Academic Council Meeting No. and Date :

Agenda Number: Resolution Number : 34 / 2.4

VidyaPrasarak Mandal's
B. N. Bandodkar
College of Science (Autonomous),
Thane

Syllabus for

Programme: Bachelor of Science

Specific Programme: PHYSICS

[F.Y.B.Sc. Physics]

Proposed under Autonomy & NEP-2020

From academic year 2023 - 2024

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Preamble

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics. It will help the student to

- To develop analytical abilities towards real world problems
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem-solving, hands-on activities, study visits
- To develop good observation ability
- To understand links of Physics to other disciplines.
- To develop scientific temperament.
- To obtain solutions to scientific questions by use of qualitative and quantitative reasoning and by experimental investigation.

The syllabus is aimed to achieve certain objectives. The syllabus spanning three years, covers from fundamental concepts in Physics and give glimpses of the scenario at the frontier. The students will be ready for the higher educational opportunities and jobs available in different fields of Physics and related environment like:

- Master's degree in Physics
- Master's degree in Computer applications MCA.
- PG Course in Radiology
- Software Development (Programming C++)
- Careers that require Scientific or Technical expertise.
- Careers in Civil and administrative Services.

Eligibility:
Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board.

Discipline/Subject: Physics

Degree Programme: B.Sc.

Duration: 1 year (Include semester I & II)

Level: 4.5

Qualification Title: UG certificate

Credits Requirement: Minimum 40 or Maximum 44 Credits

Mode of Conduct:
Offline Laboratory Practical's Offline lectures / online lectures.

Program Specific Outcome:

By the end of the program the students will be able to:

Classify, propose, and analyze physical problems. Interpret the results through a wide range of experiments, data analysis, theories and techniques, concepts, and general principles of Physics.

VPM's B.N. Bandodkar College of Science (Autonomous), Thane

F.Y.B.Sc.

Curriculum Structure for the Undergraduate Degree Program F.Y.B.Sc Physics

Structure of Programme

Course Code	Course Title	No. of lectures	Credits
23BUPH1T01	Classical Physics (Major 1)	**30**	**2**
23BUPH1T02	Modern Physics (Major 2)	**30**	**2**
23BUPH1T03	Classical Physics (Minor 1)	**30**	**2**
23BUPH1T04	Modern Physics (Minor 2)	**30**	**2**
23BUPH1P01	Practical I (Major)	**60**	**2**
23BUPH1P02	Practical II (Minor)	**60**	**2**
Total		**240**	**12**

Course Code	Course Title (Major/Minor)	No. of lectures	Credits
23BUPH2T01	Mathematical Physics (Major 1)	**30**	**2**
23BUPH2T02	Electricity And Electronics (Major 2)	**30**	**2**
23BUPH2T03	Mathematical Physics (Minor 1)	**30**	**2**
23BUPH2T04	Electricity And Electronics (Minor 2)	**30**	**2**
23BUPH2P01	Practical I (Major)	**60**	**2**
23BUPH2P02	Practical II (Major)	**60**	**2**
Total		**240**	**12**

Semester I

Course Code 23BUPH1T01	Major 1 Classical Physics	Credits 2	No. of lectures 30
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to ● Understand Newton's laws and apply them in calculations of the motion of simple systems. ● Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them. ● Understand the concepts of lens system and interference. ● Demonstrate quantitative problem-solving skills in all the topics covered			
Unit I:	**Newton's Laws:** Newton's first, second and third laws of motion, (Review) interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present) **Elasticity:** Review of Elastic constants Y, K, η and σ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder. **Fluid Dynamics:** Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in airfoil, Poiseuille'sequation.		**15**
Unit II:	**Lens's formulae:** Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal, and angular. Equivalent focal length of two thin lenses, thick lens, cardinal points of thick lens, Ramsden, and Huygens eyepiece. **Aberration**: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration, and condition for achromatic aberration. **Interference**: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective). ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures.***		**15**

Course Code 23BUPH1T02	Major 2 Modern Physics	Credits 2	No. of lectures 30

Course Outcomes: Learner will

- Understand nuclear properties and nuclear behavior.
- Understand the isotopes and their applications.
- Understand the quantum mechanical concepts.
- Understand mechanism of Nuclear reactions
- Develop quantitative problem-solving skills in all the topics covered.

Unit I:	**Structure of Nuclei**: Basic properties of nuclei, Composition, Charge, Size, Rutherford'sexpt. for estimation of nuclear size, density of nucleus, Mass defect and Binding energy, packing fraction, BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems. **Radioactivity**: Radioactive disintegration concept of natural and artificial radioactivity, Properties of α, β, γ-rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical problems. Carbon dating and other applications of radioactive isotopes (Agricultural, Medical, Industrial, Archaeological - information from net).	**15**
Unit II:	**Interaction between particles and matter**: Ionization chamber, Proportional counter and GM counter problems **Nuclear Reactions**: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Q value equation and solution of the Q equation problems. Fusionand fission definitions and qualitative discussion with examples.	**15**

Course Code 23BUPH1P01	Major Practical	Credits 2	No. of lectures in hrs. 60

Practical 1	Use of Vernier Calipers, Micrometer Screw Gauge
Practical 2	Use of Travelling Microscope
Practical 3	**Graph Plotting:** Experimental, Straight Line with intercept, Resonance Curve etc.
Practical 4	**Spectrometer:** Schuster's Method
Practical 5	**Error Calculation:** Absolute and relative errors calculation.
Practical 6	**Use of DMM:** AC DC Voltage, current and continuity.
Practical 7	**Component Testing:** Resistance, Capacitor, Diode, and Transistor.
Practical 8	**Connecting Simple circuit:** Voltage divider.
Practical 9	**J by Electrical Method:** To determine mechanical equivalent of heat.
Practical 10	**Bifilar Pendulum:** To determine the moment of Inertia of a Rectangular Wooden bar.

Practical 11	**Bifilar Pendulum:** To determine the moment of Inertia of a Spherical Wooden bar.
Practical 12	**Spectrometer:** To determine of angle of Prism.
Practical 13	**Spectrometer:** To determine refractive index of Prism.
Practical 14	**Flat spiral Spring:** To determine Y Young's Modulus of a wire material by method of vibrations.
Practical 15	**Surface Tension:** To determine the surface tension of water by capillary rise method.
Practical 16	**Combination of Lenses:** To determine equivalent focal length of a lens system by magnification method.
Practical 17	**Thermistor characteristic:** To study Electrical characteristic of Thermistor.
Practical 18	**Thermistor characteristic:** To study thermal characteristic of Thermistor.
Practical 19	**Newton's Rings:** To determine radius of curvature of a given convex lens using Newton's rings.
Practical 20	**Torsional Oscillation:** To determine modulus of rigidity η of a material of wire by torsional oscillations

Course Code **23BUPH1T03**	**Minor 1** **Classical Physics**	**Credits** **2**	**No. of lectures** **30**
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to ● Understand Newton's laws and apply them in calculations of the motion of simple systems. ● Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them. ● Understand the concepts of lens system and interference. ● Demonstrate quantitative problem-solving skills in all the topics covered			
Unit I:	**Newton's Laws:** Newton's first, second and third laws of motion, (Review) interpretation and applications, pseudo forces, Inertial and non-inertial frames of reference. Worked out examples (with friction present) **Elasticity:** Review of Elastic constants Y, K, η and σ; Equivalence of shear strain to compression and extension strains. Relations between elastic constants, Couple for twist in cylinder. **Fluid Dynamics:** Equation of continuity, Bernoulli's equation, applications of Bernoulli's equation, streamline and turbulent flow, lines of flow in airfoil, Poiseuille'sequation.		**15**
Unit II:	**Lens's formulae:** Lens Maker's Formula (Review), Newton's lens equation, magnification-lateral, longitudinal, and angular. Equivalent focal length of two thin lenses, thick lens, cardinal points of thick lens, Ramsden, and Huygens eyepiece. **Aberration**: Spherical Aberration, Reduction of Spherical Aberration, Chromatic aberration, and condition for achromatic aberration. **Interference**: Interference in thin films, Fringes in Wedge shaped films, Newton's Rings (Reflective). ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures.***		**15**

Course Code 23BUPH1T04	Minor 2 Modern Physics	Credits 2	No. of lectures 30
Course Outcomes: Learner will ● Understand nuclear properties and nuclear behavior. ● Understand the isotopes and their applications. ● Understand the quantum mechanical concepts. ● Understand mechanism of Nuclear reactions ● Develop quantitative problem-solving skills in all the topics covered.			
Unit I:	**Structure of Nuclei**: Basic properties of nuclei, Composition, Charge, Size, Rutherford'sexpt. for estimation of nuclear size, density of nucleus, Mass defect and Binding energy, packing fraction, BE/A vs A plot, stability of nuclei (N Vs Z plot) and problems. **Radioactivity**: Radioactive disintegration concept of natural and artificial radioactivity, Properties of α, β, γ-rays, laws of radioactive decay, half-life, mean life (derivation not required), units of radioactivity, successive disintegration and equilibriums, radioisotopes. Numerical problems. Carbon dating and other applications of radioactive isotopes (Agricultural, Medical, Industrial, Archaeological - information from net).		**15**
Unit II:	**Interaction between particles and matter**: Ionization chamber, Proportional counter and GM counter problems **Nuclear Reactions**: Types of Reactions and Conservation Laws. Concept of Compound and Direct Reaction, Q value equation and solution of the Q equation problems. Fusionand fission definitions and qualitative discussion with examples.		**15**

References:

Course Code 23BUPH1T01 /23BUPH1T03	Course Title Classical Physics

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Fundamentals of Physics (extended)	Haliday, Resnick and Walker	John Wiley and Sons	6th	2005
2.	Concepts of Physics (Part I)	H. C. Verma	Bharati Bhavan	1st	2015
3.	A Textbook of Optics	Brijlal Subramanyam and Avadhanulu	S. Chand	25th	2012
4.	Fundamentals of Optics	Jenkins and White	McGraw Hill International	4th	1981
5.	Classical Dynamics	Thornton and Marion	Thomson	5th	2004
6.	Optics	C L Arora	S. Chand	1st	2001

Course Code 23BUPH1T02 / 23BUPH1T04	**Course Title** **Modern Physics**

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Nuclear Physics	Irving Kaplan	Narosa Publishing House	2nd	1987
2.	Nuclear Physics	Dr. S. B. Patel	New Age International	2nd	2011
3.	Atomic and Nuclear Physics	N. Subrahmanyam, Brijlal and Seshan	S. Chand	2nd	2012
4.	Perspectives of Modern Physics	Arther Beiser	Tata McGraw Hill2nd	1st	1988
5.	Atomic Physics	S. N. Ghoshal	S. Chand	1st	2003
6.	Nuclear Physics	S. N. Ghoshal	S. Chand	2nd	2014

Course Code 23BUPH1P02	**Minor Practical**	**Credits 2**	**No. of lectures in hrs. 60**

Practical 1	Use of Vernier Calipers, Micrometer Screw Gauge
Practical 2	Use of Travelling Microscope
Practical 3	**Graph Plotting:** Experimental, Straight Line with intercept, Resonance Curve etc.
Practical 4	**Spectrometer:** Schuster's Method
Practical 5	**Error Calculation:** Absolute and relative errors calculation.

Practical 11	**Bifilar Pendulum:** To determine the moment of Inertia of a Spherical Wooden bar.
Practical 12	**Spectrometer:** To determine of angle of Prism.
Practical 13	**Spectrometer:** To determine refractive index of Prism.
Practical 14	**Flat spiral Spring:** To determine Y Young's Modulus of a wire material by method of vibrations.
Practical 15	**Surface Tension:** To determine the surface tension of water by capillary rise method.
Practical 16	**Combination of Lenses:** To determine equivalent focal length of a lens system by magnification method.
Practical 17	**Thermistor characteristic:** To study Electrical characteristic of Thermistor.
Practical 18	**Thermistor characteristic:** To study thermal characteristic of Thermistor.
Practical 19	**Newton's Rings:** To determine radius of curvature of a given convex lens using Newton's rings.
Practical 20	**Torsional Oscillation:** To determine modulus of rigidity η of a material of wire by torsional oscillations

Semester II

Course Code 23BUPH2T01	Major 1 Mathematical Physics	Credits 2	No. of lectures 30

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Understand the basic mathematical concepts and applications of them in physical situations.
- Demonstrate quantitative problem-solving skills in all the topics covered.
- Articulate the principles of object-oriented mathematical problem solving.
- Able to formulate a problem associated with physical world.

Unit I:	**Differential equations:** Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Simple Harmonic motion (spring mass system). **Transient response of circuits**: Series LR, CR, LCR circuits. Growth and decay of currents/charge.	**15**
Unit II:	**Superposition of Collinear Harmonic oscillations**: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). **Superposition of two perpendicular Harmonic Oscillations**: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses **Wave Motion**: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity. ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures.***	**15**

Course Code 23BUPH2T02	Major 2 Electricity and Electronics	Credits 2	No. of lectures 30
Course Outcomes: At the end of the course, a student will be able to: ● Understand the response of various passive components to alternating current. ● Understand and apply the theorems to solve complicated linear circuits. ● Solve the logic equations using logic circuits. ● Understand the concepts of static Electricity and magnetism.			
Unit I:	**Alternating current theory**: [(Concept of L, R, and C:AC circuit containing pure R, pure L and pure C (Review)], representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor. **AC bridges**: AC-bridges: General AC bridge, Maxwell, de-Sauty		**15**
Unit II:	**Circuit theorems**: (Review: ohm's law, Kirchhoff's laws, Thevenin's Theorem, Norton's Theorem), Superposition Theorem, Ideal Current Sources, Reciprocity Theorem, Maximum Power Transfer Theorem. Numerical related to circuit analysis using the above theorems. **Zener Diodes**: (Review: Zener forward and reverse characteristics), Zener diode as voltage stabilizer, Avalanche breakdown, Zener breakdown, Temperature coefficient of Zener. **Digital electronics**: Logic gates (Review), NAND and NOR as universalbuilding blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder.		**15**

Course Code 23BUPH2P01 & 23BUPH2P02	Major Practical	Credits 2	No. of lectures in hrs. 60
Practical 2	**To study load regulation of a Bridge Rectifier:** To study bridge rectifier without capacitor filter.		
Practical 3	**To study load regulation of a Bridge Rectifier:** To study bridge rectifier with capacitor filter.		
Practical 1	**Flywheel:** To determine the moment of inertia and to determine frictional torque graphically.		
Practical 4	**LR Circuit:** To determine the value of given inductance.		
Practical 5	**To study simple AND, OR and NOT gates**		
Practical 6	**To study NAND gate as Universal Building Block:** Design and testing of AND, OR and NOT gate using NAND gate.		

Practical 7	**To study NOR gate as Universal Building Block:** Design and testing of AND, OR and NOT gate using NOR gate.

Practical 8	**To verify De Morgan's Theorems**: Design and testing of De Morgan's 1st Theorem.
Practical 9	**To verify De Morgan's Theorems**: Design and testing of De Morgan's 2nd Theorem.
Practical 10	**Thevenin's Theorem:** To verify Thevenin's theorem for DC circuits experimentally and graphically.
Practical 11	**Norton's Theorem:** To verify Norton's theorem for DC circuits experimentally and graphically.
Practical 12	**LDR Characteristics:** To study the dependence of LDR resistance on intensity of light.
Practical 13	**CR Circuit:** To determine value of given capacitor.
Practical 14	**To study EX-OR Gate:** Design half adder verify the truth table.
Practical 15	**To study EX-OR Gate:** Design full adder and verify the truth table.
Practical 16	**LCR series Resonance**: To determine resonance frequency of LCR series circuit.
Practical 17	**LCR parallel Resonance**: To determine resonance frequency of LCR parallel circuit.
Practical 18	**Frequency of AC Mains:** To determine frequency of AC mains
Practical 19	**Laser beam divergence:** To study the divergence of Laser beam
Practical 20	**p-n junction diode:** To study the characteristics of simple p-n junction diode
Practical 21	**Zener diode:** To study the characteristics of simple zener diode

Course Code 23BUPH2T03	Minor 1 Mathematical Physics	Credits 2	No. of lectures 30

Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to

- Understand the basic mathematical concepts and applications of them in physical situations.
- Demonstrate quantitative problem-solving skills in all the topics covered.
- Articulate the principles of object-oriented mathematical problem solving.
- Able to formulate a problem associated with physical world.

Unit I:	**Differential equations:** Introduction, Ordinary differential equations, First order homogeneous and non- homogeneous equations with variable coefficients, Exact differentials, General first order Linear Differential Equation, Second-order homogeneous equations with constant coefficients. Simple Harmonic motion (spring mass system). **Transient response of circuits**: Series LR, CR, LCR circuits. Growth and decay of currents/charge.	**15**
Unit II:	**Superposition of Collinear Harmonic oscillations**: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). **Superposition of two perpendicular Harmonic Oscillations**: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses **Wave Motion**: Transverse waves on string, Travelling and standing waves on a string. Normal modes of a string, Group velocity, Phase velocity, Plane waves, Spherical waves, Wave intensity. ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures.***	**15**

Course Code 23BUPH2T04	Minor 2 Electricity and Electronics	Credits 2	No. of lectures 30
Course Outcomes: At the end of the course, a student will be able to: ● Understand the response of various passive components to alternating current. ● Understand and apply the theorems to solve complicated linear circuits. ● Solve the logic equations using logic circuits. ● Understand the concepts of static Electricity and magnetism.			
Unit I:	**Alternating current theory**: [(Concept of L, R, and C:AC circuit containing pure R, pure L and pure C (Review)], representation of sinusoids by complex numbers, Series L-R, C-R and LCR circuits. Resonance in LCR circuit (both series and parallel), Power in ac circuit. Q-factor. **AC bridges**: AC-bridges: General AC bridge, Maxwell, de-Sauty		**15**
Unit II:	**Circuit theorems**: (Review: ohm's law, Kirchhoff's laws, Thevenin's Theorem, Norton's Theorem), Superposition Theorem, Ideal Current Sources, Reciprocity Theorem, Maximum Power Transfer Theorem. Numerical related to circuit analysis using the above theorems. **Zener Diodes**: (Review: Zener forward and reverse characteristics), Zener diode as voltage stabilizer, Avalanche breakdown, Zener breakdown, Temperature coefficient of Zener. **Digital electronics**: Logic gates (Review), NAND and NOR as universalbuilding blocks. EXOR gate: logic expression, logic symbol, truth table, Implementation using basic gates and its applications, Boolean algebra, Boolean theorems. De-Morgan theorems, Half adder and Full adder.		**15**

References:

Course Code 23BUPH2T01 / 23BUPH2T03	Course Title Mathematical Physics				
Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Mechanics and Electrodynamics	Brijlal, N. Subramanyam, Jivan Seshan	S. Chand	3rd	2005
2.	Mathematical Physics	A. K. Ghatak, Chua	Macmillan India Ltd	1st	1995

3.	Mathematical Methods for Physics and Engineering	Ken Riley, Michael Hobson and Stephan Bence	Cambridge (Indian edition)	2nd	1983
4.	Mathematical Physics	H. K. Dass	S. Chand & Co.	7th	1999
5.	Mathematical Methods of Physics	Jon Mathews & R. L. Walker	W. A. Benjamin Inc	2nd	1969

Course Code **23BUPH2T02 / 23BUPH2T04**	**Course Title** **Electricity and Electronics**				
Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Electricity and Magnetism	D. Chattopadhyay, P. C. Rakshit	New Central Book agency	8th	2009
2.	A Textbook of Electrical Technology Vol. I	B. L. Theraja and A. K. Theraja	S. Chand	22nd	2004
3.	Electronics devices and Circuit Theory	Boylestad and Nashelsky	Prentice Hall of India (EEE)	10th	2009
4.	Electronics Principles	V. K. Mehta and R. Mehta	S. Chand	11th	2012
5.	Introduction to Electrodynamics	David J. Griffiths	Prentice Hall of India (EEE)	3rd	2002
6.	Digital Principles and Applications	A. P. Malvino	Tata McGraw Hill	4th	1992

Course Code 23BUPH2P01 & 23BUPH2P02	Minor Practical	Credits 2	No. of lectures in hrs. 60
Practical 5	**To study simple AND, OR and NOT gates**		
Practical 6	**To study NAND gate as Universal Building Block:** Design and testing of AND, OR and NOT gate using NAND gate.		
Practical 7	**To study NOR gate as Universal Building Block:** Design and testing of AND, OR and NOT gate using NOR gate.		
Practical 8	**To verify De Morgan's Theorems**: Design and testing of De Morgan's 1st Theorem.		
Practical 9	**To verify De Morgan's Theorems**: Design and testing of De Morgan's 2nd Theorem.		
Practical 14	**To study EX-OR Gate:** Design half adder verify the truth table.		
Practical 15	**To study EX-OR Gate:** Design full adder and verify the truth table.		
Practical 1	**Flywheel:** To determine the moment of inertia and to determine frictional torque graphically.		
Practical 19	**Laser beam divergence:** To study the divergence of Laser beam		
Practical 18	**Frequency of AC Mains: To determine frequency of AC mains**		
Practical 2	**To study load regulation of a Bridge Rectifier:** To study bridge rectifier without capacitor filter.		
Practical 3	**To study load regulation of a Bridge Rectifier:** To study bridge rectifier with capacitor filter.		
Practical 4	**LR Circuit:** To determine the value of given inductance.		
Practical 12	**LDR Characteristics:** To study the dependence of LDR resistance on intensity of light.		
Practical 13	**CR Circuit:** To determine value of given capacitor.		
Practical 16	**LCR series Resonance**: To determine resonance frequency of LCR series circuit.		
Practical 17	**LCR parallel Resonance**: To determine resonance frequency of LCR parallel circuit.		
Practical 20	**p-n junction diode:** To study the characteristics of simple p-n junction diode		
Practical 21	**Zener diode:** To study the characteristics of simple zener diode		
Practical 10	**Thevenin's Theorem:** To verify Thevenin's theorem for DC circuits experimentally and graphically.		
Practical 11	**Norton's Theorem:** To verify Norton's theorem for DC circuits experimentally and graphically.		

Evaluation Scheme

Internals Examination: (Continuation Internal Assessment for each course/paper)

Internal Test	Project (Attending Seminars/Conference/workshop/any other and writing report on it)	Attendance & Leadership qualities	Total
10	**05**	**05**	**20**

- **Internal Examination:**

Duration: 1 Hour **Total Marks: 10**

	Answer the following	**10**
Q. 1	Objective	05
Q. 2	Subjective	05

- **Theory Examination:**

Suggested Format of Question paper

Duration: $1\frac{1}{2}$ Hour

Total Marks: 30 (each paper 30 marks)

- **All questions are compulsory**

Q. 1	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**10**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3			**10**
	A	Fill in the blanks . (Any Six)	**6**
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	11		

	12		
	B	Answer in one sentence (Any Four)	**4**
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		

Academic Council Meeting No. and Date:

Agenda Number: **Resolution Number:**

Syllabus for

Programme: Bachelor of Science

Specific Programme: PHYSICS

[F.Y.B.Sc. Physics]

[Generic]

Proposed under Autonomy & NEP 2020

From academic year 2023-24

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Preamble

The systematic and planned curricula from these courses shall motivate and encourage learners to understand basic concepts of Physics. It will help the student to

- To develop analytical abilities toward real-world problems.
- To familiarize with current and recent scientific and technological developments
- To enrich knowledge through problem-solving hands on activities, study visits.
- To understand the links of Physics to other disciplines.
- To develop scientific temperament.
- To obtain solutions to scientific questions using qualitative and quantitative reasoning and experimental investigation.

The syllabus is aimed to achieve certain objectives. The One-year syllabus covers fundamental concepts in Physics and gives glimpses of the scenario at the frontier. The students will be ready for the higher educational opportunities and jobs available in different fields of Physics and related environments.

Eligibility: Level 4.0 –	HSc
Duration	1 Year (Includes SEM I and SEM II)
Mode of Conduct	Offline lectures / Online lectures
Total Credits for the Program	4
Starting year of implementation:	2023- 24
Name of the Program:	Generic Physics
Discipline/Subject	PHYSICS

VPM's B.N. Bandodkar College of Science (Autonomous), Thane

F.Y.B.Sc.(Physics-Generic)

Structure of Programme

Course Code	Course Title	No. oF lectures in Hrs.	Credits
23BUPH1T05	Basics Of Quantum Mechanics and Electricity	**30**	**2**
23BUPH2T05	Basics of Thermodynamics and Mathematical Physics	**30**	**2**

Semester I

Course Code 23BUPH1T05	Course Title **Basics Of Quantum Mechanics and Electricity**	Credit 2	No. of lectures 30
On completion of the course, student will be able to– ● Understand the basic Quantum & X-rays, Electrodynamics concepts and applications of them in physical situations. ● Demonstrate quantitative problem-solving skills in all the topics covered. ● Articulate the principles of object-oriented mathematical problem solving. ● Able to formulate a problem associated with physical world ● Demonstrate quantitative problem-solving skills in all the topics covered so as to appear competitive exams which are based on 12th Standard.			
Unit I :	**Life History of Dr. Homi Bhaba** **Origin of Quantum theory**: Black body (definition), Black Body spectrum, Wien's displacement law (Review), Matter waves, wave particle duality, Heisenberg's uncertainty Principle. Davisson - Germer experiment, G. P. Thompson experiment. **X-Rays:** X-Rays production and properties. Continuous and characteristic X-Ray spectra, X-Ray Diffraction, Bragg's Law, Applications of X-Rays. Compton Effect, Pair production, Photons and Gravity, Gravitational RedShift. ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures***		**15**
Unit II :	Electric field and potential, Electric charge, Kinds of charges.Unit of charge, Coulomb's law, Electric field, Electric field due to a point charge, Lines of electric force, Electric potential energy, Electric potential, Electric potential due to a point charge. .Introduction, Definition of magnetic field, Relation between electric and magnetic field, Motion of a charge particle in a uniform magnetic field, Magnetic force on a current carrying wire, Biot-Savart law, Magnetic field due to a current in a straight wire, Force between parallel currents, Magnetic field due to a circular current.		**15**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Electricity and Magnetism	D.Chattopadhyay, PC Rakshit	New Central Book agency	8th	2009
2.	A Textbook of Electrical Technology Vol. I	B.L. Theraja and A.K. Theraja	S. Chand	22nd	2004
3.	Electronic devices and CircuitTheory	Boylestad and Nashelsky	Prentice Hall of India	10th	2009
4.	Electronics Principals	V K Mehta and R Mehta	S Chand	11th	2012
5.	Introduction to Electrodynamics	David J. Griffiths	Prentice Hall India (EEE)	3rd	2002
6.	Digital Principles and Applications	A P Malvino	Tata McGraw Hill	4th	1992
7.	Fundamental of Physics (extended)	Halliday, Resnick and Walker	John Wiley and Sons	6th	2005
8.	Concepts of Physics (Part I)	H. C. Verma	Bharati Bhavan	1st	2015

Semester II

Course Code	Course Title	Credits	No. of lectures
23BUPH2T05	**Basics of Thermodynamics and Mathematical Physics**	**2**	**30**

On completion of the course, student will be able to–

- Understand the basic thermodynamics, mathematical concepts and applications of them in physical situations.
- Demonstrate quantitative problem-solving skills in all the topics covered.
- Articulate the principles of object-oriented mathematical problem solving.
- Able to formulate a problem associated with physical world
- Demonstrate quantitative problem-solving skills in all the topics covered so as to appear competitive exams which are based on 12th Standard.

Unit-1	**Life History of Dr. S.N. Bose** Thermal equilibrium, Zeroth law of thermodynamics, The concept of temperature. Heat, work and internal energy. The first law of thermodynamics. The second law of thermodynamics: reversible and irreversible processes. Carnot engine and its efficiency. Working of Refrigerator, Air Conditioner.	**15**
Unit-2	**Review**: Vectors, Scalars, Vector algebra, Laws of Vector algebra, Unit vector, Rectangular unit vectors, Components of a vector, Scalar fields, Vector fields, Problems based on Vector algebra. Dot or Scalar product, Cross or Vector product, Commutative and Distributive Laws, Scalar Triple product, Vector Triple product **Gradient, divergence and curl**: The ∇ operator, Definitions and physical significance of Gradient, Divergence and Curl; Distributive Laws for Gradient, Divergence and Curl (Omit proofs); Problems based on Gradient, Divergence and Curl. Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus, The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence, The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done.	**15**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Thermal Physics	A.B.Gupta	Reprint	-----	2008
2.	Mathematical Physics	A K Ghatak, Chua	Macmillan India Ltd	1st	1995
3.	Mathematical Methods for Physics and Engineering	Ken Riley**, Michael** Hobson **and Stephen** Bence	Cambridge (Indian edition)	Reprinted	1983
4.	Mathematical Physics	H. K. Dass	S. Chand &Co	7th	1999
5.	Mathematical Methods of Physics	Jon Mathews & R. L. Walker	W A Benjamin Inc	2nd	1969

Evaluation Scheme

- **Internal Examination: Class Test/ Assignments/ Tutorial Project**

Duration: 1 Hour **Total Marks: 20**

	Answer the following	**20**
Q. 1		
Q.2		

- **Theory Examination:**

Suggested Format of Question paper

Duration: 1.30 Hours **Total Marks: 30**

- **All questions are compulsory**

Q. 1	Answer ***any two*** of the following		**10**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**10**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3			**10**
	A	Fill in the blanks . (Any Six)	**6**
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	11		
	12		
	B	Answer in one sentence (Any Four)	**4**
	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		

Academic Council Meeting No. and Date:

Agenda Number: **Resolution Number: 34/2.4**

Syllabus for

Programme: Bachelor of Science

Programme: PHYSICS

[F.Y.B.Sc. Physics]

{Skill Enhancement Course (SEC)}

Proposed under Autonomy & NEP-2020
From academic year 2023 – 2024

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PROGRAM OUTLINE

Course Title & Code	Credits	Credit distribution of the course			Pre-requisite
		Lectures	Tutorial	Practical/Practice	
23BU1SEC04 Physics- Measuring skill	**2**	**1**	**0**	**1**	**NIL**
23BU2SEC04 OPAMP, Logic gates and Applications	**2**	**1**	**0**	**1**	**NIL**

PROGRAMME SPECIFIC OUTCOME (PSOs)

The purpose of this course is to provide students hands-on exposure to a variety of mechanical and electrical tools.

To understand and utilize the fundamental ideas about measurements in different other aspects of Science.

Able to learn Designing of Basic and universal gates using RTL and DTL and applications of OPAMP.

SEMESTER - I

<table>
<tr><td>Course Code
23BU1SEC04</td><td>Course Title
Physics Measuring skill</td><td>Credits
1</td><td>No.of lectures</td></tr>
<tr><td colspan="4">Learning Outcomes:
➢ On successful completion of this course the students will be able to:
➢ Perform any issue-related tasks about the Vernier caliper Screw gauge Microscope and Spectrometer.
➢ To test diode, Transistor and Ic’s
➢ To learn and understand the Mechanical and Electrical measurements.</td></tr>
<tr><td>UNIT- I</td><td colspan="2">Introduction Measuring units.

Conversion to SI and CGS Familiarization with meter scale,Vernier caliper and it's least count Screw gauge and their utility, Microscope and it's utility. Spectrometer. Measure the dimensions of a solid block, Volume of cylindrical beaker or glass, Diameter of a thin wire, Thickness of metal sheet extra.

Electrical and electronic skill.

Use of voltmeter, Use of current metre, Use of multimeter, Testing of resistors capacitors diodes and transistor using multimeter, Introduction to IC s IC 741.IC 555 and their application, Soldering of electrical circuits having discrete components (R,C, L & Diode) and ICs on PCB and Operation of CRO and its use.</td><td>15</td></tr>
<tr><td>References</td><td colspan="2">1. A test book in electrical technology B.L. Theraja, S Chand and company.
2. Measurements in Physics: Fundamental and Derived Quantities by Daniel Okoh , Harrison Onah , Ambrose Eze , Joseph Ugwuanyi , Ernest Obetta
ISBN-10 : 1533697493 ISBN-13 : 978-1533697493</td><td></td></tr>
</table>

Course Code 23BU1SEC04	Course Title Physics measuring skill Practicals	Credits 1	No.of lectures 30

Learning Outcomes

- On successful completion of this course the students will be able to:
- To minimize any measurement uncertainty by ensuring the accuracy of test equipment
- To enhance practical knowledge, skills and techniques in order to improve proficiency while applying for practical purpose.

1	Use of Vernier Callipers
2	Use of Micrometer screw gauge
3	Use of Travelling Microscope
4	Resistance of Voltmeter
5	Use of Spectrometer.
6	Use of multimeter
7	Frequency and amplitude measurement using CRO
8	Forward and reverse characteristics of diode
9	I/P Characteristics of NPN transistor
10	O/P Characteristics of NPN transistor
11	Transistor as a switch

Semester- II

Course Code 23BU2SEC04	Course Title OPAMP, Logic gates and Applications	Credits 1	No.of lectures 15
Learning Outcomes: Upon completion of this course, students will acquire knowledge about ➢ The IC 741 and their mathematical applications. ➢ Learn Designing of Basic and universal gates using RTL and DTL .			
UNIT- I	Integrated circuit Op-Amp IC 741,Pin Diagram, Working of IC 741 Op-Amp, Specifications of IC 741 Op-Amp, Op-Amp Characteristics and 741 Op-Amp mathematical Applications, IC 741 is used in Amplifier. Basic Logic gates, Universal logic gates .		

References:

1) **Op-Amps** and Linear Integrated Circuits by Ramakant A. Gayakwad

2) Logic gates for beginners by Vimal Mehta

Course Code 23BU2SEC04	Course Title OPAMP, Logic gates and Applications- Practicals	Credits 1	No.of lectures 30

Learning Outcomes

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

- To use OPAMP for Mathematical operation.
- To Design gates using RTL and DTL Techniques.

1	Inverting DC amplifier
2	Inverting AC Amplifier
3	Non-- Inverting DC amplifier
4	Non- AC Inverting amplifier
5	Op-Amp as Voltage Follower
6	Op-Amp as Adder
7	Op-Amp as Subtractor
8	Op-Amp as Comparator
9	Op-Amp as first order LPF
10	Op-Amp as first order HPF
11	To verify the truth table of basic gate (NOT, AND, OR)
12	To verify the truth table of universal gates (NAND and NOR).
13	To verify the truth table of basic gate (NOT, AND, OR) using RTL (using Resistor Transistor Logic)/ DTL (Diode Transistor Logic) circuits.
14	To verify the truth table of universal gates (NAND and NOR). using RTL (using Resistor Transistor Logic)/ DTL (Diode Transistor Logic) circuits.

Evaluation Scheme

Examination scheme and mode:

Total Marks: 50

Theory Assessment: 25 Marks

Exam (Practical): 25 Marks

**The Internal Assessment for the course may include Class participation, Assignments, Class tests, Projects, Field Work, Presentations, amongst others as decided by the faculty