II SEMESTER

Total Teaching hours =50

Course PHCT 2.1: Quantum Mechanics – I

Unit I **12 hrs**

Basic Principles:

Developments of Quantum Mechanics (in brief), Operators in Quantum Mechanics, Hermitian Operators and their properties. Momentum, Hamiltonian & Energy operators, Eigen function and Eigen Value, Eigen value equation. State functions as probability amplitude, Principle of superposition, Schrodinger equation. Normalization of wave functions, Stationary states, basic postulates of Quantum Mechanics. Probability density, Probability current density, Expectation values, Ehrenfest's thereom.

Problems

Unit II **12 hrs**

Applications:

Eigen values and Eigen functions of free particle, Dirac delta function and its properties. Particle in a square well potential with rigid values (One dimensional),Particle in a square well potential with finite walls/infinite walls. Harmonic Oscillator by Schrodinger method.

Problems

Barrier Transmission :

Tunneling of a free particle though a thick rectangular potential barrier. Derivation of transmission and reflection coefficients.

Problems

Unit III **12hrs**

Hydrogen Atom:

Reduction of two-body problem to a single particle problem. Center-of-mass and relative motions; Hydrogen like atom, Eigen values of energy and Eigen functions, Parity Operator. Parity Eigen function. Angular momentum, expression for the three Cartesian components and the square of the angular momentum, their commutation relations, expression for the operators in polar coordinates, Eigen values and Eigen functions in

terms of polar coordinates; Eigen values and Eigen functions of the square and z-component of angular momentum.

Problems

Unit IV **14 hrs**

Time-Independent Perturbation Theory:

Eigen value of energy and Eigen function in the first order approximation (the case of a system with non degenerate energy levels). Application to an harmonic oscillator and to the ground state of Helium atom (Qualitative)

Time-Dependent Perturbation Theory:

First order perturbation, Transition from one discrete level to the other, to continuum states, Fermi Golden rule, another discrete level through an harmonic perturbation to resonance transitions. Einstein A and B coefficients.

Problems

Elastic Scattering:

Differential and total cross-section, Partial analysis. Significance of the partial waves and phase shifts. The Born approximation, derivation of the expression for differential scattering cross-section, condition for validity of the approximation. Application to square well potential and screened coulomb potential (Qualitative).

Problems.

Text Books:

1. Quantum Mechanics – Theory & Applications (5^{th} Ed): A.K. Ghatak & S. Loknathan, MacMillan India Ltd. 91984)
2. A Text of Quantum Mechanics: P.M. Mathews &K. Venkateshan, Tata McGraw-Hill, New Delhi (1982)
3. Quantum Mechanics (2nd ed.), G. Aruldhas, Prentice Hall India Pvt.Ltd., New Delhi (2009)
4. Quantum Mechanics by Amit Goswami, Tata Mc Graw Hill, (1999)
5. Quantum Mechanics : S.P.Singh,M.K.Bagade,Kamal Singh, S.Chand & company (2004)
6. Quantum Mechanics : Chatwal and Anand ,Himalaya Publishing house.
7. Quantum Mechanics : Gupta,Kumar,Sharma, Jayaprakash Nath & company, Meerut.
8. Quantum Mechanics: B.K.Agarwal and Hari Prakash.
9. Quantum Mechanics : Satyaprakash

Reference Books:

1. Quantum Mechanics (2nd Ed): V.K. Thankappan, new Age International (P)Ltd. (1993)
2. Introduction to Quantum Mechanics: L. Pauling & E. Bright Wilson,McGraw-Hill, N.Y.(1935)
3. Quantum Mechanics(3rd ed): L.I. Schiff, McGraw-Hill, N.Y.(1968)
4. Quantum Mechanics: E. Merzbacher, 2nd ed., Wiley, N.Y.(1970)
5. Quantum Mechanics : B. N. Srivastava, Pragati Prakashan
6. Quantum Mechanics : David. J. Grifftiths Pearson.

Total Teaching hours =50

Course PHCT 2.2: Atomic, Molecular & Optical Physics (General)

Unit I **12 hrs**

Atomic Physics

Overview of salient features of atomic spectra. Determination of spectral terms; derivation of interaction energies for two-valence electrons in LS and jj coupling schemes.

Zeeman Effect:

Normal and Anomalous effects due to single and two valence Electrons. Paschen Back Effect, Stark Effect.

Problems

Unit II **13 hrs**

Laser Physics

Laser principles: Laser resonator; modes; the threshold condition – the Schawlow - Townes condition for laser oscillations. Two and three-level laser system, kinetics of optical absorption, shape and width of spectral lines, line broadening mechanism, natural broadening, collision broadening and Doppler broadening. Diode laser, CO_2 laser, Ruby laser. Laser applications.

Unit III **12 hrs**

Microwave Spectroscopy:

Microwave spectra (Far IR Spectra); Diatomic molecule as a rigid rotator, non-rigid rotator & symmetric top. Rotational Spectra, Intensity distribution.

Infrared Spectroscopy:

Diatomic Molecule as a harmonic oscillator, anharmonic oscillator, vibrating rotator. Vibrational spectra.

Unit IV **13 hrs**

Raman Spectroscopy:

Classical & Quantum theory of the Raman effect, Pure rotational & vibrational Raman Spectra of chlorate and nitrate ions.

Electronic Spectroscopy:

The Born – Oppenheimer approximation, vibrational & rotational structure of electronic bands. Evaluation of vibrational & rotational constants. Intensities of electronic bands in emission & absorption: the Franck –Condon Principle, its formulation, determination of vibrational temperature.

Textbooks:

1. Introduction to Atomic Spectra : H.E. White, McGraw – Hill, Tokyo (1934)
2. Physics of Atoms and Molecules – 2nd Ed., Bransden B.H. and Joachain C.J., Pearson Education, India (2006)
3. Elementary Atomic Structure (2nd ed.) : G. K. Woodgate, Clarendon Press, Oxford (1980)
4. Molecular Spectra & Molecular Structure – Vol I : Herzberg, D. Van Nostrand Co. Princeton, J. J. (1945)
5. Spectroscopy – Vol. 3:S. Walker & B. P. Strauhghan, Chapman & Hall, Lon (1976)
6. Fundamentals of Molecular Spectroscopy : C. N. Banwell and E.M. McCash, Tata Mc Graw-Hill Co., 4th revised edition, (9th reprint, 2000)
7. Lasers and Non-Linear Optics : B. B. Laud, Wiley Eastern Ltd., New Delhi (1991).
8. An Introduction to Lasers & their Applications : Donald C. O' Shea, W.Russell Callen & William T. Rhodes, Addison-Wesley, N. Y. (1977).
9. Optical Fiber & Communications Principles & Practice : John M. Seniors, Prentice Hall Intl. Ltd. London (1992)

Reference Books:

1. Fundamentals of Spectroscopy (2nd ed): B. Narayan, Allied Publishers Ltd.,New Delhi (1999).
2. Principles of Lasers : O. Svelto, Plenum Press, N. Y. (1982).
3. Laser Electronics : Joseph T. Verdeyen, Prentice-Hall of India Pvt. Ltd. New Delhi (1989).
4. Lasers : Theory & Applications : K. Thyagarajan & A. Ghatak, MacMillan India, New Delhi (1981).
5. Laser Principles & Applications : J. Wilson & J.F.B. Hawkes, Prentice-Hall Intl. Inc. (1983)
6. Fiber Optics Sensors : D. A. Krohn, Instrument Soc. Am. (1988).
7. Encyclopedia of Lasers & Optical Technology : Robert A. Meyars, Academic Press, Cal. (1991).
8. Fiber Optic Communication : D. C. Agarwal, Wheeler Pub. (1993).
9. Optoelectronics – An Introduction : J. Wilson & J.F.B. Hawkes, Prentice – Hall Intl. Inc. (1983).
10. Laser Fundamentals : W.Q. Silfvast
11. A text book of lasers : O'shea. and Principles of lasers : Svelto

Course PHCT 2.3: Nuclear Physics (General)

Total Teaching hours = 50

Unit –I **12 hrs**

Basic Properties:

Nuclear radius by α scattering and mirror nuclei method, Nuclear binding energy and separation energy.

Nuclear Spin & Magnetic Moment:

Spin and magnetic moment of odd A nucleus. Experimental determination of magnetic moment by Rabi's atomic beam method. Experimental determination of Spin by Hyperfine Structure in Optical Spectra. Systematic of spin & magnetic moment for odd A nuclei.

Unit II **13 hrs**

Liquid Drop Model:

Semi empirical mass formula, neutron proton ratio for stable nuclei, Stability against beta and alpha decay and stability against spontaneous fission**.**

Alpha decay:

Gamow's theory of alpha decay, relation between mean life and decay energy.

Beta decay:

Neutrino hypothesis; Fermi theory of beta decay.

Gamma decay:

Gamma transitions in Nuclei & classifications. Internal conversion (Qualitative)

Unit- III **12 hrs**

Nuclear reactions:

Q value of nuclear reactions. Relation between Q value and out going particle, compound nucleus model and its experimental verification (Goshal experiment).

Reactor Physics:

Four factor formula, fast breeder nuclear reactor.

Particle Physics:

Classification of elementary particles and Quark model.

Unit IV **13 hrs**

Interaction of radiation with matter:

Beta Particles :

Attenuation of beta particles in aluminium, range energy relation for beta particles and energy loss by ionizational radiation process.

Gamma Rays:

Photoelectric effect, Compton Effect, Pair production, attenuation of gamma rays in thick targets,resonance scattering of gamma rays, Mossbauer effect & its applications.

Nuclear Detectors:

NaI(Tl) Scintillation gamma ray spectrometer; Principle, working and energy resolution. Semiconductor Detector: expression for thickness of the depletion region. GM counters and proportional counters

Text Books :

1. Nuclei and Particles : E. Segre –The Benjamin Publishing, Pvt Ltd (1977).
2. Introductory Nuclear Physics : K.S. Krane- John Wiley & Sons (1987).
3. Atomic and Nuclear Physics: Vol. II S.N.Goshal-S. Chand and Company (1996).
4. Nuclear Physics: I S.N.Goshal-S. Chand and Company.

Reference Books :

1. The Atomic Nucleus : R.D. Evans – Tata McGraw Hill New Delhi (1992).
2. Physics of Nuclei and Particles: Marmer and E.Sheldon,Vol.II-Academic press (1970).
3. Physics of Nuclear Reactors: S.Garag, F.Ahmed and L.S. Kothari. – Tata McGraw Hill New Delhi (1986).
4. Introductory Nuclear Physcis : Samuel Wong-Prentice Hall (1996).
5. Fundamentals of Nuclear Physics : N.A.Jelly-Cambridge University Press (1990).
6. Introduction to Nuclear Physics : Harald A. Enge-Addison –Wiseley (1996).

Course PHET 2.4 (A) : Elective – I- Modern Physics

Total Teaching hours =50

Unit I **12 hrs**

Blackbody Radiation:

Nature of Blackbody spectrum; classical radiation laws & their limitations; Planck's radiation law & quantum hypothesis. Simple examples/problems.

The Photoelectric Effect:

Apparatus used to study the Photoelectric Effect; laws of Photoelectric Effect; Einstein Photoelectric Equation. Simple examples.

X- rays:

Nature & production of X- rays; the Bragg's law; Bragg's X-ray crystal spectrometer.

The Compton Effect:

X-ray Compton scattering from an electron; experimental set-up for Compton Scattering. Simple problems.

Unit II **13 hrs**

Atomic Structure:

Hydrogen spectrum; the Bohr model; experimental measurement of the Rydberg Constant; Franck Hertz Experiment.

Matter Waves:

The de Broglie wavelength & its relation with the Bohr Model; Davisson – Germer experiment. Heisenberg Uncertainty Principle. Momentum – position & energy – time relations. Simple examples.

Quantum Physics:

Idea of wave function & probability. One-dimensional Schrodinger wave equation: Its application to the particle in a box and Hydrogen atom; Energies & wave functions.

Vector Model:

Space Quantization: Orbital angular moment & Magnetic Moment; spin angular Moment & magnetic moment; Stern – Gerlach experiment. States of Hydrogen in terms of n, l, m1. The normal Zeeman Effect; experimental set up for Zeeman Effect. Simple problems.

Unit III **12 hrs**

Statistical Physics:

Distinguishability & indistinguishability; Maxwell – Boltzmann distribution for gas molecules; Vrms; Equipartition theorem. Quantum Statistics: F-D & B-E distributions.

Molecular structure:

Bonding Mechanisms: ionic bonds; Covalent bonds; the Hydrogen bond; Van-der Waal's Bonds. Molecular vibration & rotation Spectra. Molecular Orbitals: Hydrogen molecular ion & molecule; bonding in complex molecules.

Solid State Physics:

Ionic solids; covalent solids; metallic solids; molecular crystals; amorphous solids. Classical Models of electrical & heat conductivities in solids; Ohm's law; Weidman – Frenz law; the quantum view point.

Lasers:

Absorption, Spontaneous & Stimulated emissions; Population Inversion; laser action; typical gas (He – Ne/ CO2) characteristics.

Unit IV **13 hrs**

Magnetism:

Magnetic Moment; Magnetization. Magnetic Materials: Diamagnetic, Paramagnetic & Ferromagnetic materials. Superconductivity Phenomenon.

Nuclear Structure:

Nuclear properties: Charge, mass, size & structure; Nuclear spin & magnetic Moment; Nuclear magnetic Resonance (NMR) Phenomenon. Binding Energy & nuclear forces. The Liquid Drop Model. Radioactivity: Decay constant, half life.

Nuclear Fission/ Fusion:

Fission – basic process; a simple model; a typical nuclear reactor. Fusion: Basic process; stellar energy.

Relativity:

The Michelson – Morley Experiment. Postulates of Special theory of relativity; time dilation; length contraction; simultaneity of events; $E = mc^2$.

Textbooks:

1. Modern Physics (2nd Ed) Serway, Moses & Moyer, Saunders College Pub, 1997.
2. Fundamentals of Physics extended with Modern Physics (4th Ed) Halliday, Resnick & Walker, John Wiley, 1993

Course PHET 2..4 (B) : Elective – II
Computer Science

Total Teaching hours =50

Unit 1:

Introduction to Computer: definition of computer, history and generation of computers, characteristics of computer, classification of computer, uses of computer. System logical organization, Block diagram of computer system-Central Processing unit (ALU, CU, Main memory), Input / Output unit.

Hardware: Input devices – Keyboard, Mouse, Light pen, Joystick, Scanner, and Digitizer. Output devices- monitor, projector, printers (dot matrix, inkjet, laser, Plotter), Secondary storage devices –Hard disk, Optical disk, Floppy disk, CD-ROM.

Software: System software, Operating, System Application Software, high level, Machine and Assembly level language. Translator, compiler, interpreter, Assembler and editor. Merits and demerits of all the language. **10 Hrs**

Unit 2:

Number System: decimal, binary, octal and hexadecimal number systems and their conversations. Addition, and subtraction of binary numbers, one's complement, two's complement.

Computer Programming: Basic Programming concept : Modular Programming and structured programming. Algorithm and Flowcharts.

Overview of C : Introduction, Importance of 'C', Basic structure of 'C' program, sample 'C' Programs , Executing a 'C' Program.

Constants, Variables and Data types: character set, 'C' Tokens, keywords, identifiers, constants, variables, data types, declaration of variables, assigning values to variables, defining symbolic constants. **10 Hrs**

Unit 3:

Operators and expression : Arithmetic operators, Relational operators, Logical operators, bitwise operators, Assignment operators, increment and decrement operators, conditional operators, special operators, some computational problems type conversion in expressions, operator precedence and associativity. Mathematical functions.

Managing input and output operators: Input and Output statements, reading a character, writing characters, formatted input, formatted output statements. **08 Hrs**

Unit 4:

Decision making, Branching and looping: Decision making with IF statements, simple IF statements, The IF-ELSE statements, nesting of IF..ELSE statements, The ELSE- IF ladder,

The switch statement, The ?: operator, The GOTO statement, The WHILE statement, The DO statements, The FOR statements, jumps in loops.

Arrays: Definition of array, One Dimensional arrays- definition, declaring, initializing and processing of 1-D array. Two-dimensional arrays - definition, initializing and processing of 2-D array. Multidimensional arrays.

Handling of character strings: Declaring and initializing string variables, reading string from terminal, writing string to screen, arithmetic operation on characters, putting string together. Comparison of two strings, string handling functions, two dimensional array of character. **12 Hrs**

Unit 5:

User defined functions: Need for user-defined function, a multi-functional program the form of 'C' function, Return values and their types, calling a function, category of function- No arguments and no return values, arguments but no return values, arguments with return values, handling of non integer functions, nesting of functions, functions with arrays.

Structure and union: Structure definition, giving values to members, initialization, comparison of structure variables, array as structure, array within union. **10 Hrs**

Text Books:

1. E.Balaguruswamy: Programming in ANSI C Tata Mc Graw-Hill

2. Kamthane, Programming with ANSI and Turbo C. Pearson Education

References:

1. V.Rajaraman : " Fundamentals of Computers ", 2. S.Byron Gottfried : Programming with C,Tata McGraw-Hill

3. Yashawant Kanetkar " Let us C"

4. Brain Verminghan & Dennis M.Ritchie " ANSI C Programming "

5. Ramkumar & Rakesh Aggarwal " ANSI C Programming"

6. Kernighan, C – Programming Language ANSI C Version. Pearson Education.

7. Venkateshmurthy, Programming Techniques through C. Pearson Education.

8. P. B. Kotur "Computer Concepts and C Programming".

9. A. M. Padma Reddy "Concepts of computer and C Programming"

Course PHET 2
Course PHET 2.4 (C)Elective – III
Experimental Techniques in Physics
Total Teaching hours =50

Unit I

Nuclear Magnetic Resonance (NMR) Spectroscopy, Basic principles, nuclear amgnetic energy levels, magnetic resonance, relaxation processes, continous wave NMR pulsed (Fourier transform) NMR, Spectra and molecular structure, chemical shifts, spin spin coupling, applications. Electron spin resonance spectroscopy, ESR spectrometer, Esr spectra, hyperfine interactions, g-factor apllications.

13 Hrs

Unit II

Mass Spectroscopy : Principle, Spectrometer and its operation, resolution, mass spectrum, applications.
Mosbauer Spectroscopy : Mosbaurer effect, spectrometer, 57 Fe Mosbauer spectroscopy, nuclear hyperfine interactions. **12 Hrs**

Unit III

Infrared spectroscopy, correlation of IR spectra with molecular structure, Instrumentation, FTIR spectrometer. Introduction to production of X-ray & X-ray spectra, instrumentation, X –ray generation, collimators, filters, detectors, X- ray absorption methods, X-ray fluoroscence methods, XF- spectrometer(XFS), electron spectroscopy foe chemical analysis(ESCA), ESCa spectrometer **13 Hrs**

Unit IV

Neutron diffraction, neutron diffractometer (position sensitive diffractometer), ground based radio techniques, RADAR techniques, rocket and satellite bome probe and optical techniques for atmospheric and space research **12 Hrs**

Reference Books:

1. Instrumentation methods of analysis – 7th edition, Willard Meritt, Dean, settle, CBS publishers and distributors
2. Mosbauer Spectroscopy – Leopold May, Plenum Press, N.U.
3. Neutron diffraction – G.C. Beeon
4. X – Ray diffraction- B.D. Cutily, Edison Weisley
5. Techniques for Inonospheric Measurements: R.D.Hunsucker (Springer - Venley), 1991

Course PHET 2.4 (D) Elective – IV
Statistical Methods and Probability Theory

Total: 50 Hours

Unit I : Basics Statistics for Uni variate and Bivariate : Definition of Statistics, Applications, Classification, frequency distrubution, collection of data, presentation of data, Formation of questionnaire, measures of central tendency(AM,GM HM), Patition values, Dispersion(SD CV) , Skewness, kutosis and Moments. **Correlation and Regression** Definition of Correlation - Types, and Properties ,scatter diagram, and Regression,def, properties, two lines of regression coefficients. **14hrs**

Unit II :Theory of Probability : Introduction to Probability – Basic concepts, Mathematical and Axiomatic probability Axioms of probability Addition and multiplication theorems of probability, conditional probability and Baye's theorem. **10 hrs**

Unit III : Random variable and Mathematical Expectation: Definition of Random variables - Discrete and Continuous random variable. Probability mass function (pmf) and Probability density function (pdf) and simple examples. Definition of Expectation, properties of expectation, Moments about origin and mean, Variance and its properties. Moment generating function (m.g.f) and Cumualtive genaratinf function(CGF) its properties (without proof). **08 hrs**

Unit IV: Probability Distributions: Binomial and Poisson distribution, examples, pmf, MGF , constants- mean and variance Additive property. Fitting of Binomial and Poisson, Normal distribution def, SNV, Properties and Example. **10 hrs**

Unit V : Test of Significance and Large Sample tests : Introduction, test of significance hypothesis, simple and composite hypothesis, null hypothesis, type I & II error, level of significance, Power of the test, Steps in construction testing of Hypothesis. Tests for large sample tests - test for single mean, differences of means , single proportion and difference of proportion and problems. **08 hrs**

Books for Study:

1. Gupta S.C and Kapoor V.K.: Fundamentals of Mathematical Statistics- Sultan Chand & Sons publications.
2. Hogg .R.V.and Craig.A.T(1978):Introduction to Mathematical Statistics.-4/e Macmillan
3. Mukyopadhyay.P.(1996) .Mathematical Statistics.-Kolkotta Publishing House.
4. Goon AM, Gupta M.K., Das Gupta.B.(1991): Fundamentals of Statistics vol-I World Press Kolkatta.

Books for Reference

1. Rohatgi.V.K.(1984):An introduction to probability theory and Mathematical statistics.
2. Murry R.Speigel (1982): Theory & Problems of Statistics,Schaum's Publishing Series.
3. P.G.Hoel (1971): Introduction to Mathematical statistics,asia publishing house.
4. Cooke, Cramer and Clake: Basic Statistical Computing, Chapman and Hall.

Courses in Practicals PHCP 2.5 & PHCP 2.6.

4 Credits

PHCP 2.5: Practical-III

1. Full adder & subtractor using logic Gates.
2. Hall effect & Hall mobility in Semiconductors
3. Study of Gamma ray attenuation of gamma rays in matter - I
4. Shift Registers using IC 7495.
5. Study of Beer's Law.
6. Location of photopeak using NaI(Tl) detector.
7. Study of Active Filters
8. Experiments related Optics Condensed Matter Physics

PHCP 2.6: Practical IV:

1. Decoders & Encoders
2. Study of statistics of Nuclear counting
3. Computer programming on semiempirical mass formula, Compton scattering and alpha decay.
4. Computer programming using 'C (Solution of problem from Physics domain (expected);
5. Asynchronous & Synchronous Counters (IC 7490, IC 7492)
6. Verification of Inverse square law using G.M. Counter
7. Measurement of Physical Parameter using Sensors (e,g. LVDT/Strain Gauge)

(New experiments may be introduced each year)

Reference : (For practicals 2.5 & 2.6)

1. Microelectronics Circuits : Adel S. Sedra and Kenneth C.Smith, Oxford University Press (1991).
2. Electronic devices and circuits: R.Boylstead and Nashalsky : PHI publications (1999).
1. Electronics Principles: A.P.Malvino, TMH Publications (1984).
4. Operational Amplifier and Linear IC's: Robert F. Coughlin and Frederick F. Driscoll, PHI publications (1994).
5. Op-Amps and Linear Integrated Circuits : R. Gayakwad, PHI publications, New Delhi (2000).
6. Elementary Solid Satte Physics : M.A.Omar, Addison Wisley Pub.Ltd. New Delhi (1993).
7. X-ray Diffraction : B.D.Cullity, Addison-Wisley Ltd. New York (1972).
8. Introduction to Solid State Physics: C.Kittel, Wiley Eastern Ltd. Bangalore(1976).
9. Laboratory Manuals.
10. Advanced Practical physics : (9th Edition) B.C.Worsnop & H.T. Flint Methuen & Co.Ltd.Lond (1951).
11. Instrumental Methods of Analysis : (6th Edition) H.H. Willard, L.L.Merrit,J.A. Dean & F.A. Settle, J.K. Jain for CBS Publishers (1986).
12. Optics (2nd Edition) A.K. Gathak Tata Mc Graw Hill Pub. Comp.Ltd New Delhi (1977).
13. Experimental Spectroscopy (3rd ed): Ralph A.Sawyer, Dover Pub, N.Y. (1950).
14. Lab Manuals/Books/Charts.
15. Experiments in Modern Physics : A.C. Melissions academic press (NY)(1966).
16. Experiments in Nuclear Science, ORTEC Applications Note. ORTEC,(1971) (Available in Nuclear Physics Laboratory).
17. Practical Nucleonics: F.J.Pearson., and R.R. Dsborne, E7 F.N. Spon Ltd(1960).
18. The Atomic Nucleus: R.D.Evans, Tata McGraw Hill Pub.comp.Ltd(1960).
19. Nuclear Radiation Detectors: S.S.Kapoor and V.S.Ramamurthy,Wiely Eastern Limited(1986).
20. Experimental Nucleonics: E.Bleuler and G.J.Goldsmith, Rinehart & Co.Inc.(NY).(1958).

Question Paper Pattern

There will be 5 questions in a question paper of each theory course for semester end examination. First four questions carry 15 marks each. Of the five questions first four questions will be drawn from each of four units in the syllabus and each question will have an internal choice drawn from the same unit. Each question may consist of two parts. The fifth question carrying 10 marks shall contain four sub questions (one from each unit) with an option to answer any two.

Distribution of Marks:

a) Theory Course: Max Marks

Examination:	70
Internal Assessment:	30
Total	100

b) Practical Course Max Marks

	70 (Inclusive of 5 marks for journal and 10 marks for viva)
Internal Assessment:	30
Total	100