

Jankidevi Bajaj College of Science, Wardha (Autonomous)

Syllabus for B. Sc. I (SEM-I) w.e.f. 2017-18

Physics I (BCSPHYT101)

Unit I: Mechanics and Laws of Motion [10h]

Newton's laws of motion, Motion in a plane, Centre of Mass and Centre of gravity, Conservation of linear and angular momentum, Conservation of energy, Elastic and inelastic collisions, Single stage and multistage rockets.

Unit II: Gravitation and Astrophysics [10h]

Gravitation: Newton's law of gravitation, Relation between G and g , Gravitational field, Gravitational potential. Kepler's laws of Planetary motion, Satellite in circular orbit and applications. Geosynchronous orbits, Weightlessness.

Astrophysics: The constituents of universe (Solar system, Stars, Galaxies), Types of Galaxies, size of a planet ($d=D.\alpha$), distance of a planet by parallax method ($D=b/\theta$), Mass of the sun and the planets ($M=4\pi^2r^3/GT^2$), Structure of sun and Solar interior, surface temperature of sun ($T=[R/r]^{1/2} \cdot [S/\sigma]^{1/4}$) and Solar luminosity, Stellar spectra. The Milky way (shape, size, clusters), Cosmological theories of the universe (Concept only), Death of Star (Red Giant, White Dwarf, Nova, Neutron Star, Supernova, Black Hole).

Unit III: Free oscillations, Damped oscillations and Forced oscillations [10h]

Free oscillations: Introduction to linear and angular S.H.M., Composition of two perpendicular linear S.H.M.s for 1:1 and 1:2 (analytical method), Lissajous's figure (Without mathematical derivation), uses of Lissajous's figure.

Damped oscillations: Differential equation of damped harmonic oscillator and its solution, Energy equation of damped oscillations, Power dissipation and quality factor.

Forced oscillations: Forced oscillation with one degree of freedom, Differential equation of forced oscillation and its solution, Resonance (Amplitude), Sharpness of resonance, Power dissipation, Quality factor and bandwidth.

Unit IV: Elasticity [10h]

Introduction, Hooke's Law, Different Elastic Constants, Relation between elastic constants Y , K , η and σ , Elastic Limit, work done in stretching a wire, Bending of beam, Bending moment, Internal and external bending moment, Cantilever, Torsional pendulum, Maxwell's needle.

Unit V: Viscosity and Surface Tension [10h]

Introduction, Streamline and turbulent flow, Equation of continuity, Bernoulli's theorem and its applications, Poiseuille's Law, Reynold's number, Terminal Velocity, Stoke's law, Variation of viscosity with temperature, Introduction of Surface Tension, Angle of contact and wetting, Surface energy, Surface tension by Quincke's and Capillary rise methods.

Unit VI: Electrostatics and Dielectrics and Capacitor [10h]

Introduction (Qualitative idea only), Coulombs law in vacuum in vector form, Force between two charges, Electric Field Intensity, Electric potential, Electric potential Energy, Electric Dipole and dipole moment, Electric field intensity due to a dipole, Conservative nature of

electrostatic field, Electric field as a negative gradient of potential, Introduction, Definition of polar and non polar molecules, Polarization of charges in a dielectric, Three electric vectors D , E and P and relation between them, Clausius - Mossotti equation, Concept of capacitance, Parallel plate capacitor without and with dielectric.

Laboratory – 1 (BCSPHYP101)

List of the Experiments (Any 10) [40h]

1. To determine the Young's modulus (Y) by bending of beam.
2. To determine the Young's modulus (Y) by cantilever.
3. To determine the modulus of rigidity (η) by Maxwell's needle.
4. To determine the modulus of rigidity (η) by statical method.
5. To determine the modulus of rigidity (η) by torsional pendulum.
6. To determine the surface tension (T) of the liquid by Fergusson method.
7. To determine the surface tension (T) by capillary rise method.
8. To determine the coefficient of viscosity (η) by using Poiseuille's method.
9. To determine the dielectric constant of a material.
10. To calculate the acceleration due to gravity by compound pendulum.
11. To study the Lissajous's figure.
12. To study the spring constant of a spring.
13. To calculate the solar constant.
14. To determine the resolving power of telescope.
15. To determine the terminal velocity using Stoke's law.

Reference Books for Theory:

1. University Physics: Young, XIth edition, Pearson Education.
2. Concepts of Physics: H.C. Verma, Bharati Bhavan Publishers.
3. Fundamental of Physics (Eighth Edition), Halliday/Resnick/Walker; Wiley.
4. Mechanics: D.S. Mathur, S. Chand and Company.
5. Physics for Degree Students, C.L. Arora, P.S. Hemne, S Chand Publication.
6. Unified Physics, B.Sc. I by R.P. Goyal.
7. Waves and Oscillations, by Stephenson.
8. A Text Book of Oscillations, waves and Acoustics, by Dr. M. Ghosh, Dr. D. Bhattacharya.
9. Oscillation, waves and sound, by Sharma and Saxena.
10. Waves and oscillation, by N. Subrahmanuam and Brijlal.
11. The Physics of waves and oscillation, by N. K. Bajaj, Tata McGraw-Hill, publishing co. ltd.
12. Problems in Physics: P.K. Srivastava, Wiley Eastern Ltd.
13. Applied Fluid Mechanics: Mott Robert, Pearson Benjamin Cummir, VIth Edition. Pearson Education /Prentice Hall International, New Delhi.
14. General Properties of Matter, by- J. C. Upadhyay, Ram Prasad & Sons.
15. Mechanics, by-B. M. Roy, Das Ganu Publications.
16. The Great Universe, by G. K. Sasidharan, S Chand publications.

17. Astronomy structure of the universe, by- A. E. Roy, D. Clarke, Adam Hilger Pub.

Reference Books for practicals:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, Asia Publication House.
2. A text book of Practical Physics, Induprakash and Ramakrishna, 11th edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, 4th edition, reprinted 1985, Heinemann Education Publishers.

Bajaj College of Science, Wardha (Autonomous)
Syllabus for B. Sc. I (SEM-II) w.e.f. Session 2017-18

Physics II (BCSPHYT102)

Unit I: Electric Current and Electromagnetic Induction [10h]

Electric Current: Current Density, Equation of continuity, Kirchoff's laws, Rise and Decay of currents in LR circuit, Rise and Decay of charge in CR, Decay of charge in LCR.

Electromagnetic induction: Faraday's laws, Lenz's law, self-induction and mutual induction.

Unit II: a.c. circuits [10h]

Transformer: Theory, Principle of working and its applications.

Application of complex number in solving an a.c. circuit, j-operator method: a.c. applied to pure resistive circuit, a.c. applied to pure capacitive circuit, a.c. applied to pure inductive circuit, a.c. applied to LR circuit, a.c. applied to CR circuit, a.c. applied to series LCR circuit, a.c. applied to parallel LCR circuit. Power in a.c. circuit, wattless current, power factor (PF).

Unit III: Magnetostatics [10h]

Force on a moving charge, Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a rectangular current loop, Biot-Savart's law: Calculation of B for straight conductor, circular coil. Ampere's Law and its applications for the magnetic field for solenoid and toroid. Non-existence of magnetic monopole.

Field due to a magnetic dipole, free and bound currents, Magnetic dipole moment, angular momentum and gyromagnetic ratio. Magnetization vector (M), relationship between B, H and M. Magnetic susceptibility and permeability relationship.

Unit IV: Magnetism [10h]

Introduction of dia, para and ferro-magnetic materials. Langevin's theory of diamagnetism, its application as superconductor, critical magnetic field and Meissner effect, classical Langevin's theory of paramagnetism (without derivation), ferromagnetism, ferromagnetic domain, Curie-Weiss Law, curie temperature, Anti-ferromagnetism, Neel temperature ferrimagnetism, ferrites and its applications, Hysteresis loss (B-H curve).

Unit V: Kinetic theory of gases and Transport phenomenon in gases [10h]

Kinetic theory of gases: assumptions, Boyle's law, equipartition of energy and its applications to specific heat of gases; monatomic and diatomic gases, molecular collision, mean free path and collision cross section, estimate of molecular diameter and mean free path.

Transport phenomenon in gases: Transport of mass, momentum, energy and their relationship,

dependence on temperature and pressure, Vander Waal's gas (Real gas, Equation of state), critical constants.

Unit VI: Thermodynamics [10h]

Zeroth Law of thermodynamics, first law of thermodynamics, conversion of heat into work, applications of first law, work done during isothermal and adiabatic processes, reversible & irreversible processes, second law & entropy, third law of thermodynamics, unattainability of absolute zero. Carnot's cycle, Carnot's theorem, entropy changes in reversible & irreversible processes, entropy temperature (TS) diagrams, Maxwell's relations & applications - Joule-Thomson Effect, Clausius Clapeyron Equation.

Reference Books for Theory:

1. University physics, by H. D. Young, R. A. Freedman: Pearson
2. Electricity and Magnetism, by Satya Prakash: Pragati Prakashan
3. Basic Electrical Engineering, B.L. Thareja: S. Chand
4. Electricity and Magnetism: B. Ghosh: Books and Allied Publisher
5. Heat, Thermodynamics and Statistical Physics by Singhal, Agrawal: Pragati Prakashan
6. Heat, thermodynamics and statistical physics by Brijlal, Subramayam and Hemne: S. Chand

Laboratory – 2 (BCSPHYP102)

List of Experiments: (Any 10) [40h]

1. To determine the time constant (τ) of CR circuit.
2. To determine the unknown inductance (L) using series LR circuit.
3. To determine the unknown capacitance using series CR circuit.
4. To determine the frequency of a.c. mains (n) using Fleming's left hand rule.
5. To determine the quality factor (Q) of a series LCR a.c. circuit.
6. To study the characteristics of a transformer.
7. To determine (γ) ratio of specific heats of gas by Clement and Desorm's method.
8. To determine the thermal conductivity of a bad conductor by Lee's disc method.
9. To determine the horizontal component of Earth's magnetic field and magnetic moment of the magnet.
10. To study the variation of magnetic field along the axis of a current carrying circular coil.
11. To study of magnetic field by vibration magnetometer.
12. To determine the magnetic susceptibility of FeCl_3 solution.
13. To calculate the mechanical equivalent of heat by Calender and Barn's constant flow method.

14. To study the variation of total thermal radiation with temperature using the torch bulb filament.

Reference Books for Practicals:

1. Advanced Practical Physics for students by B.L. Flint & H.T. Worsnop: Asia Publishing House.
2. A Text Book of Practical Physics by Indu Prakash and Ramakrishna: Kitab Mahal, New Delhi.
3. Physics through experiments by B Saraf et. al. : Vikas Publications.
4. Advanced practical physics by Chauhan & Singh: Pragati Prakashan.
5. Practical Physics by D. Chattopadhyaya et al: Central Publications.

Jankidevi Bajaj College of Science, Wardha (Autonomous)

Syllabus for B.Sc. II (Sem III) w.e.f. 2018-19

Physics III (BCSPHYT203)

Unit I: Waves in media and Applied Acoustics [10h]

Speed of transverse wave on a string, Standing waves, Harmonics, Quality of sound, Intensity and loudness, bel and decibel, musical scales(Diatonic and tempered). Applied acoustic: Transducers and their characteristics (Crystal microphone, Moving coil loud speaker), Recording and reproduction of sound (Magnetic tape, Cine film, Compact disc), Acoustics of building, Reverberation and reverberation period, Sabine's formula, Factors affecting the acoustics of building, Requirements for good acoustics.

Unit II: Ultrasonics and Power Supply [10h]

Ultrasonics: Introduction, Properties and production of ultrasonic waves, piezoelectric effect, piezoelectric generator, Magnetostriction effect and oscillators, Frequency of ultrasonic waves, Application of ultrasonic waves (measurement of depth of sea, SONAR system and Medical science).

Power supply: Introduction, rectification using half wave and full wave rectifiers (Find Id.c., Vd.c., Ir.m.s., η and ripple factor), Working of Full wave bridge rectifier, Filters, Difference between regulated and unregulated power supply, line and load regulation, voltage stabilization, Zener diode as voltage regulator, IC voltage regulation.

Unit III: Interference of light [10h]

Thick lens, thin lens and lens combinations. Interference in equal thickness thin film, Phase change on reflection, refraction and transmitted system. Newton's ring and its application to determine the wavelength and refractive index, Michelson Interferometer and its application to wavelength determination and wavelength difference, Fabry- Perrot Interferometer and its application.

Unit IV: Diffraction of light [10h]

Introduction, Fresnel's diffraction- Half period zones, Zone plates, Diffraction due to straight edge and due to narrow slit. Fraunhofer diffraction- Fraunhofer diffraction at a single slit, at circular aperture, Plane diffraction grating and its application, Resolving power of grating, Rayleigh's criterion for resolution.

Unit V: Polarization [10 h]

Introduction, Brewster's law, Polarization by scattering (concept only), Blue color of the sky(only idea), Uniaxial and biaxial crystal , positive and negative crystal, ordinary and extraordinary rays, Nicol prism, its application as an analyzer and polarizer, Double refraction in uniaxial crystal, phase retardation plate (Half and Quarter wave), Double image prism, polarimeter.

Unit VI: Electrodynamics [10 h]

Electromagnetic spectrum, Electromagnetic waves and their characteristics, Equation of continuity, Displacement current, Maxwell's equations and its significance, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves and applications of electromagnetic waves.

Laboratory-3 (BCSPHY P203)

List of Experiments: (Any 10) [40h]

1. To study the speed of waves on stretched string.
2. To determine unknown frequency and to verify the law of inverse variation of frequency and volume of air by Helmholtz resonator.
3. To determine the velocity of sound wave in air (gas) with Kundt's tube.
4. To study the characteristics of microphone.
5. To study the current regulation and ripple factor of half wave / full wave rectifier using semiconductor diodes with L and Π type filter.
6. To study the characteristics of Zener diode.
7. To study the Zener diode voltage regulating characteristics.
8. To determine the focal length of long focus convex lens using short focus convex lens.
9. To study the different lenses and eyepieces.
10. To determine the wavelength of monochromatic light using Newton's ring.
11. To determine the refractive index of material of double image prism.
12. To study of polarization of light by reflection (Brewster's law).
13. To determine the resolving power of a grating.
14. To determine the wavelength of prominent lines of mercury by plane transmission grating.
15. To determine the concentration of sugar solution by half shade polarimeter.

Reference Books for theory:

1. A Text Book of sound, by- Khanna, Bedi.
2. A Text Book of sound, by- L. P. Sharma, Saxena (S. Chand)
3. Properties of Matter and Acoustics, by- R. Murugesan, Kiruthign Sivaprakash.
4. Fundamental of Acoustics 4th Edition, by- Kinsler , John Wiley and Sons.
5. A Text Book of Oscillations, Waves and Acoustics, by- Dr. M. Ghosh, Dr. D. Bhattacharya (S. Chand)
6. Oscillation, Waves and Sound, by- Sharma and Saxena.

7. Science and Technology of Ultrasonics, by- Baldevraj, Narosa publication .
8. Elements of Electronics, by- M. K. Bagde, S. P. Singh, K Singh S- Chand.
9. Solid State Physics and Electronics, by- R. K. Puri, and V. K. Babbar.
10. Solid State Electronic Devices II Edition, by- B. G. Streetman
11. Physics for Degree students for B. Sc. Second year, by- C. L. Arora, Dr. P. S. Hemne.
12. Optics and Spectroscopy, by- R. Murugeshan , Kiruthign Sivaprakash.
13. Optics, by- Brijlal and Subramayam.
14. Optics, by- Ajoy Ghatak.
15. A text book of Optics, by- Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu.
16. Optics, by- J. K. Sharma, K. K. Sarkar.
17. Fundamentals of optics, by-Jenkins and White.
18. Optics, by- D. P. Khandelwal.
19. Foundation of Electromagnetic theory, by- John R. Retitz, Fredrick, J. Milford.
20. Electromagnetics, by- B. B. Laud.

Reference Books for Practicals:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
5. Physics through experiments, B Saraf et. al.,Vikas Publications 1987.
6. Advanced practical physics, Chauhan & Singh, Pragathi Publications.
7. Practical Physics, D Chattopadhyaya et al, Central Publications.
8. An Advanced Course in Practical Physics , D Chattopadhyay, PC Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, 2002.
9. Practical Physics, D. C. Tayal 2002.

Jankidevi Bajaj College of Science, Wardha (Autonomous)

Syllabus for B. Sc. II (SEM-IV) w.e.f. 2018-19

Physics IV (BCSPHYT204)

Unit I : Crystallography [10h]

Solids: Amorphous and Crystalline Materials. Lattice translation vectors. Lattice with a Basis. Unit Cell. Miller Indices. Types of Lattices. Packing fraction, density calculation. Closed pack structures (fcc, hcp). Crystal structure of CsCl, NaCl, Diamond. Concept of reciprocal Lattice and its construction.

Unit II: X-rays and X-ray diffraction [10h]

Production of X-rays, X-ray spectra, Brehmstrahlung, Characteristic X-rays. **X-ray tubes & types**: Coolidge tube's construction and working. **Application of X-rays** (Imaging, diffraction, Auger effect). Diffraction of X-rays by crystals. Bragg's Law. Different methods of X-ray diffraction. Bragg's spectrometer. Diffraction in Reciprocal space. Bragg's law in reciprocal space.

Unit III: Molecular Physics [10h]

Quantization of vibrational and rotational energies, types of molecules based on moment of inertia, rigid diatomic molecules, Intensity distribution in rotational levels, Diatomic molecules as harmonic and anharmonic oscillator (concept only), Rotational-vibrational spectra, Born Oppenheimer approximation. **Raman effect**, **Applications of Raman effect**, **Electronic spectra**, Dissociation energy, Frank-Condon principle.

Unit IV: LASER [10h]

Spontaneous and stimulated emissions, **Theory of laser action**, **three and four level Lasing action**, **Einstein's coefficients**, **components of LASER system**, Characteristics of laser beam, Ruby LASER, He-Ne laser, Semiconductor lasers, CO₂ LASER, Nd: Yag LASER. Comparison of laser systems, Applications of lasers.

Unit V: Solid State Electronics [10h]

Light emitting diode, **Photovoltaic cell**, bipolar transistor- Construction and static characteristics, transistor as an amplifier, working in CB, CE and CC Modes, Graphical analysis of CE configuration, Current gains α and β , Relations between α and β , Load Line analysis of Transistors, DC Load line and Q-point, Hybrid parameters, Equivalent circuit at low frequency in CE mode, Thermal Runaway, Heat sink, Stabilization, Stability factor, Bias stabilizing circuits.

Unit VI: Field Effect Transistor [10h]

Construction, working and principle of JFET, **Characteristics of JFET**, **Parameters**, **JFET as an amplifier** (input and output impedance, voltage gain), **Advantage of JFET over BJT**. **MOSFET**- Types of MOSFET, Construction and working of MOSFET, Characteristics of MOSFET, Special features and applications of MOSFET. Thin film transistors (TFT), single electron transistors (SET).

Laboratory-4

(BCSPHY P204)

List of Experiments: (Any 10) [40h]

1. To study the divergence of LASER beam.
2. To determine the wavelength of LASER beam using plane diffraction grating.
3. To construct SC, BCC, FCC structures and to find packing fraction and coordination number.
4. To determine lattice parameter 'a' of a unit cell of cubic crystal using X-ray diffraction pattern.
5. Identification of unknown wavelength /element from line emission spectra.
6. Study of vibrational spectra through infra red spectroscopy.
7. To determine Planck's constant by using LED.
8. Study of solar cell as photovoltaic cell.
9. To study the characteristics of transistor in C-E mode.
10. To study the characteristics of transistor in C-B mode.
11. To study the characteristics of Field Effect Transistor (FET).
12. To study the frequency response of single stage common emitter amplifier.
13. To study the frequency response of two stage RC coupled common emitter amplifier.
14. To determine the hybrid parameters of a transistor.
15. To determine the value of Boltzmann's constant using transistor.

Reference Books for Theory:

1. Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
2. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
3. Material Science and Engineering, William Callister, Wiley.
4. Solid State Physics, M.A. Wahab, 2011, Narosa Publications.
5. Elements of Spectroscopy, by –Pragati Prakashan, Gupta, Kumar, Sharma.
6. Optics and Spectroscopy by-R. Murugesan and Kiruthiga Sivaprakash, S Chand publication.
7. Advanced Molecular Physics by-Shriram and Sharma.
8. Electronics Principles by Malvino and Bates: Mcgraw Hill Education.
9. Electronic Devices and Circuit Theory by Boylsted : Pearson Publication.
10. Textbook of Electrical Technology by B.L. Thareja: S. Chand Publication.
11. Optics and Spectroscopy, by- R. Murugesan , Kiruthign Sivaprakash.

12. Physics for Degree students for B. Sc. Second year, by- C. L. Arora, Dr. P. S. Hemne.
13. Solid State Physics and Electronics, by- R. K. Puri, and V. K. Babbar.
14. A text book of Optics, by- Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu.

Reference Books for Practicals:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
5. Physics through experiments, B Saraf et. al.,Vikas Publications 1987.
6. Advanced practical physics, Chauhan & Singh, Pragathi Publications 1ed.
7. Practical Physics, D. Chattopadhyaya et al, Central Publications.
8. An Advanced Course in Practical Physics , D Chattopadhyay, PC Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, 2002.
9. Practical Physics, D C Tayal 2002.