Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. II Physics

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 Physics

PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Physics to undergraduate students at second year of three years of B.Sc. degree course. Students will learn physics and astrophysics as a separate subject from B.Sc. I. The aim of the syllabus is to make the study of physics interesting, encouraging and popular to the students for higher studies including research. The new syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research. The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

1. TITLE: **Physics**
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 (2.0)

<table>
<tr><th rowspan="3">Level</th><th rowspan="3">Sem</th><th colspan="4">Subject</th><th rowspan="3">OE</th><th rowspan="3">VSC/SEC</th><th rowspan="3">AEC/VEC/IKS</th><th rowspan="3">Total</th></tr>
<tr><th colspan="2">DSC</th><th colspan="2">DSE*</th></tr>
<tr><th>T</th><th>P</th><th>T</th><th>P</th></tr>
<tr><td rowspan="2">5.0</td><td rowspan="2">III</td><td>Major V (2)</td><td rowspan="2">Major P III (2)</td><td>Minor V (2)</td><td rowspan="2">Minor P III (2)</td><td rowspan="2">OE III (2)</td><td rowspan="2">VSC I (2) (Major Specific)
SEC I (2) (P)</td><td rowspan="2">AEC I (2) (English)
IKS II (2) (Major Specific)</td><td rowspan="2">22</td></tr>
<tr><td>Major VI (2)</td><td>Minor VI (2)</td></tr>
<tr><td rowspan="2">5.0</td><td rowspan="2">IV</td><td>Major VII (2)</td><td rowspan="2">Major P IV (2)</td><td>Minor VII (2)</td><td rowspan="2">Minor P IV (2)</td><td rowspan="2">OE IV (2)</td><td rowspan="2">VSC II (2) (Major Specific)
SEC II (2) (P)</td><td rowspan="2">AEC II (2) (English)
VEC II (2) (Environmental Studies)</td><td rowspan="2">22</td></tr>
<tr><td>Major VIII (2)</td><td>Minor VIII (2)</td></tr>
</table>

7. EVALUATION STRUCTURE:

- **B.Sc. II NEP 2.0**

Semester III (5.0)

Course	Course Category	Course Code	Internal Evaluation (Best of Two)			ESE	Total Marks	Credits
			CCE-I (10)	CCE-II (10)	CCE-III (10)			
Major	T	BPT 231	10	10	10	30	50	02
	T	BPT 232	10	10	10	30	50	02
	P	BPP 233	20			30	50	02
Minor	T	BPT 234	10	10	10	30	50	02
	T	BPT 235	10	10	10	30	50	02
	P	BPP 236	20			30	50	02
OE	P	BPPOE 3	20			30	50	02
VSC	P	BPPVSC 1	20			30	50	02
SEC	P	BPPSEC 1	20			30	50	02
AEC I	T	BPTAEC 1	10	10	10	30	50	02
IKS II	T	BPTIKS 2	10	10	10	30	50	02
Total							**550**	**22**

Semester IV

Course	Course Category	Course Code	Internal Evaluation (Best of Two)			ESE	Total Marks	Credits
			CCE-I (10)	CCE-II (10)	CCE-III (10)			
Major	T	BPT 241	10	10	10	30	50	02
	T	BPT 242	10	10	10	30	50	02
	P	BPP 243	20			30	50	02
Minor	T	BPT 244	10	10	10	30	50	02
	T	BPT 245	10	10	10	30	50	02
	P	BPP 246	20			30	50	02
OE	T	BPPOE 4	20			30	50	02
VSC	P	BPPVSC 2	20			30	50	02
SEC	P	BPPSEC 2	20			30	50	02
AEC II	T	BPTAEC 2	10	10	10	30	50	02
VEC II	T	BPTVEC 2	10	10	10	30	50	02
Total							**550**	**22**

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) EQUIPMENTS:

a) Computer, LCD projector, visualizer, smart board

b) Laboratory Equipment:

1. Spectrometer,
2. Solar cell
3. Sextant
4. Parallax setup
5. Telescope
6. Travelling Microscope
7. LASER
8. Optical bench

B. Sc. II Physics Semester III

Course	Course Code	Course Title	Credits
Major V	BPT 231	Heat and Thermal Physics	2
Major VI	BPT 232	Waves, Oscillations and Sound	2
Major Practical III	BPP 233	Major Practical – III	2
Minor V	BPT 234	Heat and Thermal Physics	2
Minor VI	BPT 235	Waves, Oscillations and Sound	2
Minor Practical III	BPP 236	Minor Practical- III	2
OE III	BPPOE 3	Open Elective P-III	2
VSC I	BPPVSC-I	Introduction and Maintenance of Electrical Home Appliances	2
SEC I	BPPSEC-I	Tools for Physics Laboratory: Spectrometer and CRO	2
AEC I	BPTAEC-I	English P-I	2
IKS II	BPTIKS II	Indian Astronomy IKS P-II	2
		Total =	**22**

B. Sc. II Semester IV

Course	Course Code	Course Title	Credits
Major VII	BPT 241	Modern Physics & Electronics	2
Major VIII	BPT 242	Optics and Lasers	2
Major Practical IV	BPP 243	Major Practical – IV	2
Minor Paper VII	BPT 244	Modern Physics & Electronics	2
Minor Paper VIII	BPT 245	Optics and Lasers	2
Minor Practical IV	BPP 246	Minor Practical- IV	2
OE IV	BPPOE 4	Open Elective P-IV	2
VSC II	BPPVSC-2	Basic Python	2
SEC II	BPPSEC-2	Arduino: Practical Skills for beginners	2
AEC II	BPTAEC-2	English P-II	2
VEC II	BPTVEC-2	Environmental Awareness for Physics	2
		Total =	**22**

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

Name of the Course: BPT 231-Heat and Thermal Physics

Course Objectives: Students should be able to …

1) understand kinetic interpretation of temperature, Andrew's Expt. and different types of thermometers.
2) study kinetic theory of gasses and the concept of Transport phenomena.
3) explain thermo-dynamical state, thermodynamic equilibrium, various thermodynamic processes and first law of thermodynamics.
4) verify thermodynamic Potential, Maxwell's Relations and applications.

Course Outcomes: Students will be able to…

1) explain the concept of mean free path.
2) Transport of momentum, thermal energy and mass.
3) evaluate Andrew's expt., Curve and different types of thermometers.
4) differentiate otto engine and diesel engine and apply the concept of entropy.

Module	Title and Contents	Hrs
Module -1:	**Ideal, Real Gas and Thermometry** **1.1** Kinetic interpretation of temperature, **1.2** Andrew's experiment and curve, critical constants, Relation between critical constants and Van der waal's constants, **1.3** Reduced equation of state. **1.4** Principle of thermometry, types of thermometers, **1.5** Scales of temperature (Celsius, Kelvin, Fahrenheit and Rankine), **1.6** Mercury thermometer, Thermoelectric thermometer, **1.7** Platinum resistance thermometer, **1.8** Thermistor.	08
Module -2:	**Kinetic Theory of Gases and Transport Phenomena** **2.1** Review, Derivation of Maxwell's law of distribution of velocities and its experimental verification, **2.2** Mean free path, **2.3** Transport phenomena-Transport of momentum(viscosity), **2.4** Transport of thermal energy (conduction), **2.5** Transport of mass (diffusion), **2.6** Degrees of freedom, **2.7** Law of equipartition of energy (No derivation) and its application to specific heat of gases (mono and diatomic).	08
Module -3:	**Thermodynamics** **3.1** Second law of thermodynamics (Explanation and different statements), **3.2** Carnot's ideal heat engine, Carnot cycle (working and efficiency), **3.3** Carnot's theorem, Entropy (concept and significance), **3.4** Entropy changes in reversible and irreversible processes,	07

	3.5 Entropy –Temperature diagram, Third law of thermodynamics, **3.6** Heat Engines in practice, Rankine cycle, Steam Engine, **3.7** Internal Combustion Engine a) Otto Engine b) Diesel Engine**.**	
Module -4:	**Thermodynamic Potential** **4.1** Enthalpy, Gibbs function, **4.2** Helmholtz and Internal Energy function, **4.3** Maxwell's Relations and applications, **4.4** Joule –Thompson effect, **4.5** Clausius- Clapeyron Equation, **4.6** Expressions for (Cp- Cv) and Cp/ Cv , TDS equation	07

Reference Books:-

1) J. P. Agrawal, S. Prakash, *Heat Thermodynamics and Statistical Physics,* Pragati Prakashan 2018
2) M.W. Zemansky and R. Dittman, *Heat and Thermodynamics,* Tata McGraw-Hill Education Pvt. Ltd., 8th edition 2011.
3) J. B. Rajam and C. L. Arora, *Text book of Heat and Thermodynamics*, , S. Chand and Company Ltd Publisher 2009.
4) D. S. Mathur, *Heat and Thermodynamics,* S. Chand and Sons Ltd. Publisher, 2008.
5) B.S. Brijlal and N. Subramanyam, *Heat and Thermodynamics*, , S.Chand and Company Ltd. Publisher. 2001
6) S. Meghnad and B.N. Srivastava, *A treatise on Heat, Indian Press Ltd.,* 2nd edition, 1935

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

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

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

Name of the Course: BPT 232-Waves, Oscillations and Sound

Course Objectives: Students should be able to …

1) understand SHM and its solution, superposition principle and Lissajous figures and their uses.
2) study travelling and standing waves on a string, plane waves and spherical waves.
3) describe transducers and their types, to understand concept of acoustics of buildings, Sabine's experimental work and reverberation time.
4) demonstrate the Piezo-electric effect, detection of Ultrasonic waves and applications of Ultrasonic waves.

Course Outcomes: Students will be able to…

1) explain superposition principle, Lissajous figures and their uses.
2) understand plane waves, spherical waves.
3) differentiate concept of acoustics of buildings, Sabine's experiment and reverberation time.
4) analyze detection of ultrasonic waves and their applications.

Module	Title and Contents	Hrs
Module -1:	**Oscillations** **1.1** Simple harmonic motion **1.2** Differential equation of SHM and its solutions **1.3** Kinetic and potential energy **1.4** Kater's pendulum **1.5** Damped oscillations **1.6** Superposition of two collinear harmonic Oscillations **1.7** Linearity and superposition principle Oscillations having equal frequencies along the line and Oscillations having different frequencies along the same straight line (beats) **1.8** Lissajous figures with equal and unequal frequencies and their uses.	08
Module -2:	**Wave Motion** **2.1** Transverse waves on a string, traveling and standing waves on a string **2.2** traveling and standing waves on a string **2.3** normal modes of a string **2.4** Laws of vibration **2.5** Energy density and energy transport of transverse wave along a stretched string **2.6** group velocity **2.7** phase velocity **2.8** plane waves and relation between them **2.9** spherical waves, **2.10** intensity of a wave.	08
Module -3:	**Sound** **3.1** Acoustics Transducers (Qualitative)	07

	3.2 pressure microphone **3.3** moving coil loudspeaker **3.4** Digital audio system **3.5** Acoustics of Buildings: Reverberation time **3**.6 factors affecting acoustics of buildings **3.7** Sabine's experimental work and formula **3.8** optimum reverberation time **3.9** Requirements of good acoustics	
Module -4:	**Ultrasonic Waves** **4.1** Piezo-electric effect, **4.2** Magnetostriction effect **4.3** production of ultrasonic waves- magnetostriction oscillator **4.4** Piezo-electric oscillator **4.5** detection of ultrasonic waves :Kundt's tube **4.6** sensitive flame method **4.7** thermal detector **4.8** quartz crystal method **4.10** Applications of ultrasonic waves	07

Reference Books:-

1) Subrahmanyam and Brijlal, *A text book of Sound*, 2nd edition, S. Chand Publisher. 2018
2) Satya Prakash, *Oscillations and Waves*, Pragati Prakashan. 2017
3) Chattopadhyay D., *A Treatise on oscillations, waves and acoustics*, Books and allied Pvt. Ltd. Publisher. 2016.
4) Walker J., David Halliday and Robert Resnick, *Principles of Physics*,10thedition, Wiley
5) Halliday and Resnick, *Fundamentals of Physics Volume 1,* 9thedition, Wiley Publisher. , 2011
6) Mathur D. S., *Elements of properties of matter*, S. Chand and Co Ltd. Publisher. , 2010

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20Marks (Best of Two)	**End Semester Examination: 50 Marks**
• Internal Work -1 : CCE-1 - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks	• Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks • Question -3 : 05 Marks x 4 = 20 Marks

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Board of Studies in Physics

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

Name of the Course: BPP 233-Practical Heat, Thermal Physics, Waves, Oscillations & Sound

Course Objectives: Students should be able to …

1) gain practical skills in practical.
2) understand the principles of Lee's method for measuring thermal conductivity
3) differentiate the principles of coupled oscillations and bifilar pendulum.
4) gain practical experience in generating and observing Lissajous figures using oscilloscopes and signal generators.

Course Outcomes: Students will be able to …

1) acquire practical skills in practical
2) demonstrate an understanding of various methods used to measure thermal conductivity, including Lee's method and Forbes' method.
3) develop an understanding of the thermal properties of various materials, including metals, insulators, and liquids, and their significance in practical applications.
4) acquire practical skills in setting up and conducting experiments to investigate the motion of coupled oscillations,

Module	Title and Contents (Any 15)	Hrs
	1) To determine Coefficient of Thermal Conductivity of a bad conductor by Lee's method. **2)** To determine the temperature coefficient of resistance of a given coil by P. O. box. **3)** To determine the thermal conductivity of a metal rod by Forbe's method. **4)** To determine Coefficient of Thermal Conductivity of glass in the form of a tube. **5)** To determine the specific heat of a liquid (turpentine oil) by law of cooling. **6)** Determination of Stefan's constant/ Verification of Stefan's law. **7)** Study of temperature coefficient of Thermistor. **8)** To determine Mechanical Equivalent of Heat J by Callendar and Barne's constant flow method. **9)** To investigate the motion of coupled oscillations. **10)** To determine acceleration due to gravity by using Bifilar Pendulum. **11)** To study Lissajous figures. **12)** Measurement of velocity of sound by Kundt's tube method. **13)** Measurement of Velocity of Sound by CRO. **14)** Measurement of Velocity of Sound by Resonating Bottle. **15)** Measurement of log decrement by Exponential Decay. **16)** To determine velocity of transverse waves using a sonometer. **17)** To verify the laws of transverse vibration using Melde's apparatus.	60

	18) To determine the frequency of A.C supply by Melde‟s experiment **19)** To verify the laws of Probability Distribution and to verify laws of probability of throwing one coin, two coins and then coins (or more). **20)** The study of Statistical Distribution from the given data and to find most probable, average and rms values.	

Reference Books:-

1) Singh H. and P. S. Hemne, *B.Sc. Practical Physics*, 4thed , S. Chand Publication. , 2011

2) Gupta S. L. and V. Kumar,*Practical Physics, 27thed, Pragati Prakashan*, 2010

3) *Chattopadhyay D.*,P. C. Rakshit,An Advanced course in Practical Physics, New Central Book Agency Pvt. Ltd. ition. ,2005

4) Arora C. L, *B.Sc. Practical Physics,* S. Chand Publication, 1957

5) Marsh W. White , Kenneth V. Manning, *Experimental College Physics,* 3rd ed, McGraw Hill Higher Education. ,1954

6) WorsnopB.L. , H.T. Flint, *Advanced Practical Physics for Students* , 9th ed., Littlehampton Book Services Ltd. ,1951

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 Marks	**End Semester Examination: 30 Marks**
• Internal Work -1 : CCE-1 - 20 Marks	• Question -1: 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. II	**Semester** - III
Type : DSE (Minor V)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPT 234-Heat and Thermal Physics

Course Objectives: Students should be able to …

1) understand kinetic interpretation of temperature, Andrew's Expt. and different types of thermometers.
2) study kinetic theory of gasses and the concept of Transport phenomena.
3) understood thermo-dynamical state, thermodynamic equilibrium, various thermodynamic processes and first law of thermodynamics.
4) verify thermodynamic Potential, Maxwell's Relations and applications.

Course Outcomes: Students will be able to…

1) explain the concept of mean free path,
2) explain transport of momentum, thermal energy and mass.
3) evaluate Andrew's expt., Curve and different types of thermometers.
4) differentiate otto engine and diesel engine and apply the concept of entropy.

Module	Title and Contents	Hrs
Module -1:	**Ideal, Real Gas and Thermometry** **1.1** Kinetic interpretation of temperature, **1.2** Andrew's experiment and curve, critical constants, Relation between critical constants and Van der waal's constants, **1.3** Reduced equation of state. **1.4** Principle of thermometry, types of thermometers, **1.5** Scales of temperature (Celsius, Kelvin, Fahrenheit and Rankine), **1.6** Mercury thermometer, Thermoelectric thermometer, **1.7** Platinum resistance thermometer, **1.8** Thermistor.	08
Module -2:	**Kinetic Theory of Gases and Transport Phenomena** **2.1** Review, Derivation of Maxwell's law of distribution of velocities and its experimental verification, **2.2** Mean free path, **2.3** Transport phenomena-Transport of momentum(viscosity), **2.4** Transport of thermal energy (conduction), **2.5** Transport of mass (diffusion), **2.6** Degrees of freedom, **2.7** Law of equipartition of energy (No derivation) and its application to specific heat of gases (mono and diatomic).	08
Module -3:	**Thermodynamics** **3.1** Second law of thermodynamics (Explanation and different statements), **3.2** Carnot's ideal heat engine, Carnot cycle (working and efficiency), **3.3** Carnot's theorem, Entropy (concept and significance), **3.4** Entropy changes in reversible and irreversible processes, **3.5** Entropy –Temperature diagram, Third law of thermodynamics,	07

	3.6 Heat Engines in practice, Rankine cycle, Steam Engine, **3.7** Internal Combustion Engine a) Otto Engine b) Diesel Engine**.**	
Module -4:	**Thermodynamic Potential** **4.1** Enthalpy, Gibbs function, **4.2** Helmholtz and Internal Energy function, **4.3** Maxwell's Relations and applications, **4.4** Joule –Thompson effect, **4.5** Clausius- Clapeyron Equation, **4.6** Expressions for (Cp- Cv) and Cp/ Cv , TDS equation	07

Reference Books:-

1) Agrawal, J. P., Satya Prakash, *Heat Thermodynamics and Statistical Physics,* Pragati Prakashan 2018
2) Zemansky M.W. and R. Dittman, *Heat and Thermodynamics,* Tata McGraw-Hill Education Pvt. Ltd., 8th edition 2011.
3) Rajam J. B. and C. L. Arora, *Text book of Heat and Thermodynamics*, , S. Chand and Company Ltd Publisher 2009.
4) Mathur D. S., *Heat and Thermodynamics,,* S. Chand and Sons Ltd. Publisher, 2008.
5) Brijlal B.S. and N. Subramanyam, *, Heat and Thermodynamics*, , S.Chand and Company Ltd. Publisher. 2001
6) Saha Meghnad and B.N. Srivastava, *A treatise on Heat, Indian Press Ltd.,* 2nd edition, 1935

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20Marks (Best of Two)	**End Semester Examination: 50 Marks**
• Internal Work -1 : CCE-1 - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks	• Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks • Question -3 : 05 Marks x 4 = 20 Marks

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Board of Studies in Physics

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

Name of the Course: BPT 235-Waves, Oscillations and Sound

Course Objectives: Students should be able to …

1) understand SHM and its solution, superposition principle and Lissajous figures and their uses.
2) study travelling and standing waves on a string, plane waves and spherical waves.
3) describe transducers and their types, to understand concept of acoustics of buildings, Sabine's experimental work and reverberation time.
4) demonstrate the Piezo-electric effect, detection of Ultrasonic waves and applications of Ultrasonic waves.

Course Outcomes: Students will be able to…

1) explain superposition principle, Lissajous figures and their uses.
2) understand plane waves, spherical waves.
3) differentiate concept of acoustics of buildings, Sabine's experiment and reverberation time.
4) analyze detection of ultrasonic waves and their applications.

Module	Title and Contents	Hrs
Module -1:	**Oscillations** **1.1** Simple harmonic motion **1.2** Differential equation of SHM and its solutions **1.3** Kinetic and potential energy **1.4** Kater's pendulum **1.5** Damped oscillations **1.6** Superposition of two collinear harmonic Oscillations **1.7** Linearity and superposition principle Oscillations having equal frequencies along the line and Oscillations having different frequencies along the same straight line (beats) **1.8** Lissajous figures with equal and unequal frequencies and their uses.	08
Module -2:	**Wave Motion** **2.1** Transverse waves on a string, traveling and standing waves on a string **2.2** traveling and standing waves on a string **2.3** normal modes of a string **2.4** Laws of vibration **2.5** Energy density and energy transport of transverse wave along a stretched string **2.6** group velocity **2.7** phase velocity **2.8** plane waves and relation between them **2.9** spherical waves, **2.10** intensity of a wave.	08
Module -3:	**Sound** **3.1** Acoustics Transducers (Qualitative) **3.2** pressure microphone	07

	3.3 moving coil loudspeaker **3.4** Digital audio system **3.5** Acoustics of Buildings: Reverberation time **3**.6 factors affecting acoustics of buildings **3.7** Sabine's experimental work and formula **3.8** optimum reverberation time **3.9** Requirements of good acoustics	
Module -4:	**Ultrasonic Waves** **4.1** Piezo-electric effect, **4.2** Magnetostriction effect **4.3** production of ultrasonic waves- magnetostriction oscillator **4.4** Piezo-electric oscillator **4.5** detection of ultrasonic waves :Kundt's tube **4.6** sensitive flame method **4.7** thermal detector **4.8** quartz crystal method **4.9** Applications of ultrasonic waves	07

Reference Books:-

1) Subrahmanyam and Brijlal , *A text book of Sound*, 2nd edition, S. Chand Publisher. 2018
2) Satya Prakash, , *Oscillations and Waves*, Pragati Prakashan. 2017
3) Chattopadhyay D., *A Treatise on oscillations, waves and acoustics*, Books and allied Pvt. Ltd.
   a. Publisher. 2016
4) Walker J., David Halliday and Robert Resnick, *Principles of Physics*,10thedition, Wiley
5) Halliday and Resnick, *Fundamentals of Physics Volume 1,* 9thedition, Wiley Publisher. , 2011
6) Mathur D. S., *Elements of properties of matter*, S. Chand and Co Ltd. Publisher. , 2010

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20Marks (Best of Two)	**End Semester Examination: 50 Marks**
• Internal Work -1 : CCE-1 - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks	• Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks Question -3 : 05 Marks x 4 = 20 Marks

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

Programme: BSc II	**Semester** - III
Type : DSE (Minor Practical III)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPP 236-Practical Heat, Thermal Physics, Waves, Oscillations & Sound

Course Objectives: Students should be able to …

1) gain practical skills in practical.
2) understand the principles of Lee's method for measuring thermal conductivity
3) differentiate the principles of coupled oscillations and bifilar pendulum.
4) gain practical experience in generating and observing Lissajous figures using oscilloscopes and signal generators.

Course Outcomes: Students will be able to…

1) acquire practical skills in practical
2) demonstrate an understanding of various methods used to measure thermal conductivity, including Lee's method and Forbes' method.
3) develop an understanding of the thermal properties of various materials, including metals, insulators, and liquids, and their significance in practical applications.
4) acquire practical skills in setting up and conducting experiments to investigate the motion of coupled oscillations,

Module	Title and Contents (Any 15)	Hrs
	1) To determine Coefficient of Thermal Conductivity of a bad conductor by Lee's method. 2) To determine the temperature coefficient of resistance of a given coil by P. O. box. 3) To determine the thermal conductivity of a metal rod by Forbe's method. 4) To determine Coefficient of Thermal Conductivity of glass in the form of a tube. 5) To determine the specific heat of a liquid (turpentine oil) by law of cooling. 6) Determination of Stefan's constant/ Verification of Stefan's law. 7) Study of temperature coefficient of Thermistor. 8) To determine Mechanical Equivalent of Heat J by Callendar and Barne's constant flow method. 9) To investigate the motion of coupled oscillations. 10) To determine acceleration due to gravity by using Bifilar Pendulum. 11) To study Lissajous figures. 12) Measurement of velocity of sound by Kundt's tube method. 13) Measurement of Velocity of Sound by CRO. 14) Measurement of Velocity of Sound by Resonating Bottle. 15) Measurement of log decrement by Exponential Decay. 16) To determine velocity of transverse waves using a sonometer. 17) To verify the laws of transverse vibration using Melde's apparatus. 18) To determine the frequency of A.C supply by Melde"s experiment	60

	19) To verify the laws of Probability Distribution and to verify laws of probability of throwing one coin, two coins and then coins (or more). 20) The study of Statistical Distribution from the given data and to find most probable, average and rms values.	

Reference Books:-

1) Singh H. and P. S. Hemne, *B.Sc. Practical Physics*, 4thed , S. Chand Publication. , 2011
2) Gupta S. L. and V. Kumar,*Practical Physics, 27thed, Pragati Prakashan*, 2010
3) *Chattopadhyay D.*,P. C. Rakshit,An Advanced course in Practical Physics, New Central Book Agency Pvt. Ltd. ition. ,2005
4) Arora C. L, *B.Sc. Practical Physics,* S. Chand Publication, 1957
5) Marsh W. White , Kenneth V. Manning, *Experimental College Physics* , 3rd ed, McGraw Hill Higher Education. ,1954
6) WorsnopB.L. , H.T. Flint, *Advanced Practical Physics for Students* , 9th ed., Littlehampton Book Services Ltd. ,1951

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 Marks	**End Semester Examination: 30 Marks**
• Internal Work -1 : CCE-1 - 20 Marks	• Question -1: 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. II	**Semester** - III
Type : VSC I	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPPVSC-I-Vocational Skill Course in Introduction and Maintenance of Electrical Home Appliances

Course Objectives: Students should be able to …

1) learn to calculate the power consumed by a resistive load.
2) understand how current and voltage distribute in a series and parallel circuits.
3) prepare an extension board for power distribution.
4) learn the basic concepts of PCB design and understand how to rework and repair PCBs.

Course Outcomes: Students will be able to…

1) develop a wire connection to operate a two-way switch system, and understand how the control of a light bulb from two different locations works.
2) understand the correct wiring of a 3-pin socket and the importance of live, neutral, and earth connections for safety in electrical installations.
3) build and test a safe extension board with sockets, switches, and a fuse.
4) develop a circuit to control the operation of a fan and bulb remotely.

Module	Title and Contents (any 15)	Hrs
	1. Build a circuit to understand the relationship between current, voltage, and resistance. 2. Measure the power consumed by a resistive load. 3. Calculate the bill of electricity for one-month domestic use 4. Study the current and voltage distribution in series circuit. 5. Study the current and voltage distribution in parallel circuit. 6. To study the conversion of AC mains to 12V DC using a transformer, rectifier, and regulator. 7. Study about a wiring of a two-way switch to control a bulb from two locations. 8. Study the wiring of a 3-pin socket with proper live, neutral, and earthing connections. 9. To study of 3 phase transformer for its various connections i.e. star/star, star/delta, delta/star, scot 10. Design and test a wiring system for lights and sockets in a small room. 11. Study of wiring and testing a tube light for proper operation. 12. Study the role of a fuse in protecting circuits and how to replace it. 13. To study the use a relay and switch to control a bulb remotely. 14. To study the use of a relay to switch a fan on or off remotely. 15. Study about the Installation of CCTV wiring. 16. Built an extension board with sockets, switches, and a fuse. 17. Study to connect, test, and troubleshoots in fans. 18. Study to connect, test, and troubleshoot in a water heater. 19. Dismantling reassembling testing and repairs ordinary laundry iron.	60

	20. Dismantling reassembling up keeping testing & repairs blender, juicer, Grinder.	

Reference Books:-

1) Mehta, V.K., and Rohit Mehta. Basic Electrical and Electronics Engineering. S. Chand Publishing, 2008.

2) Bagde and Singh, *Elements of Electronics*, (New Delhi: Chand and Co., 2002).

3) *Hambley, Allan R.* Electrical Engineering: Principles and Applications*. 7th ed. Pearson, 2013.*

4) Mullin, Ray C*. Electrical Wiring Residential. 16th ed. Delmar Cengage Learning, 2016.*

5) Schroeder, Chris*."PCB Design for Real-World Applications." New York: McGraw-Hill Education, 2017.*

6) Gupta, R. K*."Printed Circuit Boards: Design, Fabrication, and Assembly." New Delhi: Wiley India, 2013.*

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 Marks • Internal Work -1 : CCE-1 - 20 Marks	**End Semester Examination: 30 Marks** • Question -1: 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: BSc II	**Semester** - III
Type : Skill Enhancement Course I	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPPSEC 01-Tools for Physics Laboratory Spectrometer and CRO

Course Objectives: Students should be able to …

1) learn panel control knobs of CRO and testing the components.
2) study internal hardware of CRO with block diagram.
3) understand various performing parameters of CRO.
4) know various levelling to focus for parallel light.

Course Outcomes: Students will be able to…

1) demonstrate basic experimental skills by setting up laboratory equipment/ experiment set up safely and efficiently, instruments calibration, carry out experimental procedure, data collection, analysis and report it in a written sheet manner.
2) exhibit practical skills in using CRO and spectrometer for a given measuring task.
3) demonstrate skills for measuring voltage levels, amplitude, period, frequency and also to test the electronic components.
4) analyze the different spectral components produced by the prism using spectrometer.

Module	Title and Contents (Any 15)	Hrs
	Tools for Physics Laboratory: Spectrometer and CRO	60
	1. Determination of least count of spectrometer and its calibration. 2. Spectrometer focusing for parallel rays by Schuster's method. 3. Calibration of spectrometer to measure unknown wavelength. 4. Measurement of angle of prism using spectrometer. 5. Mounting of grating normally to incident light on spectrometer. 6. Setting an oscilloscope to display sinusoidal waveform. 7. Determination of time period and frequency using CRO. 8. To determine unknown frequency using CRO (Lissajous Figures). 9. Testing and identification of electronic components 10. RC Phase shift measurement 11. Study of characteristics of diode using CRO. 12. Measure DC voltage of power supply using CRO. 13. Measurement of frequency using signal generator and CRO. 14. Study of output waveform of an oscillator circuit using CRO. 15. Study of characteristics of transinter using CRO. 16. Measurement of angle of deviation for given source of light using spectrometer. 17. Determine the least count of optical bench. 18. Study of diffraction pattern using auxiliary slit. 19. Study of diffraction pattern using optical bench. 20. Study of interference fringes using optical bench.	

Reference Books:-

1) Worsnop,B.L.,and H.T.Flint., *Advanced practical physics for students*, (London: Methuen & Co., Ltd,1962)

2) I.Prakash and Ramakrishna , *A Textbook of Practical Physics*,(Kitab Mahal,11th Edition ,2011).

3) Gupta,S.L.,andV.Kumar.,*Practical physics*.(Meerut:PragatiPrakashan,27thEdition.1973)

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20 Marks • Internal Work -1 : CCE-1 - 20 Marks	**End Semester Examination: 30 Marks** • Question -1: 30 Marks

Karmaveer Bhaurao Patil University, Satara

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

Programme: B.Sc. II	**Semester** - III
Type : Indian Knowledge System II	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPTIKS-II-Indian Astronomy

Course Objectives: Students should be able to …

1) understand motion of equinoxes.
2) describe Indian calendar system.
3) list astronomical endeavours of Indian scholars.
4) understand the measurement of "Time" in ancient period (Vedic Period).

Course Outcomes: Students will be able to…

1) describe fundamental concepts of Indian astronomy.
2) outline development of Indian astronomy in ancient times.
3) asses the ancient metallurgical specimens.
4) explain the "Time" measurements in ancient period (Vedic Period).

Module	Title and Contents	Hrs
Module -1:	**Historical Introduction** **1.1** Introduction, Ancient Indian Astronomy, **1.2** The Vedic Period and Vedanga-jyotisha, Siddhanta, Aryabhata I (476 AD), **1.3** Astronomers after Aryabhata, Contents of the Siddhantas, **1.4** Continuity in Astronomical Tradition	08
Module -2:	**Celestial Sphere** **2.1** Introduction, Diurnal Motion of Celestial Bodics, **2.2** Motion of Celestial Bodies Relative to Stars, **2.3** Celestial Horizon, Meridian, Pole Star and Directions, **2.4** Zodiac and Constellations, E **2.5** quator and Poles (Visuvad verta and Dhruva), **2.6** Latitude of a Place and Altitude of Pole Star, Ecliptic and the Equinoxes	08
Module -3:	**Co-ordinate Systems** **3.1** Introduction, Celestial Longitude and Latitude (Ecliptic System), **3.2** Right Ascension and Declination (Equatorial System), **3.3** Azimuth and Altitude (Horizontal System), **3.4** Hour Angle and Declination (Meridian System), **3.5** Phenomenon of Precession of Equinoxes, **3.6** Ancient Indian References to the Precession, **3.7** Effects of Precession on Celestial Longitude, **3.8** Tropical (Sayana) and Sidereal (Nirayana) Longitudes.	07
Module -4:	**Time in Indian Astronomy** **4.1** Introduction, Civil Day and Sidereal Day, **4.2** Solar Year and Civil Calendar, **4.3** Solar Month and Lunar Month, **4.4** Luni-Solar Year (or Lunar Year), A **4.5** dhikamāsa and Ksayamāsa, Yuga System, **4.6** Indian Eras, Time on a Microcosmic Scale	07

Reference Books:-

1) Ramasubramanian, K., Aniket Sule, and Mayank Vahia, eds. 2016. *History of Astronomy: A Handbook*. Sand HI, IIT Bombay, and T.I.F.R. Mumbai.
2) Ramasubramanian, K., and M. S. Sriram. 2011. *Tantrasaṅgraha of Nīlakaṇṭha Somayājī: Translation and Notes*. New Delhi: Hindustan Book Agency.
3) Bose, D. M., S. N. Sen, and B. V. Subbarayappa, eds. 2010. *A Concise History of Science in India*. 2nd ed. Hyderabad: Universities Press.
4) Sen, S. N., and K. S. Shukla. 2001. *History of Astronomy in India*. 2nd ed. Delhi: INSA.
5) Rao, S. Balachandra. 2000. *Indian Astronomy: An Introduction*. Hyderabad: Universities Press.

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

Karmaveer Bhaurao Patil University, Satara

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

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

Name of the Course: BPT 241-Modern Physics and Electronics

Course Objectives: Students should be able to …

1) understand special theory of relativity
2) study wave particle duality
3) differentiate various characteristics of transistor
4) analyse various types of oscillators

Course Outcomes: Students will be able to…

1) explain postulates of special theory of relativity.
2) understand concept of wave packet and Uncertainty principle.
3) differentiate negative and positive feedbacks in transistor.
4) analyze oscillators and oscillations.

Module	Title and Contents	Hrs
Module -1:	**Special theory of Relativity** **1.1** Inertial and Non-Inertial frame of references, **1.2** Galilean transformation equations, **1.3** Michelson- Morley experiment, Ether hypothesis, **1.4** Postulates of special theory of relativity, Lorentz transformation equations, **1.5** Relativistic addition of velocities, Length contraction, Time dilation, variation of mass with velocity, mass energy relation	08
Module -2:	**Matter Waves** **2.1** Wave particle duality, **2.2** De-Broglie hypothesis of matter waves, **2.3** Derivation of wavelength of matter wave, Concept of wave packet, **2.4** Davisson and Germer experiment, **2.5** Uncertainty principle (statement only): position–momentum and energy- time, **2.6** Application of uncertainty principle non existence of free electrons in the nucleus.	08
Module -3:	**Transistor** **3.1** Revision of Bipolar Junction Transistor (BJT), **3.2** Single stage common emitter transistor amplifier, **3.3** Frequency response curve of an amplifier, **3.4** negative and positive feedback, **3.5** Effect of negative feedback on the gain response curve, Problems.	07
Module -4:	**Oscillator** **4.1** Introduction, Types of waves, **4.2** Oscillations from tank circuit, **4.3** Barkhausen's criterion for sustained oscillations,	07

	4.4 Phase shift oscillator, **4.5** Colpitt's oscillator, **4.6** Problems.	

Reference Books:-

1) Albert Einstein, Relativity: The Special and the General Theory (Fingerprint Publishing, 2017) 2-62.
2) NouredineZettili, Quantum Mechanics Concept and Applications (A John Wiley and Sons Ltd Publisher, 2nd edition, 2009) 10-222.
3) Aruldas G., Quantum Mechanics (Prentice Hall India Learning Private Limited Publisher, 2nd edition, 2008) 4-48.
4) Robert Resnick, Introduction to Special Relativity (Wiley; 1st edition, 2007) 1-188.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20Marks (Best of Two)	**End Semester Examination: 50 Marks**
• Internal Work -1 : CCE-1 - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks	• Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks Question -3 : 05 Marks x 4 = 20 Marks

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Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

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

Name of the Course: BPT242-Optics and Lasers

Course Objectives: Students should be able to …

1) understand the concept of cardinal points, working of Searle's goniometer, optical magnifications, difference between resolving and magnifying powers.
2) study division of amplitude, division of wavefront, formation of interference in various films, Fresnel diffraction, Fraunhofer diffraction and a convex lens.
3) differentiate structure and types of optical fibers, principle and working of fiber optic communication system, working of some lasers and idea of Holography.
4) explore polarization principle, construction and working of polarimeter.

Course Outcomes: Students will be able to…

1) explain cardinal points, working of Searle's goniometer and optical magnifications
2) understand Fresnel diffraction, Fraunhofer diffraction, half period zones, zone plates and difference between zone plate and a convex lens.
3) differentiate structure and types of optical fibers, principle and working of fiber optic communication system.
4) analyze principle, construction and working of polarimeter.

Module	Title and Contents	Hrs
Module -1:	**Geometrical Optics** **1.1** Definition and properties of cardinal points of a lens system, coincidence of principal points and nodal points, **1.2** Image formation by cardinal points, Newton's formula, **1.3** Relation between focal lengths of an optical system, axial, lateral and angular magnifications; Abbe's sine condition. **1.4** Resolving power Resolving power, Rayleigh's criterion for the limit of resolution, **1.5** comparison between magnifying power and resolving power, **1.6** Resolving power of plane diffraction grating, resolving power of prism.	08
Module -2:	**Interference of light** **2.1** Principle of superposition of waves, **2.2** Division of amplitude, division of wavefront, **2.3** interference in thin parallel films due to reflected light, **2.4** wedge shaped films, **2.5** Newton's rings, its applications for determination of wavelength of light and R.I. of liquid.	08
Module -3:	**Diffraction and Polarization of light** **3.1** Introduction and types of diffraction,	07

	3.2 Fraunhofer diffraction and Fresnel diffraction: **3.3** plane diffraction grating, theory of plane diffraction grating, its application to determine wavelength of monochromatic light. **3.4** Polarization : Introduction, Types of polarization, **3.5** Polarization by double refraction, Huygens explanation of double refraction through uniaxial crystals, **3.6** optical rotation laws of rotation of the plane of polarization, polarimeter.	
Module -4:	**Laser system** **4.1** Absorption, spontaneous and stimulated emission, **4.2** Einstein coefficients (only definitions), **4.3** population inversion, optical and electrical pumping, properties of lasers, **4.4** Ruby laser, **4.5** Helium-Neon laser, uses of laser, **4.6** idea of holography (qualitative treatment only).	07

Reference Books:-

1) J. P. Agarwal,. *Physical optics and lasers,* 13th edition,Pragati Prakashan. 2017
2) Brij Lal, M. N. Avadhanulu and N. Subrahmanyam. A *Textbook of Optics.* 25th edition. S. Chand Publisher, 2012.
3) Thyagarajan, K., and AjoyGhatak. *Lasers Fundamentals and Applications*, 2nd edition, Springer Science and Business Media Publisher. 2011.
4) Laud, B. B. *Lasers and non-linear optics*. New Delhi: New Age International Publishers. 2011.
5) Longhurst, R. S. *Geometrical and physical optics*. 2ndedition, New York: Wiley. 1967.
6) AjoyGhatak, *Optics*. 4th edition, McGraw Hill Education India Pvt Ltd. 2008.

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

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

Programme: BSc II	**Semester** - IV
Type : DSC (Major Practical IV)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPP 243-Modern Physics, Electronics Optics and Lasers

Course Objectives: Students should be able to …

1) develop practical skills.
2) understand the principles of CE (Common Emitter) amplifier configuration.
3) learn methods for determining the frequency of oscillation.
4) gain practical skills in constructing and testing the oscillator using BJT.

Course Outcomes: Students will be able to…

1) learn measuring skills in practical
2) capable of building and testing of Colpitts, Phase shift oscillators employing BJT transistors.
3) design CE amplifiers with specified gains using voltage divider biasing techniques.
4) determine the radius of curvature of convex mirrors, enhancing their understanding of geometric optics principles.

Module	Title and Contents (any 15)	Hrs
	1. Measurement of Planck's constant. 2. To design a single stage CE amplifier of given gain using voltage divider bias. 3. Frequency response of single stage RC coupled amplifier. 4. To determine the frequency of the Crystal oscillator. 5. To build and test Colpitts oscillator using BJT. 6. To build and test Phase shift oscillator using BJT. 7. UJT as a voltage sweep generator. 8. To study divergence of a laser beam. 9. Determination of Wavelength of He-Ne Laser using grating. 10. I-V Characteristics of a solar cell 11. Study of cardinal points using Goniometer. 12. Determination of equivalent focal length of a system of lenses by using Goniometer. 13. Determination of R.I. of given liquid by Liquid Lens. 14. Determination of dispersive power of material of prism. 15. Determination of Cauchy's Constants. 16. Determination of Resolving Power of plane diffraction grating. 17. Determination of Resolving Power of prism.. 18. Determination of Wavelength of sodium source by Newton's rings. 19. Determination of specific rotation of sugar solution using Polarimeter. 20. Study of cardinal points by Newton's Method.	60

Reference Books:-

1) H. Singh and P.S. Hemne, 4th edition, B.Sc. Practical Physics.S. Chand Publisher, 2011

2) S. L. Gupta and V. Kumar, 27th edition, Practical Physics, Pragati Prakashan2010.

3) D. Chattopadhyay and P. C. Rakshit, 7th edition, An Advanced Course in Practical Physics, New Central Book Agency Pvt. Ltd., 2005.

<table>
<tr><td colspan="2">4) B. L. Worsnop and H. T. Flint, 9th edition Advanced Practical Physics for Students, Asia Pub. House, 1961.</td></tr>
<tr><td colspan="2">Evaluation Pattern: 40:60</td></tr>
<tr><td colspan="2">Total Marks: 50</td></tr>
<tr><td>Internal Continuous Evaluation: 20 Marks
Internal Work -1 : CCE-1 - 20 Marks</td><td>End Semester Examination: 30 Marks
Question -1: 30 Marks</td></tr>
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Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

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

Name of the Course: BPT 244-Modern Physics and Electronics

Course Objectives: Students should be able to…

1) understand special theory of relativity
2) study wave particle duality
3) differentiate various characteristics of transistor
4) analyse various types of oscillators

Course Outcomes: Students will be able to…

1) explain postulates of special theory of relativity.
2) understand concept of wave packet and Uncertainty principle.
3) differentiate negative and positive feedbacks in transistor.
4) analyze oscillators and oscillations.

Module	Title and Contents	Hrs
Module -1:	**Special theory of Relativity** **1.1** Inertial and Non-Inertial frame of references, **1.2** Galilean transformation equations, **1.3** Michelson- Morley experiment, Ether hypothesis, **1.4** Postulates of special theory of relativity, Lorentz transformation equations, **1.5** Relativistic addition of velocities, Length contraction, Time dilation, variation of mass with velocity, mass energy relation	08
Module -2:	**Matter Waves** **2.1** Wave particle duality, **2.2** De-Broglie hypothesis of matter waves, **2.3** Derivation of wavelength of matter wave, Concept of wave packet, **2.4** Davisson and Germer experiment, **2.5** Uncertainty principle (statement only): position–momentum and energy-time, **2.6** Application of uncertainty principle non existence of free electrons in the nucleus.	08
Module -3:	**Transistor** **3.1** Revision of Bipolar Junction Transistor (BJT), **3.2** Single stage common emitter transistor amplifier, **3.3** Frequency response curve of an amplifier, **3.4** negative and positive feedback, **3.5** Effect of negative feedback on the gain response curve, Problems.	07
Module -4:	**Oscillator** **4.1** Introduction, Types of waves,	07

	4.2 Oscillations from tank circuit, **4.3** Barkhausen's criterion for sustained oscillations, **4.4** Phase shift oscillator, **4.5** Colpitt's oscillator, **4.6** Problems.	

Reference Books:-

1) Albert Einstein, Relativity: The Special and the General Theory (Fingerprint Publishing, 2017) 2-62.
2) NouredineZettili, Quantum Mechanics Concept and Applications (A John Wiley and Sons Ltd Publisher, 2nd edition, 2009) 10-222.
3) Aruldas G., Quantum Mechanics (Prentice Hall India Learning Private Limited Publisher, 2nd edition, 2008) 4-48.
4) Robert Resnick, Introduction to Special Relativity (Wiley; 1st edition, 2007) 1-188.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20Marks (Best of Two)	**End Semester Examination: 50 Marks**
• Internal Work -1 : CCE-1 - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks	• Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks Question -3 : 05 Marks x 4 = 20 Marks

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

Name of the Course: BPT245-Optics and Lasers

Course Objectives: Students should be able to …

1) understand the concept of cardinal points, working of Searle's goniometer, optical magnifications, difference between resolving and magnifying powers.
2) study division of amplitude, division of wavefront, formation of interference in various films, Fresnel diffraction, Fraunhofer diffraction and a convex lens.
3) differentiate structure and types of optical fibers, principle and working of fiber optic communication system, working of some lasers and idea of Holography.
4) explore polarization principle, construction and working of polarimeter.

Course Outcomes: Students will be able to…

1) explain cardinal points, working of Searle's goniometer and optical magnifications
2) understand Fresnel diffraction, Fraunhofer diffraction, half period zones, zone plates and difference between zone plate and a convex lens.
3) differentiate structure and types of optical fibers, principle and working of fiber optic communication system.
4) analyze principle, construction and working of polarimeter.

Module	Title and Contents	Hrs
Module -1:	**Geometrical Optics** **1.1** Definition and properties of cardinal points of a lens system, coincidence of principal points and nodal points, **1.2** Image formation by cardinal points, Newton's formula, **1.3** Relation between focal lengths of an optical system, axial, lateral and angular magnifications; Abbe's sine condition. **1.4** Resolving power Resolving power, Rayleigh's criterion for the limit of resolution, **1.5** comparison between magnifying power and resolving power, **1.6** Resolving power of plane diffraction grating, resolving power of prism.	08
Module -2:	**Interference of light** **2.1** Principle of superposition of waves, **2.2** Division of amplitude, division of wavefront, **2.3** interference in thin parallel films due to reflected light, **2.4** wedge shaped films, **2.5** Newton's rings, its applications for determination of wavelength of light and R.I. of liquid.	08
Module -3:	**Diffraction and Polarization of light** **3.1** Introduction and types of diffraction,	07

	3.2 Fraunhofer diffraction and Fresnel diffraction: **3.3** plane diffraction grating, theory of plane diffraction grating, its application to determine wavelength of monochromatic light. **3.4** Polarization : Introduction, Types of polarization, **3.5** Polarization by double refraction, Huygens explanation of double refraction through uniaxial crystals, **3.6** optical rotation laws of rotation of the plane of polarization, polarimeter.	
Module -4:	**Laser system** **4.1** Absorption, spontaneous and stimulated emission, **4.2** Einstein coefficients (only definitions), **4.3** population inversion, optical and electrical pumping, properties of lasers, **4.4** Ruby laser, **4.5** Helium-Neon laser, uses of laser, **4.6** idea of holography (qualitative treatment only).	07

Reference Books:-

1) J. P. Agarwal,. *Physical optics and lasers,* 13th edition,Pragati Prakashan. 2017
2) Brij Lal, M. N. Avadhanulu and N. Subrahmanyam. A *Textbook of Optics.* 25th edition. S. Chand Publisher, 2012.
3) Thyagarajan, K., and AjoyGhatak. *Lasers Fundamentals and Applications*, 2nd edition, Springer Science and Business Media Publisher. 2011.
4) Laud, B. B. *Lasers and non-linear optics*. New Delhi: New Age International Publishers. 2011.
5) Longhurst, R. S. *Geometrical and physical optics*. 2ndedition, New York: Wiley. 1967.
6) AjoyGhatak, *Optics*. 4th edition, McGraw Hill Education India Pvt Ltd. 2008.

Evaluation Pattern: 40:60

Total Marks: 50

Internal Continuous Evaluation: 20Marks (Best of Two)	**End Semester Examination: 50 Marks**
• Internal Work -1 : CCE-1 - 10 Marks • Internal Work -2 : CCE-II - 10 Marks • Internal Work -3 : CCE-III – 10 Marks	• Question -1: 2 Marks x 5 = 10 Marks • Question -2 :10 Marks x 2 = 20 Marks Question -3 : 05 Marks x 4 = 20 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. II	**Semester** - IV
Type : DSE (Minor Practical IV)	**Marks:** 50
Credits : 2	**From:** A. Y. 2025-26

Name of the Course: BPP 246-Modern Physics, Electronics Optics and Lasers

Course Objectives: Students should be able to …

1) develop practical skills.
2) understand the principles of CE (Common Emitter) amplifier configuration.
3) learn methods for determining the frequency of oscillation.
4) gain practical skills in constructing and testing the oscillator using BJT.

Course Outcomes: Students will be able to…

1) learn measuring skills in practical
2) capable of building and testing of Colpitts, Phase shift oscillators employing BJT transistors.
3) design CE amplifiers with specified gains using voltage divider biasing techniques.
4) determine the radius of curvature of convex mirrors, enhancing their understanding of geometric optics principles.

Module	Title and Contents (Any 15)	Hrs
	1. Measurement of Planck's constant. 2. To design a single stage CE amplifier of given gain using voltage divider bias. 3. Frequency response of single stage RC coupled amplifier. 4. To determine the frequency of the Crystal oscillator. 5. To build and test Colpitts oscillator using BJT. 6. To build and test Phase shift oscillator using BJT. 7. UJT as a voltage sweep generator. 8. To study divergence of a laser beam. 9. Determination of Wavelength of He-Ne Laser using grating. 10. I-V Characteristics of a solar cell 11. Study of cardinal points using Goniometer. 12. Determination of equivalent focal length of a system of lenses by using Goniometer. 13. Determination of R.I. of given liquid by Liquid Lens. 14. Determination of dispersive power of material of prism. 15. Determination of Cauchy's Constants. 16. Determination of Resolving Power of plane diffraction grating. 17. Determination of Resolving Power of prism.. 18. Determination of Wavelength of sodium source by Newton's rings. 19. Determination of specific rotation of sugar solution using Polarimeter. **20.** Study of cardinal points by Newton's Method.	60

Reference Books:-

1) H. Singh and P.S. Hemne, 4th edition, B.Sc. Practical Physics.S. Chand Publisher, 2011
2) S. L. Gupta and V. Kumar, 27th edition, Practical Physics, Pragati Prakashan2010.
3) D. Chattopadhyay and P. C. Rakshit, 7th edition, An Advanced Course in Practical Physics,

<table>
<tr><td colspan="2">New Central Book Agency Pvt. Ltd., 2005.
4) B. L. Worsnop and H. T. Flint, 9th edition Advanced Practical Physics for Students, Asia Pub. House, 1961.</td></tr>
<tr><td colspan="2">Evaluation Pattern: 40:60</td></tr>
<tr><td colspan="2">Total Marks: 50</td></tr>
<tr><td>Internal Continuous Evaluation: 20Marks
• Internal Work -1 : CCE-1 - 20 Marks</td><td>End Semester Examination: 30 Marks
• Question -1: 30 Marks</td></tr>
</table>

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

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

Name of the Course: BPPVSC-1I -Basic Python

Course Objectives: Students should be able to …

1) to introduce students to Python programming as a versatile tool for scientific computation and data handling.
2) to develop proficiency in using Python for performing basic arithmetic operations and handling complex numbers.
3) to enable students to write, execute, and debug Python programs utilizing control structures, data types, and functions.
4) to foster problem-solving skills through practical applications of Python in real-world mathematical and scientific computations.

Course Outcomes: Students will be able to…

1) install and configure Python, using it effectively as an interpreter for performing arithmetic and logical operations.
2) demonstrate the ability to write Python programs using variables, data types, operators, loops, and functions.
3) apply Python's built-in modules and data structures (lists, tuples, dictionaries) to solve computational problems.
4) design and implement Python programs for real-life applications such as temperature conversion, geometric calculations, and data manipulation.

Module	Title and Contents	Hrs
	1. Installing and using Python as interpreter 2. Using Python as calculator for performing arithmetic operation of addition, subtraction, multiplication and division of two numbers 3. Using Python as calculator for performing arithmetic operation of modulus, exponent, floor division of two numbers 4. Use of complex function for complex number creation and their arithmetic operation 5. Program to read one and more than one variable using single input statement 6. Program to demonstrate input and output instruction 7. Program to interconvert integer, float, long integer and to print data type of x input 8. Program by using assignment and augmented assignment operator 9. Program to print numbers from 1 to n by using FOR loop 10. Program to print Hello n times by using WHILE loop 11. Program to print numbers from 1 to n by using nested FOR loop 12. Program to print Hello and Hi n times by using nested WHILE loop 13. Program to collect the data using LIST data type	60

	14. Program to collect the data using TUPLE data type 15. Program to collect the data using DICTIONARY data type 16. Program to study string, multiple string and its concatenation, repetition, slicing, 17. Program to study modules in Python: sqrt, pi, degrees, radians, sin, factorials 18. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice 19. Program to find the area of rectangle and square by accepting suitable input parameters from user 20. Program to find the area of circle and triangle by accepting suitable input parameters from user	

Reference Books:-

1) Lutz, Mark. *Learning Python*. 5th ed. Sebastopol, CA: O'Reilly Media, 2013.
2) Zelle, John M. *Python Programming: An Introduction to Computer Science*. 2nd ed. Franklin, Beedle & Associates, 2010.
3) Downey, Allen B. *Think Python: How to Think Like a Computer Scientist*. 2nd ed. Needham, MA: Green Tea Press, 2015.
4) Guttag, John V. *Introduction to Computation and Programming Using Python: With Application to Understanding Data*. 2nd ed. Cambridge, MA: MIT Press, 2016.
5) Beazley, David M., and Brian K. Jones. *Python Cookbook: Recipes for Mastering Python 3*. 3rd ed. Sebastopol, CA: O'Reilly Media, 2013.

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20Marks • Internal Work -1 : CCE-1 - 20 Marks	**End Semester Examination: 30 Marks** • Question -1: 30 Marks

Karmaveer Bhaurao Patil University, Satara

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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Physics

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

Name of the Course: BPPSEC 02-Arduino:Practical Skills for beginners

Course Objectives: Students should be able to …

1) learn the fundamental concepts of IoT.
2) understand roles of sensors in IoT.
3) learn to set up and use the Arduino IDE and related tools.
4) develop skills in connecting and configuring electronic components (sensors, actuators, etc.) with Arduino.

Course Outcomes: Students will be able to…

1) understand the basic architecture and functionality of Arduino microcontrollers and IoT devices.
2) understand to interface and configure various sensors (e.g., temperature, humidity, light) with Arduino.
3) develop, debug, and optimize Arduino-based programs for efficient IoT applications.
4) design and implement IoT-based solutions for real-world problems like home automation, smart irrigation, or intrusion detection.

Module	Title and Contents (Any 15)	Hrs
	Arduino:Practical Skills for beginners	60
	1. Use of breadboard. 2. Electronics circuit on breadboard with LED and resistor and study the effect of resistor value on LED's brightness. 3. Continuity tester circuit on breadboard with LED and resistor. 4. Voltage polarity indicator circuit. 5. Introduction of Arduino. 6. Arduino uno installation and programming. 7. LED blinking experiment with Arduino board. 8. Controlling the light emitting diode (led) with a push button 9. Controlling the led blink rate with the potentiometer interfacing with arduino 10. Detection of the light using photo resistor 11. Interfacing of temperature sensor LM35 with Arduino 12. Interfacing of the Relay with Arduino. 13. Building Intrusion Detection System with Arduino and Ultrasonic Sensor 14. Potentiometer And IR Sensor Interfacing With Arduino 15. Creation of Things Speak Account 16. DHT11 Temperature and Humidity sensor Data To Cloud 17. Sensor data transfer from Arduino to ThingSpeak using the ESP8266 WiFi module.	

	18. Control Arduino-connected devices (e.g., LED) through the Blynk mobile app using the ESP8266 WiFi module. 19. Sensor data transfer from Arduino to ThingSpeak using the ESP32 WiFi module. 20. Control Arduino-connected devices (e.g., LED) through the Blynk mobile app using the ESP32 WiFi module.	

Reference Books:-

1) Kumar, Rajesh, and Manohar Swain, IoT and Smart Systems: Concepts, Applications, and Challenges. New Delhi: McGraw Hill Education., 2020..

2) Sharma, Vivek. Introduction to Arduino and IoT: A Hands-On Guide for Beginners. Hyderabad: BSP Books. ,2019.

3) *Massimo Banzi and Michael Shiloh.Getting Started with Arduino. 4th ed. Sebastopol, CA: O'Reilly Media, 2022..*

4) *Peter Waher.Learning Internet of Things. Birmingham: Packt Publishing, 2015.*

Evaluation Pattern: 40:60	
Total Marks: 50	
Internal Continuous Evaluation: 20Marks • Internal Work -1 : CCE-1 - 20 Marks	**End Semester Examination: 30 Marks** • Question -1: 30 Marks

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Faculty of Science and Technology

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Board of Studies in Physics

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

Name of the Course: BPTVEC-II -Environmental Awareness for Physics

Course Objectives: Students should be able to …

1) understand 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, **1.5** global warming and climate change (causes an intensity of the problem) role of physics in creation of environmental issues	08
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.	08
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 sustainable development. **3.4** Case studies and examples of sustainable development initiatives.	07
Module -4:	**Role of Physics 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.	07

Reference Books:-

1) Sorensen, Bent. *Renewable energy: physics, engineering, environmental impacts, economics and planning*. Academic Press, 2017.
2) Theis, Tom, and Jonathan Tomkin. "Sustainability: A comprehensive foundation." (2015).
3) Tester, Jefferson W., Elisabeth M. Drake, Michael J. Driscoll, Michael W. Golay, and William A. Peters. *Sustainable energy: choosing among options*. MIT press, 2012.
4) Findley, Roger W., and Daniel A. Farber. "Environmental law: cases and materials." *(No Title)* (1985).
5) Wright, Richard T. *Environmental science*. Galgotia Publications, 1974

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