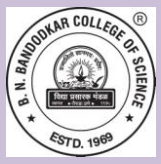
Academic Council Meeting No. and Date : 2 / April 30, 2021

Agenda Number : 4 **Resolution Number : 4.5 and 4.21**

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



Syllabus for

Programme: Bachelor of Science

Specific Programme: Physics

[F.Y.BSc. (Physics)]

Revised under Autonomy

From academic year 2021 - 2022

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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.

And many others
The students will also be trained in communication skills and green computing.

Eligibility:

Passed 12^{th} standard (HSC) of Maharashtra State Board / CBSE / ICSE board with Physics as one of the subjects.

Duration: 3 years

Mode of Conduct:

Laboratory practicals / Offline lectures / Online lectures

Program Specific Outcome

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.BSc. (Physics)

Structure of Programme

Course Code	Course Title	No. of lectures	Credits
BNBUSPH1T1	Classical Physics	**45**	**2**
BNBUSPH1T2	Modern Physics	**45**	**2**
BNBUSPH1P1	Practical I	**45**	**2**
Total		**135**	**6**

CourseCode	Course Title	No. of lectures	Credits
BNBUSPH2T1	Mathematical Physics	**45**	**2**
BNBUSPH2T2	Electricity And Electronics	**45**	**2**
BNBUSPH2P1	Practical II	**45**	**2**
Total		**135**	**6**

Semester I

Course Code	Course Title	Credits	No. of lectures
BNBUSPH1T1	**Classical Physics**	2	

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

- Understand the life and scientific work history of eminent Physicists.
- 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:	**Ancient history of Science** **Life history and work of some Physicists**- Isaac Newton, Albert Einstein, Madam Curie, C.V. Raman, S.N. Bose, Nikola Tesla, Homi Bhabha	**15**
Unit II:	**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's equation.	**15**
Unit III:	**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	Course Title	Credits	No. of lectures
BNBUSPH1T2	**Modern Physics**	2	

Learning Outcomes: Learner would gain enough knowledge about Nuclear Physics.

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's expt. 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. Fusion and fission definitions and qualitative discussion with examples.	**15**
Unit III:	**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**

Course Code BNBUSPH1P1	Course Title Practical 1	Credits 2	No. of lectures
Practical 1	**J by Electrical Method:**		**3**
a.	To determine mechanical equivalent of heat .		
Practical 2	**Bifilar Pendulum:**		**3**
a.	To determine the moment of Inertia of a Rectangular Wooden bar.		
b.	To determine the moment of Inertia of a Spherical Wooden bar.		
Practical 3	**Spectrometer:**		**3**
a.	Levelling base of spectrometer.		
b.	Levelling of the Prism table.		
c.	Schuster's method for focusing Telescope and Collimator.		
d.	To determine of angle of Prism.		
Practical 4	**Flat spiral Spring:**		**3**
a.	To determine Y Young's Modulus of a wire material by method of vibrations.		
Practical 5	**Surface Tension:**		**3**
a.	To determine the surface tension of water by capillary rise method.		
b.	Measurement of capillary rise and angle of contact.		
Practical 6	**Combination of Lenses:**		**3**
a.	To determine equivalent focal length of a lens system by magnification method.		
Practical 7	**Thermistor characteristic.**		**3**
a.	To study Thermistor characteristic Resistance vs Temperature.		
b.	To determine the temperature coefficient.		
Practical 8	**Newton's Rings.**		**3**
a.	To determine radius of curvature of a given convex lens using Newton's rings.		
Practical 9	**Torsional Oscillation**		**3**
a.	To determine modulus of rigidity η of a material of wire by torsional oscillations		
Practical 10	**Spectrometer**		**3**
a.	To determine refractive index μ of the material of Prism.		
Practical 11	**Newton's Rings**		**3**
	To determine radius of curvature of a given convex lens using Newton's rings.		

Practical 12	**Wedge Shaped Film**	**3**
Practical 13	**Coefficient of Viscosity**	**3**
	To determine Coefficient of Viscosity (η) of a given liquid by Poisseuille's Method	
	Skill Experiments	**5**
1.	Use of Vernier calipers, Micrometer Screw Gauge, Travelling Microscope	
2.	Graph Plotting: Experimental, Straight Line with intercept, Resonance Curve etc.	
3.	Spectrometer: Schuster's Method	
4.	Use of DMM	
5.	Absolute and relative errors calculation.	

References

Course Code	Course Title
BNBUSPH 1T1	Classical Physics

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Fundamental of Physics (extended)	Halliday, 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	Course Title
BNBUSPH 1T2	Modern Physics

Books and References:

Sr. No.	Title	Author/s	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	Arthur Beiser	Tata McGraw Hill	1st	1988
5.	Atomic Physics	S N Ghoshal	S. Chand	1st	2003
6.	Nuclear Physics	S N Ghoshal	S. Chand	2nd	2014

Semester II

Course Code BNBUSPH2T1	Course Title **Mathematical Physics**	Credits 2	No. of lectures
On completion of the course, student will be 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 :	**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**
Unit II :	**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 III :	**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 BNBUSPH2T2	Course Title Electricity and Electronics	Credits 2	No. of lectures
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 universal building 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**
Unit III:	**The Electric Field**: Introduction, Coulomb's Law, The Electric Field, Continuous charge Distribution, Electric Potential, Introduction to Potential, Comments on Potential, The Potential of a Localized Charge Distribution. **Work and Energy in Electrostatics:** The Work Done to Move a charge, The Energy of a Point charge distribution Magnetostatics**:** Magnetic Fields **The Biot Savart's Law:** Steady Currents, The Magnetic Field of a steady current Helmholtz coil and solenoid. ***Note: A good number of numerical examples are expected to be covered during the prescribed lectures***		**15**

Course Code BNBUSPH2P1	Course Title **Practical 2**	Credits 2	No. of lectures
Practical 1	**Flywheel**		**3**
a.	To determine the moment of inertia		
	To determine frictional torque graphically		
Practical 2	**To study load regulation of a Bridge Rectifier.**		**3**
a.	To study bridge rectifier with and without capacitor filter in order to have rectified, filtered output dc voltage.		
b.	To calculate efficiency, percentage regulation and ripple factor.		
Practical 3	**LR Circuit.**		**3**
a.	To determine the value of given inductance.		
b.	Phase angle between the applied AC and the current.		
Practical 4	**To study NAND and NOR gates as Universal Building Blocks.**		**3**
a.	Design and testing of AND, OR and NOT gate using NAND gate.		
b.	Design and testing of AND, OR and NOT gate using NOR gate.		
Practical 5	**To verify De Morgan's Theorems**.		**3**
a.	Design and testing of De Morgan's 1st Theorem.		
b.	Design and testing of De Morgan's 2nd Theorem.		
Practical 6	**Thevenin's Theorem.**		**3**
a.	To verify Thevenin's theorem for DC circuits experimentally and Graphically.		
Practical 7	**Norton's Theorem.**		**3**
a.	To verify Thevenin's theorem for DC circuits experimentally and Graphically.		
Practical 8	**LDR Characteristics**.		**3**
a.	To study the dependence of LDR resistance on intensity of light.		
Practical 9	**CR Circuit**		**3**
	To determine value of given capacitor and Phase angle		
Practical 10	**To study EX-OR Gate**		**3**
	Design half adder and full adder and verify their truth tables		
Practical 11	**Norton's Theorem:**		**3**
	To verify Norton's Theorem for DC circuits		
Practical 12	**LCR series Resonance**:		**3**
	To determine resonance frequency of LCR series circuit.		

Practical 13	**Frequency of AC Mains:**	**3**
	To determine frequency of AC mains	
	Skill Experiment	**5**
1.	Angular Momentum conservation (Rotating Platform)	
2.	Laser beam divergence, Intensity	
3.	Use of Oscilloscope	
4.	Charging and discharging of a capacitor	
5.	Light dependent switch	

References

Course Code	Course Title
BNBUSPH2T1	Mathematical Physics

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Mechanics and Electrodynamics	Brijlal, **N.** Subrahmanyam, 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 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

Course Code	Course Title
BNBUSPH2T2	Electricity and Electronics

Books and References:

Sr. No.	Title	Author/s	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.	Electronic devices and Circuit Theory	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

Evaluation Scheme

Internals

Class test	Conference / Seminars	Active Participation & Leadership qualities	Total
20	10	05 + 05 = 10	40
Certification of Swayam / NPTEL in concern course			

Internal Examination: **Based on Unit 1 / Unit 2 / Unit 3**

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

	Answer the following	20
Q. 1		
Q. 2		
Q. 3		
Q. 4		
Q. 5		

Theory Examination: **Suggested Format of Question paper**

Duration: 2 Hours **Total Marks: 60**

- **All questions are compulsory**

Q. 1	Answer ***any two*** of the following		**16**
	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		**16**
	A	Based on Unit II	
	B	Based on Unit II	
	C	Based on Unit II	
	D	Based on Unit II	
Q. 3	Answer ***any two*** of the following		**16**
	A	Based on Unit III	
	B	Based on Unit III	
	C	Based on Unit III	
	D	Based on Unit III	
Q. 4	Answer ***any three*** of the following		**12**
	A	Based on Unit I	
	B	Based on Unit II	
	C	Based on Unit III	
	D	Based on Unit I	
	E	Based on Unit II	
	F	Based on Unit III	

Marks Distribution and Passing Criterion for Each Semester

Theory					Practical		
Course Code	Internal	Min marks for passing	Theory Examination	Min marks for passing	Course Code	Practical Examination	Min marks for passing
BNBUSPH1T1	**40**	**16**	**60**	**24**	BNBUSPH1P1	**100 (40+40+20)**	**40**
BNBUSPH1T2	**40**	**16**	**60**	**24**			

Theory					Practical		
Course Code	Internal	Min marks for passing	Theory Examination	Min marks for passing	Course Code	Practical Examination	Min marks for passing
BNBUSPH2T1	**40**	**16**	**60**	**24**	BNBUSPH2P1	**100 (40+40+20)**	**40**
BNBUSPH2T2	**40**	**16**	**60**	**24**			

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