 Define traditional knowledge 1.2 Nature and characteristics, scope, importance, kinds of traditional knowledge 1.3 Indigenous, Knowledge (IK), characteristics, traditional knowledge Vs western knowledge	07
Module -2:	**Protection of traditional knowledge** 2.1 The need for protecting traditional knowledge. 2.2 Significance of Traditional knowledge Protection, the value of Traditional knowledge in the global economics 2.3 Role of Government to harness Traditional knowledge.	08
Module -3:	**Introduction to Instrumentation Systems** 3.1 Definition, scope,importance of instrumentation, 3.2 Historical evolution of measurement systems,sensors and transducers. 3.3 Signal conditioning and data conversion (ADC/DAC)	07
Module -4:	**Applications of Instrumentation Knowledge Systems** 4.1 Industrial automation 4.2 Biomedical instrumentation 4.3 Environmental monitoring	08

Reference Books:-

1. D. F. Robinson, Protecting Traditional Knowledge: Lessons from Global Case Studies, 2017
2. M. Battiste, J. (S.) Youngblood Henderson, Protecting Indigenous Knowledge and Heritage: A Global Challenge, 2000
3. J. G. Webster, A. J. Nimunkar, Medical Instrumentation: Application and Design, 2020
4. J. G. Webster, The Measurement, Instrumentation, and Sensors Handbook, 1999

Evaluation Pattern:40:60	
Total Marks: 50	
Internal Continuous Evaluation:20M • Internal Work-1:CCE I-10 Marks • Internal Work-2:CCE II-10 Marks • Internal Work-3:CCE III-10 Marks (Best of two CCE marks will be considered)	**End Semester Examination:50 M** • Question -1:2 Marks X 5 =10 Marks • Question -2:10 Marks X 2 =20 Marks • Question -3:5 Marks X 4=20 Marks (Convert 50 M into 30 M)

Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Electronics

Programme: B.Sc. II	**Semester** - IV
Type : VEC	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BIST-VEC-II -Environmental Awareness for Instrumentation

Course Objectives: Students should be able to…..

1. study the major environmental issues facing the world today.
2. identify personal and societal responsibilities towards the environment.
3. understand the concept of sustainable development and its significance in addressing global challenges.
4. explore the application of physics principles and technologies in renewable energy, climate change mitigation.

Course Outcomes: Students will be able to…..

1. explain the causes and consequences of environmental degradation.
2. discuss ethical considerations in environmental decision-making.
3. define sustainable development and explain its principles.
4. describe how physics concepts and technologies contribute to addressing environmental challenges.

Module	Title and Contents	Hrs
Module -1:	**Environmental Issues** 1.1 Pollution (air water and land), freshwater overuse, 1.2 Natural disasters, fuel and energy, 1.3 Shortage due to overuse, increase in wasteland, 1.4 Biodiversity loss, global warming and climate change (causes an intensity of the problem) role of instrumentation in creation of environmental issues	07
Module -2:	**Environmental Laws and Ethics** 2.1 Environmental Protection Act Wildlife Protection Act 2.2 Forest Conservation Act 2.3 Prevention and control of Pollution Act (air water and land) From unsustainable to sustainable development responsibilities of an environmentally aware citizen.	07
Module -3:	**Sustainable Development Goals** 3.1 Introduction to sustainable development, 3.2 United Nations Sustainable Development Goals (SDGs), 3.3 Economical, Technological and Industrial development in the context of	08

	sustainable development. 3.4 Case studies and examples of sustainable development initiatives.	
Module -4:	**Role of Instrumentation in meeting the Sustainable Development Goals** 4.1 Introduction to the role of physics in sustainable development, 4.2 Renewable energy technologies and sustainable development, 4.3 Physics based approaches to tackle climate change, 4.4 Environmental monitoring and pollution control technologies.	08

Reference Books:-

1. B. Sorensen, Renewable Energy: Physics, Engineering, Environmental Impacts, Economics and Planning, Academic Press, 2017
2. T. Theis, J. Tomkin, Sustainability: A Comprehensive Foundation, 2015
3. J. W. Tester, E. M. Drake, M. J. Driscoll, M. W. Golay, W. A. Peters, Sustainable Energy: Choosing Among Options, MIT Press, 2012
4. R. W. Findley, D. A. Farber, Environmental Law: Cases and Materials, 1985
5. R. T. Wright, Environmental Science, Galgotia Publications, 1974

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation:20 • Internal Work -1 : CCE-I - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks (Best of two CCE marks will be considered)	**End Semester Examination:** • Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks • Question -3 : 05 Marks x 4 = 20 Marks