



Karmaveer Bhaurao Patil University, Satara

**Syllabus for
B. Sc. I Nanoscience and Technology**

**Under
Faculty of Science and Technology**

(As per NEP 2.0)

With effect from Academic Year 2025-2026

Syllabus for Bachelor of Science (B.Sc.) Part – I Nanoscience and Technology

PREAMBLE:

The B.Sc. Nanoscience and Technology course under the autonomy framework will be introduced in the academic year 2026-2027. It has been designed to meet the specific needs of B.Sc. Nanoscience and Technology students in accordance with the NEP 2020 guidelines. The curriculum has been developed to reflect the expanding scope of industrial applications. The focus is on equipping students with up-to-date knowledge while maintaining a strong foundation in research and development. This approach will enable students to understand and appreciate contemporary interdisciplinary methods in physical science, chemical science, electronics and their contributions to research development. The course also includes new practical exercises, providing students with hands-on experience with the latest techniques currently in use. Additionally, the course is intended to inspire students to pursue higher studies in Nanoscience and Technology, become entrepreneurs, and seek employment in semiconducting industries.

GENERAL OBJECTIVES OF THE COURSE:

1. To investigate and understand the unique physical, chemical and biological properties that emerges at the Nano scale.
2. To design, synthesize, and characterize new Nano materials with tailored properties for various applications.
3. To enable the fabrication of smaller, faster and more efficient electronic, photonic and mechanical devices.
4. To create nanotechnologies that enhances renewable energy production, energy storage and environmental protection.

PROGRAMME OUTCOMES

After completing the B.Sc. program, graduates will:

1. To explain fundamental concepts of Nano scale phenomena and stay updated with recent advancements in the field of nanotechnology.
2. To demonstrate the functioning of advanced instruments used for Nano scale characterization and ability to interpret data to study Nano scale properties.
3. Applying the knowledge of nanomaterial synthesis design various nanostructures with specific properties.
4. To assess the potential applications of nanomaterial based on their unique properties and selecting nanomaterial for specific applications.

PROGRAMME SPECIFIC OUTCOMES

After completing the B.Sc. Nanoscience and Technology program, students will:

- Learn the fundamental principles, concepts and recent development in Nanoscience and Technology.
- Understand the properties of materials at Nano scale and working of sophisticated instruments to evaluate Nano scale properties.

- Apply the knowledge of nanomaterial synthesis methods to design nanostructures and utilize the characterization techniques for analysis of nanostructures.
- Evaluate the effectiveness of specific nanomaterials for targeted applications. Considering their unique properties.

1. **Title:** Nanoscience and Technology
2. **Year of Implementation:** 2025-2026.
3. **Duration:** 01 year
4. **Pattern:** Semester examination
5. **Eligibility of Students:** 12th Pass with Science, or equivalent
Any other eligibility prescribed by UGC, Government of Maharashtra, Karmaveer Bhaurao Patil University, Satara
6. **Medium of Instruction:** The medium of instructions shall be in English.
Batch Size:
B.Sc. I -20 students per batch
B.Sc. II -16 students per batch
B.Sc. III -12 students per batch
7. **Eligibility of the Core Faculty:**
 - Assistant Professor: Master of Science with specialization in Nanoscience or Physics and NET/ SET/ Ph.D.
 - Associate Professor: Master of Science in Nanoscience or Physics with NET/ SET/Ph.D.
 - Professor: Master of Science in Physics with NET/ SET/Ph.D.

Eligibility for Professor of Practice or Professional Trainer:

Any other eligibility as per the Guidelines and Regulations Passed by the Board of Concerned Studies, Academic Council of the College / University and Rules and Regulations of Karmaveer Bhaurao Patil University, Satara, Government of Maharashtra, and UGC norms.

Eligibility for Adjunct Professor of Practice or Professional Trainer:

As per eligibility prescribed by UGC

1. STRUCTURE OF COURSE:

As per NEP-2020 (2.0)

Sem (Level)	Courses			OE	IKS	Total Credits
	Course I	Course II	Course III			
Sem I (4.5)	DSC I (2)	DSC I (2)	DSC I (2)	OE I (2)	IKS I (2)	22
	DSC II (2)	DSC II (2)	DSC II (2)			
	DSC PI (2)	DSC PI (2)	DSC PI (2)			
Sem II (4.5)	DSC I (2)	DSC I (2)	DSC I (2)	OE II (2)	VEC I (2)	22
	DSC II (2)	DSC II (2)	DSC II (2)			
	DSC PII (2)	DSC PII (2)	DSC PII (2)			
Credits	12	12	12	04	04	44

2. COURSE TITLE

1) First Semester

Sr. No.	Course	Theory				Practical		
		Course No. & Course Code	Title of Course	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	DSC I	BNTT 111	Introduction to Nanoscience and Nanotechnology	2	2	BNTP 113	1	2
2.	DSC II	BNTT 112	Properties of Nanomaterials	2	2			
4.	DSC III	BNTT 114	Physics for Nanoscience I	2	2	BNTP 116	1	2
5.	DSC IV	BNTT 115	Digital Electronics					
6.	DSC V	BNTT 117	Chemistry for Nanoscience I	2	2	BNTP 119	1	2
7.	DSC VI	BNTT 118	Chemistry for Nanoscience II	2	2			
8.	OE	BNTT OE I	Environmental Studies	2	2	--	--	
9.	IKS	BNTT IKS I	Generic	2	2	--	-	-

2) SEMESTER II

Sr. No.	Course	Theory				Practical		
		Course No. & Course Code	Title of Course	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	DSC VII	BNTT 121	Synthesis of Nanomaterials I	2	2	BNTTP 123	1	2
2.	DSC VIII	BNTT 122	Synthesis of Nanomaterials II	2	2			
4.	DSC IX	BNTT 124	Physics for Nanoscience II	2	2	BNTTP 126	1	2
5.	DSC X	BNTT 125	Semiconductor Devices					
6.	DSC XI	BNTT 127	Nanobiology I	2	2	BNTTP 129	1	2
7.	DSC XII	BNTT 128	Nanobiology II	2	2			
8.	OE	BNTT OE 2	Environmental Studies	2	2	--	--	
9.	VEC	BNTT VEC 1	Democracy, Election and Good governance	2	2	--	-	-

3. Evaluation Structure
Semester I (4.5)

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	CCE- II	CCE- III			
DSC	T	BNTT 111	10	10	10	30	50	02
	T	BNTT 112	10	10	10	30	50	02
	P	BNTP 113	20			30	50	02
DSC	T	BNTT 114	10	10	10	30	50	02 02
	T	BNTT 115	10	10	10	30	50	
	P	BNTP 116	20			30	50	02
DSC	T	BNTT 117	10	10	10	10	10	30
	T	BNTT 118	10	10	10	10	10	30
	P	BNTP 119	20			30	50	02
OE	T	BNTT OE I	10	10	10	30	50	02
VEC	T	BNTT VEC I	10	10	10	30	50	02

CCE*-Out of three CCE marks best of two CCE marks consider

Semester II (4.5)

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	CCE- II	CCE- III			
DSC	T	BNTT 121	10	10	10	30	50	02
	T	BNTT 122	10	10	10	30	50	02
	P	BNTP 123	20			30	50	02
DSC	T	BNTT 124	10	10	10	30	50	02 02
	T	BNTT 125	10	10	10	30	50	
	P	BNTP 126	20			30	50	02
DSC	T	BNTT 127	10	10	10	10	10	30
	T	BNTT 128	10	10	10	10	10	30
	P	BNTP 129	20			30	50	02
OE	T	BNTT OE II	10	10	10	30	50	02
IKS	T	BNTT IKS I	10	10	10	30	50	02

CCE*-Out of three CCE marks best of two CCE marks consider

DSC: Discipline Specific Course; DSE: Discipline Specific Elective; VSC: Vocational Skill Course; SEC: Skill Enhancement Courses; AEC: Ability Enhancement Courses (English); OJT: On Job Training; FP: Field Project; CEP: Community Engagement Program; CC: Co-Curricular courses; T: Theory; P: Practical

4. OTHER FEATURES:

A) LIBRARY:

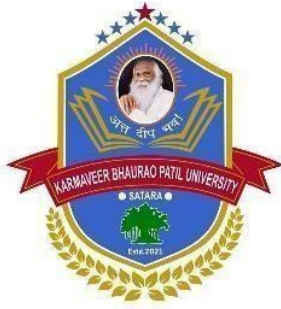
Reference books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENT:

a) Computer, LCD projector.

b) Laboratory Equipment:

- | | |
|-----------------------------|------------------------------|
| 1. Microscope | 2. Hot Air Oven |
| 3. Digital weighing balance | 4. Incubator |
| 5. pH meter | 6. Refrigerator |
| 7. Centrifuge | 8. Autoclave |
| 9. Magnetic Stirrer | 10. Ultrasonicator |
| 11. Conductometer | 11. UV- Visible Spectroscopy |

	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 Physics		
	Programme: B. Sc.		Semester – I
	Type : Major Paper I		Marks: 50
	Credits : 2		From: 2025-26
Name of the Course: BNTT 111: Introduction to Nanoscience and Nanotechnology			
Course Objective: Students will be able to 1) develop an understanding of nanoscience and nanoscale materials. 2) explore and understand the occurrence of nanoscale effects in nature. 3) explain prepare nanomaterials using different synthesis techniques. 4) study the properties of various nanomaterials			
Course Outcomes: students should be able to..... 1) describe the fundamental concepts, principles, and terminology associated with nanoscience. 2) classify nanomaterials based on their dimensionality, composition, and structural characteristics. 3) evaluate and apply laws and theories related to nanomaterials. 4) analyze the properties of the nanomaterials.			
Module	Title and Contents		Hrs
Module -1:	Origin of Nanoscience 1.1 History of Nanotechnology 1.2 Nanotechnology timeline- pre-18th century, 19 th century, 20 th century& 21 st century 1.3 Basic Introduction about Nanoscience and Nanotechnology 1.4 Nanoscale effects.		08
Module -2:	Nanoscience and Nature 2.1 Scientific revolution -Atomic structure, Molecular & atomic size, Bohr's radius. 2.2 Nano and Nature. 2.3 Nanoscopic colors (Butterfly wings), Bioluminescence (fireflies). 2.4 Tribology (Geckos sticky feet, lotus effect).		08
Module -3:	Types of Nanomaterials 3.1 Classification of Nanomaterials: 0D, 1D, 2D and 3D 3.2 Types of nanomaterials (Quantum Dots, CNTs, Bucky Balls, Nanocomposites etc.) 3.3 Nanoscience: Quantum mechanics, 3.4Brownian motion, surface forces, surface to volume ratio.		07
Module -4:	Nanomaterials and Properties 4.1 Carbon nanotubes (CNTs), Metals (Au, Ag), Metal oxides (TiO ₂ , ZnO, CeO ₂) 4.2 Semiconductors (Si, Ge, Cds, ZnSe), ceramics & composites, 4.3 Biological system- Lipids, Size-dependent properties, (Mechanical, Physical & chemical properties).		07

Reference Books:-

1. Kulkarni, Sulabha K. Nanotechnology: principles and practices; Capital Publishing Company., (2015).
2. Murty, Budaraju S., P. Shankar, Baldev Raj, Bhakta B. Rath, and James Murday. Textbook of nanoscience and nanotechnology. Springer Science & Business Media, 2013.
3. Hornyak, Gabor L., Joydeep Dutta, Harry F. Tibbals, and Anil Rao. Introduction to nanoscience. CRC press, 2008.
4. Wilson M., Kannangara K., Smith G., Raguse M. B., Raguse, 2005,

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
(Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
(50 Marks converted to 30 marks)

	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 Physics	
	Programme: B. Sc.	Semester - I
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 112: Properties of Nanomaterials		
Course Objective: Students will be able to 1) learn the different properties of nanomaterials. 2) study the mechanical, optical, electrical and magnetic properties of nanomaterials in detail. 3) understand the band structure based classification of materials. 4) analyze various properties of nanomaterials.		
Course Outcomes: students should be able to..... 1) define different terms related to properties of nanomaterials. 2) explain mechanical, optical, electrical and magnetic properties of nanomaterials. 3) demonstrate different types of semiconductors. 4) describe about the different properties of nanomaterials.		
Module	Title and Contents	Hrs
Module -1:	Mechanical Properties 1.1 Stress, strain, elastic properties, modulus of elasticity Poisson's ratio and relationship between moduli (qualitative). 1.2 Yield strength, stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength. 1.3 Toughness, elongation, plastic deformation, hardness, impact. 1.4 Strength, creep, fatigue, ductile and brittle fracture.	08
Module -2:	Optical Properties 2.1 Reflection, refraction, diffraction of light. 2.2 Absorption and transmission of electromagnetic radiation in solids. 2.3 Photoelectric emission. 2.4 Photoconductivity and photoluminescence.	08
Module -3:	Electrical Properties 3.1 Concept of energy band diagram for materials 3.2 Conductors, semiconductors and insulators, Intrinsic Semiconductors. 3.3 direct and indirect band gap semiconductors. 3.4 Extrinsic semiconductors, N- type and P –type semiconductor.	07
Module -4:	Magnetic Properties 4.1 Origin of magnetism in materials. 4.2 Para-magnetism, diamagnetism, anti-ferromagnetism, ferromagnetism, ferrimagnetism, magnetic hysteresis. 4.3 Ferromagnetic domains. Soft and hard magnetic materials 4.4 Measurement of magnetic susceptibility. Applications of magnetic materials.	07

Reference Books:-

1. Gavrilenko V. I., Optics of Nanomaterials, 2nd Ed., Jenny Stanford Publishing Pt. Ltd., 2020.
2. Kulkarni S. K., Nanotechnology: Principles and Practices, 3rd Ed., Capital Publishing Company., 2015.
3. Murty B. S., Shankar P., Baldev R., Rath B. B. and James M, Textbook of and Nanoscience Nanotechnology, Springer Universities Press (India) Private Limited., 2015.
4. William D., Callister J. R., Rethwisch D. G., Materials Science and Engineering and Introduction willey Printed in the United States of America., 2013.
5. T. Pradeep., Textbook of Nanoscience and Nanotechnology McGraw Hill Education (India) Private Limited., 2012.

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)



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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

Programme: B.Sc

Semester - I

Type : Practical Lab I

Marks: 50

Credits : 2

From: 2025-26

Name of the Course: BNTP 113 : Practical I

Course Objectives: Students will be able to

- 1) demonstrate the nano effects in nature
- 2) learn handling of sophisticated equipment used in laboratory.
- 3) study and understand the nano effects presents in nature.
- 4) evaluate the properties of nanomaterials.

Course Outcomes: Students should be able to

- 1) use sophisticated equipment used in laboratory.
- 2) describe and demonstrate the nano effects presents in nature.
- 3) analyze bandgap of semiconductor material.
- 4) apply the basic laws of science to study the magnetic and optical properties of materials.

Sr. No.	Name of Experiments	Hrs
1)	To Identify the Nano Effects in the Nature.	60
2)	To study the Classification of Nanomaterials.	
3)	Introduction to lab equipment I: Weighing balance, pH & Conductivity meter, Colorimeter, Potentiometer, Centrifuge, Hot Air Oven, Autoclave, Muffle Furnace, Distillation unit, Sonicator.	
4)	Introduction to lab equipment II: Measurement of pH and Conductivity. Use of Colorimeter and Potentiometer.	
5)	Measurement of Surface to Volume Ratio.	
6)	Young's Modulus of Material of Bar by Vibration.	
7)	Poisson's Ratio for Rubber using Rubber Tube.	
8)	Measurement of Transmittance and Absorbance of Nanomaterials.	
9)	Diffraction due to Single slit using Sodium / Laser Source.	
10)	To Investigate the Relationship between the Angle of Incidence (i) and the Angle of Refraction (r)	
11)	To Determine the Refractive Index of a Transparent Solid Medium e.g. Glass.	
12)	To study the Characteristics of the Forward and Reverse Biased Junction Diode.	
13)	To Determine the Energy Band Gap of a Semiconductor by using PN Junction Diode.	
14)	Determination of thermal conductivity of a Bad Conductor. (Lee's disc)	
15)	To study Faradays Magnetic Field Induction.	

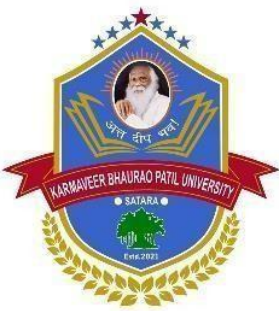
Reference Books:-

1. Department of Science Faculty of Science and Technology, National Institute of Education
PHYSICS Practical Handbook., 2017.
2. Kulkarni S. K., Nanotechnology: Principles and Practices, 3rd Ed., Capital
Publishing Company., 2015
3. T. Pradeep., Textbook of Nanoscience and Nanotechnology, McGraw Hill Education
(India) Private Limited., 2015.

Practical Evaluation Pattern 60:40**Total Marks : 50****Internal Continuous Evaluation: 20 Marks**

- Q.1 Internal work= 20 M

End Semester Examination :30 Marks**Q.1 = 30 M**

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	Board of Studies in Physics		
	Programme: B. Sc.	Semester - I	
	Type : Major Paper I	Marks: 50	
	Credits : 2	From: 2025-26	
Name of the Course: BNTT 114: Physics for Nanoscience I			
Course Objective: Students will be able to 1) inspire and boost the interest of the students towards angle of contact. 2) understand types of oscillation. 3) adopt knowledge about bending of beam. 4) evaluate the concept of viscosity.			
Course Outcomes: students should be able to..... 1) define atomic structure and unit cell. 2) explain classification of crystal structure. 3) describe the application of surface tension. 4) analyze the effect of temperature and pressure on viscosity of liquid.			
Module	Title and Contents	Hrs	
Module -1:	Crystal Structure and their Properties 1.1 Atomic structure, Atomic Bonding in solid. 1.2 Unit cells and space lattice, Crystal structure, Crystal planes and direction. 1.3 Miller Indices, Diffraction of X-ray by crystal. 1.4 Bragg's equation, Reciprocal lattice, Crystal defect point	08	
Module -2:	Surface Tension 2.1 Surface tension, Angle of contact and wettability. 2.2 Relation between surface tension, Excess of pressure and radius of curvature. 2.3 Application of surface tension, Hydrophobic and Super hydrophobic nanostructure. 2.4 Surface determination of surface tension by jaeger's method.	08	
Module -3:	Elasticity 3.1 Introduction. 3.2 Bending of beam and Bending moments, 3.3 Cantilever beam supported at both end. 3.4 Bending of beam fixed at one end.	07	
Module -4:	Fluid Dynamics and Viscosity 4.1 Introduction, General concept of fluid flow. 4.2 Viscous fluid, Experimental determination of coefficient of viscosity of liquid. 4.3 Poiseuille's capillary flow method. 4.4 Effect of Temperature and pressure on viscosity of liquid.	07	

Reference Books:-

1. Ketterson. B. J. September. The Physics of Solids. Oxford University. 2016
2. Matthew E. Cross, Emma V. E. Plunkett. June. Physics, Pharmacology and Physiology for Anaesthetists. 2014
3. Wing Kam Liu, Eduard G. Karpov, Harold S. Park. Nano Mechanics and Materials: Theory, Multiscale Methods and Applications. England: John Wiley & Sons. 2006
4. Dr. Dhaygude. N. S. Prof. Karve. S.R. Prof. Gidavir. S.S. Prof. Jadhav. K.D. Nandurker. R.D. November. A Textbook of Physics. First edition. 2003
5. Cleland. N. Andrew.. Foundations of Nanomechanics: From Solid – State Theory to Device Applications. Springer International Edition. Verlag, New York. 2003

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
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	Board of Studies in Physics	
	Programme: B. Sc.	Semester - I
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 115: Digital Electronics		
Course Objective: Students will be able to 1) learn different number systems and digital conversions 2) understand the working of logic gates and there use in logic operations 3) apply the knowledge of data processing circuits in digital circuit design. 4) understand the working of sequential logic circuits.		
Course Outcomes: students should be able to..... 1) perform the conversions of numbers from one number system to another. 2) explain concepts of logic gates and there working 3) design arithmetic and logic circuits. 4) analyze and design sequential logic circuits.		
Module	Title and Contents	Hrs
Module -1:	Number System and Codes: 1.1 Decimal, Binary, Octal and Hexadecimal number systems. 1.2 Base conversions. Representation of signed and unsigned numbers. 1.3 BCD code. Binary, octal and hexadecimal arithmetic. 1.4 Addition, subtraction by 2's .	08
Module -2:	Logic Gates and Boolean Algebra: 2.1 Truth Tables of OR, AND, NOT, NOR, NAND, XOR, XNOR. 2.2 Universal Gates, Basic postulates and fundamental theorems of Boolean algebra . 2.3 Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS),. 2.4 Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP).	08
Module -3:	Arithmetic Circuits 3.1 Binary Addition. Half and Full Adder. Half and Full Subtractor. 3.2. Half and Full Subtractor, 4- bit binary Adder / Subtractor.. 3.3 Data processing circuits. 3.4 Multiplexers, De-multiplexers, Decoders, Encoders.	07
Module -4:	Sequential Circuits 4.1 SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. 4.1 Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-slave JK Flip-Flop. 4.1 Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in Parallel-out Shift Registers (only up to 4 bits). 4.1 Counters (4 bits): Ring Counter. Asynchronous counters, Decade Counter,	07

	Synchronous Counter	
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Reference Books:-

1. P. Malvino, D. P. Leach and Saha, 2011, Digital Principles and Applications, 7th Ed., Tata McGraw
2. R. L. Tokheim, (1994) Digital Principles, Schaum's Outline Series, Tata McGraw-Hill
3. S.K. Mandal, 2010, Digital Electronics, 1st edition, McGraw Hill
4. Anand Kumar, 2009, Fundamentals of Digital Circuits, PHI Learning Pvt.Ltd. 2nd Edn.
5. Thomas L. Floyd, (1994), Digital Fundamentals, Pearson Education Asia

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 30 Marks	End Semester Examination: 50 Marks
• CCE-I: 10 Mark • CCE II: 10 Mark • CCE-III: 10 Mark • (Best of Two CCE)	• Question -1: 2 Mark x 5 = 10 Mark • Question -2: 10 Mark x 2 = 20 Mark • Question -3: 5 Mark x 4 = 20 Mark • (50 Marks converted to 30 marks)



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 Physics

Programme: B.Sc

Semester - I

Type : Practical Lab II

Marks: 50

Credits : 2

From: 2025-26

Name of the Course: BNTP 116 : Practical II

Course Objectives: Students will be able to

- 1) demonstrate the basic principles and effects in physical sciences.
- 2) explain scherer's formula for determining lattice constant and crystalline size.
- 3) understand the working of basic logic gates.
- 4) design and analyze basic logic circuits.

Course Outcomes: Students should be able to

- 1) evaluate surface tension by different methods.
- 2) analyze contact angle.
- 3) apply scherrer formula for determination of crystalline size and lattice constant.
- 4) design and analyze various types of logic circuits.

Sr. No.	Name of Experiments	Hrs
1)	To determine Youngs modulus (Y) of a wooden bar.	60
2)	To determine the contact angle.	
3)	Viscosity by Poiseuille's method.	
4)	Determination of the surface tension of a liquid by Jaeger's method.	
5)	Determine the surface tension of a given liquid at room temp using stalgomometer by drop number method	
6)	Determination of the lattice constant by using Scherrer formula.	
7)	Determination of crystalline size using Scherer's formula	
8)	Study of basic logic gate	
9)	Study universality of NAND and NOR gate	
10)	a) To design a combinational logic system for a specified Truth Table. To convert Boolean expression into logic circuit & design it using logic gate ICs.	
11)	Half Adder and Full Adder.	
12)	Half Subtractor and Full Subtractor	
13)	To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.	
14)	To build JK Master-slave flip-flop using Flip-Flop ICs	
15)	To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.	

Reference Books:-

- 1) Department of Science Faculty of Science and Technology National Institute of Education
PHYSICS Practical Handbook.2017.
- 2) Hannaford B. S. Smith A. J. Tatchell P.W.. Practical Organic Chemistry. 5th Edition. 2012
- 3) P. Malvino, D. P. Leach and Saha, Digital Principles and Applications, 7th Ed.,Tata McGraw
2011
- 4) Thomas L. Floyd, , Digital Fundamentals, Pearson Education Asia, 1994

Practical Evaluation Pattern 60:40**Total : 50 Marks****Internal Continuous Evaluation: 20 Marks****Q.1 Internal work= 20 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 Physics	
	Programme: B. Sc.	Semester - I
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNNT 117: Chemistry for Nanoscience I		
Course Objective: Students will be able to 1) Learn the principles of fundamental organic chemistry and industrial chemistry. 2) Study theories and concepts about acids and bases. 3) Remember order of reaction. 4) Understand physical properties of liquids.		
Course Outcomes: students should be able to..... 1) Define molarity and normality. 2) Explain Bronsted Lowry concept. 3) Learn the chemical kinetics and pseudounimolecular reaction. 4) Analyze the physical properties of surface tension.		
Module	Title and Contents	Hrs
Module -1:	General Concepts in Chemistry 1.1 Introduction, Definition and Explanation of the following terms- Solute, Solvent, Solution . 1.2 Polar solvent, Non-Polar solvent, Saturated solution, Unsaturated solution, Supersaturated solution . 1.3 Normality, Equivalent weight, Molecular weight, Molarity, Percentage solution, ppt, ppm, ppb solutions. 1.4 Weight fraction, Problems based on Normality, Molarity, mole fraction, mixed solution.	08
Module -2:	Acid and Bases 2.1 Introduction, Concept of pH. 2.2 Acid, Base, Acidity of the base, Basicity of acid. 2.3 pH scale, Neutralization, Arrhenius concept. 2.4 Bronsted Lowry concept, Lewis concept, Lux-Flood Concept.	08
Module -3:	Physical Properties of Liquids 3.1 Introduction & Classification of Physical Properties. 3.2. Surface Tension and Chemical Constitution. 3.3 Viscosity, Refractive Index (Snell's law). 3.4 Molecular Refractivity and Chemical Constitution.	07
Module -4:	Chemical Kinetics 4.1 Introduction, Rate of Constant or Specific Reactions Rate. 4.2 Order and Molecularity of Reaction. 4.3 First order Reactions, Pseudounimolecular Reactions. 4.4 Second Order Reactions	07

Reference Books:-

- 1) Clayden Jonathan. Greeves Nick. Stuart Warren Organic Chemistry. 2nd Edition. Oxford Publisher. 2014
- 2) Brian G. Cox.. Acids and Bases Solvent Effects on Acid–Base Strength. Oxford University Press. 2013
- 3) Ahluwalia V.K. 2011. Organic Reaction Mechanism. 4th Edition. Naroso Publishing House.
- 4) Laidler. K. J.. Chemical Kinetics. India: Pearson Education. 2004
- 5) Atkins. P. W. Physical Chemistry. 7th edition. Oxford University press. 2002

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)

	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 Physics	
	Programme: B. Sc.	Semester - I
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 118: Chemistry for Nanoscience II		
Course Objective: Students will be able to 1) learn surface chemistry and interfacial phenomena. 2) understand the process of distillation. 3) adopt knowledge about analysis of samples. 4) evaluate gravimetric estimation.		
Course Outcomes: students should be able to..... 1) define qualitative and quantitative analysis. 2) explain types of error. 3) learn the concept of filtration and sublimation. 4) analysis concept of precipitation, nucleation, crystal growth and digestion.		
Module	Title and Contents	Hrs
Module -1:	Surface Chemistry and Interfacial Phenomena 1.1 Absorption, Adsorption isotherm 1.2 Sols, Gels, Emulsions, Micro emulsions. 1.3 Aerosols, Effect of surfactants, Hydrotropes Catalysis. 1.4 Introduction, Types, Basic principles.	08
Module -2:	Unit Operations 2.1 Introduction Distillation, Recrystallization. 2.2 Filtration, Sublimation, (Phase Transition) Drying. 2.3 Utilities in industry (Fuels, Boilers, Water, Steam, Air). 2.4 Melting Point, Boiling Point	08
Module -3:	Introduction to Analytical Chemistry 3.1 Introduction Importance of Analysis Analytical Process (Qualitative and Quantitative). 3.2 Classification of Analysis Sampling of Solids, Liquids and Gases & Errors Types of Errors (Determinate and Indeterminate Errors). 3.3 Methods of Expressing Accuracy (Absolute and Relative Errors). 3.4 Significant Figures Mean, Median, Standard Deviation	07
Module -4:	Gravimetry 4.1 Introduction Precipitation Nucleation Crystal Growth. 4.2 Digestion or Ageing or Ostwald Ripening conditions for Good Precipitation. 4.3 Physical Nature of Precipitate Organic 4.4 Precipitants in Gravimetric Analysis Exercises.	07

Reference Books:-

- 1) Chatwal Gurdeep. R. Sham K. Instrumental Methods of Chemical Analysis. Anand Himalaya Publishing. 2016
- 2) Sharma B. K. Industrial chemistry. 1st edition. Goel Publishing Housing. 2011.
- 3) Khopkar S. M. Basic Concepts of Analytical Chemistry. New Age. International Publisher. 2009.
- 4) Sethi Arun. Systematic Experiment in Chemistry. New Age International Publisher. 2006

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)



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 Physics

Programme: B.Sc

Semester - I

Type : Practical Lab III

Marks: 50

Credits : 2

From: 2025-26

Name of the Course: BNTP 119 : Practical Lab III

Course Objectives: Students will be able to

- 1) learn the basic principles and effects in chemical sciences.
- 2) describe and understand the instrumental and non – instrumental experiments.
- 3) evaluate chemical oxygen demand in waste water.
- 4) analyze quantitative analysis of organic compound.

Course Outcomes: Students should be able to

- 1) use sophisticated equipment used in laboratory.
- 2) perform experiments to know the basics of physico- chemical properties of elements.
- 3) analyze the industrial practices.
- 4) estimate the reaction of organic compounds.

Sr. No.	Name of Experiments	Hrs
1)	Preparation of Standard Solution	60
2)	To determine the heat of ionization of a weak acid by using polythene bottle.	
3)	To investigate the reaction between potassium per sulphate and potassium iodide equal initial concentration of reactants.	
4)	To determine equivalent weight of metal (mg) by hydrogen displacement method using Eudiometer	
5)	To determine the energy of activation for a first order reaction of hydrolysis of methylacetate in presence of 0.5 N HCL/ 0.5 N H ₂ SO ₄	
6)	Preparation of buffer solutions: a. Sodium acetate-acetic acid. b. Ammonium chloride-ammonium hydroxide. Measurement of the pH of buffer solutions and comparison of the values with theoretical Values	
7)	Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide	
8)	Determination of total hardness of water.	
9)	Determination of chemical oxygen demand (COD) of industrial wastewater sample	
10)	b) Quantitative analysis of organic compound	
11)	Preparation mechanism of various reactions involved to be discussed recrystallization.	
12)	Determination of melting point and calculation of quantitative yield to be done	
13)	To Study of molarity of benzoic acid in water.	
14)	To determine melting point of given solid sample.	
15)	To determine boiling point of given liquid sample.	

Reference Books:-

- 1) Hannaford B. S. Smith A. J. Tatchell P.W. Practical Organic Chemistry. 5th Edition. 2012
- 2) Lechtanski Valerie Ludwig. Inquiry-based Experiments in Chemistry. Oxford University. 2000
- 3) Smith J. A., Doe J. B. Synthesis of Org. Compounds. J. org. Chem.,87(4),1120-1135. 2022

Practical Evaluation Pattern 60:40**Total : 50 Marks****Internal Continuous Evaluation: 20 Marks**

- Q.1 Internal work= 20 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 Interdisciplinary Studies (IDS)		
	Programme: Open Elective Course	Semester – I	
	Type: Practical	Marks: 50	
	Credits: 2	From: 2025-26	
	Name of the Course: BNTP OE I: Environmental Studies		
Course Objectives: 1. to understand and measure basic soil and water properties. 2. to develop practical skills in ecological observations and environmental monitoring. 3. to apply sustainable practices in agriculture and waste management. 4. to gain awareness of environmental legislation and ecology.			
Course Outcomes: 1. perform accurate soil and water analysis using standard laboratory techniques. 2. construct and interpret food chains, food webs, and ecological pyramids. 3. prepare biofertilizers, biocompost, and utilize agro-waste for biofuel. 4. demonstrate knowledge of environmental laws and microbial ecological components.			
Module	Title and Contents (Any 15 of the following)	Hrs.	
Section I	1. Determination of pH of two different soil samples. 2. Study of building of food chain and food web. 3. Determination of texture of various soil samples. 4. Study of meteorological instruments. 5. Determination of water holding capacity of two different soil samples. 6. Study of various agro waste as substrate for biofuel production. 7. Study of seed treatment for breaking dormancy. 8. Estimation of hardness of water. 9. Study of dissolve oxygen in water samples. 10. Study of physico-chemical properties of soil. 11. Estimation of Nitrate and Phosphate in Water. 12. Preparation of biofertilizer and biocompost. 13. Study of Ecological Pyramids. 14. Study of Environmental Legislation. 15. Study of Aerospora. 16. Visit to a Biodiversity Park / Botanical Garden / Protected Area 17. Visit to an Environmental Organization / Recycling Unit / Renewable Energy Site.	60	
Reference Books: - 1) S. N. Panday & S. P. Misra. Essential Environmental Studies. Taylor & Francis (Routledge), 2008. 2) R. P. Singh & Zubairul Islam. Environmental Studies. Concept Publishing Co., 2012. 3) R. Rajagopalan. Environmental Studies. Oxford University Press, 4th Edition, 2023. 4) A. Gupta & S. Gupta. Environmental Studies: Principles and Practices. SAGE Publications Pvt. Ltd., 2021.			

Practical Evaluation Pattern 60:40	
Total : 50 Marks	
Internal Continuous Evaluation: 25 Marks • Q.1 Student Performance = 5 M • Q.2 Oral = 5 M • Q.3 Journal = 10 M • Attendance= 5M	End Semester Examination :25 Marks • Q.1 = 25 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 Physics		
	Programme: B. Sc.	Semester - II	
	Type : Major Paper I	Marks: 50	
	Credits : 2	From: 2025-26	
	Name of the Course: BNTT 121: Synthesis of Nanomaterials I		
Course Objective: Students will be able to 1) study the basics of nanomaterials synthesis. 2) understand the physical methods of nanomaterials synthesis. 3) describe advantages and disadvantages of physical methods of nanoparticle synthesis. 4) learn the biological methods of nanoparticle synthesis.			
Course Outcomes: students should be able to..... 1) describe the top down and bottom up approaches of nanoparticle synthesis 2) explain physical methods of nanoparticle synthesis 3) discuss the advantages and disadvantages of physical methods of nanoparticle synthesis. 4) understand the biological synthesis approach of nanomaterials.			
Module	Title and Contents	Hrs	
Module -1:	Basics of Synthesis Method 1.1 Introduction synthesis of nanoparticles. 1.2 Factors affecting synthesis of nanoparticles. 1.3 Top down and Bottom Up Approach 1.4 Classification of Synthesis methods	08	
Module -2:	Physical Synthesis: Mechanical Method 2.1 Introduction, Mechanical method. 2.2 Working, Principle, Advantages and Disadvantages. 2.3 Ball Milling working principle 2.4 Melt mixing	08	
Module -3:	Physical Synthesis: Evaporation Method 3.1 Introduction, Physical Vapor Deposition. 3.2 Introduction, advantages and disadvantages. 3.3 Sputtering Deposition Introduction. 3.4 Advantages and disadvantages.	07	
Module -4:	Biological Synthesis 4.1 Introduction, Green synthesis of nanoparticles 4.2 Advantages and disadvantages 4.3 Synthesis of nanoparticles by bacteria, 4.4 synthesis of nanoparticles by fungi, Advantages and disadvantages, Application of biological method.	07	
Reference Books:- 1. Zhympargul Abdullaeva.Synthesis of Nanoparticles and Nanomaterials Biological Approaches Springer Nature. 2017 2. G�rard Eddy Jai Poinern.. A Laboratory Course in Nanoscience and Nanotechnology CRC Press,.Tylor and Francis Group, 2015 3. Kulkarni.Sulabha. K.. Nanotechnology: Principles and Practices.3 rd ed. Capital PublishingCompany. 2015			

4. Boca Raton, Kuno M. , Introductory Nanoscience: Physical and Chemical Concepts, CRC Press, Tylor and Francis Group. 2012
5. Boca Raton, Hornyak, G. L, Tibbals. H. F, Dutta. J. and Moore J. J. Introduction to Nanoscience and Nanotechnology, CRC Press, Tylor and Francis Group. 2009

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 30 Marks

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)

	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 Physics	
	Programme: B. Sc.	Semester - II
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 122: Synthesis of Nanomaterials II		
Course Objective: Students will be able to 1) study the chemical methods of nanomaterials synthesis. 2) understand the gaseous phase deposition of nanomaterials synthesis. 3) describe the liquid phase deposition techniques of nanomaterials synthesis. 4) describe advantages and disadvantages of chemical methods of nanoparticle synthesis.		
Course Outcomes: students should be able to..... 1) define the terminologies in chemical synthesis techniques. 2) explain the chemical vapor deposition method in detail. 3) describe the liquid phase deposition techniques of nanomaterials synthesis. 4) apply the chemical methods for nanomaterial synthesis.		
Module	Title and Contents	Hrs
Module -1:	Chemical Synthesis: Colloidal Technique 1.1 Introduction: colloids and colloids in solution 1.2 Synthesis of colloid. 1.3 Nucleation and Growth mechanism	07
Module -2:	Chemical Synthesis: Gas Phase Deposition Technique 2.1 Chemical Vapor Deposition: 2.2 Introduction, use and application, classification of CVD process. 2.3 Characteristics of CVD coating, CVD apparatus. 2.4 Advantages and Disadvantages	08
Module -3:	Chemical Synthesis: Liquid Phase Deposition Technique I 3.1 Sol gel process: Introduction. 3.2 Sol gel technique, Advantages and Disadvantages, applications. 3.3 Spray Pyrolysis: Introduction. 3.4 Advantages and Disadvantages, applications.	07
Module -4:	Chemical Synthesis: Liquid Phase Deposition Technique II 4.1 Electrodeposition: Introduction, 4.2 Advantages and Disadvantages, Applications 4.3 Hydrothermal, Solvothermal: Introduction, Advantages and Disadvantages, Applications. 4.4 Chemical Bath Deposition Technique, SILAR Method.	08
Reference Books:- 1. Kulkarni.Sulabha. K..Nanotechnology: Principles and Practices.3 rd ed. Capital PublishingCompany. 2015 2. Poinern G��rard Eddy Jai..A Laboratory Course in Nanoscience and Nanotechnology CRC Press, Tylor and Francis Group. 2015 3. Pradeep.T..Textbook of Nanoscience and Nanotechnology McGraw Hill Education (India) Private Limited. 2012 4. Cao.G.,Naostructures and Nanomaterials: Synthesis, Properties and Applications.		

Imperial College Press. 2004

5. Boca Raton, Hornyak.G.L, Tibbals.H.F, Dutta. J.and Moore.J.J. , Introduction to Nanoscience and Nanotechnology. CRC Press.Taylor and Francis Group. 2009
6. Vladimir Pokropivny Rynno Lohmus Irina Hussainova Alex Pokropivny Sergey Vlassov. Introduction to nanomaterials and nanotechnology Tartu University Press. 2007

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 30 Marks

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)

	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 Physics		
	Programme: B.Sc	Semester - II	
	Type : Practical Lab IV	Marks: 50	
	Credits : 2	From: 2025-26	
Name of the Course: BNTP 123 : Practical Lab IV			
Course Objectives: Students will be able to 1) get the practical skill of handling various instrument 2) understand the chemical approach of nanomaterial synthesis 3) learn the biological synthesis method using various biological materials. 4) synthesis thin films using various chemical methods.			
Course Outcomes: Students should be able to 1) discuss the physical, chemical and biological approach of nanomaterial synthesis. 2) design nanoparticles by using various methods. 3) prepare thin films of various materials by using chemical route. 4) handle various instrument of nanomaterial synthesis.			
Sr. No.	Name of Experiments	Hrs	
1)	Techniques of Glass/FTO/ITO/Aluminum substrate cleaning.	60	
2)	Synthesis of CdS Nanoparticles by Co-precipitation method.		
3)	Synthesis Nickel Oxide thin film preparation by SILAR method.		
4)	Synthesis of Zinc oxide nanoparticles by Chemical Reduction method.		
5)	Synthesis of Nickel nanoparticle by Electrodeposition method.		
6)	c. Synthesis of Copper nanoparticle by using plant extraction.		
7)	CdS thin film deposition by CBD method.		
8)	Biological synthesis of Iron oxide nanoparticles.		
9)	To Synthesis of MgO thin film by SILAR Technique.		
10)	c) Synthesis of NiO nanoparticle by Hydrothermal method.		
11)	Synthesis of CdS nanoparticle by Fungi.		
12)	Synthesis of Pt nanoparticle by bacteria.		
13)	Biosynthesis of silver nanoparticles using plant leaves extract.		
14)	Synthesis of Zinc oxide thin film by spray pyrolysis technique		
15)	Synthesis of Ferrite (Fe ₂ O ₃)nanomaterial by Solvothermal technique		
Reference Books:- 1. Abdullaeva Zhympargul..Synthesis of Nanoparticles and Nanomaterials Biological Approaches Springer Nature. 2017 2. Vladimir Pokropivny Rynno Lohmus Irina Hussainova Alex Pokropivny Sergey Vlassov.. Introduction to nanomaterials and nanotechnology. Tartu University Press 2007 3. Cao.G..Naostructures and Nanomaterials: Synthesis, Properties and Applications. Empirical College Press.2004			

Practical Evaluation Pattern 60:40

Total : 50 Marks

Internal Continuous Evaluation: 20 Marks • Q.1 Internal work= 20 M	End Semester Examination :30 Marks • Q.1 = 30 M
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	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 Physics	
	Programme: B. Sc.	Semester - II
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 124: Physics for Nanoscience II		
Course Objective: Students will be able to 1) understand the wave nature of particles. 2) remember atomic structure of materials. 3) adopt knowledge about spin orbit coupling and normal zeeman effect. 4) learn and understand basics of molecular physics.		
Course Outcomes: students should be able to..... 1) explain various properties of wave. 2) explain quantum structure. 3) learn schrodinger approach for the hydrogen atom. 4) analyze molecular spectra.		
Module	Title and Contents	Hrs
Module -1:	Particle properties of waves: 1.1 Black body radiation, Photoelectric effect. 1.2 Compton Effect. Wave properties of particles: De Broglie waves. 1.3 Wave description, Particle diffraction. 1.4 Uncertainty principle and application of uncertainty principle.	08
Module -2:	Atomic structure 2.1 Electron orbits, The Bohr atom. 2.2 Quantum Structure: 2D (Quantum well), 1D (Quantum Wires), 0D (Quantum Dots). 2.3 Quantum mechanics: Schrodinger equation (steady state form), Particle in a box. 2.4 Finite potential well, potential Barrier.	08
Module -3:	Schrodinger Approach for the Hydrogen Atom 3.1 Schrodinger approach for the hydrogen atom. 3.2 Quantum numbers: principal, orbital and magnetic, Electron probability density. 3.3 Radiative transitions, Selection rules, Normal Zeeman effect. 3.4 Degeneracy of Hydrogen atom energy levels, Spin Orbit coupling.	07
Module -4:	Molecular Physics 4.1 Molecular bond, mechanism of covalent bond 4.2 H ₂ molecular Ion, Molecular Spectra, Rotational, Vibration Levels 4.3 Raman Spectrum, Size dependent physical properties. 4.4 Chemical, optical and magnetic properties.	07

Reference Books:-

1. Puri B. R. Pthania Madan .S. Sharma L. R.. Principal of physical chemistry. 47th Edition. 2019
2. Luciano Colombo. September. Atomic and Molecular Physics, University of Cagliari. 2019
3. William D. Callister. David J.R. Rethwisch G. Materials Science and Engineering
An Introduction willey Printed. United States of America, 2018
4. Wing Kam Liu, Eduard G. Karpov, Harold S. Park. Nano Mechanics and Materials,
2011

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)

	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 Physics	
	Programme: B. Sc.	Semester - II
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 125: Semiconductor Devices		
Course Objective: Students will be able to 1) learn the semiconductor properties of materials. 2) explain the concept of pn junction. 3) analyze the working of semiconductor devices. 4) understand the working principle of opto-electronic devices.		
Course Outcomes: students should be able to..... 1) explain basic concepts and phenomenon in semiconductor materials. 2) demonstrate and analyze the construction and working of pn junction diode. 3) applications of pn junction in semiconductor devices 4) explain the construction and working of Semiconductor devices.		
Module	Title and Contents	Hrs
Module -1:	Semiconductor Basics: 1.1 Conductor, Semiconductor, Insulator, Introduction to Semiconductor Materials. 1.2 Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect. 1.3 Diffusion Process, Einstein Relation, Current Density Equation. 1.4 Carrier Injection, Generation and Recombination Processes.	08
Module -2:	P-N Junction Diode: 2.1 Formation of Depletion Layer, Space Charge, Electrostatic Potential Difference at Thermal Equilibrium. 2.2 Depletion Width and Depletion Capacitance of an Abrupt Junction, Concept of Linearly Graded Junction. 2.3 Derivation of Diode Equation and I-V Characteristics, Idea of Static and Dynamic Resistance. 2.4 Q point and DC Load Line.	08
Module -3:	Applications of PN Junction: 3.1 Zener and Avalanche Breakdown Mechanism, Zener diode as voltage regulator. 3.2 Photodiode Schottky diode, Tunnel diode, point contact diode. 3.3 JFET: Construction, working and I-V characteristics (output and transfer), Pinch-off voltage. 3.4 UJT: basic construction, working, equivalent circuit and I-V characteristics.	07

Module -4: Optoelectronic Devices:	07
4.1 Light- emitting diodes and lasers. 4.2 Photon absorption and emission. 4.3 Inter-band emission and absorption in semiconductors. 4.4 Laser diodes, Light- emitting diodes.	

Reference Books:-

- 1) R. S. Sedha, Textbook of Applied Electronics, S. Chand Publication
- 2) Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education, 2006
- 3) Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons, 2001
- 4) Robert F. Pierret, Semiconductor Device Fundamentals, Pearson Education. 2006

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 30 Marks	End Semester Examination: 50 Marks
• CCE-I: 10 Mark • CCE II: 10 Mark • CCE-III: 10 Mark • (Best of Two CCE)	• Question -1: 2 Mark x 5 = 10 Mark • Question -2: 10 Mark x 2 = 20 Mark • Question -3: 5 Mark x 4 = 20 Mark • (50 Marks converted to 30 marks)



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 Physics

Programme: B.Sc

Semester - II

Type : Practical Lab V

Marks: 50

Credits : 2

From: 2025-26

Name of the Course: BNTP 126 : Practical Lab V

Course Objectives: Students will be able to

- 1) demonstrate and understand wave nature.
- 2) learn the scilab software.
- 3) perform measurement of electronic parameters.
- 4) analyze characteristics of semiconductor devices.

Course Outcomes: Students should be able to

- 1) demonstrate and understand wave nature.
- 2) perform mathematical analysis using sci lab software
- 3) understand working of various semiconductor devices.
- 4) analyze the characteristics of semiconductor devices.

Sr. No.	Name of Experiments	Hrs
1)	Huygens's principle in water waves.	60
2)	To determine the wavelength of a given monochromatic light by investigating the diffraction pattern by a straight edge.	
3)	To study the photoelectric effect, variations of photocurrent versus intensity and wavelength of light.	
4)	Sci lab Experiment I (Problem from quantum mechanics)	
5)	Sci Lab Experiment II (Problem from quantum mechanics)	
6)	d. Diffraction due to single slit using sodium/ Laser source.	
7)	Calibration of spectrophotometer	
8)	Measurement of wavelength of LASER using plane diffraction grating	
9)	To familiarize with basic electronic components (R, C, L, diodes, transistors) digital Multimeter, Function Generator and Oscilloscope	
10)	d) Study of the I-V Characteristics of p-n junction Diode	
11)	Study of the I-V Characteristics of Zener diode	
12)	Study of the I-V Characteristics UJT	
13)	Study of the output and transfer I-V characteristics of common source JFET	
14)	Study of I-V characteristics Solar cell	
15)	Characteristics of Photodiode	

Reference Books:-

- 1) Panigrahi S. Mallick B. 2015. Engineering practical physics. Cengage learning India Pvt. Ltd.
- 2) Indu Prakash and Ramkrishna, Kitaab Mahal, 2011. A textbook of practical physics. 11th edition.
- 3) Ben G Streetman and S. Banerjee, (2006), Solid State Electronic Devices, Pearson Education
- 4) Jasprit Singh, (2001) Semiconductor Devices: Basic Principles, John Wiley and Sons

Practical Evaluation Pattern 60:40

Total : 50 Marks

Internal Continuous Evaluation: 20 Marks • Q.1 Internal work= 20 M	End Semester Examination :30 Marks • Q.1 = 30 M
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	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 Physics	
	Programme: B. Sc.	Semester - II
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 127: Nanobiology I		
Course Objective: Students will be able to 1) define basics of chemical science in relevance to biological systems 2) know concept of evolution 3) understand fundamental biomolecules 4) memorize biomolecules		
Course Outcomes: students should be able to..... 1) illustrate basics of chemical science in relevance to biological systems 2) describe the concept of evolution 3) discuss the biomolecules 4) classify the biomolecules		
Module	Title and Contents	Hrs
Module -1: Origin of life	1.1 Basic concept, A.I. Oparin concept, Urey Miller's experiment. 1.2 Concept of Biomolecules-in general about Carbohydrate, amino acids. 1.3 Protein, lipid just definition with at least one example. pH, pk value definition. 1.4 Biological buffer systems- e.g. Phosphate, Bicarbonate, Hemoglobin buffer system.	08
Module -2: Nucleic Acids	2.1 Structure and functions of Nucleic acids. 2.2 Purines& pyrimidines, Nucleosides & Nucleotides, Biologically important nucleotides. 2.3 Double helical model of DNA structure and forces responsible for A, B & Z – DNA. 2.4 Denaturation and denaturation of DNA, RNA and its Types (rRNA, tRNA, mRNA).	08
Module -3: Carbohydrates	3.1 Structure, Function, Classification, Characteristic Reactions. 3.2 Physical and Chemical Properties, D&L Glyceraldehydes, structure of Monosaccharide, Disaccharides, and Polysaccharides. 3.3 Chemical/Physical Properties of Carbohydrate. 3.4 Chemical Reactions for Detection of Monosaccharides, Biological functions of carbohydrates	07
Module -4: Lipids	4.1 Classification of Lipids, Properties of Saturated, Unsaturated Fatty Acids. 4.2 Rancidity, and Hydrogenation of Oils Phospholipids. 4.3 Lecithin, Cephalin structure and function Cholesterol.	07

	4.4 Structure and Function, Lipoproteins: Structure and Function, Storage Lipids, Structural Lipids.	
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Reference Books:-

1. Voet J. G., Voet D., Pratt C.W., 5th Ed. Fundamentals of Biochemistry, John Wiley and Sons Inc, New York, USA, 2016
2. Satyanarayanan U. 4th edition Biochemistry Elsevier, 2016
3. Com E.E & Stumpf P.K. 5th Ed. John .Outlines of Biochemistry. Wiley Publications, 2010
4. Palmer T., Philip B. 2nd Edition, Enzymes: Biochemistry, Biotechnology, and clinical Chemistry, , Woodhead Publishing, 2007

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 30 Marks	End Semester Examination: 50 Marks
• CCE-I: 10 Mark • CCE II: 10 Mark • CCE-III: 10 Mark • (Best of Two CCE)	• Question -1: 2 Mark x 5 = 10 Mark • Question -2: 10 Mark x 2 = 20 Mark • Question -3: 5 Mark x 4 = 20 Mark • (50 Marks converted to 30 marks)

	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 Physics	
	Programme: B. Sc.	Semester - II
	Type : Major Paper I	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT 128: Nanobiology II		
Course Objective: Students will be able to 1) inspire and boost the interest of the students towards basic of biology. 2) learn and understand functions of biomolecules. 3) adopt knowledge about energy metabolism process. 4) study the immunology		
Course Outcomes: students should be able to..... 1) explain basic structure of cells and organs 2) analyze the structure of dna and ran 3) explain energy metabolism processes 4) explain antibody structure and its types		
Module	Title and Contents	Hrs
Module -1: Basics of Biology I	1.1 Structure and function of cells. 1.2 Organelles in Prokaryotes and Eukaryotes. 1.3 Nucleus, chromosome organization. 1.4 Structure and function of genetic material, Ribosomes	08
Module -2: Basics of Biology II	2.1 Introduction and structure of Endoplasmic reticulum. 2.2 Golgi apparatus, Mitochondria, Lysosom. 2.3 Plasma membrane. Cell division and Cell Cycle. 2.4 Mitosis - Meiosis	08
Module -3: Energy Metabolism	3.1 Energy Metabolism - aerobic respiration and anaerobic respiration. 3.2 Glycolysis (EMP Pathway), Tricarboxylic acid cycle (TCA). 3.3 Electron Transport Chain, Substrate level phosphorylation and oxidative phosphorylation. 3.4 ATP generation, Gluconeogenesis.	07
Module -4: Immunology	4.1 History of immunology, Innate and acquired immunity, Hematopoiesis, Cells and organs of the immune system. 4.2 B and T- cell activation. Phagocytosis – Oxygen dependent and Oxygen independent killing. 4.3 Antigen -Properties of antigen. Antibody- structure and types. Hybridoma Technology. 4.4 Immuno-hematology, Blood group, Rh - incompatibilities. Immuno techniques – ELISA, RIA.	07

Reference Books:-

1. Campbell, Neil A., and Jane B. Reece. Biology. 10th ed. San Francisco: Pearson Education, 2019.
2. Lander, Geoffrey M., and Robert E. Hausman. The Cell: A Molecular Approach. 8th ed. Sunderland, MA: Sinauer Associates, 2019
3. Lewin, Benjamin. Genes X. 10th ed. Burlington, MA: Jones & Bartlett Learning, 2018
4. Lanza R., Atala A., 3rd Edition Essentials of stem cell biology, , Academic press, 2013

Evaluation Pattern: 60:40**Total Marks: 50****Internal Continuous Evaluation: 30 Marks**

- CCE-I: 10 Mark
- CCE II: 10 Mark
- CCE-III: 10 Mark
- (Best of Two CCE)

End Semester Examination: 50 Marks

- Question -1: 2 Mark x 5 = 10 Mark
- Question -2: 10 Mark x 2 = 20 Mark
- Question -3: 5 Mark x 4 = 20 Mark
- (50 Marks converted to 30 marks)



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 Physics

Programme: B.Sc

Semester - II

Type : Practical Lab VI

Marks: 50

Credits : 2

From: 2025-26

Name of the Course: BNTP 129 : Practical Lab VI

Course Objectives: Students will be able to

- 1) understand concepts of solutions and buffers
- 2) know about various biomolecules
- 3) understand biomolecules detection techniques
- 4) know different research organizations in India

Course Outcomes: Students should be able to

- 1) apply knowledge in working of various instruments related to biotechnology
- 2) analyse various biomolecules & their qualitative analysis
- 3) prepare buffer, standardized and calibrate ph meter.
- 4) understand sterilization process.

Sr. No.	Name of Experiments	Hrs
1)	To determine sugars by Molisch test, Benedict's test & Barfoed's test	60
2)	To determine sugars by Fehling's test	
3)	To perform Qualitative tests for Non - Reducing Sugars	
4)	To Detect of unknown Carbohydrate from mixture (Glucose, fructose, maltose, sucrose, xylose and starch)	
5)	To estimate Glucose by DNSA method	
6)	To Determine iodine number of oil sample	
7)	To Estimation of vitamin C (Ascorbic acid)	
8)	Finding the coagulation time of blood	
9)	Latex Agglutination	
10)	Sterilization procedure for glassware, media and plastic ware	
11)	Preparation of buffers (Phosphate buffer, acetate buffer) and determination of pH with pH meter	
12)	Preparation of culture media for bacteria (Using pepton water, Nutrient broth, Nutrient agar, Mc Conkey's agar)	
13)	Pure culture Techniques (i) Spread Plate (ii) Pour Plate (iii) Streak Plate	
14)	Morphology of (i) Bacteria – Gram Staining and (ii) Fungi - Lacto Phenol Cotton Blue Mount	
15)	To study mitosis using onion root tips	

Reference Books:-

1. Upadhyay A. , Upadhyay K., Nath N., 4th Edition Biophysical Chemistry Himalaya Publishing House Pvt. Ltd., 2016
2. Wilson K. and Walker J., 8th edition Principles and Techniques of Biochemistry and Molecular Biology Cambridge University Press; 2018

3. Plummer D., 3rd Edition An Introduction to Practical Biochemistry McGraw Hill Education; 2017
4. Champe P. C., Harvey R. A., Ferrier D. R. 3rd edition. Biochemistry Lippincott Williams and Wilkins; 2004
5. Sadasivam S, Manickam 2nd edition A Biochemical methods., New Age International (p) Ltd. Publisher, New Delhi., 1996
6. Plummer D. 3rd ed An Introduction to Practical Biochemistry.. Tata McGraw Hill, New Delhi, 1988

Practical Evaluation Pattern 60:40

Total : 50 Marks

Internal Continuous Evaluation: 20 Marks	End Semester Examination :30 Marks
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- Q.1 Internal work= 20 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 Physics	
	Programme: B. Sc.	Semester - II
	Type : VEC	Marks: 50
	Credits : 2	From: 2025-26
Name of the Course: BNTT VEC I: Democracy, Elections and Good governance		
Course Objective: Students will be able to 1) introduce the meaning of democracy and it's important. 2) understand the election procedure in india. 3) introduce the philosophy of constitution of india. 4) learn the fundamental rights and duties.		
Course Outcomes: students should be able to..... 1) explain the meaning of democracy and it's important. 2) examine critically election process in the country. 3) explain the philosophy of constitution of india. 4) define the fundamental rights and duties.		
Module	Title and Contents	Hrs
Module -1: Democracy in India	1.1 Introduction: Meaning, Definition of democracy 1.2 Classification: Direct democracy and representative democracy, features of direct and representative democracy 1.3 Dimensions of Democracy: Social, Economic and Political Decentralization. 1.4 Grassroots Level Democracy	08
Module -2: Election	2.1 73rd and 74th Constitutional Amendment Acts: 2.2 Institutions at the local level and Role of State Election commission. 2.3 Local Body Elections: 2.4 Urban & Rural Duties of an Individual towards electoral proces	08
Module -3: Philosophy Of The Indian Constitution	3.1 Constitutional History of India, Role of Dr. B.R. Ambedkar in Constituent Assembly 3.2 Preamble - Source and Objects Sovereign and Republic Socialist and Secular 3.3 Democratic - Social and Economic Democracy,Justice - Social, Economic and Political,Liberty - Thought, Expression, Belief, Faith and Worship 3.4 Equality - Status and Opportunity,Fraternity, Human Dignity, Unity and Integrity of the Nation	07
Module -4: Fundamental Rights and Duties	4.1 Right to equality, Right to freedoms, Right against exploitation. 4.2 Right to freedom of religion,Cultural and educational rights,Right to constitutional remedies,Duty to abide by the Constitution. 4.3 Duty to cherish and follow the noble ideals,Duty to defend the country and render national service,Duty to value and preserve the rich heritage of our composite	07

	culture. 4.4 Duty to develop scientific temper, humanism ,the spirit of inquiry & reform Duty to safeguard public property and abjure violence,Duty to strive towards excellence.	
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Reference Books:-

- 1) D. D. Basu, Introduction to the Constitution of India, LexisNexis
- 2) Granville Austin, The Constitution of India: Cornerstone of a Nation, Oxford University Press
- 3) Subhash Kashyap, Our Constitution, National Book Trust
- 4) M.P. Jain, Indian Constitutional Law, LexisNexis
- 5) V.N.Shukla, Constitution of India, Eastern Book Company
- 6) P.M. Bakshi, The Constitution of India, Universal Law Publishing
- 7) M.V.Pylee, Constitutional Government in India, S. Chand
- 8) V. S. Khare, Dr. B.R.Ambedkar and India's National Security
- 9) Banerjee- Dube, I, A history of modern India, Cambridge University Press, (2014).
- 10) Basu, D. D. , Introduction to the Constitution of India, Delhi: Prentice Hall of India, (1982).
- 11) Bhargava, R, Political theory: An introduction. Chennai: Pearson Education India, (2008).
- 12) Bhargava, R., & Vanaik, A, Understanding Contemporary India: Critical Perspective. New Delhi: Orient Blackswan, (2010).
- 13) Chandhoke, N., & Prasad, P. (Ed.), Contemporary India: Economy, Society, Politics. Chennai: Pearson Education India, (2009).
- 14) Chandra, B, Essays on contemporary India, New Delhi: Har-Anand Publications Pvt Ltd, (1999).
- 15) Chatterjee, P, State and Politics in India. New Delhi: Oxford University Press. (1997).
a. Dasgupta. S., (Ed.). Political Sociology. Chennai: Pearson Education India, (2011).

Evaluation Pattern: 60:40

Total Marks: 50

Internal Continuous Evaluation: 30 Marks	End Semester Examination: 50 Marks
• CCE-I: 10 Mark • CCE II: 10 Mark • CCE-III: 10 Mark • (Best of Two CCE)	• Question -1: 2 Mark x 5 = 10 Mark • Question -2: 10 Mark x 2 = 20 Mark • Question -3: 5 Mark x 4 = 20 Mark • (50 Marks converted to 30 marks)

