Semester wise B.Sc. Syllabus
in the subject of Physics

UNIVERSITY OF JAMMU

PHYSICS
(Semester-III)
(For examinations to be held in the years 2015, 2016, 2017)

Course No. : PH-301(Theory) **Title: Mathematical Methods, Thermodynamics and Electronics-I**

Duration: 3 hours **Maximum Marks: 100**

Theory Examination: 80 Marks

Credits: 4 **Internal Assessment : 20 Marks**

Unit-I: *Electronics*

P-N junction diode as half wave and Full wave rectifier. Ripple factor and efficiency of HWR and FWR.Zener diode and its characteristics. Zener diode as voltage regulator, construction and characteristics of unijunction diode, tunnel diode and light emitting diode. Construction, working and characteristics of UJT, SCR and JFET.

Chacteristics of a transistor in common- base and common emitter modes (both npn & pnp). Operational amplifier and its applications as adder and inverter. Logic gates: OR, AND, NOT, NOR and NAND, XOR.

Unit-II: *Fourier Series*

Periodic functions, even and odd functions continuous and discontinuous functions, Dirichlet's conditions, sine and cosine series, properties of Fourier series, complex form of Fourier series, graphical representation of a function, extension of interval, Fourier solution of simple functions. Applications of Fourier theorem to square wave, rectangular wave, half wave rectifier and full wave rectifier.

Unit-III: *Differential equations*

Legendre differential equation and its series solution. Legendre polynomial, generating function, orthogonality property, recurrence relations.

Hermite differential equation and its series solution. Hermite polynomial, generating function, orthogonality property, recurrence relations.

Unit-IV: *Thermodynamics I*

Second law of thermodynamics, Carnot theorem, thermodynamic scale of temperature and its identity with gas scale, Entropy, statistical definition of entropy, additive nature of entropy, entropy changes in reversible and irreversible processes, law of increase of entropy with examples. T-S diagram, entropy and disorder. Heat death of universe, impossibility of attaining absolute zero. Nernst heat theorem and third law of thermodynamics.

Adiabatic expansion, Joule Thomson expansion, Boyle temperature, temperature of inversion and critical temperature of a gas. Principle of regenerative cooling and of cascade cooling.

Unit-V: *Thermodynamics II*

Extensive and intensive thermodynamic variables, Maxwell's general relationships. Application to Joule- Thomson cooling. Clasius Clapeyron latent heat equation. Thermodynamic potentials and equilibrium of thermodynamic system relation with thermodynamic variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

Hint for examiners/paper setters

The question paper shall be of 80 marks. There shall be 10 questions in the paper with two from each unit. Each question shall be of 16 marks. The students have to attempt five questions selecting one from each unit. In each question, part A of would be a numerical /short answer type question of 4 marks while part B would be long answer type question comprising 12 marks.

Books for Study and Reference:

1. Principles of Electronics-V. K. Mehta, S. Chand & Co.
2. Basic Electronics - B. L. Theraja, S. Chand & Co.
3. Basic Electronics and Linear Circiuts - Bhargava and Gupta, Tata McGraw Hill.
4. Solid State Physics and Electronics - Babbar and Puri.
5. Mathematical Physics - Rajput.
6. Mathematical Physics - Satya Parkash, S. Chand & Co.
7. Statistical Physics and Thermodynamics - V.S. Bhatia
8. Heat, Thermodynamics and Statistical Physics - Singhal, Agarwal and Satya Parkash.
9. Heat and Thermodynamics - M. S. Yadav.
10. Statistical and Thermal Physics - S. Lokanathan and R. S. Gambir.
11. Thermodynamics and Statistical Physics - J.K. Sharma
12. Heat and Thermodynamics - M. W. Zeemansky and R. Dittman.

Physics
(Semester-III)
(For examinations to be held in the years 2015, 2016, 2017)

Course No. : PH-301(Practical) **Title: Lab Course III**

Duration: 3 hours **Maximum Marks: 50**

External Examination: 25 Marks

Credits: 2 **Internal Examination: 25 Marks**

Note: *The candidates are required to complete atleast 5 practicals.*

1. Find V-I characteristics of PN Junction Diode.
2. To Find V-I characteristics of Zener Diode
3. To find the Ripple factor of Half wave rectifier with different filters.
4. To find the Ripple factor of Full wave rectifier with different filters.
5. To find Input/output characteristics of common base PNP/NPN transistor.
6. To find Input/output characteristics of common emitter PNP/NPN transistor.

Note for distribution of 25 Marks in internal Assessment in Practical Examination

i) Ist assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

ii) 2nd assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

iii) Class Test : 08 Marks

iv) Regularity of Attendance : 05 Marks

Reference Books

1. B. Sc Practical Physics - C. L. Arora.
2. Practical Physics - G L Squires Cambridge University Press
3. Advanced Practical Physics for Students - Worsnop and Flint
4. Practical Physics - R K Shukla
5. B.Sc Practical Physics - Harnam Singh

PHYSICS
(Semester-IV)
(For examinations to be held in the years 2016, 2017, 2018)

Course No. : PH-401(Theory) **Title: Waves, Optics and Statistical Mechanics**

Duration: 3 hours **Maximum Marks: 100**

Theory Examination: 80 Marks

Credits: 4 **Internal Assessment : 20 Marks**

Unit-I: *Waves*

Wave equation in simple and differential form, general solution of wave equation, velocity of transverse waves in a string, velocity of longitudinal waves in a fluid, energy density and intensity of a progressive wave, phase and group velocity, characteristic impedance of a string, reflection and transmissions of transverse waves in a string at boundary (discontinuity), reflection and transmission coefficients, impedance matching.

Superposition principle and Linearity, stationary/ standing waves on a string of fixed length, eigen functions, energy of a vibrating string, eigen frequencies.

Unit-II: *Optic-I Interference*

Condition for interference, Young's double slit experiment, theory of interference fringes, Fresnel's Biprism and its application to the determination of wave length of sodium light, phase change on reflection, thin films (reflected and transmitted cases), Newton's rings, determination of refractive index of liquid and wavelength of monochromatic light. Michelson's interferometer and its application to determination of (i) wave length of monochromatic light (ii) thickness of thin transparent plate (iii) resolution of spectral lines (iv) Determination of refractive index of glass.

Unit-III: *Optic-II Diffraction*

Fresnel's diffraction, Fresnel's half – period zones, rectilinear propagation of light, zone plate, action of zone plate, diffraction a straight edge, rectangular slit and thin wire, Fraunhofer diffraction, one slit diffraction, two slit diffraction, plane transmission grating, determination of wavelength of monocromatic light using grating, width of principal maximum, absent spectra, dispersive power of grating, limit of resolution, Rayleigh's criterion, resolving power of grating.

Unit-IV: *Optic-III Polarization*

Polarization by reflection, Brewster's law, Malus Law , phenomenon of double refraction, Huygen Theory of double refraction, Nicol prism, quarter wave plate and half wave plate; theory, production and detection of plane, circularly and elliptically polarized light, optical activity, specific rotation, Laurent's half shade polarimeter.

Unit-V: *Statistical Mechanics*

Probability, macro and micro states, thermodynamic probability, effects of constraints on a system, deviation from the state of maximum probability, equilibrium state of a dynamic system. Distribution of n distinguishable particles in K compartments of unequal sizes. Phase space, types of statistics, Boltzmann' s distribution law, Maxwell's distribution of speeds and velocities, mean, r.m.s. and most probable speeds, Bose – Einstein (B- E) statistics and distribution law, derivation of Planck's radiation law. Fermi Dirac (F – D) statistics and its distribution law, application of F-D statistics to electron gas in metals, Zero point energy.

Spatial distribution of black body radiation, Rayleigh – Jean's law, the ultraviolet catastrophe, Planck's law and deduction of Wien and Rayleigh Jean's law from Planck's law.

Hint for examiners/paper setters

The question paper shall be of 80 marks. There shall be 10 questions in the paper with two from each unit. Each question shall be of 16 marks. The students have to attempt five questions selecting one from each unit. In each question, part A of would be a numerical /short answer type question of 4 marks while part B would be long answer type question comprising 12 marks.

Books for Study and Reference

1. Waves and Oscillations, Berkeley Physics course Vol. III.
2. The Physics of Vibrations and Waves - H.J. Pain, Mac Millan.
3. Vibrations and Waves - French.
4. Optics - Brijlal, Subrahmanyam and M.N. Avadhanulu, S. Chand & Co.
5. Optics – Jenkins & White, McGraw Hill.
6. Waves, Optics and Electronics - K.K. Sharma, Sharma Publications.
7. Introduction to Statistical Mechanics by B. B. Laud
8. Statistical Physics by M. Reif.
9. Statistical Physics by K. Haung.
10. Statistical and Termal Physics by S. Lokanathan and R. S. Gambir.
11. Thermodynamics and Statistical Physics by J.K. Sharma

Physics
(Semester-IV)
(For examinations to be held in the years 2016, 2017, 2018)

Course No. : PH-401(Practical) **Title: Lab Course IV**
Duration: 3 hours **Maximum Marks: 50**
External Examination: 25 Marks
Credits: 2 **Internal Examination: 25 Marks**

Note: *The candidates are required to complete atleast 5 practicals.*

1. To find Refractive index of water by using hollow prism.
2. To find Refractive index of O-ray and E-ray.
3. To find wave length by using Diffraction Grating.
4. To find wave length of Sodium light using Newton's Rings.
5. To find specific rotation of sugar by polarimeter.
6. To find Cauchy's Constant.
7. Michelson Interferometer.

Note for distribution of 25 Marks in internal Assessment in Practical Examination

i) Ist assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

ii) 2nd assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

iii) Class Test : 08 Marks

iv) Regularity of Attendance : 05 Marks

Reference Books

1. B. Sc Practical Physics - C. L. Arora.
2. Practical Physics - G L Squires Cambridge University Press
3. Advanced Practical Physics for Students - Worsnop and Flint
4. Practical Physics - R K Shukla
5. B.Sc Practical Physics - Harnam Singh

PHYSICS
(Semester-V)
(For examinations to be held in the years 2016, 2017, 2018)

Course No. : PH-501(Theory) **Title: Atomic, Nuclear Physics & Quantum Mechanics**

Duration: 3 hours **Maximum Marks: 100**

Theory Examination: 80 Marks

Credits: 4 **Internal Assessment : 20 Marks**

Unit-I: *Quantum Mechanics-I*

Limitations of Classical Laws (Qualitative description), Quantum Nature of Radiation, Compton Effect and its Experimental Verification, Wave–Particle Duality, Davisson and Germer Experiment, Wave Packets, Phase and Group Velocity, Wave Packets and Uncertainty Principle, Applications of Uncertainty Principle to (i) Particle in a box, (ii) Electron Diffraction from a single Slit.

Derivation of Schrodinger Equation in time dependent and independent forms, Wave function and its physical Significance, Physical Observables and Operators, Experimental Values, Probability Current Density and Continuity Equation, Statement and Proof of Ehrenfest's Theorem.

Unit-II: *Quantum Mechanics-II*

One Dimensional Problems: Solution of Schrodinger Wave equation for (i) Particle in a box (ii) Step Potential (calculation of Reflection I and Transmission Coefficients (T)) (iii) Potential Barrier for $E>0$ and $E<0$ (Tunnelling effect) and (iv) Harmonic Oscillator.

Three dimensional Problems: Schrodinger Equation for a Spherically Symmetric Potential in Spherical Polar Coordinates, its separation into angular, radial equations using variable separable method, Solution of Radial equation for Coulomb type of potential, Interpretation of Principal Quantum (n), Solution of equations of Angular part and Interpretation of '*l*' and 'm' quantum numbers, Hydrogen Atom Wave Functions.

Unit-III: *Atomic Physics*

Frank and Hertz Experiment, Space Quantization, Larmor's Precession, Bohr's Correspondence Principle, Electron spin, Stern Gerlach Experiment, Vector Atom Model (*ls*, *jj* coupling), Spectroscopic Terms and their notations, Spin-Orbit interaction, Fine Structure of Hydrogen Atom, Normal and Anomalous Zeeman Effect (explanation by Classical and Quantum theory), D1, D2 lines of Sodium Atom, Lande 'g' factor, Paschen Back Effect for one electron atoms.

Unit-IV: *Nuclear Physics –I*

Basic nuclear properties: Size Measurement of Nuclear Radius by Electron Scattering method and Mirror Nuclei method, Nuclear Density, Packing Fraction, Mass Defect, Binding energy, Discussion of Average Binding energy curve, Nuclear Stability, Nuclear Spin and Magnetic Moments, Liquid Drop Model of Nucleus, Weizsacker's Semi-Empirical Mass Formula, Nuclear Forces and their properties (qualitative treatment), Radioactive Series, Alpha Decay (qualitative treatment), Discrete Nature of α-particle energies, Measurement of velocity of α-particle, Beta Decay, Beta particle energy spectrum, Pauli's theory of Neutrino, Inverse Beta decay, Simple idea about Gamma Decay.

Unit-V: *Nuclear Physics –II*

Energy Loss of charged particle through matter, theory of particle detectors like Ionization Chamber, Proportional Counter and G.M. Counter, Classification of elementary particles, Strangeness, Baryon Number and Isospin, Parity Quantum Number, Gell Mann Nishizima Scheme, Quark as the basic constituent of matter, quark properties, Quark contents in low lying Baryons and Mesons, Fundamental Forces (Strong, Weak and Electromagnetic and their characteristics).

Hint for examiners/paper setters

The question paper shall be of 80 marks. There shall be 10 questions in the paper with two from each unit. Each question shall be of 16 marks. The students have to attempt five questions selecting one from each unit. In each question, part A of would be a numerical /short answer type question of 4 marks while part B would be long answer type question comprising 12 marks.

Books for Study and Reference

1. Quantum Mechanics – L.I. Schiff, Mc.Graw Hill Books Company Inc.
2. Quantum Mechanics – B. Craseman and J. D. Powell, Addison Wesley
3. Concepts of Modern Physics – A. Beiser, Tata McGraw Hill Publication.
4. Atomic Spectra – H.E. White, Tata McGraw Hill.
5. Fundamentals of Molecular Spectroscopy – C. N. Banwell and E. M. Mac Cash, Tata McGraw Hill.
6. Atomic Spectra – G. Heizberg.
7. Molecular Spectra & Molecular Structure – G. Heizberg.
8. Nuclear Physics – D.C.Tayal, Himalaya Publishing House.
9. Nuclear Radiation Detector – S.S.Kapoor.
10. Nuclear Physics – Ghoshal.

Physics
(Semester-V)
(For examinations to be held in the years 2016, 2017, 2018)

Course No. : PH-501(Practical) **Title: Lab Course V**
Duration: 3 hours **Maximum Marks: 50**
External Examination: 25 Marks
Credits: 2 **Internal Examination: 25 Marks**

Note: *The candidates are required to complete atleast 5 practicals.*

1. To find Dispersive power of a prism.
2. To find Brewster Angle and refractive index of material of given prism.
3. To find Self-inductance by Enderson Method.
4. Find Voltage regulating characteristic of Zener Diode.
5. Thyratron ball.
6. To find e/m by Helical Method.

Note for distribution of 25 Marks in internal Assessment in Practical Examination

i) Ist assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

ii) 2nd assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

iii) Class Test : 08 Marks

iv) Regularity of Attendance : 05 Marks

Reference Books

1. B. Sc Practical Physics - C. L. Arora.
2. Practical Physics - G L Squires Cambridge University Press
3. Advanced Practical Physics for Students - Worsnop and Flint
4. Practical Physics - R K Shukla
5. B.Sc Practical Physics - Harnam Singh

PHYSICS
(Semester-VI)
(For examinations to be held in the years 2017, 2018, 2019)

Course No. : PH-601(Theory) **Title: Solid State Physics, Electronics-II & Quantum Optics**

Duration: 3 hours **Maximum Marks: 100**

Theory Examination: 80 Marks

Credits: 4 **Internal Assessment : 20 Marks**

Unit-I: *Electronics*

Classification of amplifiers, General principles of operation of small signal amplifiers, Distortion in amplifiers, Hybrid parameters and equivalent circuit, Gain and frequency response(low, mid, high) of R-C couple and transformer coupled amplifiers, feedback in amplifiers and its types, voltage gain of feedback amplifiers, noise in electronic circuits.

Classification of transistor oscillators, Barkhausen criteria, Hartley, Colpitt and Phase shift oscillators.

Unit-II: *Solid State Physics-I*

Periodicity, Lattices and bases, Unit cell and Wigner –Seitz cell, Symmetry operations, Bravais lattices in two and three dimensions, Miller Indices, Some examples of identification of crystal planes, Interplanar spacing between lattices, Reciprocal lattice and its application to simple cubic, bcc and fcc.

Laue's theory of X-ray diffraction, Bragg's law, Experimental methods in X-ray diffractions (laue, Rotating crystal and powder method)

Unit-III: *Solid State Physics-II*

Lattice vibrations, Harmonic motion, Normal modes of lattice, vibration of one-dimensional monoatomic chain under harmonic and nearest neighbour approximation, density of modes, specific heat of solids, Einstein's Theory and Debye's model of specific heat of solids

Langvein's classical theory and quantum theory of paramagnetism, Superconductivity, Meissner effect, Type I & II superconductors, Josephson's junctions, BCS theory (elementary idea), Ferroelectric crystals and their applications, Crystal defects. Schottky and Frankel defects, Equilibrium number of Frankel and Schottky defects

Unit-IV: *Quantum Optics-I*

A. Mechanism of light emission

Electric dipole, Retarded potentials, Oscillating electric dipole, Wave mechanical explanation of photon emission, Raman effect-classical and quantum mechanical explanation, properties of spectral lines, Luminescence

B. Fibre Optics

Optical fibre and its types, Critical angle of propagation, modes of propagation, Acceptance angles, Numerical aperture, Pulse dispersion, Attenuation and its various mechanism, Advantages and applications of optical fibres.

Unit-V: *Quantum Optics-II*

Attenuation of light in an optical medium, Thermal equilibrium, Interaction of light with matter, (absorption, spontaneous, Einstein's prediction, stimulated emission), Einstein's relations, Light amplification, Population inversion, Pumping, Principal pumping schemes (three and four levels) Optical resonant cavity, conditions for laser action.

Types of lasers (Ruby, He- Ne and semiconductor), Characteristics and applications of laser

Hint for examiners/paper setters

The question paper shall be of 80 marks. There shall be 10 questions in the paper with two from each unit. Each question shall be of 16 marks. The students have to attempt five questions selecting one from each unit. In each question, part A of would be a numerical /short answer type question of 4 marks while part B would be long answer type question comprising 12 marks.

Books for Study and Reference

1. A Text Book of Electrical Technology - B. L. Theraja, S. Chand & Co.
2. Principles of Electronics - V. K. Mehta, S. Chand & Co.
3. Solid State Physics & Electronics - Babbar & Puri, R. Chand
4. Introduction to Solid State Physics - C. Kittel, John wiley & Son 7th Editio.
5. Solid State Physics - S.O. Pillai, New Age International
6. Solid State Physics - A. J. Decher, Macmillan
7. Elementary Solid State Physics - R. Raramaswamy, Lakshmi Publications, Madhurai
8. Superconductivity - T. V. Ramakrishnan and N. R. Rao, Wiley Eastern Ltd.
9. Solid State Physics - R. L. Singhal, Kedar Nath and Co.
10. Solid State Physics - G. I. Epifanov, Mir Publishers, Mowcow

Physics
(Semester-VI)
(For examinations to be held in the years 2017, 2018, 2019)

Course No. : PH-601(Practical) **Title: Lab Course-VI**
Duration: 3 hours **Maximum Marks: 50**
External Examination: 25 Marks
Credits: 2 **Internal Examination: 25 Marks**

Note: *The candidates are required to complete atleast 5 practicals.*

1. To find frequency response of series LCR Circuit.
2. To find frequency response of parallel LCR Circuit.
3. Study RC coupled Amplifier.
4. To study Operational Amplifier inverting and non inverting.
5. Four-Probe energy graph.
6. Study Logic Gates.

Note for distribution of 25 Marks in internal Assessment in Practical Examination

i) Ist assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

ii) 2nd assessment on the basis of day-to-day performance in the Laboratory: 06 Marks

iii) Class Test : 08 Marks

iv) Regularity of Attendance : 05 Marks

Reference Books

1. B. Sc Practical Physics - C. L. Arora.
2. Practical Physics - G L Squires Cambridge University Press
3. Advanced Practical Physics for Students - Worsnop and Flint
4. Practical Physics - R K Shukla
5. B.Sc Practical Physics - Harnam Singh