Academic Council Meeting No. and Date :

Agenda Number : **Resolution Number :**

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

Syllabus for

Programme: Bachelor of Science

Specific Programme: PHYSICS

[S.Y.B.Sc. Physics]

Level 5.0

[CHOICE BASED GRADING SYSTEM]

Revised under NEP

From academic year 2024 - 2025

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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 reasoningand 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 scientific communication skills.

Eligibility: Level 5.0 – F.Y.B.Sc.

Duration: 1 Year (includes SEM III and SEM IV)

Mode of Conduct: Offline Laboratory Practicals/Virtual lab Practicals

Offline lectures / Online lectures

Total Credits for the Program: 44

Starting year of implementation: 2024- 25

Name of the Degree Program: B.Sc

Discipline/Subject: PHYSICS

Specific Programme: S.Y.B.Sc. (Physics -Major)
Credits: 44

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.

Assessment: Weightage for assessments (in percentage) For Major

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40%	60%

B. N. Bandodkar College of Science, (AUTONOMOUS)-Thane

S.Y.B.Sc.

Level	SEM.	Faculty - DSC							Any Faculty	Vocational & Skill Enhancement Course (VSEC)	Ability Enhancement Course (AEC) / Indian Knowledge System (IKS)			Field Project / Apprenticeship / Community Engagement & Services		Credit	Cumulative Credits
		Subject					Subject		Subject								
		Major (6T + 4P)					Minor		GE & OE								
		Course - I	Course - II	Course - III	Practical Course – I	Practical Course – II	Course – I		Course – I		AEC	VEC	IKS	FP	CC		
5.0	III	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)		02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	44
	IV	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)		02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	

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

S.Y.B.Sc.

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

Structure of Programme

Semester-wise Titles of the Papers in S.Y.B.Sc. (Major Physics)

Year	Sem.	Course code	Course Title	Theory/ Practical	No. of Lectures	Credits
Second Year	III	24BUPH3T01	Analog and Digital Electronics	Theory	30	02
		24BUPH3T02	Laser, Fiber Optics and Communication	Theory	30	02
		24BUPH3T03	Solar Energy	Theory	30	02
		24BUPH3P01	Major Practical - 1	Practical	60	02
		24BUPH3P02	Major Practical - 2	Practical	60	02
	IV	24BUPH4T01	Solid State Devices and Circuits	Theory	30	02
		24BUPH4T02	Optical Physics	Theory	30	02
		24BUPH4T03	Microprocessor and Medical Physics	Theory	30	02
		24BUPH4P01	Major Practical – 1	Practical	60	02
		24BUPH4P02	Major Practical – 2	Practical	60	02
Total Credits					**20**	

Semester III

Course Code 24BUPH3T01	Major – 1 Course Title: **Analog and Digital Electronics**	Credit 2	No. of Lecture 30

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

- Understand the requirements of transistor biasing
- Understand and build general amplifier
- Understand working and construction of sequential circuits
- Understand the number system and convert the numbers in various number systems.

UNIT I	**Transistor Biasing:** Inherent Variations of Transistor Parameters, Stabilization, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Biasing with Collector Feedback Resistor, Voltage Divider Bias Method, Stability factor for Potential Divider Bias *VM : 9.1 – 9.13* **General amplifier characteristics:** Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance. Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width.	**15**
UNIT II	**Number System :** Binary number system , Arithmetic building blocks, Digital IC signal levels, Binary to Decimal ,Decimal to binary , Hexadecimal number, Hexadecimal to decimal Conversion, Decimal to hexadecimal conversion, Hexadecimal to binary conversion, Binary to hexadecimal conversion, Binary addition, Unsigned binary numbers, Sign magnitude numbers, 1's complement, 2's complement, Converting to and from 2's complement representation, 2's complement arithmetic, The adder-subtractor (ignore IC specific diagrams) *NGP : 1.2, 1.3, 1.4, 1.6, 2.1-2.7* **Sequential Circuits:** SR, D, JK and T Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop. *NGP : 8.1 – 8.8* **Counters (4 bits):** Ring Counter, Asynchronous counters, Decade Counter, MOD N Counter, Synchronous Counter, *NGP : 9.1 – 9.3, 9.5, 9.7, 9.8* **Shift registers (4 bits):** Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers. *NGP : 10.1-10.5*	**15**

Reference Books :

1. **VM :** Principles of Electronics by V. K. Mehta and Rohit Mehta, S. Chand & Company(Multicolor edition)
2. **NGP:** Digital Electronics and logic Design by N. G. Palan, Technova publication
3. **RJ:** Modern Digital Electronics by R. P. Jain, McGraw Hill education, 4th edition
4. **LMS:** Digital Principles and Application by Malvino, Leach & Saha, McGraw Hill Education

Course Code 24BUPH3T02	Major – 2 Course Title: **Laser, Fiber Optics and Communication**	Credit 2	No. of Lecture 30

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

- Understand the concept and application of laser and fiber optics
- Understand the concept of communication electronics and satellite communication
- Understand the concept of amplitude and frequency modulation
- Design the circuit for amplitude and frequency modulation.

UNIT I	**Laser:** Introduction, transition between atomic energy states, Principle of Laser, Properties of Laser: Coherence Properties of LASER, Spatial Coherence Length, Directionality, Intensity, Helium–Neon Laser, Application of Laser, Holography SP: 9.1, 9.2, 9.3, 9.4, 9.4.1, 9.4.2, 9.4.3, 9.4.4, 9.6& 9.10 SB: Ch. 22 **Fiber Optics:** Light propagation through Fibers, Fiber Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibers, Applications of Optical Fibers. SP: 13.3, 13.3.1, 13.3.2, 13.3.3, 13.5 & 13.9	**15**
UNIT II	**Basics of Communication:** Block diagram of communication system, types of communication system: simplex, duplex, analog and digital communication, Electromagnetic spectrum, base band and broad band communication. K : 1.2, 1.3, 2.1, 2.2, 2.4, 2.5, **Amplitude Modulation:** Need of modulation, concept of modulation, AM waveform, mathematical expression of AM, concept of sideband, demodulation principles. AM Receiver: TRF and super heterodyne receiver. K : 3.1, 6.1 **Frequency Modulation:** Definition, mathematical representation, frequency spectrum, bandwidth, and modulation index. Concept of ASK, PSK, FSK, PAM, PWM, PPM, PCM. K : 5.1.1 – 5.1.3, 13.2, 13.3	**15**

Reference Books :

1. **SP** : Modern Physics Concept and Applications by Sanjeev Puri, Narosa Publication
2. **RK** : Atomic and Molecular Spectra, LASER by Raj Kumar, KedarNath Ram Nath Publishers
3. **BL:** Lasers and Nonlinear Optics by B B Laud, New Age International (P) Ltd., New Delhi
4. **K:** Electronics Communication Systems by Kenndy, Tata McGraw Hill edition
5. **SB:** A Textbook of Optics by N. Subrahmanyam & Brij Lal, S. Chand publication

Course Code 24BUPH3T01	Major – 3 Course Title: **Solar Energy**	Credit 2	No. of Lecture 30

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

- To know the structure of sun and its relevance with respect to earth
- Understand the methods to measure solar radiation
- Understand the techniques involved in the measurement of solar energy
- Understand the working of solar power plant

UNIT I	**Solar Radiation:** Structure of the sun, Solar constant, Sun's radiation, Composition of Sun's radiation, basic sun- earth angle, tilt factor, Solar Radiation Geometry **Energy Source of the Sun:** The p – p Chain, Carbon Chain **Solar Radiation Measurement:** Pyrheliometers, Angstrom, Abbot silver disc and Eppley, Pyranometers- Eppley Pyranometers, Yellot Solarimeter [Photovoltaic solar cell] Average value of Horizontal Solar radiation, Solar radiation on the tilted surface. GR: 2.1, 2.2, 2.3, 2.3.4, 2.4.1- 2.4.7, 2.6.1, 2.6.2, 2.9, 2.10. CJ : 3.3 BS: 2.1 – 2.7	**15**
UNIT II	**Solar Energy:** Solar photovoltaic (PV) energy conversion / Photovoltaic effect, Performance analysis of solar photovoltaic (PV) Cell, Current in a short circuit, voltage in an open circuit, Power delivered to the load, Maximum current, Maximum power, Efficiency of solar cell, Fill factor, Limitation of Solar Cell, Solar cell material, Solar power plant, Autonomous solar power plant / off grid power plant, Grid connected Solar power plant, Solar photovoltaic (PV) energy conversion limitations SR : 3.1, 3.2, 3.2.1, 3.2.2. 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, 3.2.8, 3.3, 3.4, 3.5, 3.5.1, 3.5.2, 3.6.	**15**

Reference Books:

1. **GR** : Non- Conventional Energy Sources - A textbook of Engineering students by G. D. Rai,6th edition, Khanna publishers, 2017
2. **BS :** Non- Conventional Energy Sources by B. L. Singhal, Tech-Max publication
3. **CJ :** Physics of Solar Energy by C. Julian Chen, John Wiley & Sons INC. , 2011
4. **SR:** Solar Energy - Fundamentals, Economic and Energy Analysis by Saurabh Kumar Rajput, Nitra Publication, 1st edition, 2017

PRACTICALS

Course Code 24BUPH3P01	Course Title: **Practical I**	Credit 2	No. of Lecture 60

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

- Choose the correct value components and devices for a particular experiment
- Design and construct the appropriate circuit
- Record the necessary readings, tabulate, calculate and plot the graph.
- Analyze the result and draw the conclusion.

1	BJT as CE characteristics
2	BJT as CB characteristics
3	BJT as CC characteristics
4	CE amplifier: variation of gain with load
5	CE amplifier: determination of bandwidth
6	Half and Full Subtractor
7	Study of Flipflops
8	Shift register: SISO and SIPO
9	Shift register: PISO and PIPO
10	Study of UP counter using IC 74190 / IC 74193
11	Study of DOWN counter using IC 74190 / IC 74193
12	Study of preset UP/DOWN counter using IC 74190 / IC 74193 (MOD N)
13	Study of RING Counter
14	Binary to Gray Code and Gray code to Binary Conversion Using IC 7400
15	BCD to Excess 3 code and Excess 3 to BCD code conversion using IC 7400 & IC7404
16	4-bit comparator using IC 7485
17	8-bit comparator using IC 7485

**The above list can be modified as per the need and requirement.*

Online Virtual Lab Experiment List/Link

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu
2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in
3. An MoE Govt. of India initiative, https://de-iitr.vlabs.ac.in

Course Code 24BUPH3P02	Course Title: **Practical II**	Credit 2	No. of Lecture 60

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

- Arrange the apparatus for study of optical phenomena.
- Choose the correct value components and devices for a particular experiment and construct appropriate circuit
- Record the necessary readings, tabulate, calculate and plot the graph.
- Analyze the result and draw the conclusion.

1	To find the wavelength of laser using grating
2	To find the wavelength of laser using ruler scale
3	To find Refractive index using total internal reflection by Laser
4	Fiber optics - 1
5	Fiber optics -2
6	I-V characteristics Of Solar Cell.
7	Study of PV cell in series
8	Study of PV cell in parallel
9	Effect of distance on cell current of solar cell
10	Effect of different color filter on solar cell
11	Effect of Shading on Cell Current with 1 cell covered and all cell covered
12	Interfacing of DC motor, LED, Relay using solar Cell
13	Frequency modulation
14	Amplitude modulation
15	Simulation on Multisim

**The above list can be modified as per the need and requirement.*

Online Virtual Lab Experiment List/Link

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu
2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in
3. An MoE Govt. of India initiative, https://de-iitr.vlabs.ac.in

Semester IV

Course Code 24BUPH4T01	Major – 1 Course Title: **Solid State Devices and Circuits**	Credit 2	No. of Lecture 30

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

- Understand the concept of FET, MOSFET, SCR and UJT
- Design and build FET, SCR and UJT
- Understand the concept of multivibrator using transistor and 555 timer IC and some special diodes
- Design multivibrator using transistor and 555 timer IC

UNIT I	**Field effect transistors:** JFET: Basic ideas, drain curve, The transconductance curve, Biasing in the ohmic region and the active region, Transconductance, JFET common source amplifier, JFET analog switch, multiplexer, voltage-controlled resistor, Current sourcing. **MOSFET:** Depletion and enhancement mode, MOSFET operation and characteristics, digital switching. **SCR:** construction, static characteristics, Analysis of the operation of SCR, Gate Triggering Characteristics, Variable half wave rectifier and Variable full wave rectifier, Current ratings of SCR. **UJT:** Construction, Operation, characteristics and application as a relaxation oscillator MB: 13.1 to 13.9 MB: 14.1, 14.2, 14.4, 14.6. AM: 28.1, 28.5	**15**
UNIT II	**Transistor Multivibrators:** Astable, Monostable and Bistable Multivibrators, Schmitt trigger. **555 Timer**: Review Block diagram, Monostable and Astable operation Voltage Controlled Oscillator, Pulse Width modulator, Pulse Position Modulator, Triggered linear ramp generator. **Special Diodes:** Zener Diode, Tunnel diode, Varactor diode, Point contact diode, V-I characteristic of these diodes, Optoelectronic devices: Light emitting diode. Photodiode, Phototransistor. AM: 18.11 2. KVR: 14.5.2.1, 14.5.2.5, 14.5.2.6, 14.5.4.1 3. MB: 23.8, 23.9 4. MB:24.1, 24.3, 24.4	**15**

Reference Books :

1. MB: Electronic Principles, Malvino & Bates,7th Ed, TMH Publication.
2. AM: Electronic Devices and Circuits, Allen Mottershead, PHI Publication
3. BT : Solid state and Electronics by B L Theraja,

Course Code 24BUPH4T02	Major – 2 Course Title: **Optical Physics**	Credit 2	No. of Lecture 30

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

- Understand the concept of polarization and its types
- To produce and analyze the polarized light
- To understand the Fresnel's diffraction and analyze the spectra
- To underhand the Fraunhoffer diffraction and analyze the spectra.

UNIT I	**Polarization:** Types of polarization, Plane polarized light, Circularly polarized light, Elliptically polarized light, Partially polarized light, Production of Plane polarized light, Polarization by reflection from dielectric surface, Polarization by refraction –pile of plates, Polarization by scattering, Polarization by selective Absorption, Polarization by double refraction, Polarizer and Analyzer, Malus' Law, Anisotropic crystal, Calcite crystal, Optic Axis, Double refraction in calcite crystal, Huygens' explanation of double refraction, Ordinary and Extra ordinary rays, Positive and Negative crystals, Superposition of waves linearly polarized at right angles, Superposition of e-Ray and o-Ray, Retarders, Quarter wave plate, Half wave plate, Production of linearly polarized light, Production of elliptically polarized light, Production of circularly polarized light, Analysis of polarized light, Applications of polarized light. **SB:** 20.1 – 20.22, **AG:** 22.1 – 22.7	**15**
UNIT II	**Fresnel's Diffraction:** Fresnel's assumptions, rectilinear propagation (Half period zones) of light, Diffraction pattern due to straight edge, Positions of maxima and minima in intensity, Intensity at a point inside the geometrical shadow (straight edge), Diffraction due to a narrow slit, Diffraction due to a narrow wire **SB :** 17.1 – 17.12, **AG :** 20.1 – 20.3, 20.6 **Fraunhoffer Diffraction:** Introduction, Fraunhoffer diffraction at a single slit, Intensity distribution in diffraction pattern due to a single slit, Fraunhoffer diffraction at a double slit, Distinction between single slit and double slit diffraction pattern and missing orders, Plane diffraction Grating, Theory of plane transmission grating, Width of principal maxima **SB:** 18.1 – 18.5, **AG:** 18.1, 18.2, 18.6	**15**

Reference Books:

1. **SA:** A Textbook of Optics by N. Subrahmanyam & Brij Lal, S. Chand publication
2. **AG:** Optics by Ajoy Ghatak, McGraw hill educations
3. **DM:** A text of optics by D.S. Mathur

Course Code 24BUPH4T03	Major – 3 Course Title: **Microprocessor and Medical Physics**	Credit 2	No. of Lecture 30

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

- Write 8085 assembly language the programs
- Execute the programs
- Understand the concept used in the Biomedical instruments
- Understand the modern medical imaging and instrumentation system

UNIT I	**Building Concept of Microprocessor:** Introduction, Study of Memory, Input Device, Output Device, Input/output Device, Central Processing Unit. **8085 Microprocessor:** Introduction, Features of Inter 8085, Pin Diagram of 8085 , 8085 CPU Architecture , Arithmetic and Logical Group (ALU , Accumulator, Temporary Register, Flag Register (PSW)), Register Group (Temporary Registers (W and Z) , General purpose registers, Special Purpose registers), Interrupt Control , Serial I/O Control Group, Instruction Register, Decoder and Control Group (Instruction Register , Instruction Decode, Timing and Control) **8085 Instruction Set:** Introduction, Flowchart, Classification of Instruction Set (Data Transfer Group, Arithmetic Group, Logical Group, Branching Group , Stack and Machine Control Group) , Notations used in Instructions and Opcode , Data Transfer Group , Program Examples for Data Transfer Group , Arithmetic Operation Group , Branch Group , Logical Group , Addressing Modes , 8085 Programmers Model. RG : Ch 3,4 & 6	**15**
UNIT II	**Medical Physics:** **Biomedical Electrodes, Sensors and Transducers:** Sources of Bioelectric Potential - Resting and Action potential, Propagation of action potential, Electrode Theory, Goldman and Nernst Equations, Ag-AgCl Reference Electrode; Surface electrodes, Needle electrodes, microelectrodes; Classifications and Characteristics of Sensors and Transducers, Pressure, Flow, Temperature and Optical transducers. **The bioelectric potentials**: ECG, EEG, EMG, ERG, EOG, EGG; Digital Biosignals, Types of Noise. SA: Ch 6, 7, 12 **Modern Medical Imaging and Instrumentation Systems:** Ultrasound and Ultrasonic imaging system – Ultrasound Doppler and flow detector, Echocardiogram; Physics of X-rays and X-ray machines, X-ray images and data, Computer Tomography (CT) – Principles and scans; Magnetic resonance imaging (MRI) Positron Emission Tomography (PET). SA: Ch 14,15	**15**

Reference Books:

1. **RG :** Microprocessor Architecture Programming and applications with 8085, R.S. Gaonkar, 2002, Prentice Hall.
2. **SA:** Biomedical Instrumentation by S. Chatterjee and Aubert Miller Cengage Learning
3. Biomedical Instrumentation and Measurements by Lesli Cromwell, F J Weibell, Erich Pfeiffer PHI
4. Handbook of Biomedical Instrumentation by R S Khandpur, TMH
5. Biomedical Digital Signal Processing by Willis J Tompkins, PHI

PRACTICALS

Course Code **24BUPH4P01**	**Course Title:** **Practical I**	**Credit** **2**	**No. of Lecture 60**
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to ● Understand and demonstrate the optical phenomenon like reflection, refraction, Diffraction and polarization, ● Design and construct the circuits based on Transistor and 555 Timer IC. ● Design and construct the circuits for characteristics of solid-state devices. ● Apply the knowledge in constructing new circuits.			
1	Fresnel's bi-prism: determination of λ		
2	Determination of Cauchy's constants.		
3	R.P. of telescope.		
4	R.P. of grating		
5	R. P. of prism		
6	Brewster's law: determination of μ		
7	Double refraction		
8	Transistorized Astable/ Monostable/ Bistable multivibrator		
9	Characteristics of Photodiode/ Phototransistor		
10	IC 555 timer as Astable/ Monostable multivibrator		
11	IC 555 timer as a Ramp generator		
12	Energy band gap		
13	SCR characteristics		
14	FET as VVR and VCA		
15	UJT characteristics		
16	UJT as relaxation oscillator		
17	Thermistor characteristics.		
18	Thermocouple- Seebeck effect		
**The above list can be modified as per the need and requirement.*			
Online Virtual Lab Experiment List/Link			
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Course Code 24BUPH4P02	Course Title: **Practical II**	Credit 2	No. of Lecture 60

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

- Understand the 8085 instructions.
- Select the appropriate instructions.
- Write 8085 assembly language program for a given specific case.
- Execute 8085 assembly language program and analyze the result.

1	8 -bit addition/ subtraction.
2	8-bit addition with carry and subtraction with borrow
3	Addition of series of numbers.
4	Multiplication of two hexadecimal numbers.
5	Division of two hexadecimal numbers.
6	Find largest number in given block.
7	Find smallest number in given block.
8	Find number of even elements in given block.
9	Find number of odd elements in given block.
10	Find number of negative elements in given block.
11	Find number of positive elements in given block.
12	Arrange given number in descending order.
13	Arrange given number in ascending order.
14	Memory block transfer from one location to another.
15	Sixteen-bit subtraction.
16	Sixteen-bit addition.

**The above list can be modified as per the need and requirement.*

Online Virtual Lab Experiment List/Link

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu
2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in
3. An MoE Govt. of India initiative, https://de-iitr.vlabs.ac.in

Academic Council Meeting No. and Date:

Agenda Number: **Resolution Number:**

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

Syllabus for

Programme: Bachelor of Science

Specific Programme: PHYSICS

[S.Y.B.Sc. Physics]

Level 5.0

[CHOICE BASED GRADING SYSTEM]

Revised under NEP

From academic year 2024 - 2025

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B. N. Bandodkar College of Science, (AUTONOMOUS)-Thane

S.Y.B.Sc.

Level	SEM.	Faculty - DSC							Any Faculty	Vocational & Skill Enhancement Course (VSEC)	Ability Enhancement Course (AEC) / Indian Knowledge System (IKS)			Field Project / Apprenticeship / Community Engagement & Services		Credit	Cumulative Credits
		Subject					Subject		Subject								
		Major (6T + 4P)					Minor		GE & OC								
		Course - I	Course - II	Course - III	Practical Course – I	Practical Course – I	Course – I		Course – I		AEC	VEC	IKS	FP	CC		
5.0	III	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)		02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	44
	IV	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)		02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	

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

S. Y.B. Sc.

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

Structure of Programme

Semester-wise Titles of the Papers in S.Y.B.Sc. (Physics) [MINOR]

Year	Sem.	Course code	Course Title	Theory/ Practical	No. of Lectures	Credits
Second Year	III	23BUPH3T04	Fundamental probability and distribution	Theory	30	02
	IV	23BUPH4T04	Nanotechnology	Theory	30	02
Total Credits					**04**	

Semester III

Course Code	Course Title:	Credit	No. of Lecture
23BUPH3T04	**Fundamental probability and distribution**	**2**	**30**

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

- Students will grasp the foundational concepts of probability, such as sample spaces, events, and probability rules.
- Students will learn about common probability distributions such as binomial, Poisson, and normal distributions.
- They will understand how to use these distributions to model real-world situations,

UNIT I	Measure of central tendency: Mean, weighted mean, median, mode, geometric and harmonic means, properties, merits and limitations, relation between these measures. Partition values. Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation and their relative measures. Moments, Skewness and Kurtosis.	**15**
UNIT II	Review of basic concepts, introduction, sample space, events, independent events, (derivation of formulae not expected), random variables, p.m.f, p.d.f, c.d.f continuous distributions (omit joint distributions), binomial distribution, the normal distribution, the Poisson Distribution. Ref: MB – 15.1-15.9 Expected to cover solved problems from each section	**15**

Reference Books :

1. MB: Mathematical Methods in the Physical sciences: Mary L. Boas Wiley India, 3rd ed.
2. Basic Statistics Agarwal B.L. New Age International Ltd.
3. Theory and Problems of Statistics, Spiegel M.R. Tata McGraw Hill.
4. Fundamentals of Statistics, Volume II Goon A.M., Gupta M.K., Das Gupta B. The World Press Private Limited, Calcutta.
5. Complete Business statistics Aczel Sounder Pandian Tata McGraw Hill

Semester IV

Course Code	Course Title:	Credit	No. of Lecture
23BUPH4T04	**Nanotechnology**	**2**	**30**

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

- Students will grasp the foundational concepts of probability, such as sample spaces, events, and probability rules.
- Students will learn about common probability distributions such as binomial, Poisson, and normal distributions.
- They will understand how to use these distributions to model real-world situations,

UNIT I	**1.1 MACRO, MICRO, NANO** 1.1.1 Production Methods in Development of Technology and the Importance of Material 1.1.2 Importance of Size in Material Characterization 1.1.3 Macro Structures 1.1.4 Micro Structures 1.1.5 Nano Structures **1.2 The HISTORY of NANOTECHNOLOGY** 1.2.1 Historical Development of Nanotechnology **1.3 DEVELOPMENT of NANOTECHNOLOGY** 1.3.1 Nanotechnology in Material and Production 1.3.2 Nanotechnology in Electronics and Information Technologies 1.3.3 Nanotechnology in Medical Applications 1.3.4 Energy, Environment and Nanotechnology 1.3.5 Textile and Nanotechnology 1.3.6 Food Industry and Nanotechnology	**15**
UNIT II	**1.4 NANOMETROLOGY** 1.4.1 The Nanometre (nm) 1.4.2 The Nano gram (ng) 1.4.3 Current Nano scale Measurement Studies **1.5 IMPACT of NANOTECHNOLOGY** 1.5.1 The impact of nanotechnology 1.5.2 How can nanotechnologies change our lives in the future? 1.5.3 The economic and social impact of nanotechnology 1.5.4 Nanotechnology Future today 1.5.6 Nano impact today **NANOMATERIALS** 3.1 NATURAL NANOPARTICLES 3.1.1 Natural Nanoparticles 3.1.2 Natural Nanoparticles in the Atmosphere 3.1.3 Natural Nanoparticles in the Hydrosphere 3.1.4 Mechanisms for the formation of natural nanoparticles (NNPs)	**15**

Reference Books :

1. Nanotechnology 1 by Prof. Dr. Mustafa ersöz, Dr. Arzum işitan meltem balaban ISBN 978-975-6992-77-71st edition October 2018

Academic Council Meeting No. and Date:

Agenda Number: **Resolution Number:**

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

Syllabus for

Programme: Bachelor of Science

Specific Programme: PHYSICS

[S.Y.B.Sc. Physics]

Level 5.0

[CHOICE BASED GRADING SYSTEM]

Revised under NEP

From academic year 2024 - 2025

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B. N. Bandodkar College of Science, (AUTONOMOUS)-Thane

S.Y.B.Sc.

Level	SEM.	Faculty - DSC							Vocational & Skill Enhancement Course (VSEC)	Ability Enhancement Course (AEC) / Indian Knowledge System (IKS)			Field Project / Apprenticeship / Community Engagement & Services		Credit	Cumulative Credits
		Subject					Subject	Any Faculty Subject								
		Major (6T + 4P)					Minor	GE & OC								
		Course - I	Course - II	Course - III	Practical Course – I	Practical Course – I	Course – I	Course – I		AEC	VEC	IKS	FP	CC		
5.0	III	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)	02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	44
	IV	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)	02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	

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

S. Y.B. Sc.

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

Structure of Programme

Semester-wise Titles of the Papers in S.Y.B.Sc. (Physics) [Skill Enhancement Course]

Year	Sem.	Course code	Course Title	Theory/ Practical	No. of Lectures	Credits
Second Year	III	24BU3SEC04	Basics of C++	Theory + Practical	15+30	02
	IV	24BU4SEC04	Advanced C++	Theory + Practical	15+30	02
Total Credits					**04**	

Semester III

Course Code	Course Title:	Credit	No. of Lecture
24BU3SEC04	Basic of C++	1	15

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

- Students will learn how to write and execute simple C++ programs
- Students will understand and implement control structures
- Students will know how to define and use functions in C++

UNIT I	**Basics of Object-Oriented Programming & Beginning with C++:** Basic concepts of Object-Oriented Programming, Benefits of OOP, Object Oriented Languages, Applications of OOP. What is C++?, Applications of C++, A simple C++ program, More C++ Statements, Example with Class, Structure of C++ Program, Creating the Source File, Compiling and Linking. EB: 1.5, 1.6, 1.7 & 1.8 EB: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7 & 2.8 **Tokens and Expressions in C++:** Introduction, Tokens, Keywords, Identifiers and Constants, Basic Data Types, User-Defined Data Types, Derived Data Types, Symbolic Constants, Type Compatibility, Declaration of Variables, Dynamic Initialization of Variables, Reference Variables, Operators in C++, Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator, Expressions and Their Types, Special Assignment Expressions, Implicit Conversions, Operator Overloading, Operator Precedence, Control Structure EB: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, 3.19, 3.20, 3.21, 3.22, 3.23& 3.24 TG: Ch. 1, 2, 3, 4, 5	**15**

Reference Books :

1. **EB:** Object Oriented Programming with C++ by E Balagurusamy, Third /Fourth Edition, Tata McGraw-Hill Publishing Company Limited.
2. **TG:** Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company

Course Code	Course Title:	Credit	No. of Lecture
24BU3SEC04	**Basic of C++ Practical's**	1	30

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

- Students will learn how to write and execute simple C++ programs
- Students will understand and implement control structures
- Students will know how to define and use functions in C++

1.	Positive and Negative Number
2.	Even and Odd Number
3.	Create a Calculator
4.	Swap 2 numbers
5.	Armstrong Number
6.	Program using Switch Case
7.	Fibonacci Series
8.	Sum of series
9.	palindrome number
10.	Swap of palindrome number
11.	Create a C program that uses both a keyword and an identifier in a variable declaration and demonstrates their usage.
12.	Write a program that calculates the area of a rectangle given its length and width, using appropriate variable declarations and data types.
13.	Declare variables of different data types and print their sizes using the `size of` operator.
14.	Create a C program that prompts the user to enter two numbers, assigns them to variables, and then swaps the values of these variables.

**The above list can be modified as per the need and requirement.*

Reference Books :

1. **EB:** Object Oriented Programming with C++ by E Balagurusamy, Third /Fourth Edition, Tata McGraw-Hill Publishing Company Limited.
2. **TG:** Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company

Semester IV

Course Code	Course Title:	Credit	No. of Lecture
24BU4SEC04	Advanced C++	1	15

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

- Students will learn how to write and execute simple C++ programs
- Students will understand and implement control structures
- Students will know how to define and use functions in C++

UNIT I	**Functions:** Control Structures, Functions: The Main Function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Default Arguments, Constant Arguments, Function Overloading, Math Library Functions. **Arrays, Pointers, C - Strings** EB:4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9 & 4.11 TG: 7.1 – 7.9, 9.1 – 9.5, 10.1 – 10.4	**15**

Reference Books:

1. **EB:** Object Oriented Programming with C++ by E Balagurusamy, Third/Fourth Edition, Tata McGraw-Hill Publishing Company Limited.
2. **TG:** Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company

Course Code	**Course Title:**	**Credit**	**No. of Lecture**
24BU4SEC04	**Advanced C++ Practical's**	**1**	**30**

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

- Students will learn how to write and execute simple C++ programs
- Students will understand and implement control structures
- Students will know how to define and use functions in C++

1.	Write a function prototype for a function that takes an array of integers and its size, and returns the average of the array elements.
2.	Implement a function that swaps the values of two integers using call by reference and test it in a program.

3.	Create a function that returns a reference to the largest integer in an array. Test it in a program.
4.	Implement an inline function that calculates the square of a number and use it in a program to calculate the squares of numbers from 1 to 10.
5.	Write a function that takes two integers with a default value for the second parameter. Use the function to calculate the sum of the two integers.
6.	Create a function that takes an array and its size as parameters, both marked as const. The function should calculate the sum of the array elements and print the result.
7.	Implement overloaded functions for addition: one for integers, one for floating-point numbers, and one for arrays of integers.
8.	Trapezoidal rule
9.	Simpson's 1/3 rd Rule
10.	Simpson's $3/8^{th}$ Rule
11.	Create a program that takes an array of integers and reverses the order of its elements. Print the original and reversed arrays.
12.	Implement a function that calculates the sum of elements in each row of a 2D array and prints the results.
13.	Write a program that takes two C-strings (arrays of characters) as input and concatenates them. Print the result.
14.	Implement a function that compares two C-strings and returns whether they are equal. Use this function in a program to compare user-provided strings.
15.	Create a function that finds a substring within a C-string and returns the starting index of the substring if found. Use the function in a program and test it with various inputs.

**The above list can be modified as per the need and requirement.*

Reference Books :

1. **EB:** Object Oriented Programming with C++ by E Balagurusamy, Third /Fourth Edition, Tata McGraw-Hill Publishing Company Limited.
2. **TG:** Starting out with C++ by Tony Gaddis, Third Edition, Addison Wesley Publishing Company

Academic Council Meeting No. and Date:

Agenda Number: **Resolution Number:**

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

Syllabus for

Programme: Bachelor of Science

Specific Programme: PHYSICS

[S.Y.B.Sc. Physics]

Level 5.0

[CHOICE BASED GRADING SYSTEM]

Revised under NEP

From academic year 2024 - 2025

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B. N. Bandodkar College of Science, (AUTONOMOUS)-Thane

S.Y.B.Sc.

Level	SEM.	Faculty - DSC							Vocational & Skill Enhancement Course (VSEC)	Ability Enhancement Course (AEC) / Indian Knowledge System (IKS)			Field Project / Apprenticeship / Community Engagement & Services		Credit	Cumulative Credits
		Subject					Subject	Any Faculty Subject								
		Major (6T + 4P)					Minor	GE & OC								
		Course - I	Course - II	Course - III	Practical Course – I	Practical Course – I	Course – I	Course – I		AEC	VEC	IKS	FP	CC		
5.0	III	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)	02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	44
	IV	02 (2T)	02 (2T)	02 (2T)	02 (2P)	02 (2P)	02 (2T)	02 (2T)	02 (1T + 1P)	02 (2P)	-	-	02 (2P)	02 (1T + 1P)	22	

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

S.Y.B.Sc.

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

Structure of Programme

Semester - wise Titles of the Papers in S.Y.B.Sc. (Physics) [Open Elective Course]

Year	Sem.	Course code	Course Title	Theory/ Practical	No. of Lectures	Credits
Second Year	III	24BUPH3 T05	Designing of Mobile Charger and Frequency Generator	Theory	30	02
	IV	24BUPH4 T05	Environmental Physics	Theory	30	02
Total Credits					04	

Semester III

Course Code 24BUPH3T05	Course Title: Designing of Mobile Charger and Frequency Generator	Credit 2	No. of Lecture 30
Course Outcomes: Upon completion of this course, students will acquire knowledge about and able to • Understand the basic principles of mobile charging technology. • Learn how to select appropriate components for a mobile charger. • Understand the concepts of frequency generation and waveforms. • Learn how to select and use frequency generating components effectively.			
UNIT I	**1.** Working of Resistance, Capacitors, Inductors, Diode, **2.** Working of Transistor, Optocoupler and Transformer etc. **3.** Bridge rectifier without Capacitor and with Capacitor for A.C to D.C conversion. **4.** Study the working of DC power supply/ mobile Charger. **5.** Fault findings in a Faulty DC power supply. **6.** Designing a DC power supply/mobile Charger of 5V/10V output.		**15**
UNIT II	**1.** Study of Transistorised Astable Multivibrator. **2.** Study of Transistorised Mono-stable Multivibrator. **3.** Study of Transistorised Bistable Multivibrator. **4.** Study the working of Frequency Generator. **5.** Fault findings in a Faulty Frequency Generator. **6.** Designing a frequency generator of 1k to 10k Hz output frequency by using quartz crystal.		**15**

Reference Books :

1. "Power Supply Design Handbook" by Khurram Kazi:
2. "Switch-Mode Power Supply Design" by Abraham I. Pressman:
3. "Practical Electronics for Inventors" by Paul Scherz and Simon Monk:
4. Digital Principles & Applications (Sie) Book by Albert Paul Malvino and Donald P. Leach

Semester IV

Course Code 24BUPH4T05	Course Title: **Environment Physics**	Credit 2	No. of Lecture 30

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

- Students will have a comprehensive understanding of the physical processes that govern the Earth's environment.
- Explore the interactions and dynamics of Earth's atmospheric system this includes understanding processes such as energy transfer, atmospheric circulation and Photochemical pollution.
- Examine the physics behind" wind", including Principal forces acting on air masses Greenhouse Effect and Global Warming

UNIT I	**The human environment, Energy transfers-** Conduction. - Fourier's law of thermal conduction. Convection. Newton's law of cooling, Radiation, Stefan-Boltzmann law, Kirchhoff's law, Planck's law and Wien's displacement law. Evaporation **Structure and composition of the atmosphere-** Troposphere, Stratosphere, Mesosphere, Ionosphere, Thermosphere, Exosphere, Magnetosphere **Photochemical pollution**, Atmospheric aerosol, Atmospheric pressure, Ozone: Advantage of ozone: Disadvantage of ozone, Ozone hole, Greenhouse Effect and Global Warming.	**15**
UNIT II	**Wind**- Physics of wind Creation, - **Principal forces acting on air masses-**Gravitational force, Pressure gradient, Coriolis force, The frictional force **Energy and the** environment-Energy resources: 1- Fossil fuels, 2- Nuclear power: **Renewable resources**: - 1- Hydro-electric power 2- Tidal power, 3- Wind power 4- Wave power 5- Biomass (as fuel) 6- Solar power- **Noise pollution**- Hearing loss: Noise control: **Thermal Pollution**-Ecological effects - warm water, Ecological effects - cold water, Industrial wastewater, and Urban runoff.	**15**

Reference Books :

1. "BASIC ENVIRONMENTAL PHYSICS" by Pankaj singh, tanveer ahmad wani Pragati Prakashan, ISBN: 978-93-85904-19-6.
2. Forinash, K. "Foundation of Environmental Physics", Island Press,2010.

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