Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Physics)

Submitted by

Board of Studies,

Bachelor of Science (Physics)

B. Sc. Semester-I Discipline Specific Core Course (DSC-1)-PHYSICS - Paper-I (BPH1T01) (Measurements, Mechanics, and Properties of Matter)			
DSC-1 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Measurements	Definition of Physics; levels and need of measurement; CGS and SI units, fundamental and derived physical quantities, and their units. Length, mass, and time measurements. Definition of Seven Fundamental Units and their applications in industries and society. Least count, accuracy, and precision of measuring instruments (Viz. Meter scale, Vernier Callipers, Screw Gauge, Travelling microscope, spectrometer, voltmeter, ammeter, etc.). Errors in measurement, Significant figure. Dimensions of Physical quantities, dimensional analysis, and its applications.		**7 Hrs**
Unit-II			
Newtonian Mechanics	Force and Inertia, Newton's First Law of motion; Momentum, Newton's Second Law of motion; Impulse; Newton's Third Law of motion. Law of conservation of linear momentum and its applications, Collisions. Static and Kinetic friction, laws of friction, rolling friction. Dynamics of uniform circular motion: Centripetal and centrifugal forces and their applications		**7 Hrs**
Unit III			
Motion	Frame of reference, motion in a straight line: position-time graph, speed, and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity, uniformly accelerated motion, velocity-time, position-time graphs, relations for uniformly accelerated motion. Relative Velocity, Motion in a plane, Projectile Motion, Uniform Circular Motion.		**8 Hrs**
Unit IV			
Properties of Matter	Elastic behaviour, Stress-strain relationship, Hooke's Law, Young's modulus, bulk modulus, modulus of rigidity. Pressure due to a fluid column; Pascal's law and its applications. Viscosity, Stokes' law, terminal velocity, streamline and turbulent flow, Reynolds number. Bernoulli's principle and its applications. Surface energy and surface tension, angle of contact, application of surface tension – drops, bubbles, and capillary rise.		**8 Hrs**

Reference Books:

1. Mechanics: D.S. Mathur, S. Chand, and Company.
2. The Physics of Sound Third Edition Richard E. Berg, David, David G. Stork, Pearson Publication, 2012.
3. Introduction to Classical Mechanics, 2nd ed. - Atam P. Arya by Prentice Hall Publishing
4. Continuum Mechanics and Elements of Elasticity Structural Mechanics - Victor E. Saouma.
5. Feynman Lectures on Physics (Volumes 1,2,3)- Feynman, Leighton and Sands.
6. Theory of elasticity, McGraw-Hill Education (India) Private Limited, 2010
7. Handbook of Measurement Error Models, Edited By Grace Y. Yi, Aurore Delaigle, Paul Gustafson, 2021, published by Chapman & Hall

List of Experiments:

1. Torsional Oscillations: To determine modulus of rigidity η of a material of wire by torsional pendulum
2. Torsional Oscillations: To determine modulus of rigidity η of a material of wire by Maxwell's needle
3. Spectrometer: To find least count of a spectrometer.
4. Spectrometer: To determine angle of prism.
5. To determine 'Y' (Young's Modulus) of a wire material by method of vibrations-Flat spiral Spring
6. To find the Young's Modulus of a material by method of bending of beam
7. To determine Coefficient of Viscosity (η) of a given liquid by Poiseuille's Method
8. Determination of Surface Tension of mercury / Angle of contact of liquids
9. To determine equivalent focal length of a lens system by magnification method.
10. Spectrometer: To determine refractive index μ of the material of prism
11. To determine the moment of inertia of a fly-wheel.
12. To find the surface tension by capillary rise method
13. To determine the surface tension of a liquid by Jaeger's method.

Course outcomes

After this course the students will be able to

Sr. No.	Course outcome
1.	Develop interest in measurement with conceptual knowledge of physics.
2.	Develop practical skills in accurate measurements with minimal errors.
3.	Understand and practice these skills while performing physics practical.
4.	Understand the use of apparatus and their use without fear.
5.	Correlate their physics theory concepts with practical outcomes.
6.	Understand the concepts of errors and their estimation.

B. Sc. Semester-I Discipline Specific Core Course (DSC-2)-PHYSICS - Paper- II (BPH1T02) (Kinetic theory of gases and Thermodynamics)			
DSC-2 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20=100**	**Credit: 2+1=03**
Unit-I			
Kinetic Theory of Gases	Assumptions of kinetic theory of gases, Molecular collision, Mean free path and collision cross section, Expression for mean free path (Clausius Expression) Degrees of freedom, Law of equipartition of energy, Derivation of Maxwell's law of distribution of velocities and its experimental verification. Momentum and viscosity of gas, Transport of energy and thermal conductivity, Transport of mass and diffusion, their relationship,		**7 Hrs**
Unit-II			
Real Gases and Thermodynamics	Van der wall's real gas, Equation of state, Critical constants, Van der wall's constants, Critical coefficient, limitations. Thermodynamic variables, Thermal equilibrium and temperature, Zeroth law of thermodynamics, Thermodynamic processes (isothermal, adiabatic, isochoric, isobaric), Indicator diagram, Work done during isothermal and adiabatic processes, Specific heats at constant pressure and volume, First law of thermodynamics,		**7 Hrs**
Unit III			
Heat Engine and Entropy	Thermodynamic processes (Reversible and Irreversible), Heat engine, Carnot's ideal heat engine, Carnot's cycle and it's efficiency, Second law of thermodynamics, Carnot's theorem. Concept of entropy, Change in entropy in reversible cycle, Principle of increase of entropy of the universe in reversible and irreversible process. Second law of thermodynamics in terms of entropy, Thermodynamic scales of temperature, Absolute zero on thermodynamic scale, Third law of thermodynamics, T-S diagram.		**8 Hrs**
Unit IV			
Maxwell's Relations	Maxwell's thermodynamic relations [δ (T, S)/ δ (x, y) = δ (P, V)/ δ (x, y)] and it's applications, Clausius-Clapeyron latent heat equation, Joule-Thomson effect, Porous plug experiment, Joule-Thomson coefficient. Inversion temperature, Boyls law.		**8 Hrs**

Reference books -

1. Heat, Thermodynamics and Statistical Physics, by- Singhal, Agrawal.
2. Heat and Thermodynamics, by- Brijlal, Subramanyam.
3. A Text Book of Heat, by- J. B. Rajam.
4. Heat, thermodynamics and statistical physics, by- Brijlal, Subramayam and Hemne.
5. Heat and thermodynamics, by- C. L. Arora.
6. Principles of Thermodynamics by Jean-Philippe Ansermet, Sylvain D. Brechet, Cambridge University Press; 1st edition (2019)
7. Introduction to Electrodynamics by David J. Griffiths (Author)Cambridge University Press; 4th edition (2017)

List of Experiments:

1. To determine the pressure coefficient of air by constant volume air thermometer.
2. To verify the Stefan's law of radiation by using an incandescent lamp.
3. Thermal conductivity of a metal rod using Forbes method.
4. Thermal conductivity of a bad conductor by Lee's disc method.
5. To determine the critical temperature and critical pressure of a gas.
6. To determine the coefficient of thermal conductivity of glass in the form of a tube.
7. To determine specific heat of a given liquid by method of cooling.
8. Mechanical equivalent of heat by Calendar- Barne's constant flow method.
9. To determine the mechanical equivalent of heat (J) with the help of Joule's calorimeter.
10. To determine temperature coefficient of resistance of platinum using platinum resistance thermometer
11. Study of heating efficiency of electrical kettle with varying voltages.
12. To determine the ratio of specific heats of a gas (γ) by Clement and Desormes method.
13. To study the Boyle's law and to verify it experimentally.
14. To study Charle's law and to verify it experimentally.
15. To verify the Stefan's law of radiation by using an incandescent lamp.

COURSE OUTCOMES

After this course the students will be able to

Sr. No.	Course outcome
1.	Understand the assumptions of kinetic theory of gases, ideal and real gases.
2.	Understand the nature of calorimetry by specific heat of solids and gases.
3.	Analyses different transport phenomena in gases
4.	Describe basic concepts of Thermodynamics.
5.	Analyses the laws of thermodynamics in different cases and entropy.
6.	Restate definition of system, surrounding, closed and open system, extensive and intensive variables and properties.
7.	Design various types of basic heat engines.
8.	Apply Maxwells thermodynamic relations.
9.	Understanding the low temperature physics

B. Sc. Semester-1
Vocational Skill Course (VSC - 1) - PHYSICS Course Code (BVS1P01)
(Electronic and Electrical Components)

VSC-1 Practical	04 Hours /Week	Marks: 100	Credit: 02

Components	Name of Experiments (Any 10 experiments to be performed)
Resistors	1. **To study the coding of given Carbon Resistance and compare it with its practical value measured by a Multimeter. Find its tolerance range and calculate the error involved.**
Extension Activity: Laws of series and parallel combination of resistances and finding the possible errors involved in both the combinations using tolerance information	
Capacitors	2. **To study the coding of given Capacitor (Ceramic/ Electrolytic/ Miller etc.) and compare it with its practical value measured by a Multimeter. Find its tolerance range and calculate the error involved.**
Extension Activity: Laws of series and parallel combination of Capacitors and finding possible errors involved in both the combinations using tolerance information.	
Transformers	3. **To study the efficiency, turn's ratio, and power calculations of Transformers (Step-up/ Step-down / power etc.) and comparison between theoretical and practical values with errors involved in the measurements.**
Extension Activity: Find the induction of Primary and Secondary windings of the transformer. Also find the mutual inductance between them	
Semiconductor Diodes	4. **To study the characteristic properties of a Diode, Zener Diode and LED and compare the respective cut-in, breakdown and knee voltages. Gather information about the limiting values of these components.**
Extension Activity: Using a small power supply design a working device such as a half wave/ full wave rectifier or a regulated power supply using a Zener diode or a working LED/s of different colours.	
Power Controlling Devices	5. **To study the Circuit Breakers (MCBs and RCCBs) with their current limits. Study of Wires (Aluminium, Copper, Still, etc.) with their gauges and to find their current carrying capacities.**
Extension Activity: Loading effect on fuses and MCBs. Study of current carrying capacities of given wires with temperature measurement.	
Analogue and Digital Meters	6. **To study the voltmeter, ammeter, galvanometer and other analogue devices and comparison of their loading effect with the digital Multimeter and/or Digital Storage Oscillator.**
Extension Activity: Open a non-working ammeter, voltmeter, and a galvanometer. Find the differences among them. Justify why a digital voltmeter is preferred over these analogue devices?	

Induction Motors	7. **To study the Principle, Construction and Working of DC and AC Induction Motors and Measurement of their RPM with electrical parameters.**
Extension Activity: Study of a BLDC Motor and comparison of its efficiency with other type of motors.	
Light emitting devices	8. **Study of different types of Bulbs (Viz. Incandescent, CFL, Plasma tubes and LEDs). Analysis and comparison of their efficiencies using a Luxmeter.**
Extension Activity: Use of a Solar Photo Cell for measurement of light intensity of these devices. Use of filters for calibration with wavelength range of these devices.	
Semiconductor Transistors	9. **To study the Principle, Construction and Working of different types of Transistors (UJT, BJT, FET, MOSFET etc.)**
Extension Activity: Identification of the lids of the given component (anyone from the list), its biasing and use as a fully operable device.	
Energy Storages Devices	10. **Study of Supercapacitors and Rechargeable Batteries. Their Charging and Discharging through a load and finding their energy densities.**
Extension Activity: Use sophisticated instruments for the measurement of charge-discharge cycle of any one of these devices.	
Active Components	11. **To study the Principle, Construction and Working of different types of Transistors (UJT, BJT, FET, MOSFET etc.)**
Extension Activity: Identification of the lids of the given component (anyone from the list), its biasing and use as a fully operable device.	
Introduction to Measuring Devices	12. **Study and Use of ExpEyes-17 / SeeLab 3.0 for performing various experiments in Physics**
Extension Activity: Characteristics of most of the electronic components using either ExpEyes-17 / SeeLab 3.0 or equivalent equipment.	

References:

1. Electronic Devices and Circuits by Allen Mottershead, Prentice Hall India Learning Private Limited.
2. Integrated Electronics Analog Digital Circuits, Jacob Millman and D. Halkias, McGraw Hill.
3. Electronic Devices and Circuit Theory, by Boylestad / Nashelsky; Pearson Education India; 11th edition (1 January 2015)
4. Basic Electronics by B. L. Theraja, S. Chand & Company Limited, New Delhi
5. Electrical Circuit Theory M Scheme Sem Iii Electrical & Electronics Polytechnique By A Balakrishnan (Author), T Vasantha (Author); NV Publications Pollachi

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
7.	Get acquainted hands-on practice for electronic components and their uses in electronic circuits
8.	Get acquainted hands-on practice for electrical components and their uses in electrical circuits
9.	Apply the practical knowledge in conducting various practical during graduation.
10.	Apply the practical knowledge in repairing household electronic and electrical gadgets.

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr P.U. Meshram, Allied Publishers, New Delhi.
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Semester-II Discipline Specific Core Course (DSC-)-PHYSICS - Paper-III (BPH2T03) (Acoustic and Ultrasonics)			
DSC - 3 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80+20 = 100**	**Credit: 2+1=03**
Unit-I			
Musical Sound and Noise	Musical Sound, characteristics of musical sound (Loudness, Quality, and Pitch) sound intensity level, bel and decibel, Consonance and Dissonance, Harmony and melody, Musical interval, Musical Scales (diatonic scale), temperament, Musical instruments (sitar, flute, harmonium), Weber-Fechner law, Limits of human audibility, Noise, Noise thermometer, Noise standards, Noise Hazards, and control.		**7 Hrs**
Unit-II			
Acoustics	Absorption coefficient, Reverberation and reverberation period, Live and Dead room, Sabine's formula, Factors affecting the acoustics of the building, Sound absorbers, Requirements for good acoustics. Transducers and their characteristics, Active and Passive Transducers, Microphone (Moving coil electrodynamic microphone, Crystal microphone, Condenser microphone), Loudspeaker (Moving coil loudspeaker), Hearing aids, Earphone, headphone, Recording and reproduction of sound.		**7 Hrs**
Unit III			
Ultrasonic Waves	Introduction, Properties of Ultrasonic waves (velocity, specific acoustic impedance, intensity & pressure), detection of ultrasonic waves, production of USW, Mechanical method (Galton whistle), electrostatic method, piezoelectric effect, piezoelectric generator, Magnetostriction oscillators, measurement of Frequency and velocity of ultrasonic waves (Acoustical Grating), Sing around technique		**8 Hrs**
Unit IV			
Application of Ultrasonic Waves	Measurement of depth of sea, SONAR system, Non-destructive testing, Pulse Echo testing, Soldering Cavitation), Ultrasonic welding, cleaning, flowmeters, Medical applications: ultrasonography, Types of scan, applications of B scan (Qualitative), Ultrasonic Microscopy, Blind stick		**8 Hrs**

Reference Books:

1. Modern Acoustics by A.B. Gupta Books and Allied (P) Ltd. 2016
2. Oscillation, Waves and Sound by- Sharma and Saxena.
3. Waves and Oscillation by- N. Subrahmaniam and Brijlal, Vikas Publishing House Pvt. Ltd., Second Revised Edition, 2010
4. Science and Technology of Ultrasonics, Bldev Raj, V, Rajendran, P, Palanichamy, Narosa Pub. House, 2004
5. A Text Book of Oscillations, Waves and Acoustic by Dr. M. Ghosh, Dr. D. Bhattacharya, S. Chand Publication
6. 7. The Physics of Waves and Oscillation by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd. 1984
7. Textbook of Sound by V.R. Khanna and R.S.Bedi, 1st edition, Kedharnaath Publish &. Co, Meerut (1998)
8. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition,2003

9. Mechanics: D.S. Mathur, S. Chand, and Company.
10. The Physics of Sound Third Edition Richard E. Berg, David, David G. Stork, Pearson Publication, 2012

Physics Practical / Laboratory

List of the experiments-

1. To determine the frequency of unknown tuning fork by Helmholtz resonator
2. To determine the velocity of sound by resonance method.
3. To determine unknown frequency and to verify the law of inverse variation of frequency and volume of air by Helmholtz resonator.
4. To determine the velocity of sound wave in air (gas) with Kundt's tube.
5. To determine the velocity of ultrasonic wave using ultrasonic interferometer.
6. To study the characteristics of micro phone.
7. Study of loudspeaker (woofer, squawker, tweeter) as a transducer.
8. Study of Piezoelectric transducer.
9. To study the Noise level in the different places with the help of sound level meter.
10. To study the characteristics of an NTC/PTC thermistor as transducer.
11. To study the thermocouple as transducer.
12. To determine velocity of ultrasonic waves using by acoustical grating method.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the different aspects and attributes of a musical sounds. Also response of ear to sound and audible limits of human ear
2.	Learn about various musical scales and musical instruments
3.	Learn about acoustics of a hall and requirement of a good acoustic of a hall
4.	Learn about different microphones their design and action and also about loudspeaker.
5.	Learn about the characteristics and production method as well as detection of USW.
6.	Learn about different applications of USW like SONAR, soldering, cleaning and medical applications like sonography etc.

B. Sc. Semester-II Discipline Specific Core Course (DSC-4)-PHYSICS - Paper-IV (BPH2T04) (Oscillations and Black body radiation)			
DSC - 4 THEORY	**Hours: 2+2=04 Hours /Week**	**Marks: 80 + 20 = 100**	**Credit: 2+1=03**
Unit-I			
Free Oscillation	Introduction to linear and angular S.H.M., , Differential equation of S.H.M. and its solution, Mass attached to spiral spring, Torsional pendulum, Composition of two perpendicular linear S.H.M.s for 1:1 and 1:2 (analytical method), Lissajous's figure. Applications of Lissajous figures.		**7 Hrs**
Unit-II			
Damped and Forced Oscillation	Differential equation of damped harmonic oscillator and its solution, logarithmic decrement, Energy equation of damped oscillations, Power dissipation and quality factor. Forced oscillation, Differential equation of forced oscillation and its solution, Resonance, Sharpness of resonance, Power Absorption, Power dissipation, Quality factor and bandwidth,		**7 Hrs**
Unit III			
Waves in Media	Introductions, transverse and longitudinal waves, General equation of progressive wave, Speed of transverse wave on a stretched string, differential equation of a wave motion in a fluid, Wave equation for a transverse wave in a string, harmonics and overtones, phase velocity and group velocity and their relation. Doppler effect.		**8 Hrs**
Unit IV			
Black Body Radiation	Properties of Thermal Radiation, Blackbody radiation, spectral distribution, Weins Displacement law, Wiens distribution Law, Sahas Ionization Formula, Rayleigh Jeans Law, Ultra-Violet catastrophe concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.		**8 Hrs**

Reference Books:

1. Mechanics: D.S. Mathur, S. Chand, and Company.
2. The Physics of Waves and Oscillation by- N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd. 1984
3. Modern Acoustics by A.B. Gupta Books and Allied (P) Ltd. 2016
4. Oscillation, Waves and Sound by- Sharma and Saxena.
5. Waves and Oscillation by- N. Subrahmaniam and Brijlal, Vikas Publishing House Pvt. Ltd., Second Revised Edition, 2010
6. A Text Book of Oscillations, Waves and Acoustic by Dr. M. Ghosh, Dr. D. Bhattacharya, S. Chand Publication
7. Textbook of Sound by V.R. Khanna and R.S.Bedi, 1st edition, Kedharnaath Publish &. Co, Meerut (1998)
8. Oscillations and Waves by Satya Prakash Pragathi Prakashan, Meerut, Second Edition,2003

List of Experiments

1. Study the speed of waves on stretched string.
2. Determination of velocity of sound using volume resonator.

3. To Stefan's constant by incandescent bulb
4. To study the Lissajous's figure using CRO.
5. To determine the frequency of tuning fork using sonometer.
6. To study the logarithmic decrement, coefficient of damping, relaxation time and quality factor of a damped simple pendulum.
7. To study the logarithmic decrement using compound pendulum.
8. To find Planck's constant using photocell.
9. To study the oscillation of bifilar suspension
10. To study the oscillations of oscillations of compound pendulum
11. To study the oscillations of rubber band and draw its potential energy curve.
12. To study the oscillations of spring and find spring constant and verify laws of spring.

COURSE OUTCOMES

After completing this course students will be able to

Sr. No.	Course outcome
1.	Understand the simple harmonic motion, and properties of different oscillatory motion of an object
2.	Understand the damped and forced oscillation
3.	Understand mechanical waves in a medium and wave equation of the transverse waves on string and longitudinal waves in a fluid.
4.	Understand black body radiation and development of quantised nature of blackbody radiation.
5.	Understand the temperature of heavenly bodies

B. Sc. Semester-II
Vocational Skill Course (VSC) - PHYSICS Course Code (BVS2P03)
(Instrumental Errors in Measurement)

VSC-3 Practical	04 Hours /Week	Marks: 100	Credit: 02

Instruments	Name of Experiments (Any 10 experiments to be performed)
Vernier Calliper	1. **To study the probable and percentage error of the measuring instrument vernier calliper.**
Extension Activity: Find least count of the vernier calliper. Find significant figures, probable error and percentage error after taking observations and calculations.	
Screw Gauge	2. **To study the probable and percentage error of the measuring instrument screw gauge.**
Extension Activity: Find least count of the screw gauge. Find significant figures, probable error and percentage error after taking observations and calculations.	
Travelling Microscope	3. **To study the probable and percentage error of the measuring instrument travelling microscope.**
Extension Activity: Find least count of the travelling microscope. Find significant figures, probable error and percentage error after taking observations and calculations.	
Sextant	4. **To study the probable and percentage error of the measuring instrument sextant.**
Extension Activity: Find least count of the screw gauge attached with sextant instrument. Find significant figures, probable error and percentage error after taking observations and calculations.	
Spectrometer	5. **To study the probable and percentage error of the measuring instrument Spectrometer.**
Extension Activity: Find least count of the Spectrometer and identify its different parts. Find significant figures, probable error and percentage error after taking observations and calculations.	
Compound Pendulum	6. **To study the probable and percentage error of the gravity related apparatus compound pendulum**
Extension Activity: Find significant figures, probable error and percentage error after taking observations and calculations. Drawing of graph.	
Meter Bridge	7. **To study the probable and percentage error of the measuring electrical equipment meter bridge.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Light emitting devices	8. **To study the probable and percentage error of the measuring electrical equipment potentiometer.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	

Rheostat, Milliammeter, Voltmeter, and Galvanometer	9. **To study the probable and percentage error of the measuring electrical equipment Rheostat, Milliammeter, Voltmeter, and Galvanometer**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Analogue and Digital Multimeter	10. **To study the probable and percentage error of the measuring electrical equipment analogue and digital multimeter**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Magnetometer	11. **To study the probable and percentage error of the magnetic equipment like magnetometer in the determination of horizontal component of earth's magnetic field.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	
Copper Calorimeter	12. **To study the probable and percentage error of the copper calorimeter for measuring heat of physical changes and heat capacity.**
Extension Activity: Making electrical circuit connection, find significant figures, probable error and percentage error after taking observations and calculations.	

References:

1. An Advanced course in practical physics by C. Chattopadhyay and P. C. Rakshit.
2. Practical Physics by S. L. Gupta and V. Kumar
3. B. Sc. Practical Physics by C. L. Arora
4. Measurement uncertainties: Physical parameters and calibration of instruments by S. V. Gupta
5. B. Sc. Practical Physics by Harnam Singh and P.S. Hemne

Course outcomes

After the completion of this course students will be able to

Sr. No.	Course Outcome
1.	Understand the function of different instruments.
2.	Choose and apply proper instrument for the measurement.
3.	Handle the instrument carefully and apply the practical knowledge in his further study.
4.	Find the different man made and instrumental errors in doing different practical.

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf