RADHA GOVIND UNIVERSITY
RAMGARH, JHARKHAND

DEPARTMENT OF PHYSICS

COURSE CURRICULUM FOR UNDERGRADUATE COURSES UNDER CHOICE BASED CREDIT SYSTEM

B.Sc (GEN/PASS in Physics)

With effect from 2018-2020

RADHA GOVIND UNIVERSITY

RAMGARH

Course Structure

Course Name		Full Marks	END SEM	INTERNAL
SEM I				
PHY-G.E.-1. T.	MECHANICS (04 Credits, 60 Lectures)	75	60	15
PHY-G.E.-1. P.	(PRACTICAL) (02credits)	25	20	05
DSC- 2A	from other discipline (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
DSC- 3A	from other discipline (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
AECC-1	LANGUAGE (ENGLISH/HINDI) (Credits: 02; Theory: 30 Lectures)	50	40	10
SEM II				
PHY-G.E.-2. T.	ELECTRICITY & MAGNETISM (04 Credits, 60 Lectures)	75	60	15
PHY-G.E.-2. P.	(PRACTICAL) (02credits)	25	20	05
DSC -2B	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
DSC -3B	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
AECC-2	ENVIRONMENTAL STUDIES (Credits: 02; Theory: 30 Lectures)	50	40	10
SEM III				
PHY-G.E.-3. T.	THERMAL PHYSICS AND STATISTICAL MECHANICS (04 Credits, 60 Lectures)	75	60	15
PHY-GE-3. P .	(PRACTICAL) (02 credits)	25	20	05
DSC -2C	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
DSC -3C	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25) &	/(60+20) 20	(15+05)
SEC-1	Annexure - 1 (Credits: 02; Theory: 30 Lectures)	50	40	10
SEM IV				
PHY-G.E.-4. T.	WAVES & OPTICS (04 Credits, 60 Lectures)	75	60	15
PHY-GE-4. P	(PRACTICAL)(02 Credits)	25	20	05
DSC- 2D	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
DSC- 3D	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
SEC-2	Annexure - 1 (Credits: 02; Theory: 30 Lectures)	50	40	10

	SEM V			
PHY-DSE-1A. T	DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION (04 Credits, 60 Lectures)	75	60	15
PHY-DSE-1A. P	DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION (02 Credits, 30 Lectures)	25	20	05
DSE- 2A	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
DSE- 3A	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
SEC-3	Annexure - 1 (Credits: 02; Theory: 30 Lectures)	50	40	10
	SEM VI			
PHY-DSE-1B.T	ELEMENTS OF MODERN PHYSICS (04 Credits, 60 Lectures)	75	60	15
PHY-DSE-1B.P	ELEMENTS OF MODERN PHYSICS (02 Credits, 30 Lectures)	25	20	05
DSE- 2B	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
DSE- 3B	from other disciplines (06 Credits/(04 + 02 Credits))	100/(75+25)	80/(60+20)	20/(15+05)
SEC-4	Annexure - 1 (Credits: 02; Theory: 30 Lectures)	50	40	10
	Extra-Curricular Based Activities *(list-under UG regulation: page 17)*	50	40	10

Total Marks = 2150

Important Instructions for faculty members and questions setters
(see Table-09 of UG regulation).

Para I:
A paper having 06 credits carry 100 marks; 80 marks for end semester exam and 20 marks for internal exam (midterm), which further divided as 15 (internal exam-theory/practical) + 05 (attendance and other activities).

A candidate has to answer Five Questions out of Nine Questions of which Question no. 1 is compulsory and will be of short answer type to be answered in about 100 words (4 Questions to be answered out of 8). Out of the remaining 08 (eight) Questions, 04 (four) are to be answered. Each question carries 16 marks.

Para II:
A paper having 04 credits carry 75 marks; 60 marks for end semester exam and 15 marks for internal exam (midterm), which further divided as 10 (internal exam-theory/practical) + 05 (attendance and other activities).

A candidate has to answer Five Questions out of Nine Questions of which Question no. 1 is compulsory and will be of short answer type to be answered in about 100 words (3 Questions to be answered out of 6). Out of the remaining 08 (eight) Questions, 04 (four) are to be answered. Each question carries 12 marks.

Para III:
A paper having 02 credits carry 50 marks; 40 marks for end semester exam and 10 marks for internal exam (midterm), which further divided as 05 (internal exam-theory/practical) + 05 (attendance and other activities).

A candidate has to answer Three Questions out of Five Questions of which Question no. 1 is compulsory and will be of short answer type to be answered in about 100 words (2 Questions to be answered out of 4) and carry 05 marks each. Out of the remaining 04 (four) Questions, 02 (two) are to be answered and carries 15 marks.

NB: Questions may be framed as per the direction issued to the paper setter from Examination Department, Numerical problems may be included
Some of the questions may be repeated from previous year.

Annexure - 1
SKILL DEVELOPMENT COURSES (SEC)
For General/Pass Course Degree:

(i) Compulsory for All Disciplines

1. Constitution of India and Human Rights
2. Environment and Public Health
3. Computer Applications and Information Technology
    in *Semester 3, Semester 4, and Semester 5 respectively.*

(II) Sixth semester: One from the following may be chosen, may be common for a faculty or all faculty

The courses may include the following:
1. Entrepreneurship
2. Life Skills and Personality Development
3. Human Resource Development
4. Legal Aid and Awareness
5. Indian History, Culture and Diversity
6. Science and Life
7. Banking and Finance
8. Building Mathematical Ability
9. Capital and Stock Market

Extension and Co-curricular and Extra-curricular Based Activities

A student shall opt for one of the activities mentioned below and offered in the college, in each of the first four semesters of the undergraduate programmes. The activity carries a credit each and will be internally assessed for 50 marks.

a) N.S.S./N.C.C
b) Sports and Games
c) Physical Education or Activities related to Yoga
d) Field study/Industry Implant Training
e) Involvement in campus publication
f) Publication of articles in newspapers, magazines or other publications
g) Community work such as promotion of values of National Integration, Environment, Human rights and duties, Peace, Civic sense, etc.
h) A Small project work concerning achievements of India in different fields
i) Evolution of study groups/seminar circles on Indian thoughts and ideas
j) Activity exploring different aspects of Indian civilizations

k) Involvement in popularization programs such as scientific temper

l) Computer assisted/web-based learning and e-library skills

m) Innovative compositions and creations in music, performing and visual arts, etc.

n) Other activities such as Cultural Activities or any other activity as prescribed by the University. Evaluation of Co-and Extra Curricular Activities shall be as per the procedure evolved by the university from time to time.

SEMESTER - I

PHY-G.E.1. T. MECHANICS (04 Credits, 60 Lectures)

Vector Analysis: Triple Scalar product, Triple Vector product, gradient, divergence, Curl and their physical significance, scalar and vector fields, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem. **(12 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.
(8 Lectures)

Central force field: Motion of a particle in a central force field –two body problem. Kepler's Laws and their deduction.
(5 Lectures)

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages.
(5 Lectures)

Elasticity: Elastic constants and their interrelations, Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire -Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion, Torsional pendulum. **(12 Lectures)**

Fluids: Surface Tension: Excess of pressure - Application to spherical and cylindrical drops and bubbles - variation of surface tension with temperature. Viscosity - Rate flow of liquid in a capillary tube - Poiseuille's formula - Determination of coefficient of viscosity of a liquid - Variations of viscosity of liquid with temperature. **(10 Lectures)**

Special Theory of Relativity: Galilean transformations. Postulates of Special Theory of Relativity. Lorentz transformation, Length contraction. Time dilation. Relativistic addition of velocities.
(8 Lectures)

Reference Books:

1. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
3. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHY-G.E.-1.P. (PRACTICAL) (02 credits)

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.

SEMESTER - II
PHY-G.E.-2.T. ELECTRICITY & MAGNETISM (04 Credits, 60 Lectures)

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Polarization, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.
(25 Lectures)

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of Dia-, para-and ferro- magnetic materials.   **(12 Lectures)**

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.   **(8 Lectures)**

 Maxwell`s equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves.   **(15 Lectures)**

Reference Books:

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
2. Electricity & Magnetism, J.H. Fewkes&J.Yarwood. Vol. I, 1991, Oxford Univ. Press
3. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
5. D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

PHY-G.E.-2.P. (PRACTICAL)(02 Credits)

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. To compare capacitances using De'Sauty's bridge.
3. To study the Characteristics of a Series RC Circuit.
4. To study a series LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
5. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
6. To determine a Low Resistance by Carey Foster's Bridge.
7. To verify the Thevenin and Norton theorems
8. To verify the Superposition, and Maximum Power Transfer Theorems

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, I.Prakash& Ramakrishna, 11th Ed.2011, KitabMahal

SEMESTER – III

PHY-G.E.-3.T. THERMAL PHYSICS AND STATISTICAL MECHANICS (04 Credits, 60 Lectures)

Laws of Thermodynamics: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics (statement only), Unattainability of absolute zero.

(22 Lectures)

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations.

(10 Lectures)

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, mean free path, Transport Phenomena: Viscosity, Conduction and Diffusion, Law of equipartition of energy and its applications to specific heat of gases; mono- atomic and diatomic gases.

(10 Lectures)

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction from Planck's law-Rayleigh- Jeans Law, Stefan Boltzmann Law and Wien's displacement law.

(6 Lectures)

Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity, Quantum statistics: Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.

(12 Lectures)

Reference Books:
1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
3. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
4. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and
   G.L. Salinger. 1988, Narosa
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHY-GE-3.P. (PRACTICAL)(02 Credits)

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of Cu by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and
   Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.

Reference Books:
1. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
2. A Laboratory Manual of Physics for Undergraduate Classes, D.P.Khandelwal, 1985, Vani Publication.

SEMESTER – IV
PHY-G.E.-4. T. WAVES & OPTICS (04 Credits, 60 Lectures)

Superposition of Two Collinear Harmonic oscillations: Linearity & Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).

(6 Lectures)

Waves Motion: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity.

(8 Lectures)

Sound: Forced vibrations and resonance, Fourier's Theorem - Application to saw tooth wave and square wave Acoustics of buildings, Reverberation and time of reverberation - Absorption coefficient - Sabine's formula.

(10 Lectures)

Interference: Interference: Division of amplitude and division of wavefront. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.

(10 Lectures)

Michelson's Interferometer: (1) Idea of form of fringes (no theory needed), (2) Determination of wavelength, (3) Wavelength difference, (4) Refractive index, and (5) Visibility of fringes.

(5 Lectures)

Diffraction: Fraunhofer diffraction- Single slit; Double Slit. Plane Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.

(14 Lectures)

Polarization: Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

(7 Lectures)

Reference Books:

1. Fundamentals of Optics, F.A Jenkins and H.E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publications
4. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young. 13/e, 1986. Addison-Wesley

PHY-GE-4.P. (PRACTICAL)(02 Credits)

1. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda2 - T$ Law.
2. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
3. To determine the Refractive Index of the Material of a Prism using Sodium Light.
4. To determine Dispersive Power of the Material of a Prism using Mercury Light
5. To determine the value of Cauchy Constants.
6. To determine the Resolving Power of a Prism.
7. To determine wavelength of sodium light using Fresnel Biprism.
8. To determine wavelength of sodium light using Newton's Rings.
9. To determine the wavelength of Laser light using Diffraction of Single Slit.
10. To determine wavelength of (1) Sodium and (2) Spectral lines of the Mercury light using plane diffraction Grating
11. To determine the Resolving Power of a Plane Diffraction Grating.

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint and H.T.Worsnop, 1971, Asia Publishing House.

SEMESTER –V
PHY-DSE-1A.T DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION (04 Credits, 60 Lectures)

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.   **(7 Lectures)**
De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra.   **(8 Lectures)**
Binary Addition. Binary Subtraction using 2's Complement Method).Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor.   **(4 Lectures)**
Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics-Static and Dynamic, Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.   **(7 Lectures)**
Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Active, Cutoff, and Saturation Regions. Voltage Divider Bias Circuit for CE Amplifier.h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers.   **(17 Lectures)**
Sinusoidal Oscillators: Barkhuizen's Criterion for Self-sustained Oscillations. Determination of Frequency of RC Oscillator   **(5 Lectures)**
Instrumentations: Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.   **(4 Lectures)**
Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Zener Diode and Voltage Regulation   **(8 Lectures)**

Reference Books:

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuits, S. Salivahanan and N.Suresh Kumar, 2012, Tata Mc- Graw Hill.
3. Microelectronic Circuits, M.H. Rashid, 2nd Edn.,2011, Cengage Learning.
4. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning
5. Digital Principles & Applications, A.P.Malvino, D.P.Leach&Saha, 7th Ed.,2011, Tata McGraw Hill
6. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
7. OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

PHY-DSE-1A.P. DIGITAL AND ANALOG CIRCUITS & INSTRUMENTATION (02 Credits, 30 Lectures)

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. Half adder, Full adder and 4-bit Binary Adder.
4. Adder-Subtractor using Full Adder I.C.
5. To design an astable multivibrator of given specifications using 555 Timer.
6. To design a monostable multivibrator of given specifications using 555 Timer.
7. To study IV characteristics of PN diode, Zener and Light emitting diode
8. To study the characteristics of a Transistor in CE configuration.
9. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
10. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
11. To design a non-inverting amplifier of given gain using Op-amp 741 and study its Frequency Response.
12. To investigate the use of an op-amp as a Differentiator
13. To design a Wien Bridge Oscillator using an op-amp.

Reference Books:

1. Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller, 1994, Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

SEMESTER – VI
PHY-DSE-1B.T ELMENTS OF MODERN PHYSICS (04 Credits, 60 Lectures)

Quantum Mechanics: De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Bohr Correspondence Principle **(6 Lectures)**

Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Energy-time & Position-momentum uncertainty principle **(8 Lectures)**

Time dependent Schrodinger equation and Time independent Schrodinger equation, Properties of Wave Function. Interpretation of Wave Function, Probability and probability current densities; Conditions for Physical Acceptability of Wave Functions. Normalization, Eigenvalues and Eigenfunctions. Expectation values of position and momentum **(10 Lectures)**
One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions
(4 Lectures)

Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, Liquid Drop model: semi-empirical mass formula and binding energy. **(6 Lectures)**

Radioactivity: stability of the nucleus; Law of radioactive decay; Mean life and half-life, successive disintegration; Elementary idea of Alpha decay; Beta decay.
(10 Lectures)

Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. **(4 Lectures)**

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. **(12 Lectures)**

Reference Books:

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
2. Modern Physics, John R.Taylor, Chris D.Zafiratos, Michael A.Dubson,2009, PHI Learning
3. Six Ideas that Shaped Physics:Particle Behave like Waves, Thomas A. Moore, 2003, McGraw Hill
4. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw-Hill Co.
5. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning

PHY-DSE-1B.P ELMENTS OF MODERN PHYSICS (02 Credits, 60 Lectures)

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colors.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapor.
7. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photo sensor and compare with incoherent source – Na light.
8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
9. To determine the value of e/m by magnetic focusing.
10. To setup the Millikan oil drop apparatus and determine the charge of an electron.

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi.