DEPARTMENT OF PHYSICS AND ELECTRONICS

LACHOO MEMORIAL COLLEGE OF SCIENCE AND TECHNOLOGY (AUTONOMOUS)

JODHPUR

MEETING OF BOS-2017

ON MARCH 22, 2017

PROPOSED SYALLABUS FOR

UG: PHYSICS AND ELECTRONICS (2017-2020)

PG: PHYSICS (2017-2019)

ANUXTURE- A1(1)

PAPERS SCHEME

B.Sc. (PHYSICS)

(2017-2020)

I SEMESTER

1. BSPH111: MECHANICS
2. BSPH112: ELECTROMAGNETICS
3. BSPH121: PHYSICS LAB

II SEMESTER

1. BSPH211: OPTICS
2. BSPH212: WAVES AND OSCILLATIONS
3. BSPH221: PHYSICS LAB

III SEMESTER

1. BSPH311: STATISTICAL AND THERMAL PHYSICS
2. BSPH312: (A) ELECTRONIC DEVICES AND CIRCUITS

   : (B) PROGRAMMING IN BASIC LANGUAGE

3 BSPH321: PHYSICS LAB

IV SEMESTER

1. BSPH411: ELECTRODYNAMICS
2. BSPH412: QUANTUM MECHANICS
3. BSPH421: PHYSICS LAB

V SEMESTER

1. BSPH511: ATOMIC AND MOLECULAR SPECTROSCOPY AND LASER PHYSICS
2. BSPH512: SOLID STATE PHYSICS
3. BSPH521: PHYSICS LAB

VI SEMESTER

1. BSPH611: NUCLEAR PHYSICS
2. BSPH612: (A) ANALOG AND DIGITAL ELECTRONICS

   :(B) PROGRAMMING IN C LANGUAGE

3. BSPH621: PHYSICS LAB

Note: The paper (B) of III and VI semester are for the students who opted electronics as an optional subject.

ANUXURE –A1 (2)
SCHEME OF TEACHING AND EXAMINATION
BSc. I, II AND III YEAR (I-VI SEMESTERS)
SUBJECT: PHYSICS
(2017-2020)

"PHYSICS I 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

"PHYSICS II 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

"PHYSICS III SEMESTER"

Code	Description	Pd/w	Exam	CIA	ESE	Total
BSPH311	STATISTICAL AND THERMAL PHYSICS	3	3	20	80	100
BSPH312(A)	ELECTRONIC DEVICES AND CIRCUITS	3	3	20	80	100
BSPH312(B)	PROGRAMMING IN BASIC LANGUAGE	3	3	20	80	100
BSPH321	PHYSICS LAB	6	3	20	80	100
	Total					300

"PHYSICS IV 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

"PHYSICS V 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

"PHYSICS VI SEMESTER"

Code	Description	Pd/w	Exam	CIA	ESE	Total
BSPH611	NUCLEAR PHYSICS	3	3	20	80	100
BSPH612(A)	ANALOG AND DIGITAL ELECTRONICS	3	3	20	80	100
BSPH612(B)	PROGRAMMING IN C LANGUAGE	3	3	20	80	100
BSPH621	PHYSICS LAB	6	3	20	80	100
	Total					300

Note: The paper (B) of III and VI semester are for the students who have opted electronics as an optional subject.

Grand Total Marks of Physics Papers for BSc. (I-VI Semester) = 1800

ANUXURE- B1(1)

SYLLABUS OF BSc. I YEAR (I AND II SEMESTERS)

SUBJECT: PHYSICS

(2017-2018)

BSc. I Year (I Semester)

Physics Paper I

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, equation of motion of moving particle under central force, Law of conservation of angular momentum, total energy and areal velocity, Trajectories of moving bodies under inverse central force, Cases of elliptical and circular orbits, Kepler's laws.

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 moment, Theory of bending of beam loaded at middle, 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.

BSc. I Year (I Semester)

Physics Paper II

BSPH112: ELECTROMAGNETICS

Unit I

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

Unit II

Electric Field and Electric Fields in Matter: Potential and electric field due to a quadrupole, The electric moments of an arbitrary charge distribution, Electrostatic energy of an uniformly charged sphere, 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.

Unit III

Force on Moving Charges and Magnetic Fields in Matter: Force on a moving charge in uniform electric field, Alternating electric field, Uniform Magnetic field and Transverse electric and magnetic field. Uniform Bio-Savart's law, Amperes circuital law, Differential form and it's applications, Vector potential, Electric currents in atoms, Bohr Magneton, Electron spin, Magnetic moment, Magnetic susceptibility, Magnetic field due to magnetized matter.

Unit IV

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 LCR Series and parallel circuits, Resonance, Bandwidth, Anderson's bridge for inductance measurement, De Sauty's bridge for capacitance measurement.

Unit V

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.

Suggested Reading:

1. S.I. Ahmed and K.C. Lal: *Electricity, Magnetism and Electronics*, Unitech 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.

BSc. I Year (I Semester)

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 Faraday's Law.

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), Pragti Prakashan, Meerut, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti *: Advanced Physics Laboratory Manual*, South Ashian Publishers Pvt. Ltd., New Delhi, 2007.

BSc. I Year (II Semester)

Physics Paper I

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: Concept of half periods zones, Diffraction from a Zone plate, Circular aperture and circular disc (Plane wavefront), Cylindrical wavefront and half period strips, Diffraction from a straight edge, Rectangular slit.

Unit IV

Frounhoffer Diffraction: 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 Brij Lal: *Optics*, S. Chand Publication, 1997.
2. Ajoy Ghatak: *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.

BSc. I Year (IInd Semester)

Physics Paper II

BSPH212: WAVES AND 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.

Fourier Method: Fourier theorem and its applications.

Unit II

Superposition of Two Collinear Harmonic Oscillations: 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.

Unit III

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

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

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.

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.

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 Kleppner and Robert J. Kolenkow: *An Introduction to Mechanics*, McGraw-Hill, 1973.
5. Franks Crawford: *Waves: BERKELEY PHYSICS COURSE (SIE),* Tata McGraw Hill, 2007.
6. Suresh Grag, C.K. Ghosh and Sanjay Gupta: *Oscillations and Waves,* PHI Learning Private Limited, New Delhi, 2009.
7. N. Subrahmanyam and Brij Lal, *Waves and Oscillations,*Vikas Publishing House Pvt. Ltd., Noida, 2013.

BSc. 1 year (II Semester)

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 capacitance by De-Sauty bridge.
9. Study of charging and discharging of CR circuit.
10. Specific rotation of sugar solution by biquartz polarimeter.
11. Study of phase and frequency by using CRO (Lissajous figures)

Suggested Reading:

1. M.G. Bhatawedekar, S.S. Choudhry and T.L. Dashora: U*niversity 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), Pragti Prakashan, Meerut, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti*: Advanced Physics Laboratory Manual*, South Ashian Publishers Pvt. Ltd., New Delhi, 2007.

ANUXURE- B1(2)

SYLLABUS OF BSc. II (III AND IV SEMESTERS)

SUBJECT: PHYSICS

(2018-2019)

BSc. II Year (III Semester)

Physics Paper I

BSPH311: STATISTICAL AND THERMAL PHYSICS

Unit I

Introduction: 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*, Mc-Graw 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. Satya Prakash and J.P. Agrawal: *Statistical Mechanics,* Kedar Nath Ram Nath & Co., Meerut, 2006.
6. H.P. Sinha: *Kinetic Theory, Thermodynamics & Statistical Physics*, Ram Prasad & Sons, Agra, 2008.

BSc. II Year (III Semester)

Physics Paper II (A)

BSPH312(A): Electronic Devices and Circuits

(For Students not having Electronics as an Optional Subject)

Unit I

Semiconductor: 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, Zener and avalanche breakdown, Zener diode.

Unit II

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

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

Small Signal Transistor Amplifiers, Frequency response, h-parameters- definitions, Analysis of transistor amplifier using h-parameters, Current gain, Voltage gain, Input-output impedance, Cascading of transistor amplifiers.

Unit V

Power Amplifiers: Need of power amplifiers, Classification of power amplifiers, Class A, Class B and Class C power amplifiers, Efficiencies, Push pull amplifiers, Transformer coupled amplifier

Books Suggested:

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.

BSc. II Year (III Semester)

Physics Paper II (B)

BSPH312 (B): PROGRAMMING IN BASIC LANGUAGE

(For Students having Electronics as an Optional Subject)

Unit I

Introduction to Computer Programming Concepts: Solving problem by using computer, Algorithm, Flow chart, Advantages of flowchart, Software and Hardware, System Software and applications software, Low level and high level languages, Interpreter and Compiler, Errors in programming, Debugging, Various programming languages.

Unit II

Getting started with Basic: Constants and variables, Operators and expressions, Assignment statement, Input and output statements: INPUT and PRINT; READ-DATA and RESTORE statements, REM and END statements, GO TO statements.

Unit III

Branching and Looping: Relational operators, Conditional branching, Multiple branching, STOP statement, Building a loop, Closing a loop, Nested loop, Library Functions.

Unit IV

Arrays, Functions and Subroutines: List and Tables, Subscripted variables, DIM statement, Defining a function, Referencing a function, Multiline function, Defining a subroutine, Referencing a subroutine, RND function.

Unit V

Data Files and other Features of BASIC: Sequential data files ,Creating, Reading and writing a sequential data file, Random Data files, Creating, Reading and writing a random data file, LEN, LEFT$, RIGHT$, MID$, SPACE$, STR$, VAL statements.

Suggested Reading:

1. Byron S. Gottfrid: *Theory and Problems of Programming with BASIC, Schaum's Outline Series*, Tata McGRaw-Hill, New Delhi, 1991.

BSc. II Year (III Semester)

BSPH321: PHYSICS LAB

List of Experiments:

Part 1 (For students not having Electronics as an optional subject)

1. Study of characteristics of a P-N junction diode.
2. Study of characteristics of a Zener diode.
3. Voltage regulation using zener diode
4. Determination of ballistic constant by condenser method.
5. Determination of ballistic constant by steady deflection method.
6. Determination of coefficient of self-induction by using ballistic galvanometer.
7. Determination of coefficient of mutual induction by using ballistic galvanometer.
8 Determination of high resistance by leakage method.
9. Measurement of inductance of coil by Anderson bridge.
10. Experimental verification of first law of thermodynamics by discharging of condenser.

Part 2 (For students having Electronics as an optional subject)

1. Evaluation of sum of a finite series by using BASIC language.
2. Evaluation of sum of a AP and GP series by using BASIC language.
3. Evaluation of factorial of a number by using BASIC language.
4. Evaluation of sum and difference of two square matrixes by using BASIC language.
5. Evaluation of product of two square matrixes by using BASIC language.
6. Preparation of mark sheet of students of a class by using BASIC language.
7. Determination of ballistic constant by condenser method.
8 Determination of ballistic constant by steady deflection method
9. Determination of coefficient of self-induction by using ballistic galvanometer.
10. Determination of coefficient of Mutual induction by using ballistic galvanometer.
11. 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)*, Pragti Prakashan, Meruth, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti: *Advanced Physics Laboratory Manual*, South Ashian PublishersPvt. 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.

BSc. II Year (IV Semester)

Physics Paper I

BSPH411: ELECTRODYNAMICS

Unit I

Electromagnetic Waves: Displacement current, Maxwell's equations, Electromagnetic wave equation, Poynting 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, 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, Total internal reflection, 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, Dispersion in solids, Clausius- Mossotti equation. Scattering of electromagnetic waves and scattering parameters, Thomson, Resonant and Rayleigh scattering cross-section.

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 Mc-Graw 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*, Pragati Prakashan, Meerut, 1990.
7. F.T. Ulaby: *Fundamentals of Applied Electromagnetics*, Prentice Hall, Upper Saddle River, New Jersey, 1997.

BSc. II Year (IV Semester)

Physics Paper II

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 Uncertainty 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, Prabha Dashora and Deepika Bhandari: *Elementary Quantum Mechanics and Spectroscopy*, Ramesh Book Depot, 2006.

BSc. II Year (IV Semester)

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 resistance thermometer 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 etalon.

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)*, Pragti Prakashan, Meruth, 1998.
4. Patitapaban Mishra and Jyotis Chandra Mohanti: *Advanced Physics Laboratory Manual*, South Ashian PublishersPvt. 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.

ANUXURE- B1(3)

SYLLABUS OF BSc. III (V AND VI SEMESTERS)

SUBJECT: PHYSICS

(2019-2020)

BSc. III Year (V Semester)

Physics Paper I

BSPH511: ATOMIC AND MOLECULAR SPECTROSCOPY AND LASER PHYSICS

Unit I

Introduction: Bohr's theory of spectra of hydrogen like atoms, Origin of spectral series, 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 (qualitative idea); Relativistic 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.

Unit III

Effect of Magnetic and Electric Field on Spectral Lines: Angular momentum and magnetic moment, Zeeman Effect: Normal Zeeman effect its selection rules, Anomalous Zeeman effect and its selection rules, Paschen back effect and selection rules, Stark effect: Linear 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*, Pragati Prakashan, Meerut, 1990.
3. Raj Kumar: *Atomic & Molecular Spectra: LASER*, Kedar Nath 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.

BSc. III Year (V Semester)

Physics Paper II

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 three dimensional, Simple crystal structure: SC, BCC, FCC, HCP, Miller indices, Inter planer spacing , Diffraction of X-rays by crystals: Braggs Law, Von-Laue's equation, Reciprocal lattice and its properties.

Unit II

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

Thermal properties: Specific heat of Solids, Einstein's theory of specific heat, Debye's model of specific heat, Thermal conductivity of metals.

Unit III

Free Electron Theory of Metals: Free electron gas model, Lorentz-Drude theory, Electrical conductivity, Fermi- Dirac distribution, Density of states, Fermi energy, Specific heat of electron gas, Boltzmann transport equation for electrons, Sommerfield's theory of electrical conductivity, 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.

Superconductivity: Experimental Results: Zero resistance, Critical temperature, Effect of magnetic field, Meissner effect, Persistent current, 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.

BSc. III Year (V Semester)

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. To find J by Callender and Barne's method
6. To study the frequency of energy transfer between two pendulums as function of coupling strength (through mass).
7. Determination of Planck's constant by LED method.
8. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
9. Study of electromagnetic damping in LCR circuit using metal plate.
10. Plot of thermo e.m.f versus temperature and find the neutral temperature.
11. Study of B-H curve using CRO.

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)*, Pragti Prakashan, 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.

BSc. III Year (VI Semester)

Physics Paper I

BSPH611: NUCLEAR PHYSICS

Unit I

General Properties: Rutherford scattering and Rutherford's scattering formula, Constituents of nucleus, Measurement of radius by (i) Hofstadter experiment, (ii) Mesonic X-ray method. (iii) Lifetime of alpha emitters, Nuclear spin and parity, Magnetic dipole moment of nuclei, Basic idea about quadruple moment of nucleus, Measurement of magnetic moment by Rabi's method.

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, Coulomb, Asymmetry and Pairing energy terms), Prediction of stability against beta-decay for members of an isobaric family, Stability limits against spontaneous 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.

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: Range of particles, Geiger Nuttal's law, Fine structure of the alpha-ray spectra; 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, Bohr-Wheeler theory of fission (qualitative idea), Neutron cycle in thermal reactor, Four factor formula.

Unit V

Radiation Detectors: Introduction of various methods used in detection of nuclear radiation, Principle and working of (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*, Mc-Graw Hill, 1955.
4. N.S. Saxena, S. Singh and S.S. Rawat: *Nuclear Physics* (Hindi), College Book House, Jaipur, 2006.

BSc. III Year (VI Semester)

Physics Paper II

BSPH612 (A): Analog and Digital Electronics

(For Students not having Electronics as an Optional Subject)

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,

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).

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

Unit V

Combinational Circuits: Half adder, Full adder, Parallel adder, Half subtractor, Full subtractor, Parallel subtractor,

Sequential Circuits: Flipflops; RS, D, JK, Clocked and edge triggered, PRESET and CLEAR, Counters: Synchronous and Asynchronous counter,

Books Suggested:

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*, IVth Ed., Pearson, 2001.

BSc. III Year (VI Semester)

Physics Paper II

BSPH612 (B): PROGRAMMING IN C LANGUAGE

(For Students having Electronics as an Optional Subject)

Unit I

C Language Preliminaries: C character set, Identifiers and keywords, Data types, Declarations, Expressions, Statements and symbolic constants.

Input-Output: getchar, putchar, scanf, printf, gets, puts, functions.

Unit II

Pre-processor Commands: #include, #define, #ifdef.

Operators and Expressions: Arithmetic, Unary, Logical, Bit-wise, Assignment and conditional operators.

Control Statements: While, Do-While, For statements, Nested loops, If else, Switch, Break, Continue and goto statements, Comma operators.

Unit III

Storage Types: Automatic, External, Register and static variables.

Functions: Defining and accessing, Passing arguments, Function prototypes, Recursion, Library functions, Static functions.

Arrays: Defining and processing, Passing arrays to a function, Multi dimensional arrays.

Unit IV

Strings: Defining and operations on strings.

Pointers: Declarations, Passing pointers to a function, Operations on pointers, Pointer arithmetic, Pointers and arrays, Arrays of pointers, Function pointers.

Unit V

Structures: Defining and processing, Passing to a function, Unions, typedef, Array of structure, and pointer to structure.

File Structures: Definitions, Concept of record, File operations: Storing, Creating, Retrieving, Updating sequential, Relative, Indexed and random access mode.

Suggested Reading:

1. K.R. Venugopal and S.R. Prasad: *Mastering C*, TMH, Delhi, 2006.
2. E. Balagurusamy: *C–Programming*, Tata Mc-Graw Hill, 2006.
3. R.G. Dromey: *How to solve it by Computer*, Pearson Education India, 2008.
4. B.S. Gottfried: *Schaums Outline of Theory and Problems of Programming with C*: Mc-Graw Hill, 1993.
5. B.W. Kerninghan and D.M. Ritchie: *C Programming Language*: Prentice Hall, 1988.

6. Ram Kumar and Rakesh Agarwal: *Programming in ANSI C*, West Pub. Co., 1992
7. Y.P. Kanetkar: *Let Us C*, Infinity Science Press, LCC, 2008.

BSc. III Year (VI Semester)

BSPH621: PHYSICS LAB

List of Experiments:

Part 1 (For the students not having Electronics as an optional subject)

1. Study of characteristics of PNP/NPN transistor in common emitter configuration.
2. Study of characteristics of PNP/NPN transistor in common base configuration.
3. Study of frequency response of R-C coupled singe stage amplifier.
4. Study of input and output impedance of a transistor amplifier.
5. Study of full wave rectifier with and without different filters (LC and π filters
6. Study of characteristics of FET.
7. Study of astable multivibrator
8. Study of phase shift oscillator.
9. Study of Hartley oscillator
10. Study of various logic gates and verification of Demorgan theorem (using IC's and logical circuits)
11. Study of flip flop by logic circuits.

Part 2 (For the students having Electronics as an optional subject)

Use C Language Programming to solve the followings.

1. Evaluation of Sine and Cosine series.
2. Evaluation of roots of a quadric equation.
3. Evaluation of product of two square matrixes.
4. Evaluation of inverse of a matrix.
5. Evaluation of single root of a nonlinear equation by Newton Raphson method.
6. Evaluation of single root of a nonlinear equation by bisection method
7. Integration by Trapezoidal rule.
8. Integration by Simpson 1/3 rule.
9. Differentiation by Newton's Method.
10. Solution of differential equation by Heun's method.

11. Solution of differential equation by Runga-Kutta second order 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)*, Pragti Prakashan, 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.
7. K.R. Venugopal and S.R. Prasad: *Mastering C*, TMH, Delhi, 2006.
8. E. Balagurusamy: *C–Programming*, Tata Mc-Graw Hill, 2006.
9. R.G. Dromey: *How to solve it by Computer*, Pearson Education India, 2008.
10. B.S. Gottfried: *Schaums Outline of Theory and Problems of Programming with C*: Mc-Graw Hill, 1993.
11. B.W. Kerninghan and D.M. Ritchie: *C Programming Language*: Prentice Hall, 1988.
12. Ram Kumar and Rakesh Agarwal: *Programming in ANSI C*, West Pub. Co., 1992.
13. Y.P. Kanetkar: *Let Us C*, Infinity Science Press, LCC, 2008.
14. Allen Mottershed: *Electronic Devices and Circuits*, PHI, 2005.
15. Jacob Millman and Christos C. Halkias: *Electronic Devices and Circuits*, TMH, 2000.
16. A.P. Malvino and D.P. Leach: *Digital Principle and Applications 4th Ed*. TMH, 1990.
17. M. Morris Mano: *Digital Design*, 4th Ed., Pearson, 2001.