B.Sc. PHYSICS

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH111	MEHANICS	3	3	20	80	100
BSPH112	ELECTROMAGNETICS	3	3	20	80	100
BSPH121	PHYSICS LAB	6	3	20	80	100
BSPH211	OPTICS	3	3	20	80	100
BSPH212	WAVES AND OSCILLATIONS	3	3	20	80	100
BSPH221	PHYSICS LAB	6	3	20	80	100
BSPH311	STATISTICAL AND THERMAL PHYSICS	3	3	20	80	100
BSPH312	ELECTRONIC DEVICES AND CIRCUITS	3	3	20	80	100
BSPH321	PHYSICS LAB	6	3	20	80	100
BSPH411	ELECTRODYNAMICS	3	3	20	80	100
BSPH412	QUANTUM MECHANICS	3	3	20	80	100
BSPH421	PHYSICS LAB	6	3	20	80	100
BSPH511	ATOMIC AND MOLECULAR SPECTROSCOPY AND LASER PHYSICS	3	3	20	80	100
BSPH512	SOLID STATE PHYSICS	3	3	20	80	100
BSPH521	PHYSICS LAB	6	3	20	80	100
BSPH611	NUCLEAR PHYSICS	3	3	20	80	100
BSPH612	ANALOG AND DIGITAL ELECTRONICS	3	3	20	80	100
BSPH621	PHYSICS LAB	6	3	20	80	100
TOTAL						**1800**

B.Sc. IST SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH111	MEHANICS	3	3	20	80	100
BSPH112	ELECTROMAGNETICS	3	3	20	80	100
BSPH121	PHYSICS LAB	6	3	20	80	100
Total						300

BSPH111: MECHANICS

UNIT-I: FRAMES OF REFERENCE:

Inertial and non-inertial frames of references, Components of displacement, Velocity and acceleration in different coordinate system, Galilean transformation, Transformation of velocity and acceleration between rotating frames, Pseudo forces, Coriolis force and its application, Motion relative to earth, Foucault's pendulum.

UNIT-II: SPECIAL THEORY OF RELATIVITY:

Michelson Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Addition of velocities, Variation of mass with velocity, Mass-energy relation, Relativistic energy-momentum relation, Four vector, Momentum four vector.

UNIT-III: MOTION UNDER CENTRAL FORCES:

Motion under central forces, Reduced mass, Two body problem: equation of motion of moving particle under central force, Trajectories of moving bodies under inverse central force, Cases of elliptical and circular orbits, Kepler's laws, Inertia and gravitational mass.

UNIT-IV: CONSERVATION LAWS AND RIGID BODY DYNAMICS:

Conservation forces, Rectilinear motion under conservative forces, Potential energy, Potential energy curve and motion of a particle, Centre of mass, Centre of mass frame of reference, Collision of two bodies in L-frame and C-frame. Rigid body: Equation of motion of a rotating body, Inertial coefficients, Case of j not parallel to ω, Kinetic energy of rotation and idea of principal axes, Precessional motion of spinning top.

UNIT-V: ELASTIC PROPERTIES OF MATTER:

Elasticity, Young's modulus, Bulk modulus, Modulus of rigidity, Poisson's ratio, Relation between elastic constants, Bending of beam, Torsion of a cylinder, Experimental determination of elastic constants. Searle's two bar experiment, Statical and dynamical method.

SUGGESTED READING:

1. J.C. Upadhyaya: *Mechanics, Oscillation and Properties of Matter*, Ram Prasad & Sons Agra, 2004
2. D.S. Mathur : *Mechanic,*S.Chand& Company LTD, New Delhi,1996
3. J.C. Upadhyaya: *Mechanics, Oscillation and Properties of Matter* (Hindi), Ram Prasad & Sons, Agra, 2004
4. N.S. Saxena, S. Singh and S.S. Rawat :*Mechanics* (Hindi), CBH, Jaipur,2006.

BSPH112: ELECTROMAGNETICS

UNIT-I: VECTOR FIELDS:

Scalar field and vector field, Gradient of a scalar function, Divergence of a vector field, Physical significance of divergence of a vector, Gauss divergence theorem, Curl of vector function, Physical significance of curl, Stoke's theorem, Gauss law in differential form, Poisson's and Laplace's equations.

UNIT-II: ELECTRIC AND MAGNETIC FIELDS IN MATTER:

The moment of a charge distribution, Atomic and molecular dipoles, Permanent dipole moments, Potential and field due a polarized sphere, Dielectric sphere in a uniform field, Electric susceptibility and atomic polarizability, Electric currents in atoms-Bohr Magneton, Electron spin, Magnetic moment, Magnetic susceptibility, Magnetic field due to magnetized matter.

UNIT-III: FIELD OF MOVING CHARGES AND MAGNETIC FIELD:

Measurement of charge in motion, Field of a point charge moving with constant velocity, Force on a moving charge, Magnetic field, Amperes circuital law, Differential form and it's applications, Vector potential, Field of a current carrying conductor and deduction of Biot-Savart's law.

UNIT-IV: TRANSIENT CURRENT AND BALLISTIC GALVANOMETER:

Growth and decay of current in circuits containing (i) LR (ii) RC circuits, Complete theory of Ballistic Galvanometer, Damping, Logarithmic decrement, Determination of Self Inductance (Rayleigh Method), High resistance by leakage method and measurement of magnetic field by search coil using ballistic galvanometer

UNIT-V: ELECTROMAGNETIC INDUCTION AND A.C. CIRCUITS:

Faraday's laws, Lenz' law, Self Induction and mutual induction, Coefficient of self and mutual induction, Energy stored in a coil, Power factor and its measurement in different A.C. circuits, Series and parallel resonance, Bandwidth, Anderson's bridge for inductance measurement, De Sauty's bridge for capacitance measurement.

SUGGESTED READING:

1. S.I. Ahmed and K.C. Lal: *Electricity, Magnetism and Electronics*, UNIT-ech House, Lukhnow, 1986.
2. K.K. Tiwari :*Electricity and Magnetism wth Electronics*, S. Chand Publication , Delhi.
3. A.S. Majahan and A.A. Rangwala: *Electricity and Magnetism*, TMH, Delhi, 1997
4. S.L. Kakani and C. Hemrajani : *Electromagnetism Theory and Problems*, CBS Publisher & Distributors, Delhi, 2004
5. J.C. Upadhyaya, H.P. Sinha and S. C. Upadhyaya :*Electric, Magnetism and Electromagnetic Principle (Hindi)*, Ram Prasad & Sons, Agra, 2004.
6. M.L. Kalra, K.C. Bhandhari and S.L. Kakani :*Electromagetics (Hindi)*, Himanshu Publication Udaipur, 2004.

BSPH121: PHYSICS LAB

LIST OF EXPERIMENTS:

1. Study of bending of a beam and determination of Young's modulus.
2. Modulus of rigidity by Statical method.
3. Modulus of rigidity by Dynamical method (Maxwell's needle).
4. Elastic constants by Searle's method.
5. To determine the Poisson's ratio of a rubber tube.
6. Determination of surface tension of water by Jaegger's method.
7. Low resistance by Carey Foster's bridge.
8. Variation of magnetic field along the axis of circular coil.
9. Study of phase relations in CR circuit.
10. Study of phase relations in LCR circuit.
11. Study of charging and discharging of CR circuit.

SUGGESTED READING:

1. M.G. Bhatawedekar, S.S. Choudhry and T.L. Dashora :*University Physics Practicals*, Ramesh Book Depot, Jaipur, 1987.
2. K.C. Bhandhari, *Practical Physics* (Hindi) :Himanshu Publication , Udaipur, 2004.
3. S.L. Gupta and V. Kumar: *Practical Physics*(Hindi& English), PragtiPrakashan, Meerut, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti*: Advanced Physics Laboratory Manual*, South AshianPublishersPvt. Ltd., New Delhi, 2007.

B.Sc. IIND SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH211	OPTICS	3	3	20	80	100
BSPH212	WAVES AND OSCILLATIONS	3	3	20	80	100
BSPH221	PHYSICS LAB	6	3	20	80	100
TOTAL						**300**

BSPH211: OPTICS

UNIT-I

Geometrical Optics: Magnification, Abbe's Sine condition, Aplantic surfaces and aplantic points, Focal length of combination of two lens system separated by a distance, Cardinal points, Properties of Nodal points, Newton's formula, Huygens and Ramsden eye piece. Spherical and chromatic aberration (Qualitative only)

UNIT-II

Interference: Concept of Coherence, Interference in thin films (Parallel and Wedge shape), Newton's Rings and their applications, Michelson and Fabroy- Perrot Interferometers: Intensity of fringes and applications regarding wavelength and difference of close wavelengths determinations.

UNIT-III

Fresnel Diffraction: Rectilinear Propagation of Light, Diffraction from a Zone plate, Circular aperture and circular disc (Plane wavefront), Cylindricalwavefront and half period strips, Diffraction from a straight edge, Rectangular slit.

UNIT-IV

Frounhoffer Diffraction: Diffraction from a single and double slit, Plane transmission grating: Diffraction pattern and intensity calculation of fringes, Absent spectra, overlapping spectra, Dispersive power and wavelength determination, Concave Reflection Grating and its self-focusing action, Rayleigh criterion of resolution, Resolving power of plane transmission Grating, Comparison of grating and prism spectra.

UNIT-V

Polarization: Concept of polarization, Malus law and Brewster's law, Double refraction and its Huygens's theory, Different kind of polarized lights, Nicol prism, Quarter wave and half wave plate. Production and detection of different polarized lights, Rotatory polarization: Fresnel's laws, Fresnel theory of rotatory polarization, Half shade polarimeter and determination of specific rotation of sugar solution.

SUGGESTED READING:

1. N. Subramanyam and BrijLal : *Optics*, S.Chand Publication, 1997.
2. AjoyGhatak :*Optics*, TMH, New Delhi, 1994.
3. M.L. Kalra, K.C. Bhandhari and S.L. Kakani: *Optics (Hindi),* Himanshu Publication Udaipur, 2004.
4. J.C. Upadhyaya, S. C. Upadhyaya and S.K. Sharma :*Optics (Hindi),* Ram Prasad & Sons, Agra 11th Edition, 2005.

BSPH212: WAVES AND OSCILLATIONS

OSCILLATIONS

UNIT-I

SHM: Simple harmonic oscillations, Differential equation of SHM and its solution, Amplitude, Phase, Time period, Reference circle, Rotating vector Representation of SHM, Complex number and complex exponential representation.

Free Oscillations of Systems with One Degree of Freedom: Mass-spring systems, Simple pendulum, Oscillations in a U-Tube, Compound pendulum: Centers of percussion and oscillation.

UNIT-II

Superposition of Two Collinear Harmonic Oscillations: Linearity and superposition principle: Oscillations having equal frequencies and oscillations having different frequencies (Beats), Superposition of N collinear harmonic oscillations with equal phase differences and equal frequency differences.

Superposition of Two Perpendicular Harmonic Oscillations: Superposition of two mutually perpendicular simple harmonic motions with frequency ratio 1:1 and 1: 2 using graphical and analytical methods, Lissajous figures and their uses.

UNIT-III

System with Two Degrees of Freedom: Coupled oscillators, Normal coordinates and normal modes, Energy relation and energy transfer normal modes of N coupled oscillators.

Damped Oscillations: Differential equation and its solution, Power dissipation and quality factor, Log decrement, Forced oscillations: Differential equation and its solution, Amplitude, Phase, Resonance and sharpness of resonance.

WAVES

UNIT-IV

Wave Motion: Plane and spherical waves, Longitudinal and transverse waves, Plane progressive (Travelling) waves, Wave equation, Particle and wave velocities, Differential equation, Pressure of a longitudinal wave, Energy transport, Intensity of wave, Water waves: Ripple and gravity waves (Idea only).

Velocity of Waves: Velocity of transverse vibrations of stretched strings, Velocity of longitudinal waves in a fluid in a pipe, Newton's formula for velocity of sound, Laplace's correction.

UNIT-V

Waves in the Bounded Medium: Rigid boundary and absolutely free boundary, Changes w.r.t position and time, Standing (Stationary) waves in a string: Fixed and free ends, Normal modes of stretched strings, Longitudinal standing waves and normal modes, Open and closed pipes, Flow of energy in stationary waves, Phase and group velocities.

Fourier Method: Fourier theorem and its applications, Transverse motion of a string fixed at both ends, Plucked and strucked string.

SUGGESTED READING:

1. A.P. French :*Vibrations and Waves* , CBS Pub. &Dist, 1987.
2. N.K. Bajaj :*The Physics of Waves and Oscillations*,Tata McGraw-Hill, 1988.
3. K. Uno Ingard :*Fundamentals of Waves & Oscillations* Cambridge University Press, 1988.
4. Daniel Kleppnerand Robert J. Kolenkow : *An Introduction to Mechanics*, McGraw-Hill, 1973.
5. Franks Crawford: *Waves: BERKELEY PHYSICS COURSE (SIE),* Tata McGraw Hill, 2007.

BSPH222: PHYSICS LAB

LIST OF EXPERIMENTS:

1. Specific rotation of sugar solution by half shade polarimeter.
2. Wavelength of mercury light by plane transmission grating.
3. Dispersive power of material of prism by spectrometer.
4. Wavelength of sodium light by Newton's ring method.
5. Determination of cardinal points of combination of two lenses using nodal slide assembly.
6. Verification of Malus law.
7. Resolving power of a telescope.
8. Measurement of inductance of coil by Anderson bridge.
9. Measurement of capacitance by De-Sautybridge.
10. Experimental verification of first law of thermodynamics by discharging of condenser.
11. Specific rotation of sugar solution by biquartzpolarimeter.

SUGGESTED READING:

1. M.G. Bhatawedekar, S.S. Choudhry and T.L. Dashora :*University Physics Practicals*, Ramesh Book Depot, Jaipur, 1987.
2. K.C. Bhandhari, *Practical Physics* (Hindi) :Himanshu Publication , Udaipur, 2004.
3. S.L. Gupta and V. Kumar: *Practical Physics*(Hindi& English), PragtiPrakashan, Meerut, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti*: Advanced Physics Laboratory Manual*, South Ashian Publishers Pvt. Ltd., New Delhi, 2007.

B.Sc. III[RD] SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH311	STATISTICAL AND THERMAL PHYSICS	3	3	20	80	100
BSPH312	ELECTRONIC DEVICES AND CIRCUITS	3	3	20	80	100
BSPH321	PHYSICS LAB	6	3	20	80	100
TOTAL						**300**

BSPH311: STATISTICAL AND THERMAL PHYSICS

UNIT-I: INTRODUCTION:

Probability fundamental, Particles states, System states, Macrostates and microstates, Equilibrium and fluctuations, The equi-a –priori probability postulate, Statistical ensemble, Ensemble average and time average, Constraints , Accessible and inaccessible states, Phase space, States accessible to a particle in a momentum and energy interval, Reversibility and irreversibility, Entropy and law of increase of entropy.

UNIT- II: CANONICAL ENSEMBLE:

Canonical ensemble, Thermal interaction and condition of Equilibrium, Helmholtz free energy, Boltzmann entropy formula, Boltzmann canonical distribution law, Partition function, Adiabatic Interaction and condition of Equilibrium, Enthalpy, General Interaction and condition of Equilibrium, Gibb's free energy, Clausis- Clayperon equation.

UNIT- III: MAXWELL DISTRIBUTION AND ITS APPLICATIONS:

Maxwell Distribution law for velocity and speed of an ideal gas, Partition function for an ideal gas, Specific heat and Entropy of an ideal gas, Gibb's paradox and its removal, Equation of state of an ideal gas, Partition function for real gas, Equation of state of real gas, Specific heat of diatomic gas.

UNIT- IV: GRAND CANONICAL ENSEMBLE:

Grand Canonical ensemble, Chemical potential, Grand potential, Grand canonical distribution law, Grand canonical partition function and its relation with various quantities, Chemical potential for translation mode of an ideal gas, Partition function for quantum particles, Fermi –Dirac and Bose-Einstein distribution function, Comparison between Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein statistics.

UNIT- V: MAXWELL EQUATIONS, THERMODYNAMICS OF RADIATION AND LOW TEMPERATURE METHODOLOGIES:

Second Law of Thermodynamics, Thermodynamics variables and potentials, Maxwell relations, Radiation pressure for normal incidence, Stefan's Law, Joule and Joule Thomson effects, Regenerative cooling, Cooling by adiabatic demagnetization of paramagnetic salt, Third law of thermodynamics and negative temperature.

SUGGESTED READING:

1. S. Lokanathan and R.S. Gambhir: *Statistical and Thermal Physics,* Prentice –Hall of India Priv. Ltd., New Delhi, 1991.
2. F. Reif, *Statistical Physics: Barkely Physics Course, Vol. V,* McGraw-Hill, New York, 1967.
3. C. Kittel and H. Kroemer: *Thermal Physics*, W.H. Freeman, San Francisco, 1980.
4. Kapur Mal Jain: *Basic of Thermal and Statistical Physics*, South Assian Pub., New Delhi, 2004.
5. SatyaPrakash and J.P. Agrawal: *Statistical Mechanics,* KedarNath Ram Nath& Co., Meerut, 2006.
6. H.P. Sinha: *Kinetic Theory, Thermodynamics & Statistical Physics,* Ram Prasad & Sons, Agra, 2008.

BSPH312: ELECTRONIC DEVICES AND CIRCUITS

UNIT-I

Semiconductor: Energy band in solids (metal, semiconductor and insulators), Intrinsic semiconductors, Extrinsic semiconductors: N-type and P-type, Mobility of charge carriers, Recombination, Life time, Drift current, Diffusion current, Fermi levels, P-N junction diode, formation of depletion layer, Derivation of barrier potential at thermal equilibrium, depletion width and depletion capacitance, Forward and Reverse biasing, I-V characteristic, Band diagram, Diode equation, Zener and avalanche breakdown, Zener diode, Tunnel diode.

Power Supply: Half and full wave rectifiers, Ripple factor and efficiency, Filters: Series Inductor, Shunt capacitor, L and π section, Voltage regulation using Zener diode.

UNIT-II

Network Analysis: Network definitions, Voltage and current sources, Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Voltage division and current division.

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem.

UNIT-III

Bipolar Junction Transistors (BJT): PNP and NPN transistors, Transistor action, CB, CE and CC configurations: Input and Output characteristics, Current gains and their relationship.

Field Effect Transistors (FET): JFET: Construction and working, channel formation, pinch-off voltage, Transfer characteristics, MOSFET: Construction and working, I-V characteristics, Enhancement and depletion modes.

UNIT-IV

Transistor Biasing: Need for biasing, DC load line and operating point, Thermal instability, Stability factor, Fixed Bias, Emitter bias, Voltage divider bias.

Transistor Amplifiers: Small signal amplifier, Frequency response, Band width, h-parameters-definitions, Analysis of transistor amplifier using h-parameters, Current gain, Voltage gain, Input-output impedance and power gain, Comparison between CE, CB and CC amplifiers, Cascading of transistor amplifiers.

UNIT-V

Power Amplifiers: Need of power amplifiers, Classification of power amplifiers, Class A, Class B and Class C operations, Efficiencies, Push pull amplifiers, Distortions in amplifiers, Transistor phase inverter, Class C tuned amplifier.

SUGGESTED READING:

1. N.N. Bhargava, D.C. Kulshrestha and S.C. Gupta: *Basic Electronics and Linear Circuits*,T.T.T.I., Chandigarh,Tata McGraw-Hill Publishing Company Ltd., New Delhi, 1984.
2. V.K. Mehta and R. Mehta: *Principles of Electronics*, S. Chand and Company, Rev. Ed., 2010.
3. Allen Mottershead: *Electronic Devices and Circuits: An Introduction*, Prentice-Hall of India, 2005.
4. R. S Sedha: *A Textbook of Applied Electronics*, S.Chand and Company Ltd.,1990.

BSPH321: PHYSICS LAB

LIST OF EXPERIMENTS:

1. Study of characteristics of a P-N junction diode.
2. Study of characteristics of a Zener diode.
3. Study of full wave rectifier with and without different filters (LC and π filters)
4. Study of characteristics of PNP/NPN transistor in common emitter configuration.
5. Study of characteristics of PNP/NPN transistor in common base configuration.
6. Determination of ballistic constant by condenser method.
7. Determination of ballistic constant by steady deflection method
8. Determination of coefficient of self-induction by using ballistic galvanometer.
9. Determination of coefficient of mutual induction by using ballistic galvanometer.
10. Determination of high resistance by leakage method.

SUGGESTED READING:

1. M.G. Bhatawedekar, S.S. Choudhry and T.L. Dashora: *University Physics Practicals*, Ramesh Book Depot, Jaipur, 1988.
2. K.C. Bhandhari, *Practical Physics* (Hindi): Himanshu Publication, Udaipur, 2005.
3. S.L. Gupta and V. Kumar: *Practical Physics (Hindi & English)*,PragtiPrakashan, Meruth, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti: *Advanced Physics Laboratory Manual*, South AshianPublishersPvt. Ltd., New Delhi, 2007.
5. M.P. Saxena, P.R. Singh, S.S. Rawat, N.S. Saxena and Sardar Singh: *Practical Physics(Hindi)*, CBH, Jaipur, 1994.
6. M.N. Srinivasan, S. Balasubranian and R. Ranganathan: *A Text Book of Practical Physics*, S. Chand & Sons, New Delhi, 2009.
7. Byron S. Gottfried: *Theory and Problems of Programming with BASIC, Schaum's Outline Series*, Tata Mc-Graw-Hill, New Delhi, 1991.

B.Sc. IVTH SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH411	ELECTRODYNAMICS	3	3	20	80	100
BSPH412	QUANTUM MECHANICS	3	3	20	80	100
BSPH421	PHYSICS LAB	6	3	20	80	100
TOTAL						**300**

BSPH411: ELECTRODYNAMICS

UNIT-I

Electromagnetic Waves: Displacement current, Maxwell's equations, Electromagnetic wave equation, Pointing theorem, Plane electromagnetic waves in free space, Wave impedance of free space, Propagation of plane electromagnetic waves in non-conducting and conducting medium, Skin depth, Propagation of electromagnetic waves in ionized gases, Scalar and vector potentials, Lorentz condition and D'Alembert's equations.

UNIT-II

Reflection and Reflection of Electromagnetic Waves: Boundary condition at the surface of discontinuity, Reflection and reflection of electromagnetic waves at the interface of non-conduction media, Fresnel's equations, Reflection and transmission coefficients, Brewster's law and degree of polarization, Total internal reflection, Phase difference between parallel and perpendicular components and polarization of the reflected wave, Reflection from a conducting plane.

UNIT-III

Interaction of Electromagnetic Waves with Matter: Normal and anomalous dispersion of light, Empirical relations, Lorentz theory of dispersion in gases, Scattering of electromagnetic waves and scattering parameters, Thomson, Resonant and Rayleigh scattering cross-section, Dispersion in liquids and solids, Clausius- Mossotti equation.

UNIT-IV

Relativity Mechanics : Coordinate transformation, Contravariant and covariant vectors, Tensors of second and higher rank, Addition, Subtraction, Contraction, Outer and inner product of tensors, Covariance of tensor equations, Minkowski space, Geometrical interpretation of Lorentz transformation, Space like and time like vectors, Four vectors, Four dimensional gradient, Divergence and curl operators, Four-velocity, Four- acceleration, Four- momentum and four-force vectors.

UNIT-V

Relativistic Electrodynamics: Invariance of charge, Transformation of surface charge density, Electric field measured in different frames of reference, Transformation of volume-charge density and current density, Equation of continuity in the covariant form, Transformation of Electromagnetic potentials, Electromagnetic field tensor, Maxwell equations in the form of electromagnetic field tensors.

SUGGESTED READING:

1. S.P. Puri: *Electrodynamics*, Tata McGraw Hill, 1990.
2. J.D. Jackon: *Classical Electrodynamics*, John Wiley & Sons, Singapore, 1999.
3. B.B. Laud: *Electromagnetic*, New Age International (P) Limited, Publisher, New Delhi, 1987.
4. E.C. Jordon and K.G. Balmain: *Electromagnetic Waves and Radiating System*, PHI, 1968.
5. D.J. Griffiths:*Introducton to Electrodynamics*,Pearson Education, 2012.
6. S.I. Gupta, V. Kumar and S.P. Singh: *Electrodynamics*,PragatiPrakashan, Meerut, 1990.
7. F.T. Ulaby: *Fundamentals of Applied Electromagnetics*, Prentice Hall, Upper Saddle River, New Jersey, 1997.

BSPH412: QUANTUM MECHANICS

UNIT-I

Development of Quantum Mechanics: Black body radiation spectrum, classical theory and its failure, Planck quantum hypothesis, Average energy of quantum oscillator, Density of quantum oscillators, Planck radiation formula and explanation of experimental results of black body radiation spectrum results, Photo electric effect and Compton's effect, Classical and quantum theories of photoelectric and Compton's effects.

UNIT-II

Matters Waves: Dual nature of radiations, De Broglie's hypothesis, wave packet, Phase velocity and group velocity, Davison- Germer experiment.

Heisenberg Uncertainty Principle: Relations of Heisenberg uncertainty principle, Illustration of Heisenberg uncertainty principal by Gamma Ray Microscope, Single slit Diffraction and double slit interference experiment.

UNIT-III

Applications of Heisenberg Uncertainity Principal: Nonexistence of electrons in the nucleus, Ground state energy and radius of Hydrogen atom, Natural energy width, Zero point energy of harmonic oscillator, Mass of π- Mesons.

Schrodinger's Wave Equation: Need for a wave function, Born's and statistical interpretation of wave function, Time dependent and independent Schrodinger's wave equation.

UNIT-IV

Operators in Quantum Mechanics and their Applications: Definition of operator in quantum mechanics, Eigen function , Eigen value and Eigen value equation, Hermition operator, Parity operator, Exchange operator, Expected value, Normalization of wave function, Orthogonally of wave function, Stationary states.

UNIT-V

Application of Schrodinger's Wave Equation (One Dimension): Probability current density, Ehrenfest theorem, Bound states: Particle in infinite deep square potential well, Particle in finite square potential well, Free states: Scattering of particle from potential step and potential barrier.

SUGGESTED READING:

1. Mahesh C. Joshi: *Quantum Mechanics: A Textbook for Undergraduates Students*, PHI, 2007.
2. R. Eisberg and R. Resnick: *Quantum Physics of Atoms, Molecules, Solid, Nuclei and Particles*, John Wiley & Sons, Singapore, 1985.
3. Mahipal Singh: *Quantum Mechanics & Modern Physics*, Ram Prasad & Sons, Agra, 2008.
4. Mahipal Singh: *A Text Book of Quantum Mechanics and Relativity*, Ram Prasad & Sons, Agra, 2008.
5. R.C. Bhandari, PrabhaDashora and DeepikaBhandari: *Elementary Quantum Mechanics and Spectroscopy*, Ramesh Book Depot, 2006.

BSPH421: PHYSICS LAB

LIST OF EXPERIMENTS:

1. Determination of γ by using Clement -Desorme method.
2. Determination of thermal conductivity of bad conductor by Lee's method.
3. Determination of temperature coefficient of platinum by using platinum resistancethermometer and Carry Foster bridge.
4. Verification of Rutherford-Soddy law by using statistical board and dices.
5. Verification of Gaussian distribution law by using statistical board and dices.
6. Determination of e/m by Thomson method.
7. Study of damping in pendulum.
8. Determination of magnetic field between the pole pieces of an electromagnets using search coil.
9. Determination of wavelength of sodium light using Michelson interferometer.
10. Determination of wavelength of sodium light using Fabory-Perrot interferometer.

SUGGESTED READING:

1. M. G. Bhatawedekar, S.S. Choudhry and T.L. Dashora: *University Physics Practicals*, Ramesh Book Depot, Jaipur, 1988.
2. K.C. Bhandhari: *Practical Physics (Hindi):*Himanshu Publication, Udaipur, 2005.
3. S. L. Gupta and V. Kumar: *Practical Physics (Hindi & English),* PragtiPrakashan, Meruth, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti: *Advanced Physics Laboratory Manual,* South AshianPublishersPvt. Ltd., New Delhi, 2007.
5. M.P. Saxena, P.R. Singh, S.S. Rawat, N.S. Saxena and Sardar Singh: *Practical Physics(Hindi),* CBH, Jaipur, 1994.
6. M.N. Srinivasan, S. Balasubranian and R. Ranganathan: *A Text Book of Practical Physics*, S. Chand & Sons, New Delhi, 2009.

B.Sc. VTH SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH511	ATOMIC AND MOLECULAR SPECTROSCOPY AND LASER PHYSICS	3	3	20	80	100
BSPH512	SOLID STATE PHYSICS	3	3	20	80	100
BSPH521	PHYSICS LAB	6	3	20	80	100
TOTAL						**300**

BSPH511: ATOMIC AND MOLECULAR SPECTROSCOPY AND LASER PHYSICS

UNIT-I

Introduction: Bohr's theory of spectra of hydrogen like atoms, Origin of spectral series, Energy levels, Ritz combination rule, Effect of finite mass of the nucleus on the spectrum, Bohr's correspondence principle, Wilson-Sommerfield's quantum condition, Sommerfield's theory of elliptic orbit; relativity correction, Frank and Hertz principle, Limitations of Bohr's theory.

UNIT-II

Vector Model of Atom and Stern - Gerlach Experiment: Angular momentum of electron, Stern – Gerlach experiment and its consequence, Space quantization, Spin orbit interaction energy, Total angular momentum, Coupling schemes, Fine structure of a spectral line, Selection rules, Spectral term and their notations, Hund's rule, Pauli's exclusion principle and Lande interval rule.

UNIT-III

Effect of Magnetic and Electric Field on Spectral Lines: Angular momentum and magnetic moment, Zeeman Effect: Normal Zeeman effect its selection rules, Anamalous Zeeman effect and its selection rules, Paschen back effect and selection rules, Stark effect, Linear and quadratic Stark effect.

UNIT-IV

X-rays: Origin of continuous and characteristic X-Rays, Absorption and emission spectrum, Energy levels and Moseley's law, Fine structure of X-ray levels, Auger effect, Comparison of optical and X-ray spectra.

Molecular Spectra : Classification of molecular spectra, Rotational spectra and Rotational-Vibrational spectra and selection rules.

UNIT-V

Lasers: Einstein theory of atomic transition, Pumping and population inversion, Laser action, Components of a laser system, Characteristics and properties of lasers, Ruby laser, He-Ne lasers, Semiconductor lasers, Principle of holography.

SUGGESTED READING:

1. S. N. Ghoshal: *Atomic Physics (Modern Physics)*, S. Chand & Comp. Ltd., New Delhi, 2004.
2. S.L. Gupta, V. Kumar and R.C. Sharma: *Elements of Spectroscopy*,PragatiPrakashan, Meerut, 1990.
3. Raj Kumar: *Atomic & Molecular Spectra: LASER*, KedarNath Ram Nath, Meerut, 2007.
4. Mahipal Singh: *Quantum Mechanics & Modern Physics*, Ram Prasad & Sons, Agra, 2008.
5. R. Eisberg and R. Resnick: *Quantum Physics of Atoms, Molecules, Solid, Nuclei and Particles*, John Wiley & Sons, Singapore, 1985.
6. Colin N. Banwell and Elaine M. Mccash: *Fundamentals of Molecular Spectroscopy*, Tata McGraw-Hill, New Delhi, 1995.

BSPH512: SOLID STATE PHYSICS

UNIT- I

Crystal Structure: Crystalline and Amorphous solids, Space lattice, Basis, Crystal structure, Crystal translation vector, Primitive cell and UNIT- cell, Fundamental types of lattices in two dimensional and three dimensional, Simple crystal structure: SC, BCC, FCC, HCP, Miller indices and lattice planes, Inter planer spacing between lattice planes.

Crystal Diffraction and Bonding: Diffraction of X-rays by crystals: Braggs Law, Von-Laue's equation of X-rays diffraction, Reciprocal lattice and its properties. Types of bonding in solids: Ionic bonding, Cohesive energy and compressibility of Ionic crystals, Covalent bonding, Metallic bonding, Vander Waal's bonding, Hydrogen bonding.

UNIT- II

Lattice Vibrations: Concept of Phonons, Vibration of monatomic lattice, Lattice with two atoms per primitive cell, Acoustical and optical mode.

Thermal properties: Specific heat of Solids, Einstein's theory of specific heat, Debye's model of specific heat (Debye T^3-Law), Specific heat of metals (Electronic).

UNIT- III

Free Electron Theory of Metals: Free electron gas model, Lorentz- Drude theory, Drift velocity, Mobility, Relaxation time and mean free path, Electrical conductivity and resistivity, Fermi-Dirac distribution, Density of states, Fermi energy, Effect of temperature on Fermi Dirac distribution function.

Transport Properties: Thermionic emission, Boltzmann transport equation for electrons, Sommerfield's theory of electrical conductivity, Thermal conductivity of metals, Wiedmann Franz Law, Hall effect.

UNIT- IV

Band theory of Solids: Formation of bands in solids, Periodic potential, Bloch theorem, Kroning-Penney model, Velocity and crystal momentum, Effective mass of an electron, Concept of holes, Negative mass, Classification of solids with energy band diagram, Energy band gap, Fermi level in intrinsic and extrinsic semiconductor.

UNIT- V

Magnetic Properties: Diamagnetic, Paramagnetic, Ferromagnetic materials, Classical Langevin's theory of diamagnetism and paramagnetism, Curie's law, Weiss's molecular theory of ferromagnetism, Curie-Weiss's law.

Superconductivity: Experimental Results: Persistent current, Zero resistance, Critical temperature, Effect of magnetic field, Meissner effect, Type I and type II superconductors, Isotope effect, Entropy, Specific heat, Energy gap, BCS theory (elementary ideas).

SUGGESTED READING:

1. Charles Kittel: *Introduction to Solid State Physics, 7th Edition*, John Wiley and Sons, 2009.
2. A.J. Dekker: *Solid State Physics*, Macmillan India Limited, 2005.
3. N. W. Ascroft and N. D. Mermin: *Solid State Physics*, Harcourt Asia, Singapore,2003.
4. S.L. Gupta and V. Kumar: *Solid State Physics* , Kadar Nath& Co. Meerut, 2013
5. S. S. Rawat*: Solid State Physics (Hindi),* College Book House (CBH), Jaipur, 2008.

BSPH521: PHYSICS LAB

LIST OF EXPERIMENTS:

1. Determination of Planck constant using solar cell.
2. Determination of Stefan's constant using photocell.
3. Determination of e/m by helical method.
4. Determination of band gap of semiconductor using P-N junction diode.
5. Study of electromagnetic damping in LCR circuit using metal plate.
6. To find J of Callender and Barne's method
7. To study the frequency of energy transfer as function of coupling strength.
8. Study of photoelectric effect and determination of Planck's constant.
9. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
10. Determination of Planck's constant by LED method.
11. Plot of thermo e.m.f versus temperature and find the neutral temperature.

SUGGESTED READING:

1. M.G. Bhatawedekar, S.S. Choudhry and T.L. Dashora: University Physics *Practicals*, Ramesh Book Depot, Jaipur, 1988.
2. K.C. Bhandhari: *Practical Physics (Hindi),* Himanshu Publication, Udaipur, 2005.
3. S.L. Gupta and V. Kumar: *Practical Physics (Hindi & English),*PragtiPrakashan, Meruth, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti*: Advanced Physics Laboratory Manual*, South AshianPublishersPvt. Ltd., New Delhi, 2007.
5. M.P. Saxena, P.R. Singh, S.S. Rawat, N.S. Saxena and Sardar Singh: *Practical Physics (Hindi),* CBH, Jaipur, 1994.
6. M.N. Srinivasan, S. Balasubranian and R. Ranganathan: *A Text Book of Practical Physics*, S. Chand & Sons, New Delhi, 2009.

B.Sc. VITH SEMESTER

CODE	DESCRIPTION	PD/W	EXAM	CIA	ESE	TOTAL
BSPH611	NUCLEAR PHYSICS	3	3	20	80	100
BSPH612	ANALOG AND DIGITAL ELECTRONICS	3	3	20	80	100
BSPH621	PHYSICS LAB	6	3	20	80	100
TOTAL						**300**

BSPH611: NUCLEAR PHYSICS

UNIT- I

General Properties: Rutherford scattering and Rutherford's nuclear model, Constituents of nucleus, discovery of neutron, Mass of proton and neutron, Measurement of charge radius by (i) Hofstadter experiment, (ii) Mesonic X-ray method. Measurement of potential radius by (i) Lifetime of alpha emitters (ii) Neutron scattering experiment, Variation of nuclear radius with mass number A, Nuclear spin and parity, Magnetic dipole moment of nuclei, Basic idea about quadrupole moment of nucleus.

UNIT- II

Binding Energy and Semi-Empirical Mass Formula: Mass defect, Mass difference, Packing fraction and binding energy of nucleus, Variation of binding energy with mass number, Liquid drop model of nucleus, Semi-empirical mass formula (Volume, Surface, Coloumb, Asymmetry and Paring energy terms), Prediction of stability against beta-decay for members of an isobaric family, Stability limits against spontaneous fission, Energetic of symmetric fission.

UNIT- III

Radioactivity: The law of radioactive decay, Statistical nature of radioactivity, Radioactive growth and decay, Successive disintegrations, Radioactive equilibrium; Transient and secular equilibrium. Radioactive series.

Nuclear Reactions: Types of nuclear reactions (only qualitative statement), Conservation laws in nuclear reactions, The balance of mass and energy in nuclear reaction, Q value equation, Solution of the Q value equation.

UNIT- IV

Alpha Decay: Disintegration energy, Range of particles, Geiger Nuttal's law, Fine structure of the alpha-ray spectra; Long range alpha particles, Gammow theory of alpha disintegration.

Beta Decay: Beta ray spectrometer (principle and working), Beta ray spectrum and its qualitative explanation (Neutrino hypothesis).

Nuclear Energy: Nuclear induced fission, Energy released in fission of U^{235}, Fission chain reaction, Neutron cycle in thermal reactor, Elementary idea of nuclear reactors, Nuclear fusion; Fusion in stars, carbon and p-p cycle problems of controlled fusion.

UNIT- V

Radiation Detectors: Introduction of various methods used in detection of nuclear radiation, Detailed description of principle and working of following detectors based on detection of free-charge carriers (i) Ionization chamber (ii) Proportional counter (iii) Geiger- Muller counter; Dead time, Recovery time and paralysis time.

Elementary Particles: Properties of particles, Classification of elementary particles: Leptons, Mesons and Baryons, Conservation laws (only qualitative discussion): Energy, Momentum, Angular momentum, Charge, Lepton numbers, Iso-spin, Strangeness and Baryon number, Resonance states and Quark model (only qualitative idea).

SUGGESTED READING:

1. S.N.Ghoshal*: Nuclear Physics, 1st edition*, S. Chand Publication, Delhi, 2012.
2. D.C.Tayal*: Nuclear Physics, 4th edition*, Himalaya Publishing House, 1982
3. R.D.Evans: *The Atomic Nucleus*, McGraw Hill, 1955.
4. N.S.Saxena, S. Singh and S.S.Rawat: *Nuclear Physics* (Hindi), College BookHouse, Jaipur, 2006.

BSPH612: ANALOG AND DIGITAL ELECTRONICS

UNIT- I

Feedback Amplifiers : Feedback concept, Positive and negative feedbacks and their properties, Sampling and mixing, Feedback topology: Voltage series, Voltage shunt, Current series, Current shunt, Effect of positive and negative feedback on gain of amplifier, Frequency response, Gain-stability, Noise, Distortions, Effect of negative feedback on input and output impedances of an amplifier, CE amplifier with current series feedback, Emitter follower.

UNIT- II

Sinusoidal Oscillators: Classification of oscillators, Barkhausen criterion for sustained oscillations, R-C Phase shift oscillator, Hartley oscillator, Colpitts oscillators.

Non Sinusoidal Oscillators: Transistor as a switch, Introduction to multivibrators, Astable (free running multivibrator), Multivibrator using 555 timer, UJT, UJT as saw tooth waveform generator.

UNIT- III

OPAMP and its Basic Applications: Differential Amplifier: Common mode and difference mode signals and their gains, CMRR, Emitter- Coupled differential amplifier.

Basic Operational Amplifier (Op-Amp): Ideal operational amplifier, Concept of virtual ground, Inverting and non-inverting OPAMP.

Applications of Op-Amp: Inverting Op-Amp as constant multiplier, Sign-Changer, Adder or summing amplifier, Integrator, Differentiator.

UNIT- IV

Number System : Decimal, Binary, Octal and Hexadecimal, Interconversion, Character codes, ASCII, BCD, Gray code, Logical operations, Boolean algebra, Simplification of boolean expression,

Gates: NOT, AND, OR, NAND, NOR and XOR gates, De-Morgans theorems, Universal gates, Logic circuits for boolean expressions, Simplification of logical expression, Karnaugh Maps.

UNIT- V

Combinational Circuits: Half adder, Full adder, Parallel adder, Halfsubtractor, Full subtractor, Parallel Subtractor, MUX and DMUX.

Sequential Circuits: Flipflops; RS, D, JK, Clocked and edge triggered, PRESET and CLEAR, Counters: Ripple counters, Synchronous counter, Mod counter.

SUGGESTED READING:

1. Allen Mottershed: *Electronic Devices and Circuits*, PHI, 2005.
2. Jacob Millman and Christos C. Halkias: *Electronic Devices and Circuits*, TMH, 2000.
3. A.P. Malvino and D.P.Leach: *Digital Principle and Applications IV Ed*. TMH, 1990.
4. M. Morris Mano: *Digital Design*, IV Ed.,Pearson, 2001.

BSPH621: PHYSICS LAB

LIST OF EXPERIMENTS:

1. Study of frequency response of R-C coupled singe stage amplifier.
2. Study of input and output impedance of a transistor amplifier.
3. Study of frequency response of R-C coupled two stage amplifier.
4. Study of characteristics of FET.
5. Study of differential amplifier and measurement of CMRR.
6. Study of phase shift oscillator.
7. Study of Hartley oscillator
8. Study of negative feedback in amplifier.
9. Study of various logic gates and verification of Demorgan theorem (using IC's and logical circuits)
10. Study of flip flop by logic circuits.

SUGGESTED READING:

1. M.G. Bhatawedekar, S.S. Choudhry and T.L. Dashora: *University Physics Practicals*, Ramesh Book Depot, Jaipur, 1988.
2. K.C. Bhandhari: *Practical Physics (Hindi):*Himanshu Publication, Udaipur, 2005.
3. S.L.Gupta and V. Kumar*: Practical Physics (Hindi & English),*PragtiPrakashan, Meruth, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti: *Advanced Physics Laboratory Manual,* South Ashian Publishers Pvt. Ltd., New Delhi, 2007.
5. M.P. Saxena, P.R. Singh, S.S. Rawat, N.S. Saxena and Sardar Singh: *Practical Physics(Hindi), CBH*, Jaipur, 1994.
6. M.N. Srinivasan, S. Balasubranian and R. Ranganathan: *A Text Book of Practical Physics,* S. Chand & Sons, New Delhi, 2009. K.R. Venugopal and S.R. Prasad : Allen Mottershed: *Electronic Devices and Circuits*, PHI, 2005.
7. Jacob Millman and Christos C. Halkias: *Electronic Devices and Circuits*, TMH, 2000.
8. A.P. Malvino and D.P.Leach: *Digital Principle and Applications IV Ed*. TMH, 1990.
9. M. Morris Mano: *Digital Design*, IV Ed., Pearson, 2001.