VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI

Department of Studies in Physics

BACHELOR OF SCIENCE

SYLLABUS

(I to VI Semester)

With effect from 2016-17

BACHELOR OF SCIENCE IN PHYSICS
COURSE OF VSK UNIVERSITY
VIJAYANAGAR SRIKRISHNADEVARAYA UNIVERSITY, BELLARY

B. Sc. PHYSICS Syllabus

Semester	Code No.	Title of the paper	Examination Hours	Max marks	I A marks	Teaching hours
I	PHY-101	Paper I: Mechanics and Properties of matter	3 Hrs	80	20	4 Hrs/week
	PHY-101	Practical	3 Hrs	40	10	3x2=6 hrs
II	PHY-201	Paper II: Heat, Thermodynamics, Waves & Oscillations	3 Hrs	80	20	4 Hrs/week
	PHY-201	Practical	3 Hrs	40	10	3x2=6 hrs
III	PHY-301	Paper III: Electricity, Vector analysis & ectromagnetic theory	3 Hrs	80	20	4 Hrs/week
	PHY-301	Practical	3 hrs	40	10	3x2=6 hrs

IV	**PHY-401** PHY-401	Paper –IV Physical Optics, Fibre Optics and ɔmputational Physics **Practical**	**3 Hrs** **3 hrs**	**80** **40**	**20** **10**	**4 Hrs/week** **3x2=6 hrs**
V	**PHY-501** PHY-501	Paper -V: Atomic & Molecular Physics **Practical**	**3 Hrs** **3 hrs**	**80** **40**	**20** **10**	**3 Hrs/week** **3x2=6 hrs**
V	**PHY-502** PHY-502	Paper -VI R elativity, Statistical mechanics, Quantum mechanics & Electronics-I **Practical**	**3 Hrs** **3 hrs**	**80** **40**	**20** **10**	**3 Hrs/week** **3x2=6 hrs**
VI	**PHY-601** **PHY-601**	Paper VII: Nuclear physics, Solid State Physics, Astrophysics & Biophysics **Practical**	**3 Hrs** **3 hrs**	**80** **40**	**20** **10**	**3 Hrs/week** **3x2=6 hrs**
VI	**PHY-602** **PHY-602**	Paper –VIII: Material Science & Electronics-II **Practical**	**3 Hrs** **3 hrs**	**80** **40**	**20** **10**	**3 Hrs/week** **3x2=6 hrs**

C. INSTRUCTIONS TO TEACHERS

1 Lectures must be delivered on all the topics in the syllabus. Use only SI units.

2 The allotted hours for each chapter are only the teaching hours. If required, extra classes can also be engaged with the permission of the Head of the Department/Principal.

3 Complete teaching notes should not be dictated in the class. Notes in the form of highlights may be distributed.

4 A good number of problems must be solved on all possible topics in the syllabus so that the students can appreciate the concepts, phenomenon, ideas and theories and also get acquainted with physical quantities and their units.

5 Home work in the form of assignments/problems must be given to the students.

6 Class seminars by the students be conducted. Participation of students in the conferences, Science exhibitions etc., be encouraged.

7 A good number of problems must be solved on all possible topics in the syllabus so that the students can appreciate the concepts, phenomenon, ideas and theories and, get acquainted with physical quantities and units.

D. LABORATORY INSTRUCTIONS TO STUDENTS

1 Measurements and results must be written in SI units only.

2 Required number of experiments in each semester must be performed in order to be eligible for taking semester end examination.

3 Measurements, calculations and results must be recorded in the observations book first and get them verified and signed by the course teacher in the Laboratory. After that, they can be copied to the Practical Journal.

4 After completing all the experiments in the given semester and writing up the Journals, students have to get certify their Journals by the Head of the Department after due verification by the concerned teachers.

5 An internal practical test for 10 marks in each semester shall be conducted and all the students must have to appear for the test. For absentees, it cannot be conducted again under any circumstances.

6 Candidates will be permitted to take Semester end practical examinations only if they produce a certified Practical Journal. If the candidate fails produce the certified journal and produces a letter from the Head of the Department/Principal to the effect that he/she has completed the concerned practical course, then the candidate will be allowed for the examination. However, such candidates will loose marks prescribed

for the journal.

E. SCHEME OF EXAMINATION

In each course (paper), there shall be an **Internal Test** and **Semester End Examination**. Internal Test (one hour duration) shall be conducted for **20** marks in theory courses and **10** marks (three hours duration) in practical courses. Similarly, Semeter End Examination shall be conducted for **80** marks in theory courses and **40** marks in practical courses. Division of marks in practical examinations is detailed below.

Internal Practical Test			Semester End Practical Examination		
No.	Item	Max.marks	No.	Item	Max.marks
1	Journal	02	1	Journal	08
2	Experimental skill	02	2	Circuit diagram / ray diagram / Measurements	08
3	Measurements	02	3	Experimental skill	08
4	Graph/calculation/result	02	4	Graph/calculation/result	08
5	Viva	02	5	Viva	04
			6	Procedure	04

B. Sc (Semester I) Examination
Optional-PHYSICS

Model Question Paper for Semester End Examination

Paper1: Mechanics and Properties of matter

Time: 3 hours **Max. Marks: 80**

Instructions: 1. Answers all the questions of Section A.
2**.** Answer any five questions from Section B and four questions from Section C.

SECTION-A

Marks

1. What kind of force is responsible for whirlwinds and cyclones? (1x15)

   Ans: Corioli's force.

2. Why centripetal and centrifugal forces do not constitute action and reaction pair?

   Ans: They cannot form action and reaction pair because both the force act on the same body.

3. Two similar spheres A and B suffer head-on elastic collision. If their respective velocities before the collision are $2ms^{-1}$ and $3ms^{-1}$, what is velocity of A just after the collision?

   Ans: The two bodies exchange their velocities during the elastic head-on collision. Therefore, the velocity of A soon after the collision becomes $3ms^{-1}$.

4. What is the force that controls the planetary motion.

   Ans: Gravitation.

5. Name the liquid for which liquid the angle of contact is obtuse.

   Ans: Mercury.

6. Give the limiting values of Poison's ratio.

   Ans: The limiting values of Poison's ratio, σ, is $-1<\sigma<1/2$

7. Why the race-tracks are saucer shaped?

   Ans: To provide essential centripetal force and thereby avoiding the vehicle Skidding

8. Mention the advantage of using I-section girders.

   Ans: To save the money and material without compromising quality.

9. State the condition for dynamic equilibrium of a body.

   Ans: The body must have a uniform velocity.

10. Mention the condition for a closed orbit.

    Ans: For a closed orbit such as elliptical path, the satellite must possess a net negative energy, E. i.e., E ‹ 1

11. Steel is more elastic than rubber- give justification for this statement.

    Ans: The elasticity is measured not by the amount of deformation suffered by the degree recovery. When the steel and rubber are deformed to the same extent,
    The steel regains its original shape and size more than that of rubber.
    Therefore, steel is considered to be more elastic than rubber.

12. What is multistage rocket?

    Ans: A multi-stage rocket is a combination of rockets joined one inside other so that it reaches its destiny in a more than one stage.

13. What is the weight of a body of mass 10kg on a lift falling under the action of gravity?

    Ans: Zero

14. If ‘a’ is the amplitude of the particle performing simple harmonic motion, then at what distance form the mean position the particle has its kinetic energy is equal to potential energy.?

    Ans: We have, $E_k = \frac{1}{2} m\omega^2 \left(a^2 - y^2\right)$ and $E_p = \frac{1}{2} m\omega^2 y^2$

    when, $E_p = E_k$ then we get $y = a/\sqrt{2}$

15. Write the general expression for the excess pressure inside a curved surface.

    Ans: $\Delta p = T(1/R_1 + 1/R_2)$

SECTON –B

16.	Write a note on a geo-stationary satellite.	(5)
17.	State and prove parallel axes theorem.	(5)
18.	Derive an expression for couple per unit twist.	(5)
19.	Describe single stage rocket and derive an expression for its velocity neglecting the weight of the rocket.	(5)
20.	What is a frame of reference? Deduce Galilean transformation equations for length, velocity and acceleration.	(5)
21.	Derive a general expression for the pressure within the curved surface of a liquid.	(5)
22.	Show that the velocity after a perfect plastic collision between two bodies is zero in the centre of mass frame of reference.	(5)

SECTION-C

23.	Deduce expressions for radial and transverse components of velocity and acceleration.	(10)
24.	a) Derive Poiseuille's equation for a steady flow of liquid through a capillary tube. b) A coin of 2gm is pushed down on a vertical spring compressing the spring by 1cm. The force constant for the spring is $40Nm^{-1}$.How far from this position will the coin go up if it is released?	(7+3)
25.	a)Describe Boy's method to determine the universal gravitational constant G. b) The earth is revolving around the sun in circle of radius 1.5×10^{11}m. Find the mass of the sun. Given; G =$6.67x10^{-11}$ SIU	(8+2)
26.	a) Give the theory of compound pendulum. b) A thin uniform bar of 1.20m is oscillating about one end in a vertical plane. Find the period of oscillation and locate the point of oscillation.	(7+3)
27.	a) Obtain an expression for the bending moment of a rectangular beam. b) The length of a wire increases by 8 mm when a load of 3kg is hung. If diameter of the wire is doubled and rest of the conditions are the same then what is the possible extension in the wire?	(7+3)
28.	a) Derive an expression for finding the moment of inertia of a solid cylinder about an axis passing through the centre of gravity and perpendicular to its length. b) By the knowledge of moment of inertia how do you distinguish between a solid sphere and a hollow sphere of same size and mass?	(8+2)

Instruction to the paper setter: The questions of Section A should not be of objective type. They must test the students for their understanding of Physics concepts/phenomenon/theory and Scientific reasoning. Each chapter in the syllabus must be represented in the question paper proportionate to the teaching hours prescribed against it.

B.Sc Semester I

Paper 1: Mechanics & Properties of Matter

Code :PHY-101 Univ Code :
Contact Hours :56 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Frames of Reference** 8 hrs

Inertial frames. Galilean transformation equation for position, length, velocity, momentum, acceleration. Non inertial frames, fictitious force, Rotating frame of reference, concept of Corioli's force (derivation) and effects of Corioli's force. Centre of mass and it's characteristics. Motion of centre of mass and centre of mass as frame of reference.

2. **Conservation laws** 10 hrs

Linear momentum
Law of conservation of linear momentum. Elastic collision; head-on and oblique collisions in one dimension. Newton's law of impact. Inelastic collision-expression for the loss of kinetic energy in one-dimension. Conservation of momentum in case of variable mass. Examples: single stage rocket,-expression for velocity and multi stage rocket.

Angular momentum
Angular momentum-relation to angular velocity and torque. Conservation of angular momentum. Illustrative examples such as. Ballet dancer, skating motion of a planet around the sun (proof of Kepler's second law of planetary)

Energy
Conservation of energy as a basic principle. Illustrations with verification of law of conservation of energy for a particle executing Simple Harmonic Motion and spiral spring.

3. **Rigid bodies** 10 hrs
Rotational motion about an axis, concept of moment of inertia (MI), radius of gyroton, $L = I\omega$, $\tau = I \times Mg$, Perpendicular and parallel axes theorems with proof. Calculation of moment of inertia of thin uniform rod, uniform bar of rectangular area of cross section, circular disc, annular ring, solid sphere and hollow cylinder-extension to the solid cylinder as a special case of hollow cylinder. Theory of compound pendulum and its properties. Bar pendulum and fly wheel (theory and experiment).

4. **Elasticity** 10 hrs

Review of elastic behavior of solids in general, origin of elastic forces, stress- strain diagram, elastic limit and hook's Law. Moduli of elasticity, Poisson's ratio, relation among elastic constants:
$k = y/3(1-2\sigma), n = y/2(1+\sigma)\ \&\ 3/y = (1/n) + (1/3k)$

Torsion; Expression for couple per unit twist. Torsion pendulum-theory and experiment. Work done in stretching and twisting a wire.

Bending: Bending moment, mention of expression for bending moment, theory of light cantilever, uniform bending –beam loaded at the centre and I-section girder.

5. **Gravitation** 3 hrs

Newton's law of gravitation, Kepler's laws of planetary motion-explanation without derivations, elements of satellite motion and geostationary satellite.

6. **Surface Tension** 7 hrs

Surface tension, cohesive and adhesive forces, angle of contact and surface energy. Derivation of general expression for excess pressure within a curved surface – extension to excess pressure inside liquid drop and soap buddle. Effect of temperature on surface tension (qualitative).Theory and experiment of drop weight method and interfacial surface tension.

7. **Viscosity** 6 hrs

Streamline, turbulent motion, critical pressure and equation of continuity. Coefficient of viscosity. Poiseuille's equation (derivation). Motion of a body in a viscous medium, stokes' law, terminal velocity and its significance. Effect of temperature on viscosity of liquids (qualitative).

Reference books

1. Mechanics by D.S. Mathur
2. Mechanics by J.C. Upadhaya
3. Properties of matter by D.S. Mathur
4. Properties of matter by Brijlal & Subrmanyam
5. Physics for Degree Students (B.Sc. I year) by C.L. Arora and P.S Hemne
6. Physics Vol. I by Resnick by Halliday and krane
7. Berkely Physics Vol I

Practical Course for Semester I

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 10 marks be conducted at the end of practical course in the semester.
3. Minimum of 12 experiments from the list mentioned below should be performed in semester I. Of these, one experiment can be open ended type (Course teacher may develop a new innovative experiment and introduce into the course). Open ended experiment must also be considered for examination.

List of experiments

1. Bar pendulum- T versus L graph.
2. Bar pendulum- L^2 versus LT^2 graph.
3. M.I. of fly –wheel.
4. Moment of inertia of an irregular body.
5. Torsion pendulum –Rigidity modulus.
6. Verification of parallel axes theorem.
7. Verification of perpendicular axes theorem.
8. Y- by stretching – elongation versus load graph.
9. Verification of Hook's law and determination of unknown mass.
10. Y- by uniform bending – load depression method.
11. Y- by cantilever.
12. Y- by oscillation method.
13. Y- by Koenig's method and determination of unknown load.
14. Elastic constants by Searle's double bar.
15. Rigidity modulus by static torsion method.
16. Surface tension and interfacial tension by drop-weight method.
17. Surface tension and angle of contact by Quincke's drop method.
18. Coefficient of viscosity by Stokes' method.
19. Viscosity by poiseuille's method.
20. Determination of g and unknown mass by spiral spring.
21. Critical pressure for stream line flow.
22. Radius of capillary tube by mercury pellet method.

Syllabus for B. Sc. II Semester
Optional Physics

Paper 2: Heat, Thermodynamics, Waves & Oscillations

Code :PHY-201 Univ Code :
Contact Hours :56 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Kinetic theory of gases** 7 hrs
Basic assumption of kinetic theory of gases and expression for pressure. Maxwell's law for the distribution of molecular velocity (no derivation), Average, r.m.s and most probable velocities (derivation), mean free path. Degrees of freedom and equipartition of energy, application to the specific heats of gases.

2. **Thermodynamics** 10 hrs
First law of thermodynamics and its applications like C_p-C_v = R & L (latent heat). Work done in isothermal and adiabatic changes. Carnot's heat engine, carnot's cycle and expression for its efficiency. Principle of refrigeration.
Second law of thermodynamics (both Kelvin and clausius statements), Concept of entropy, entropy change in adiabatic and irreversible processes (during radiation and free expansion). Clausius & Clapeyron latent equations-variation in melting and boiling points.

3. **Low temperatures** 8 hrs
Ideal and real gases. Andrew's experiments, porous plug experiment. Expression for temperature of inversion. Principle of regenerative cooling, Linde's air liquefier, liquid nitrogen and liquid helium and their properties. Production of low temperatures by adiabatic demagnetization method. Concept of absolute zero temperature and third law of thermodynamics.

4. **Radiation** 7 hrs
Black body radiation and the spectrum of energy distribution, Kirchhoff's law of radiation, Stefan's law, Statements of wien's displacement law and Rayleigh-Jeans law, Derivation of Planck's law of radiation, deduction of wien's, Rayleigh-jeans and Stefan's laws from the Planck's law. Radiation pressure (no derivation). Crookes' radiometer.

5. **Oscillations** 7 hrs
Review of Simple Harmonic Motion (SHM) - derivations of K.E and P.E at any instant. Expression for frequency from the equation $F \propto x$ (derivation). Theory of superposition of SHMs at right angles to each other- Lissajous' figures. Forced, free and damped vibrations- write their respective differential equations and discuss their solutions in exponential form (qualitative) Resonance

(discus amplitude and phase at resonance).

6. **Waves** 5 hrs

Wave motion, General equation for progressive wave in one dimension, differential form of wave equation, derive relation between amplitude and intensity. Wave groups –wave velocity and group velocity, relation between wave velocity and group velocity.

7. Sound 7 hrs

Introduction to sound. Expression for the velocity of a longitudinal wave in a gas. Derivation of Newton's formula and discuss Laplace's correction. Effect of pressure, temperature, humidity and wind on the velocity of sound. Theory of stationary waves and beats. Longitudinal waves in a rod: expression for velocity and its harmonics in free- free rod and rod fixed at the middle (qualitative). Laws of stretched strings, transverse waves in a stretched string- expression for velocity and harmonics.

8. **Applied acoustics** 5 hrs

Sound transducers and their characteristics. Recording and reproduction of sound electrically (microphone and loudspeaker). Requisites of good auditorium. Absorption coefficient, reverberation time, Sabine's formula with derivation.

Reference Books

1. A text book of Heat by D.S. Mathur
2. A treatise on Heat by Shah and Srivastava
3. Heat and thermodynamics by J.B.Rajam
4. Heat and thermodynamics by Brijilal and Subramanyam.
5. A text book of sound by Braijilal and Subramanyam
6. Sound by Khanna and Bedi
7. Waves and Oscillations by A.P.French

Practical course for Semester II

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 10 marks be conducted at the end of practical course in the semester.
3. Minimum of 12 experiments from the list mentioned below should be performed in semester II. Of these, one experiment can be open ended type (Course teacher may develop a new innovative experiment and introduce into the course). Open ended experiment must also be considered for examination.

List of experiments

1. Thermal conductivity of poor conductor (rubber)
2. Thermal conductivity of good conductor by Searle's method.
3. Thermal conductivity of a bad conductor by Lee's method.
4. Emissivity of a surface.
5. Latent heat of steam.
6. Specific heat of liquid by cooling-graphical method.
7. J by electrical method.
8. Ratio of specific heats – Clement and Desorme method.
9. Stefan's constant.
10. Verification of Stefan- Boltzmann law.
11. J by continues flow method.
12. Platinum resistance thermometer-Determination of boiling point of a liquid.
13. Helmholtz resonator.
14. Laws of transverse vibrations of stretched string using sonometer.
15. Determination of velocity of transverse wave in stretched string using sonometer.
16. Laws of transverse vibrations of stretched string using Melde's apparatus.
17. Relative linear density using Melde's apparatus.
18. Frequency of electrically maintained tuning fork using Melde's apparatus.
19. Velocity of sound for higher model of vibrations or volume resonator using signal generator.

B. Sc. II Semester
Physics Open Elective
Elementary Physics

Contact Hours: 56 hrs Work load: 4 hours per week
Credit Points: 4

Unit I: Units and Measurement **12 hrs**

Units of measurement; systems of units; SI units, fundamental and derived units. Length, mass and time measurements; accuracy and precision of measuring instruments; errors in measurement; significant figures. Dimensions of physical quantities, dimensional analysis and its applications.

Unit II: Kinematics **16 hrs**

Frame of reference, Motion in a straight line: Position-time graph, speed and velocity. Uniform and non-uniform motion, average speed and instantaneous velocity. Uniformly accelerated motion, velocitytime and position-time graphs, relations for uniformly accelerated motion (graphical treatment). Elementary concepts of differentiation and integration for describing motion. Scalar and vector quantities: Position and displacement vectors, general vectors and notation, equality of vectors, multiplication of vectors by a real number; addition and subtraction of vectors. Relative velocity. Unit vectors. Resolution of a vector in a plane – rectangular components. Scalar and Vector products of Vectors. Motion in a plane. Cases of uniform velocity and uniform acceleration – projectile motion. Uniform circular motion.

Unit III: Laws of Motion **14 hrs**

Concept of force. Inertia, Newton's first law of motion; momentum and Newton's second law of motion; impulse; Newton's third law of motion. Law of conservation of linear momentum and its applications. Static and kinetic friction, laws of friction, rolling friction, lubrication. Dynamics of uniform circular motion: Centripetal force, basic examples of circular motion

Unit IV: Work, Energy and Power **14 hrs**

Work done by a constant force and a variable force; kinetic energy, work-energy theorem, power. potential energy, potential energy of a spring, conservative forces; conservation of mechanical energy (kinetic and potential energies); non-conservative forces; motion in a vertical circle, elastic and inelastic collisions in one and two dimensions.

Reference books

1. Concepts of Physics I by H C Verma
2. Concepts of Physics II by H C Verma
3. Mechanics by D S Mathur ties of matter by D.S. Mathur
4. Properties of matter by D.S. Mathur
5. Properties of matter by Brijlal & Subrmanyam
6. Physics for Degree Students (B.Sc. I year) by C.L. Arora and P.S Hemne
7. Physics Vol. I by Resnick by Halliday and krane

Syllabus for B.Sc. III Semester
Optional Physics

Paper 3: Electricity, Vector analysis & Electromagnetic theory

Code :PHY-301 Univ Code :
Contact Hours :56 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Basic Electrical Components** 3 hr
   Definitions of resistance, capacitance and inductance; color code and ratings and their defining equations. Ideas of reactance and impedance.

2. **Network Theorems** 6 hrs
   Revision of Kirchhoff's current and voltage laws, Voltage and current divider circuits. Thevenin's, Norton's Reciprocity and Maximum power theorems with examples.

3. **Alternating Currents** 15 hrs
   Expression for mean and rms values. Response of LR, CR and LCR circuits to sinusoidal voltages using j-operator. Series & parallel resonant circuits, band width, Q-factor. Power in electrical circuits, Maxwell and Anderson bridges, Derive expression for L and discuss experimental determination of L by Anderson bridge. RC Filter circuits: High pass & low pass.

4. **Cathode Ray Oscilloscope** 4 hrs
   Construction and working of cathode ray oscilloscope, Expression for electrostatic and magnetic deflection sensitivity, Measurement of voltage, current, frequency and phase of the signals using CRO.

5. **Galvanometers** 4 hrs
   Construction, working and theory of Helmholtz galvanometer, moving coil galvanometer, Dead beat galvanometer and Ballistic galvanometer. Construction and study of simple analog multimeter.

6. **Thermoelectricity** 7 hrs
   Seebeck, Peltier and Thomson effects. Thermo-emf as a function of temperature, neutral temperature and temperature of inversion, thermoelectric series, laws of thermoelectric effect, thermo-electric power, thermo-electric (Tait) diagrams. Thermo-couple and thermo-piles.

7. **Vector Analysis:** 5 hrs
   Review of vector algebra, vector calculus, Scalars and vectors. Gradient, divergence and curl and their physical significance. Vector identities.

Statements of Gauss, Stokes' and green's theorems.

8. **Electromagnetic Theory** 12 hrs

Coulomb's law, electrostatic field, Gauss law, applications of Gauss law, electrostatic potential, poison's & Laplace's equations. Biot- Savart law, Ampere's circuit law and its applications. Concept of dipole, current loop as a dipole. Torque on a dipole. Concept of displacement current. Maxwell's electromagnetic field equations (no derivations). Modified Ampere's circuit law. Wave equation for field vectors. Statement of Pointing theorem and its physical significance. Equation for plane electromagnetic waves in free space. Production of electromagnetic waves. Hertz experiment.

Reference books

1. Electricity and magnetism by K. K Tewari
2. Electricity and magnetism by Sehigal and Chopra
3. Electricity and magnetism by Khare and Srivastav
4. Physics part-II by Halliday and Resnik
5. Electrodynamics by B.B.Laud
6. Fundamentals of Electronics by B.Basavaraj

Practical course for Semester III

Instructions

1.	Two experiments (3 hours duration each) per week should be performed.
2.	One practical internal test of 3 hours duration for 10 marks be conducted at the end of practical course in the semester.
3.	Minimum of 12 experiments from the list mentioned below should be performed in semester III. Of these, one experiment can be open ended type (Course teacher may develop a new innovative experiment and introduce into the course). Open ended experiment must also be considered for examination.

List of experiments

1. Verification of current divider theorem and voltage divider theorem.
2. Verification of Thevenin 's theorem and reciprocity theorem.
3. Verification of Norton's theorem and maximum power transfer theorem.
4. Determination of time constant of an RC circuit (both charging and discharging).
5. Frequency of AC using Sonometer.
6. Determination of cut off frequency –RC low pass and high pass filters.
7. LCR series and parallel resonance –determination of resonant frequency, bandwidth and Q-factor.
8. Determination of time period, frequency, amplitude and phase of an ac signal using CRO.
9. Comparison of frequencies by Lissajous figures using CRO.
10. Determination of capacitance using de sauty's dc bridge using spot galvanometer.
11. De sauty's ac bridge – determination of capacitance of the given capacitor.
12. Construction of simple multimeter (single versatile circuit).
13. Study of variation of thermo emf with temperature.
14. Determination of B_H using Helmholtz galvanometer.
15. Measurement of low resistance.
16. Charge sensitivity of B.G.
17. Field along the axis of a circular coil using Biot and Savart apparatus (Magnetometer)
18. Dispersive power of prism/grating.
19. Double refraction –determination of and
20. Dispersive power of plane diffraction grating.
21. Diffraction grating –minimum deviation method.
22. Resolving power of prism.
23. Verification of Newton's formula for the equivalent focal length of two convex lenses separated by a distance (with principle plane, focal plane, nodal planes).

Syllabus for B.Sc. IV Semester
Optional Physics

Paper -4: Physical Optics, Fibre Optics and Computational Physics

Code :PHY-401 Univ Code :
Contact Hours :56 Work load : 4 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Interference of Light** 11 hrs

Review of theories of light. Huygens' principle, ideas of reflection, refraction and coherence of light. Interference, interference by division of wave front, young's double slit experiment, Fresnel's bi-prism (both theory and experiment). Interference by division of amplitude, thin film of uniform thickness and wedge shape, Newton's rings by reflection; theory and experiment, Michelson's interferometer and experimental determination of wavelength of sodium light and its doublet separation.

2. **Diffraction of light** 9 hrs

Diffraction, Concepts of Fresnel and Fraunhoffer diffractions. Rectilinear propagation of light. Theory of Zone plate, comparison between zone plate and convergent lens. Fresnel's diffraction at a straight edge and wire. Fraunhoffer diffraction at a single slit – derivation expression for intensity, with theory of double slit method. Transmission grating (both theory and experiment)-determination of wavelength of light. Dispersion and resolution of grating.

3. **Polarization of light** 9 hrs

Polarization, methods for obtaining polarized light. Double refraction in uniaxial crystals, Huygens' theory, positive and negative crystals and principal refractive indices. Huygens' construction of O and E rays in uniaxial crystals for plane wavefront. Quarter and half wave plates. Production and detection of plane, circularly and elliptically polarized light. Babinet compensator (qualitative). Optical activity; specific rotation, Fresnel's theory and Laurent's half shade polarimeter.

4. **Optical Instruments** 7 hrs

Cardinal points; Equivalent focal length of two thin convex lenses separated by a distance (derivation), tracing of cardinal points. Abberrations; Spherical and chromatic aberrations in lenses. Achromatic combination of lenses; in contact and separated by a distance. Huygens' and Ramsden's eye pieces.

5. **Optical fibres** 5 hrs

Review of the idea total internal reflection. Optical fibres: structure, dispersion & propagation of light through optical fibres, angle of acceptance, expression for numerical aperture and refractive index, applications of optical fibres.

6. **Computational Physics** 15 hrs

Flow charts and their symbols, simple examples for writing flow charts.

C language

Character set, reserved words, identifiers, constants and variables. Data types, operators; arithmetic, relational, logical, assignment, incrementing, decrementing and conditional operators, arithmetic expressions, input and output (I/O) functions.

Control Statements; GO TO, I/F, IF-ELSE statements and switch. Looping statements**;** WHILE, DO- WHILE and FOR. BREAK & CONTINUE statements. Arrays**;** one dimensional and two dimensional arrays, character strings.

(Practice C-programming to solve some numerical and simple physical problems concerning interference, diffraction and polarization of light)

Reference books

1. A Text Book of Optics by Brijilal and Subramanyam
2. Optics by Ajay Ghatak
3. A Text Book of Optics by D.S. Mathur
4. Optics & Spectrosecopy by R. Murugeshan- S Chand & Co.
5. Programming in ANSIC by E. Balguru Swamy
6. Introduction to Computers and C by P.B.Kotur

Practical course for Semester IV

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 10 marks be conducted at the end of practical course in the semester.
3. Minimum of 12 experiments from the list mentioned below should be performed in Semester IV. Of these, one experiment can be open ended type (Course teacher may develop a new innovative experiment and introduce into the course). Open ended experiment must also be considered for examination.

List of experiments

1. Interference at a wedge – Measurement of the thickness of paper separator.
2. Determination of wavelength of momochromatic light using biprism.
3. Newton's rings –Determination of radius of curvature and its verification by telescope method.
4. Diffraction at a wire – Diameter of wire.
5. Diffraction grating – Normal incidence method.
6. Diffraction of Cauchy's constants.
7. Conductivity of an electrolyte using Kohlrausch bridge
8. Brewster's law.
9. Resolving power of grating using spectrometer.
10. Resolving power of telescope.
11. Specific rotation of sugar solution using polarimeter.
12. Searle's Goniometer- Determination of equivalent focal length of combination of lenses for at least three separations and its verification.
13. Liquid lens –Determination of refractive index of liquid.
14. Measurement of numerical aperture of an optical fiber using LASER.
15. Measurement of fiber attenuation by cut beck method using LASER.
16. Determination of mutual inductance of a pair of coils using BG.
17. Turn table –equivalent focal length and cardinal points.
18. Sextant – height of an inaccessible object such as hill, tree ete.
19. Determination of coefficient of damping, relaxation time and quality factor of a damped oscillator.
20. C-programming –I on computer (Any four numerical problems to calculate area, volume of shapes, sum of the series, numerical integration).
21. C-programming –II on computer (Any four physical problems to calculate physical quantities concerning light experiments).

Syllabus for B.Sc. Semester V
Optional Physics

Paper -5.1: Atomic & Molecular Physics

Code :PHY-501 Univ Code :
Contact Hours :48 Work load : 3 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Basic Properties of Atom** 7hrs
Constitution of atom and its properties, Determination of charge of the electron by Millikan's oil drop method. Determination of specific charge of the electron by J.J. Thomson's method. Atomic mass determination by Dempster's method and atomic mass unit.

2. **Atomic models** 10hrs
Review of Thompson and Rutherford models, alpha scattering experiment – concept of impact parameter (qualitative). Bohr's theory of hydrogen atom and its inadequacies, effect of nuclear mass, Somerfield model – qualitative. Excitation and ionization energies and their potentials. Frank –Hertz experiment.

3. **Vector atom model** 12hrs
Concept of spatial quantization, spinning electron hypothesis, quantum number. Pauli's exclusion principle. Fine structure of spectral lines; Stern and Gerlach experiment; degeneracy associated with magnetic quantum number. Selection rules. Coupling schememes LS and JJ-coupling for a pair of electrons.
Zeeman effect; experimental study, quantum theory of normal and anomalous zeeman effect, Stark effect (qualitative).

4. **X –Ray spectra** 4hrs
Production –Coolidge X –ray tube, properties and application of X – rays. Continuous and characteristic spectra, Mosley's law.

5. **Molecular spectra** 6hrs
Introduction to molecular spectra. Classification of molecular spectra. Eigen value expressions for rotational, vibrational and electronic spectra of diatomic molecules. Band structure of diatomic molecules. Fluorescence and phosphorescence phenomenon.

6. **Raman effect** 3hrs
Coherent and incoherent scattering, Rayleigh scattering, scattering as a spectacular phenomena of light- blue sky,
deep blue sea, red sunset and white clouds. Raman effect Experimental study, classical and quantum theory. application of

Raman effect- determination of force constant, bond length of diatomic molecule and structure of tri-atomic molecule.

7. **LASERS** 6hrs

Definition of laser, properties of lasers, Ideas of Induced absorption, spontaneous emission and stimulated emission. Expression for Einstein's coefficients. population inversion, electrical and optical pumping techniques used to achieve population inversion, construction and working of solid state laser (Ruby), Gas laser (He-Ne), Semiconductor lasers (intrinsic and doped). Applications of lasers. Principle of Holography.

Reference books

1. Modern Physics by R. Murugeshan
2. Atomic Physics by Ghatak
3. Modern Physics by Saha & Srivastava
4. Atomic & Nuclear Physics by Subrahmanyam & Brijilal
5. Introduction to molecular Physics by Banwell
6. LASERS by Adikeshalu
7. LESERS & Non- linear Optics (II Edition) by B.B.Laud
8. Concepts of Modern Physics by Arthur Beiser, Tata McGraw –Hall pubs.

Syllabus for B.Sc Semester V
Optional Physics

Paper -5.2 Relativity, Statistical mechanics, Quantum mechanics & Electronics-I

Code :PHY-502 Univ Code :
Contact Hours :48 Work load : 3 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

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1. **Special theory of relativity** 11hrs
Michelson–Morley experiment and explanation of its negative result. Postulates of special theory of relativity. Lorentz transformations, length contraction, time dilation–illustrations with twin-paradox and μ-meson, relativity of simultaneity, addition of velocities, variation of mass with velocity. Derivation of Einstein's mass–energy relation. Minkowski;s space.

2. **Statistical Mechanics** 6hrs
Statistical ideas in physics, Phase space, ensemble, ensemble average, probable and most probable distributions, Boltzman equipartition theorem (derivation), Gibbo's paradox (no derivation) Stirling's approximation, Maxwell- Boltzmann, Bose-Einstein and Fermi-Dirac distribution functions and their comparison (qualitative-no derivations).

3. **Elements of Quantum mechanics** 8hrs
Origin of quantum theory –Compton effect –expression for Compton shift. Concept of de Broglie's matter waves. Expression for de Broglie's wavelength, Davisson & Germer experiment. Heisenberg uncertainty principle–illustrations of Gamma ray microscope & diffraction at a single slit.

4. **Wave mechanics** 8hrs
Wave function and its physical interpretation, Schrodinger time–independent wave equation, Eigen values and Eigen functions. Problems: particle in one-dimensional box (derive eigen values and eigen functions), linear harmonic oscillator (derive eigen values and eigen functions), concept of zero point energy.

5. **Band theory of solids** 5hrs
Formation of energy bands in bands, the concepts of valence band, conduction band and energy gap in semiconductors, electrical conductivity of conductors, semiconductors and insulators (qualitative). Intrinsic and extrinsic semiconductors. Deviation of

expression for electrical conductivity and energy gap in semiconductors. Hall effect, Hall coefficient and applications (in semiconductors).

6. **Semiconductor devices** 5hrs

PN junction, rectifiers (half wave, full wave & bridge). Filters (L and pi-section filters), Zener breakdown and avalanche breakdown, Zener diode as voltage regulator. Transistor action, configurations (CE, CB & CC) and relation between $a \& \beta$. Transistor amplifier in CE-mode.

7. **Special purpose Diodes and Display Devices** 5hrs

Photo diode, Solar Cell, LED, application of LED in display, liquid crystal, type of liquid crystals, liquid crystal display (LCD), comparison between LED and LCD. 7- Segment display.

Reference books

1. Statistical Mechanics by K Huang.
2. Statistical Mechanics by S.L.Gupta & V. Kumar
3. Concepts of Modern Physics by Arthur Beiser, Tata McGraw-Hill pubs.
4. Modern Physics by B.V.N. Rao
5. Modern Physics by Murugeshan
6. Electronic devices and circuits by Jacob Millman & Halkias
7. Fundamentals of Electronics by B. Basavaraj
8. Modern Physics, Vol-II B by Basavaraj, Omkar Publications
9. Concept of Modern Physics by S.L Gupta and S.Gupta

Practical course for Semester V

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 10 marks be conducted at the end of practical course in the semester.
3. Minimum of 6 experiments from set A and 6 experiments from set B should be performed in semester V.

List of experiments

Set A

1. Determination of energy band gap of a semiconductor.
2. Forward and reverse biased characteristics of a PN –junction diode-determination of forward resistance and Reverse
3. Characteristics of a zener diode-determine Zener breakdown voltage
4. Half wave and full rectifiers- study input and output waveforms and determine ripple factors.
5. Unregulated power supply –shunt capacitor filter. Series inductor filter and comparison of ripple factors.
6. Regulated power supply using Zener diode. - Line regulation and load regulation.
7. Characteristics of LED (three different colours).
8. Characteristics of photodiode.
9. Characteristics of a solar cell – determination of fill factor.
10. Input, output and transfer characteristics of a transistor in CB Configuration.
11. Input, output and transfer characteristics of a transistor in CE Configuration.
12. Spectral response of a LDR.
13. Capacitance of reverse biased semiconductor diode.
14. Estimation of chlorophil in plant cell
15. Mapping of H-R diagrams
16. Fermi energy of copper by four –probe point method.

Set B

1. Charge of electron by dispersion method.
2. Specific charge of electron by Thomson's method.
3. Co-efficient of linear expansion of material of razor (blade) by LASER diffraction method.
4. Determination of refractive index using LASER.
5. Determination of μ_o and μ_e using LASER
6. Diffraction grating using LASER- determination of wavelength of laser light.
7. Determination of temperature coefficient of resistance of a wire using P.O.Box.
8. Calibration of thermistor and determination of temperature coefficient of resistance and unknown temperature.
9. Planck's constant – using photocell.
10. Thermionic emission – Verification of Child's law.
11. Determination of Rydberg constant using H_2-source and spectrometer
12. Temperature of flame by line reversal method.
13. Ionization potential of Xenon / Mercury.
14. Excitation and ionization potentials.
15. Hall Coefficient.

Syllabus for B.Sc. VI Semester
Optional Physics

Paper 6.1: Nuclear physics, Solid State Physics, Astrophysics & Biophysics

Code :PHY-601 Univ Code :

Contact Hours :48 Work load : 3 hours per week

Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Nuclear Physics** 4 hrs
Nucleus composition; mass, charge, size, density, spin and magnetic moment. Binding energy of nucleus. nuclear force; characteristics of nuclear forces, Yukawa theory – qualitative. Nuclear models; liquid drop model and shell model (qualitative).

2. Radioactivity 4 hrs
Radioactivity decay law, half life and mean life with derivations Radioactive particles α, β and γ and their characteristics, Alpha decay - Gamow's theory (brief description), Beta decay- Fermi theory (brief description), neutrino hypothesis and Gamma-decay.

3. **Nuclear Instruments** 4 hrs
Detectors of nuclear radiation: Geiger –Muller Counter and Scintillation Counters. Particle accelerators: Construction and theory of Cyclotron and Betatron.

4. **Elementary Particles** 3 hrs
Classification of particles. Particles and anti –particles. Four basic interactions in nature. Quark model of hydrons (Higg's boson).

5. **Alternate energy Sources** 5 hrs
Conventional and non-conventional energy sources, ecological and sociological perspective. Wind energy, tidal energy and bio-energy (qualitative). Nuclear energy: Nuclear reaction, Q –value. Nuclear fission, nuclear reactors, nuclear fusion, thermonuclear reaction.

6. **Crystal Structure** 4 hrs
Concept of lattice, unit cell, Bravais lattice, crystal, crystal planes and Miller indices, structure of NaC1. X-ray diffraction-Bragg's law derivation, types of X-ray diffraction techniques (qualitative),

7. **Electrical and thermal properties of solids** 6 hrs
Free electron theory of metals, Expression for electrical and thermal conductivities. Concept of Fermi energy and its variation with temperature (qualitative). Specific heats of solids: Dulong and Petit law,

Einstein and Debye theories (main features and results).

8. **Magnetic properties of solids** 4 hrs

Define magnetic moment. Diamagnetism (explain origin)-Langevins classical theory, paramagnetism- curies law, ferromagnetism, hysterisis loop, Weiss theory (main features).

9. **Superconductivity** 5 hrs

Discovery of superconductivity, zero resistivity, Meissner effect, give examples of metals exhibiting superconductivity, persistent current, critical fields, type I and type II of superconductors, London's penetration depth, Results of BCS theory. High temperature superconductors, applications of superconductors.

10. **Astrophysics** 5 hrs

Light year and parsec; luminosity of stars, apparent & absolute magnitudes. Colour and surface temperature of stars. spectrall classification of stars, HR diagram, Formation and evolution of stars (qualitative); end stages of stars – white dwarfs, neutron stars and black holes (qualitative).

11.. **Biophysics** 4 hrs

Scope & meaning of Biophysics, Cell as basic unit of life. The orgeneller constituents of cell. The chemical composition of cells, membrane potential and its physical basis.

Reference books

1. Introduction to solid state physics by C Kittel.
2. Solid State physics by A J Dekkar.
3. Introduction to solid state physics by J S Blackmore
4. Modern physics by R Murugeshan.
5. Nuclear physics by D C Tayal.
6. Non –Conventional Energy Source by G D Rai.
7. Energy Technology by S Rao and B B Rarulekar.
8. Introductory Nuclear physics by Kenneth Crane (john Wiley).
9. An Introduction to Astrophysics by Baidyanath Basu.
10. Astronomy by Fundamentals and Frontiers –R jastrow and M H Thompson.
11. Biophysics by Vasanth Pattabhi and N Gautham.
12. Essentials of Biophysics by P Narayanan.

Syllabus for B. Sc. VI Semester
Optional Physics

Paper -6.2 Material Science & Electronics-II

Code :PHY-602 Univ Code :
Contact Hours :48 Work load : 3 hours per week
Credit Points :

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination - 80 marks

1. **Materials Science** 4 hrs
   Scope of Materials science, engineering classification of materials, engineering requirement of materials, crystalline and non-crystalline states of materials.

2. **Bonding in materials** 4 hrs
   Covalent bonding, ionic bonding and metallic bonding. Give examples and discuss covalent solids, ionic solids and metallic solids.

3. **Mechanical properties of materials** 4 hrs
   Strength, elasticity and hardness (give examples and compare properties of different materials), fatigue, creep and fracture.

4. **Electrical and thermal properties of materials** 4 hrs
   Conductivity of metals, semiconductors and superconductors. Dielectric properties of insulators (dielectric properties), thermal conductivity and thermal expansion

5. **Thin films** 3 hrs
   Definition, methods of preparation: physical and chemical, thermal evaporation in vacuum (describe experiment), applications of thin films.

6. **Nanophysics & nanomaterials:** 4 hrs
   Nanoscale systems, size effect, correlation with quantum mechanical particle in a box, quantum structures, quantum wells.
   Synthesis of nano materials, , characterization and applications (qualitative).

7. **Bipolar junction transistor:** 5 hrs
   Operating point, DC and AC load lines. Biasing; fixed biasing , collector biasing, collector to base bias, emitter bias circuit, voltage divider bias circuit, stability factor, bias compensation. Thermal runaway, thermal resistance and condition for thermal stability. JFET characteristics & MOSFET.

8. **Amplifiers:** 5 hrs
   Classification of amplifier. Single stage CE amplifier, Analysis by graphical method using DC load line, transistor equivalent circuits, h – parameters, mathematical analysis of transistor amplifier in CB, CE and CC

configuration. Emitter follower and single tuned and double tuned amplifiers.

9. Oscillators: 4 hrs

Sinusoidal oscillators: Tuned oscillators-Barkhausen criterion for oscillations, Hartly and Colpitt's oscillators. RC oscillators – Phase shift oscillator and Wien Bridge oscillator. Non- sinusoidal oscillators: Astable, Monostable and Bi- stable multivibrators.

8. **Digital Electronics:** 6 hrs

Number systems: Decimal, Binary, Hexadecimal and their inter –conversion. Boolean algebra, K- maps, basic theorems, Logic gates; OR, AND, NOT, NAND and XOR gates. Half adder, full adder and adder. Flif flops; RS, D, JK and M/S filp flops, counters – Serial and Parallel counters, modified counter, shift register, ring counter, shift counter and mod – 16 counter.

9. **Radio Communication:** 5 hrs

Radio – wave propagation, need for modulation, Amplitude modulation, modulation factor, side band. band width, power in AM wave, Frequency modulation, de-modulation, super-hetrodynes. Block diagrams of AM selectivity, sensitivity, dynamic range, image frequency and image rejection. FM receivers.

Reference books

1. Materials Science and processes by S.K.Hajra Choudhury
2. Materials Science by Raghavan V
3. Material Science, M.Arunugam, Anuradha agencies, Kumbakonam (2002)
3. Applied electronics by R.S. Sedha
4. Operational Amplifiers and linear integrated Circuits by Ramakanth Gayakawad
5. Digital Principles and Applications by Malvino and Leach.
6. Digital Electronics by Gathmann
7. Electronics Communication by Sanjeev Gupta.
8. Integrated Circuits by K R Botkar, Khanna Publilshers.
9. Introduction to Solid State physics by C Kittel.
10. Solid State Physics by A J Dekkar.
11. Introduction to Solid State Physics by J S Blackmore.

Practical course for Semester VI

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 10 marks be conducted at the end of practical course in the semester.
3. Minimum of 6 experiments from set A and 6 experiments from set B should be performed in semester VI.

List of experiments

Set A

1. Analysis of random error: Poisson distribution, statistics of nuclear counting.
2. Characteristics of GM tube.
3. Verification of inverse square law using GM tube.
4. Determination of half life using GM tube.
5. Absorption coefficient of aluminum for β - rays.
6. Attenuation coefficient of γ - rays.
7. Field Effect Transistor.
8. Phase shift oscillator using transistor.
9. Astable multivibrator using transistor.
10. Determination of self inductance of a coil using Anderson's bridge.
11. Frequency response of an RC coupled single stage CE amplifier.- determination of bandwidth.
12. Frequency response of emitter follower.- determination of bandwidth.
13. Determination of voltage gain, current gain, input impedance, output impedance of an emitter follower.
14. Hartley oscillator using transistor
15. Wein bridge oscillator using transistor

Set B

1. Determination of capacitance of capacitor using Maxwell's bridge.
2. Colpitt's oscillator using transistor.
3. Construction of OR, AND, NOT, NOR & NAND gates using diodes/transistor/IC and verification of their truth tables.
4. Verification of de Morgan's theorem. (using ICs)
5. Verification of truth table of half adder and full adder. (using ICs)
6. Study of 4-bit binary adder (using IC 7483).
7. Construction and verification of RS and JK flip- flops.
8. Study Op-Amp characteristics: Determine Offset voltage and CMMR
9. Operational Amplifier: voltage to current and current to voltage converter
10. Operational Amplifiers – Inverting and Non- inverting.
11. Measurement of resistance of thin films by four- probe method.
12. Interplanar Spacing – X-ray diffraction.