BANGALORE UNIVERSITY B.Sc.(CBCS)
PHYSICS

Approved Syllabus effective from
Academic year 2016-17

BANGALORE UNIVERSITY
Scheme of Instruction & Examination for B.Sc. PHYSICS , CBCS

Serial Number	Paper Number	Teaching hours per week	Examination duration	Maximum marks		Maximum total marks	Credits
				Final exam	Internal Assessment		
01	PHY T101	4	3 hours	70	30	150	2
02	PHY P102	3	3 hours	35	15		1
03	PHY T201	4	3 hours	70	30	150	2
04	PHY P202	3	3 hours	35	15		1
05	PHY P301	4	3 hours	70	30	150	2
06	PHY T302	3	3 hours	35	15		1
07	PHY T401	4	3 hours	70	30	150	2
08	PHY P402	3	3 hours	35	15		1
09	PHY T501	3	3 hours	70	30	150	2
10	PHY P502	3	3 hours	35	15		1
11	PHY T503	3	3 hours	70	30	150	2
12	PHY P504	3	3 hours	35	15		1
13	PHY T601	3	3 hours	70	30	150	2
14	PHY P602	3	3hours	35	15		1
15	PHY T603	3	3 hours	70	30	150	2
16	PHY P604	3	3hours	35	15		1
Grand total						1200	16(T) 8(P)

Note-I:

- The paper number is a three digit number with ' **0** ' in the middle
- The digit to the left of ' **0** ' indicates the semester number
- Odd number to the right of ' **0** ' indicates a theory paper
- Even number to the right of ' **0** ' indicates a practical paper
- The prefix **T** indicates Theory paper and **P** indicates Practical

Note-II:

The marks distribution for the final practical examination is as follows:

1. Writing Principle / Statement/ Formula with explanation of symbols and units	05 Marks
2. Diagram/Circuit Diagram / Expected Graph	05 Marks
3. Setting up of the experiment + Tabular Columns + taking readings	10 Marks
4. Calculations (explicitly shown) + Graph	07 Marks
5. Accuracy of results with units	03 Marks
6. Class Records (to be valued at the time of practical examination)	05 Marks
Total for Practical Examination	**35 Marks**
Note : Wherever explicit setting up of experiments does not exist like in the case of spectral charts or pre – acquired data is involved(astrophysics or atmospheric experiments) , the marks for setting up of experiment may be provided for additional graphs and formulae	

Note-III:

- A minimum of **EIGHT** (8) experiments must be performed in each practical paper
- Experiments marked "Mandatory" should be performed necessarily

Syllabus for I Sem BSc, (Physics) Paper –I : Phy-T101:

MECHANICS – 1 , HEAT AND THERMODYNAMICS – 1

UNIT – I

- **MOTION** : Newton's Laws of Motion (Statement and illustration), Motion in a resistive medium; Drag force& Drag Coefficient, Drag force with v dependence (only vertical) and v^2 dependence (only vertical) – derivation for velocity and position- graphs with and without resistance, concept of terminal velocity

4 hours

- **FRICTION** : Static and Dynamic Friction – Friction as a self adjusting force, Coefficient of Static and dynamic friction; Expression for acceleration of a body moving along an inclined plane with and without friction, Free Body Diagrams for the following cases (i)Two masses connected by a string hanging over a frictionless pulley (ii)Two masses in contact and masses connected by strings (horizontal only) (iii)Two masses connected by a string passing over a frictionless pulley fixed at the edge of a horizontal table.

4 hours

- **PLANETARY & SATELLITE MOTION** : Motion along a curve - radial and transverse components of acceleration(derivation); Newton's law of gravitation (vector form only), Kepler's laws (statements only);Gravitational Field and Potential – relation between them; Field and Potential due to a solid sphere (derivation); Orbital and Escape Velocity (derivation), Satellite in circular orbit and applications; Geostationary and Geosynchronous orbits.

5 hours

UNIT – II

- **WORK & ENERGY :**Work done by a constant and variable force; Work energy theorem; Work and potential energy; examples of potential energy; Work done by gravitational force; Work done by a spring force; Conservative and non – conservative force; Conservation of mechanical energy **4 hours**
- **SYSTEM OF PARTICLES :**Centre of mass of rigid bodies – General expression; Newton's law for a system of particles; Linear momentum for a particle and a system of particles; Conservation of linear momentum; System with varying mass; Single stage Rocket

motion – Velocity & Acceleration with and without gravity; Elastic and inelastic collisions (only 2D)

4 hours

- **BLACK BODY RADIATION** : Black body radiation and its spectral energy distribution; Kirchhoff's law, Stefan-Boltzmann's law, Wien's displacement law, Rayleigh-Jeans law (Statements), Derivation of Planck's law – deduction of Wien's Law & Rayleigh – Jeans Law, Solar constant and its determination using Angstrom's Pyrheliometer; Estimation of the surface temperature of the sun

5 hours

UNIT – III

- **KINETIC THEORY OF GASES :**Basic assumptions of kinetic theory; Derivation of - deduction of perfect gas equation; Maxwell's law of distribution of velocity *(without derivation)*- deduction of most probable velocity, mean velocity and root mean square velocity; Derivation of expression for mean free path $\left(\lambda = \frac{3}{4\pi\sigma^2 n}; Maxwell's distribution law: \lambda = \frac{1}{\sqrt{2}\pi\sigma^2 n}\right)$; Degrees of freedom and principle of equipartition of energy; Derivation of , Specific heats of an ideal gas, atomicity of gases

6 hours

- **TRANSPORT PHENOMENA** :

  Viscosity and thermal conduction in gases *(*with derivation) ;Relation between coefficient of viscosity and coefficient of thermal conductivity of a gas

2 hours

- **Real Gases :** Derivation of van der Waal's equation of state; Andrews experiments on Carbon dioxide; Derivation of the critical constants; Comparison of van der Waal's isotherms with Andrew's isotherms

5 hours

UNIT – IV

- **Basic Concepts and the Zeroth law of thermodynamics**

  Macroscopic and microscopic descriptions of a system; Thermal Equilibrium - Zeroth Law of Thermodynamics; Concept of temperature; Thermodynamic equilibrium;

Thermodynamic coordinates - extensive and intensive; Equations of state; Various processes - PV indicator diagrams **3 hours**

- **First Law of Thermodynamics**

  The first law of Thermodynamics; Sign convention for heat and work; Derivation of equation of state $PV^{\gamma} = const$; Work done in an isothermal and adiabatic process for an ideal gas; Internal energy as a state function; Application of the first law for (i) Cyclic Process (ii) Adiabatic Process (iii) Isochoric Process (iv) Isobaric Process and (v) Isothermal Process. **3 hours**

- **Second Law of Thermodynamics**

  Reversible and irreversible processes; Carnot Engine; Carnot Cycle and its efficiency (with derivation); Second law of thermodynamics (Kelvin's & Clausius' statements and their equivalence); Practical internal combustion engines - Otto and Diesel Cycles (qualitative treatment); Carnot theorem (proof); Refrigerator- Coefficient of performance

  4 hours

- **Entropy**

  The concept of entropy; Entropy of an ideal gas; Entropy - reversible process, Entropy - irreversible process; Entropy and the second law; Clausius inequality; Principle of increase of entropy; Entropy change in (i) adiabatic process (ii) free expansion (iii) cyclic process (iv) isobaric process; TdS diagram of a Carnot cycle; Entropy and disorder

  3 hours

References:

1. Fundamentals of Physics- R.Resnik,D. Halliday and Walker; Wiley 6ed(**2001**)
2. Physics-Classical and Modern, FJ Keller, E Gettys and J J Skove, McGraw Hill Second Revised Edition(**1993**)
3. Classical Mechanics-K N Sreenivasa Rao, Universities Press- Orient Longman (**2003** ed)
4. Concepts of Physics Vol (1)-H C Verma, Bharathi Bhavan Publishers, **2004** Edition

5. University Physics- F W Sears, M W Zemansky & H D Young, Pearson Education First ed.(**2014**)

6. Mechanics- J C Upadhaya, Himalaya (**2014** ed)

7. Mechanics- Berkeley Physics Course Vol(1)- SI units CharlesKittel etal, McGrawHill Education (India) 2e (2011)

8. Elements of Properties of matter – D S Mathur, S.chand(GL) 7 Co Ltd,Dehi 1ed(**2010**)

9. Properties of Matter - Brijlal & Subramanyam, S Chand & Co, (**2002)**

10. Newtonian Mechanics- A P French, Nelson & Sons UK, (**1971**)

11. Mechanics & Thermodynamics, G Basavaraju & Dipan Ghosh, McGrawHill Education (India) 1ed (**1985**)

12. A treatise on general properties of matter, Sengupta and Chatterjee, New Central Book Agency Pvt Ltd, Calcutta (7th Revised edition -**2010**)

13. Waves & Oscillations, P K Mittal & Jai Dev Anand, Hari Anand Publications Pvt Ltd (2011ed)

14. Heat and Thermodynamics- M M Zemansky,McGrawHill Education (India) 8ed (**2011**)

15. Heat & Thermodynamics, MWZemansky & RHDittman, McGraw Hill Book company,Inc.US Seventh Revised edition(**1997**)

16. Heat and Thermodynamics- Brij Lal and N Subramanyam, SChand & Co, New Delhi -1985

17. Heat and Thermodynamics – D S Mathur, SChand & Co, New Delhi, 5th Edition(2004)

18. Heat, Thermodynamics & Stastical Mechanics, BrijLal & Subramanyam, S. Chand & Company,Delhi; (**2008** ed)

19. Thermodynamics & Statistical Physics, Sharma & Sarkar, Himalaya Publishing House, Third Edition(1991)

20. Thermodynamics, Kinetic theory & Statistical Thermodynamics, FWSears & GLSalinger, Narosa Publishing House (Third Edition **1998**)

21. Fundamentals of Classical Thermodynamics, Gordon J V Wylen & Richard E Sonntag, John

Wiley Eastern Limited; 4th ed (**1994**)

22. Thermal Physics, S C Garg, R M Bansal & C K Ghosh, McGrawHill Education (India) Second ed (**2013**)

PHYSICS – P102, PRACTICAL PHYSICS – I

1. Error Analysis – Data analysis techniques and graphing techniques to be learnt (**Mandatory**)
2. Atwood machine – with photogate
3. Determination of coefficients of static, kinetic and rolling frictions
4. Verification of principle of conservation of energy
5. Simple pendulum - dependence of T on amplitude
6. Determination of coefficient of viscosity by Stokes' method
7. Determination the Acceleration due to Gravity and Velocity for a freely falling body, using Digital Timing Techniques.
8. Work done by variable force
9. Interfacial tension by drop weight method
10. Thermal behavior of a torch filament
11. Specific heat by Newton's law of cooling
12. Verification of Newton's law of cooling and Stefan's law of radiation
13. Determination of Stefan's constant by emissivity method
14. Determination of Solar constant
15. Calibration of Thermistor for Temperature measurement
16. Calibration of thermocouple for Temperature measurement

Note: A minimum of EIGHT (8) experiments must be performed

References:

1. B Saraf etc, - Physics through experiments, Vikas Publications (**2013**)
2. D P Khandelwal – A Laboratory Manual of Physics for Undergraduate Classes, Vikas Publications First ed (**1985**)
3. Advanced Practical Physics for Students – Worsnop & Flint, Methuen & Co, London

4. An Advanced Course in Practical Physics , D Chattopadhyay, P C Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, (**2002)**

5. BSC, Practical Physics, CL Arora, SChand & Co, New Delhi, (**2007**) Revised Edition

Syllabus for II Sem BSc (Physics) Paper II-Phy-T201:

MECHANICS – 2 , HEAT AND THERMODYNAMICS – 2

UNIT – I

- **OSCILLATIONS :** SHM ; Differential equation of SHM and its solutions, Kinetic and Potential energy, Simple and compound pendulum; oscillations of two masses connected by a spring; damped oscillations – over damped, under damped and un-damped oscillations; forced oscillations - concept of resonance; Coupled Oscillators - in phase and out of phase oscillations- energy transfer. **6 hours**
- **ELASTICITY**: Hooke's law, Stress – Strain diagram, definitions of three elastic moduli; Relationship between three elastic constants (derivation); Poisson's ratio; Work done in stretching a wire; Bending of beams; Bending moment, Theory of single cantilever, Couple per unit twist, Torsional oscillations.
  7 hours

UNIT – II

- **Thermodynamic potentials :** Internal Energy; Enthalpy; Helmholtz free energy; Gibbs free energy and their significance; Maxwell's thermodynamic relations (using Thermodynamic potentials) and their significance; TdS relations; Energy equations and Heat Capacity equations; Third law of thermodynamics (Nernst Heat theorem)
  4 hours
- **Phase transitions of the first order :** Melting, vaporization and sublimation; Condition of equilibrium of phases in terms of Gibbs potential;Clausius-Clapeyron equation - elevation of boiling point, depression of freezing point; Equilibrium between phases - triple point **3 hours**
- **Low Temperature Physics :** Methods of producing low temperatures: (i) Joule Thomson (Joule Kelvin / Throttling / Porous plug) experiment, Joule Thomson

Coefficient, inversion temperature (ii) Adiabatic demagnetization - working and theory **4 hours**

- **Liquefaction of gases :** Regenerative cooling coupled with Joule Thomson cooling; Adiabatic expansion with Joule Thomson cooling (qualitative)

2 hours

UNIT – III

- **FRAMES OF REFERENCE :** Inertial and Non inertial frames of reference - Importance of Inertial frame, Linearly accelerated frames, Concept of frame dependent forces; Galilean relativity - Transformation of Position, Distance/Length, Velocity (Non-relativistic velocity addition theorem), Acceleration; Principle of Invariance, Michelson – Morley Experiment, Search for ether

5 hours

- **SPECIAL THEORY OF RELATIVITY :** Postulates of the special theory of relativity; Lorentz Transformations – Length Contraction, Time Dilation – twin paradox, Velocity Addition Theorem; Variation of mass with velocity; Mass – Energy equivalence; Relativistic momentum and kinetic energy

8 hours

UNIT – IV

- **MOMENT OF INERTIA** : Review of rotational motion of Rigid bodies; Kinetic energy of rotation-Moment of Inertia of a body; Theorem of Moment of Inertia-Parallel and perpendicular axes theorem with proofs (2-D case); Calculation of moment of inertia of a disk, annular ring, solid sphere and rectangular bar; Conservation of angular momentum with illustrations.

9 hours

- **WAVES :** Wave Equation, Speed of transverse waves on a uniform string; Speed of longitudinal waves in a fluid; Group velocity and Phase velocity – relation between

them; **4 hours**

References:

1. **References:**
2. Fundamentals of Physics- R.Resnik,D. Halliday and Walker; Wiley 6ed(**2001**)
3. Physics-Classical and Modern, FJ Keller, E Gettys and J J Skove, McGraw Hill Second Revised Edition(**1993**)
4. Classical Mechanics-K N Sreenivasa Rao, Universities Press- Orient Longman (**2003** ed)
5. Concepts of Physics Vol (1)-H C Verma, Bharathi Bhavan Publishers, **2004** Edition
6. University Physics- F W Sears, M W Zemansky & H D Young, Pearson Education First ed.(**2014**)
7. Mechanics- J C Upadhaya, Himalaya (**2014** ed)
8. Mechanics- Berkeley Physics Course Vol(1)- SI units CharlesKittel etal, McGrawHill Education (India) 2e (2011)
9. Elements of Properties of matter – D S Mathur, S.chand(GL) 7 Co Ltd,Dehi 1ed(**2010**)
10. Properties of Matter - Brijlal & Subramanyam, S Chand & Co, (**2002)**
11. Newtonian Mechanics- A P French, Nelson & Sons UK, (**1971**)
12. Mechanics & Thermodynamics, G Basavaraju & Dipan Ghosh, McGrawHill Education (India) 1ed (**1985**)
13. A treatise on general properties of matter, Sengupta and Chatterjee, New Central Book Agency Pvt Ltd, Calcutta (7th Revised edition -**2010**)
14. Waves & Oscillations, P K Mittal & Jai Dev Anand, Hari Anand Publications Pvt Ltd (2011ed)
15. Heat and Thermodynamics- M M Zemansky,McGrawHill Education (India) 8ed (**2011**)
16. Heat & Thermodynamics, MWZemansky & RHDittman, McGraw Hill Book company,Inc.US

Seventh Revised edition(**1997**)

17. Heat and Thermodynamics- Brij Lal and N Subramanyam, SChand & Co, New Delhi -1985
18. Heat and Thermodynamics – D S Mathur, SChand & Co, New Delhi, 5th Edition(2004)
19. Heat, Thermodynamics & Stastical Mechanics, BrijLal & Subramanyam, S. Chand & Company,Delhi; (**2008** ed)
20. Thermodynamics & Statistical Physics, Sharma & Sarkar, Himalaya Publishing House, Third Edition(1991)
21. Thermodynamics, Kinetic theory & Statistical Thermodynamics, FWSears & GLSalinger, Narosa Publishing House (Third Edition **1998**)
22. Fundamentals of Classical Thermodynamics, Gordon J V Wylen & Richard E Sonntag, John Wiley Eastern Limited; 4th ed (**1994**)
23. Thermal Physics, S C Garg, R M Bansal & C K Ghosh, McGrawHill Education (India) Second ed (**2013**)
24. Physics of Waves, University Leadership Project, Prasaranga, Bangalore University
25. Perspectives of Modern Physics, Arthur Beiser, Mc- Graw Hill;
26. Introduction to Special Theory of Relativity, Rober Resnick, John Wiley and Sons First Edition

27. Special Relativity, A P French, MIT, w.w.Nortan and CompanyFirst Ed (**1968)**

28. Concepts of Modern physics McGraw hill Education(India) Pvt Ltd;6th ed **(2000)**

PHYSICS – P202, PRACTICAL PHYSICS – II

1. Torsional pendulum – to determine C and Rigidity modulus
2. Bar pendulum – determination of g
3. Spring mass- (a) static case to determine 'k'
   (b) dynamic case to determine 'k'
   (c) 'k' as a function of L of spring
4. Rigid pendulum – T and decay of amplitude
5. Coupled oscillator – string coupled with change of tension
6. Rolling dumb bell - on parallel inclined rails
7. Verification of parallel and perpendicular axis theorem
8. Searle's double bar
9. Cantilever of negligible mass to find Young's modulus
10. q- by Stretching
11. q by uniform bending
12. q by single cantilever
13. q by Koenig's method
14. n by dynamic method
15. Fly wheel
16. Verification of Clausius-Clapeyron equation using pressure cooker
17. Thermal conductivity of a bad conductor by Lee's and Charlton's method
18. Thermal conductivity of rubber
19. Determination of thermal conductivity of a good conductor by Angstrom method / Searle's method

Note: A minimum of EIGHT (8) experiments must be performed

References:

1. B Saraf etc, - Physics through experiments, Vikas Publications
2. D P Khandelwal – A Laboratory Manual of Physics for Undergraduate Classes, Vani Publications
3. Advanced Practical Physics for Students – Worsnop & Flint, Methuen & Co, London
4. An Advanced Course in Practical Physics , D Chattopadhyay, P C Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, 2002

5. BSC, Practical Physics, C L Arora, S Chand & Co, New Delhi, 2007 Revised Edition

Syllabus for III Sem BSc (Physics) Paper III-Phy-T301:

ELECTRICITY and MAGNETISM

UNIT – I

DC CIRCUIT ANALYSIS : Concept of Voltage and Current Sources, Kirchhoff's Current Law, Kirchhoff's Voltage Law (statements). Principle of Duality (voltage and current source equivalents). Thevenin's Theorem (statement and proof), Superposition Theorem(statement and proof), Norton's Theorem (Statement and explanation). Reciprocity Theorem. Maximum Power Transfer Theorem (statement and proof).

8 hours

Transient currents : Self inductance – definition, explanation, expression $L = \frac{\mu N^2 A}{l}$; Magnetic field energy stored in an inductor; Growth and decay of charge in series RC circuit, Growth and decay of current in series LR circuit, Decay of charge in series LCR circuit - Damped, under-damped and over-damped conditions

5 hours

UNIT – II

Magnetic Field and Forces : Force on a moving charge in a magnetic field, Lorentz force and definition of **B**, force on a current carrying conductor in uniform magnetic field, Force between parallel conductors; Definition of ampere;

Biot – Savart's law, Magnetic field due to a straight current carrying conductor (Derivation for Finite/Infinite Length, Amperes swimming rule, Right hand palm rule), Magnetic field of a circular loop; Force and torque on a circular current loop in a magnetic field, magnetic dipole moment, Field on the axis of a solenoid (derivation and explanation), Principle and theory of a moving coil BG, Concept of dead beat galvanometer, determination of high resistance by leakage, theory of HTG, Ampere's Circuital law (statement), Application of Ampere's law to straight wire, solenoid and toroid

13 hours

UNIT III

Scalar and vector fields : Gradient of a scalar function (use of del operator), Divergence and Curl product rules (explanation with geometrical representation), Line, surface and volume integrals

(explanation with examples), Fundamental theorem for divergence and curl (statements only).

3 hours

ELECTROMAGNETIC WAVES : Equation of Continuity, Displacement Current, Maxwell's equations in differential form (Derivation and physical significance), Derivation of wave equation (for one dimension), Velocity of em waves in free space and isotropic dielectric medium(derivation), Relation between refractive index and permittivity (qualitatively), Transverse nature of Plane em waves, , Poynting Vector, Energy density in electromagnetic field, Momentum and Pressure of em waves (derivation), Electromagnetic waves in a conducting medium – skin effect and skin depth

10 hours

UNIT IV

ALTERNATING CURRENT : rms and average value of ac – definition and expressions, Representation of sinusoids by complex numbers (brief explanation), response of LR, CR and LCR series circuit to sinusoidal voltage – j operator method, series and parallel resonant (LR parallel C) circuits (mention condition for resonance with expressions for impedance and current), expression for Q factor, band width, AC bridge - Maxwell bridge (derivation of condition for balance , determination of self-inductance of a coil).

6 hours

THERMOELECTRICITY : Seebeck effect (brief explanation, experiment and temperature dependence), Thermoelectric series, Neutral temperature, Laws of thermoelectricity (qualitative), Peltier effect, Peltier coefficient (qualitative analysis), Thomson effect, Thomson coefficient (qualitative analysis), Theory of thermoelectric circuits using thermodynamics (Application of thermodynamics to a thermocouple and connected relations with derivation), Thermoelectric diagrams and uses (in finding the Seebeck Coefficients, Peltier coefficient, Thomson coefficient, total emf of a thermocouple, neutral temperature) Applications of thermoelectricity - Boys' Radio-micrometer, thermopile and thermoelectric pyrometer (brief explanation with experimental setup).

7 hours

References:

1. Electricity and magnetism by Brij Lal and N Subrahmanyam, Rathan Prakashan Mandir, Nineteenth Edition, 1993

2. Principles of Electronics by VK Mehta and Rohit Mehta, SChand & Company, Eleventh Edition, **2008**

3. Feynman Lecture series, VolII, RPFeynnman et al, Narosa Publishing House, New Delhi

4. Electricity & Magnetism, NSKhare & SSSrivastava, AtmaRam & Sons, New Delhi

5. Electricity & Magnetism, DLSehgal, KLChopra, NKSehgal, SChand & Co, Sixth Edition, (**1988**)

6. Electricity & Electronics, DCTayal, Himalaya Publishing House, Sixth Edition(**1988**)

7. Basic Electronics & Linear Circuits, NN Bhargava, DC Kulshrestha & SC Gupta, TMH Publishing Company Limited, 28th Reprint, (**1999**)

8. Fundamentals of Physics by Halliday, Resnick and Walker, Asian Books Private Limited, New Delhi, 5th Edition, (**1994**)

9. Introduction to Electrodynamics by DJ Griffiths Pearson Education (**2015**)

10. Electromagnetism by BB Laud 2ed

11. Electrical Networks, Theraja 3rd revised edition

PHYSICS – P302, PRACTICAL PHYSICS – III

1. To find L and C by equal voltage method
2. Energy consumption in an electrical circuit - to find power factor
3. Resonance in LCR series circuit
4. Resonance in LCR parallel circuit
5. Mirror galvanometer- figure of merit
6. High resistance by leakage using BG
7. Thermoelectric circuit - find Seebeck coefficients
8. Verification of Law of intermediate metals
9. Study of thermo emf as a heat pump
10. Load regulation of constant current source

11. Black box - identify & measure R, L and C
12. Verification of Thevenin's theorem
13. Verification of Superposition theorem
14. Verification of maximum power transfer theorem
15. Maxwell's impedance bridge
16. Desauty's bridge
17. Anderson's bridge

Note: A minimum of EIGHT (8) experiments must be performed

References:

1. Physics through experiments, BSaraf etc,Vikas Publications **1987**
2. Advanced practical physics, Chauhan & Singh, Pragathi Publications 1ed
3. Practical Physics, DChattopadhyaya et al, Central Publications
4. An Advanced Course in Practical Physics , D Chattopadhyay, PC Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, **2002**
5. Practical Physics, D C Tayal **2002**

Syllabus for IV Sem BSc (Physics) Paper IV - PhyT401:

OPTICS and FOURIER SERIES

UNIT I

WAVE OPTICS: Huygen's wave theory of light; Huygen's principle, construction Huygen's wave front, Laws of reflection and refraction using spherical wave for at a plane surface (derivation of image distance = object distance using Huygen's construction, derivation of Snells law).

3 hours

INTERFERENCE :

Coherent sources and their production; Conditions for observing interference (mention); Conditions for

constructive and destructive interference (mention)

1 hour

Coherent sources by division of wave front

Biprism-theory and working, experiment to determine wavelength; Effect of thin film in the path of one of the beams; Calculation of thickness of the **5 hours**

Coherent sources by division of amplitude:

Interference at thin films - reflected and transmitted light, Colours of thin films; Theory of air wedge; Theory of Newton's rings (Only reflected System). Determination of Refractive index of a liquid **4 Hours**

Unit - II

Diffraction - Fresnel diffraction

Concept of Fresnel's half period zones; Theory of rectilinear propagation; Fresnel diffraction, Construction and working of Zone plate; Comparison of Zone plate with lens; Cylindrical Wavefront (Half period strips – qualitative), Theory of diffraction at a straightedge **7 hours**

Fraunhoffer diffraction

Theory of single slit diffraction; Theory of grating - normal and oblique incidence - Experimental determination of wavelength; Discussion of Dispersive power; Resolving power, Rayleigh's criterion; Expression for resolving power of grating and telescope; Comparison of prism and grating spectra **6 Hours**

UNIT III

Polarization

Review of plane polarized light and method of production; Double refraction at crystals; Huygens' explanation of double refraction; Theory of retarding plates - Quarter wave plates and Half wave plates; Theory of superposition of two plane polarized waves with perpendicular vibrations, Production and detection of linearly , elliptically and circularly polarized light; Optical activity - Fresnel's explanation, Laurent's half shade polarimeter. **6 Hours**

Lasers

Introduction; Spontaneous and stimulated emission; Einstein's coefficients and optical amplification; Population inversion; Main components of a laser; Lasing action; Ruby Laser - construction and working - energy level diagram; He-Ne Laser - construction and working - energy level diagram;
Spatial Coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density

7 hours

UNIT IV

Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series {Example : Fourier Series for

(i) $f(x) = e^x if -\pi < x < \pi$

(ii) $f(x) = \begin{cases} -1 -\pi \le x \le 0 \\ 10 \le x \le \pi \end{cases}$

(iii) $f(x) = x^2 \in theinterval[-1, +1]$ }

Expansion of functions with arbitrary period.
(Concept of change of scale; Fourier Series for Periodic Rectangular Wave; Half – Wave rectifier; Trapezoidal wave :

$$f(x) = \begin{cases} x, 0 \le x \le 1 \\ 1, 1 \le x \le 2 \\ 3 - x, 2 \le x \le 3 \end{cases}$$

)Application to Square wave, triangular Wave and Saw Tooth Wave (superposition of first three components to be shown graphically) . **9 hours**

Optical Fibres

Optical fiber-principle, description and classification; Why glass fibers? Coherent bundle; Numerical aperture of fiber; Attenuation in optical fibers - limit Multimode optical fibers; Ray dispersion in multi-mode step index fibers; **4 hours**

References:

1. Optics, Ajoy Ghatak, Tata Mc Graw Hill, 4th Edition

2. Introduction to Modern Optics, Ajoy Ghatak, Tata McGraw Hill Publications (**2009**)

3. Fundamentals of Physics by Halliday, Resnick and Walker, Asian Books Private Limited, New Delhi, 5th Edition, (**1994)**

4. A K Ghatak and K Thyagarajan, Contemporary Optics, Macmillan/Premium Publishing Corp (**1978**)

5. Jenkins and White, Optics, McGraw Hill Education India Pvt Ltd 4th ed(**2011**)

6. Optics, Brij Lal and Subramaniam, SChand & Company, 22nd Edition, (**1994**)

7. Principles of Optics, B K Mathur, Gopal Printing Press, Kanpur, 6th Edition, (**1996**)

8. An Introductions to LASERS-Theory & Applications, M N Avadhanulu, S Chand & Co, (**2001**)

9. Introduction to Fibre Optics, Ajoy Ghatak & K Thyagarajan, Cambridge University Press, First Edition Reprint,(**2002**)

10. Optical Fibre Communications, Gerd Keiser, McGraw Hill, 3rd Edition, (**2000**)

10. Fibre Optic Communication, DCAgarwal, Wheeler Publications, Second Edition Reprint,(**1996**)

11. Optics, Klein and Furtak, Wiley Publications Pvt Ltd 2ed (**2011**)

12. B B Laud, Lasers and Non-Linear optics. NewAge International Pvt Ltd Publishers (**2011**)

13. Physics of Waves, University Leadership Project, Prasaranga, Bangalore University(1ed **1981**)

14. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley 10th ed(**2003**)

15. Mathematical Physics, B D Gupta, Vikas Publshing House, 4th ed (**2016**)

PHYSICS – P402, PRACTICAL PHYSICS – IV

1. Verification of Brewster's law
2. Refractive index of a liquid by parallax method
3. Focal length of combination of lenses separated by a distance
4. Biprism – determination of wavelength of light
5. Air wedge – determination of thickness of object
6. Newton's rings – determination of radius of curvature of lens surface
7. Newton's rings – determination of refractive index of a liquid.
8. Diffraction grating in minimum deviation position
9. Diffraction grating in normal incidence position
10. Resolving power of telescope
11. Resolving power of a grating
12. Diffraction at straight edge
13. Polarimeter – determination of specific rotation of a solution
14. Diffraction of LASER at a wire
15. Measurement of numerical aperture of an optical fibre.
16. Fraunhoffer diffraction of LASER at single slit
17. Diffraction of LASER at graduations of a metal scale

Note: A minimum of EIGHT (8) experiments must be performed

References:

1. An Advanced Course in Practical Physics , D Chattopadhyay, P C Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, **2002**

2. Practical Physics, Experiments with He-Ne laser, R S Sirohi 2nd ed

3. Advanced Practical Physics, Worsnop & Flint Asia Pub.(1979)

4. BSc, Practical Physics, C L Arora, S Chand & Company, New Delhi, Revised Edition, **2007**

Syllabus for V Sem. B.Sc. (Physics) Paper V – Phy T501:

STATISTICAL PHYSICS, QUANTUM MECHANICS – I, ATMOSPHERIC PHYSICS AND NANOMATERIALS

UNIT I : STATISTICAL PHYSICS (15 HOURS)

Specification of state of the system, Macro state, Micro State, Phase Space, Stirling's Approximation, Thermodynamic Probability and its calculation (Description of each with an example); Entropy and Thermodynamic probability ($S = kln\Omega$). Basic postulates of Statistical Physics ; Ensemble (Micro – canonical, canonical and grand canonical ensembles)

2 hours

Maxwell – Boltzmann Statistics : Maxwell – Boltzmann Distribution function (Derivation of $n_i = \frac{g_i}{e^{\alpha+\beta E_i}}$, Energy distribution function $f(E_i) = \frac{n_i}{g_i}$); Maxwell – Boltzmann law of velocity distribution (mention- most probable velocity, average velocity, rms velocity) Limitations of M – B statistics **3 hours**

Bose – Einstein Statistics : B-E distribution function (Derivation of $n_i = \frac{g_i}{e^{\alpha+\beta E_i - 1}}$) Bose-Einstein condensation properties of liquid He (qualitative) [Mention of expression of Bose Temperature T_B– Concept BE Condensation –variation of N_o (number of particles in Zero energy state) and N_e (number of particles in non-Zero energy state) with temperature- BE condensation properties of Liquid He^4 (Qualitative description)]

Radiation as photon gas, Bose's derivation of Planck's law, Rayleigh-Jeans law, Wein's law ; Specific Heat capacity of metals [Einstein's theory of specific heat capacity of solids – [Derivation of the equation where $\theta = h\nu/k$] **5 hours**

Fermi – Dirac Statistics :

Fermi-Dirac distribution function; Fermi sphere and Fermi energy, Fermi gas; Electronic Specific heat Capacity in metals (Mention of the contribution to specific heat capacity from free electrons)

Comparison of Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac distribution functions

5 hours

UNIT II : QUANTUM MECHANICS – I

Failure of Classical Physics to explain the phenomena such as stability of atom, atomic spectra, black body radiation, photoelectric effect, Compton effect and specific heat of solids, Planck's quantum theory, Explanation of the above effects on the basis of quantum mechanics

[Experimental observation, failure of classical theory, quantum mechanical explanation, Photoelectric effect -Einstein's explanation, Compton Effect – mention of expression for wavelength shift (no derivation), Specific heat of solids -Einstein's and Debye's explanation of specific heat (qualitative). Stability of atom and atomic spectra, Black body radiation [Mention of Planck's equation, arrive at Wien's and Rayleigh-Jean's equation for energy distribution from Planck's equation]. **5 hours**

de Broglie's hypothesis of matter waves (λ in terms of momentum, energy, temperature for monoatomic gas molecules); Thomson's experiment; Davisson and Germer's experiment – normal incidence method; Concept of wave packet, Group velocity and particle velocity (relation between group velocity and particle velocity) Heisenberg's uncertainty principle - different forms; Gamma ray microscope experiment; Application to Non – existence of electron in nucleus **10 hours**

UNIT III : ATMOSPHERIC PHYSICS

Fixed gases and variable gases; Temperature structure of the atmosphere; Hydrostatic balance, Variation of pressure with altitude, scale height; Relative and Absolute humidity **4 hours**

Beer's law (derivation); Global energy balance for earth – atmosphere system, Greenhouse effect; Atmosphere dynamics –Accelerated rotational frames of reference – Centripetal and Coriolis force (derivation), Gravity and pressure gradient forces (with derivation), Applications of Coriolis force – Formation of trade winds, cyclones, erosion of river banks **6 hours**

NANOMATERIALS

Nanomaterials – Introduction, classification – (0D, 1D, 2D). Quantum dots, nanowires and nanofilms, Multilayered materials- Fullerene, Carbon Nano Tube (CNT), Graphene (Mention of structures and properties); Synthesis techniques (Top down- Explanation of Milling & bottom up - Sol gel process). Characterisation techniques- (brief description of SEM, TEM, AFM).

Electron confinement (0D, 1D, 2D- energy levels as a particle in a box); Size effect-Surface to volume ratio; distinction between nanomaterials and bulk materials in terms of energy band. Distinct properties of nano materials (Mention- optical, electrical, mechanical and magnetic properties);

Mention of applications: (Fuel cells, catalysis, phosphors for HD TV, next generation computer chips, elimination of pollutants, sensors) **5 hours**

References :

1. Quantum Mechanics, ***B.H. Bransden and C.J. Joachain***, 2nd Edition, Pearson Education (**2004**)
2. Introduction to Quantum Mechanics, ***David J. Griffiths***, 2nd Edition, Pearson Education ,(**2005**)
3. Modern Quantum Mechanics, ***J.J. Sakurai***, Pearson Education, (**2000**)
4. Principles of Quantum Mechanics, ***Ghatak and Lokanathan***, Macmillan, (**2004**)
5. Statistical Mechanics, An Introduction, **Evelyn Guha**, Narosa (**2008**)
6. Statistical Mechanics, ***R.K.Pathria***, 2nd edition, Pergamon Press (**1972**)
7. Statistical and Thermal physics, ***F.Reif***, McGraw Hill International(**1985**)
8. Statistical Mechanics, ***K.Huang***, Wiley Eastern Limited, New Delhi (**1975**)
9. Basic of Atmospheric Physics, A Chandrasekar, PHI Learning Private Limited (EEE)
10. Weather, climate and atmosphere by Siddartha.
11. Atmospheric Science by John M Wallace and Peter V Hobbs, Elsevier Publications (**2006**).
12. Introduction to Atmospheric Science by Turberick &Lutzens,Elsevier Publications
13. Nano materials, A K Bandopadhyay. New Age International Pvt Ltd Publishers (**2007**)
14. Nanocrystals, C. N. Rao, P. John Thomas.
15. Nanotubes and wires, C. N. Rao, A. Govindaraj.

PHYSICS – P502, PRACTICAL PHYSICS – V(A)

1. Applications of CRO in the (a) study of Lissajous figures (b) calculation of rms voltage (c) calculation of frequency of AC. **(Mandatory)**
2. Monte Carlo experiment & error analysis
3. Verification of Maxwell's distribution of velocity
4. Maxwellian distribution of velocities for electron using EZ81vacuum diode
5. Dice experiment – to study statistical nature of results
6. Study of statistical distribution on nuclear disintegration data (using GM counter as a black box)
7. Characteristics of a photo cell-determination of stopping potential.

8. Determination of Planck's constant.
9. Characteristics and spectral response (selenium photocell)
10. Determination of particle size using XRD Scherer's formula.
11. Temperature of atmospheric air - by using Thermograph (Bimetallic type)- Plotting the graph of temperature Vs time.
12. Relative humidity using hair hygrometer
13. Estimation of relative humidity using wet and dry bulb thermometer
14. Wind speed and direction by Hand held anemometer and wind wane
15. Estimation of height from the given pressure data
16. Regulated power supply (using zener diode).
17. Determination of transistor h-parameters.
18. Frequency response of a CE amplifier.
19. Transistor as a switch and active device.
20. Construction of RFO or AFO - using transistor
21. Emitter follower

Note: A minimum of EIGHT experiments must be performed.

References :

1. Worsnop and Flint , Advanced practical physics for students, Asia Pub.(**1979**)
2. Singh and Chauhan, Advanced practical physics, 2 vols., Pragati prakashan, (**1976**)
3. Misra and Misra, Physics Lab. Manual, South Asian publishers (**2000**)
4. Gupta and Kumar, Practical physics, Pragati prakashan, (**1976**)
5. Ramalingom & Raghuopalan : A Lab. Course in Electronics
6. Bharagav et al : Electronics, TTI tata MacGraw Hill 33rd Reprint (**2002**)

Syllabus for V Sem. B.Sc. (Physics) Paper VI – Phy T503:

ASTROPHYSICS, SOLID STATE PHYSICS AND SEMICONDUCTOR PHYSICS

UNIT-I : ASTROPHYSICS (15 hours)

Parallax and distance: Helio-centric parallax, Definition of parsec (pc), Astronomical unit (AU), light year (ly) and their relations.

Luminosity of stars: Apparent brightness, Apparent magnitude - scale of Hipparchus. Absolute magnitude - distance - modulus relationship. Distinction between visual and bolometric magnitudes, Radius of a star. **3 hours**

Stellar classification: Pickering classification and Yerke's luminosity classification. H-R diagram, Main sequence stars and their general characteristics.

Gravitational potential energy or self energy of a star based on the linear density model, Statement and explanation of Virial theorem.

Surface or effective temperature and color of a star : Wien's displacement law. Expressions for - average temperature, core temperature, hydrostatic equilibrium, core pressure of a star based on the linear density model of a star. Photon diffusion time (qualitative), Mass – Luminosity relationship and expression for lifetime of a star.

7 hours

Evolution of stars: Stages of star formation (GMC – Protostar- T-Tauri) and main sequence evolution, White dwarfs, Pulsars, Neutron stars and Black holes, Variable stars, Supernova explosion- its types, Chandrasekhar limit. Event Horizon,Singularity,Schwarzchildradius(qualitative)

5Hours

Unit-2: Solid State Physics (15 hours)

Crystal systems and X-rays: Crystal systems-Bravais lattice; Miller indices– Spacing between lattice planes of cubic crystals, Continuous and characteristic X-ray spectra; Moseley's law, Scattering of X-rays - Compton effect, Bragg's law. **6 hours**

Free electron theory of metals : Electrical conductivity- classical theory (Drude-Lorentz model); Thermal conductivity; Wiedemann - Franz's law; Density of states for free electrons (with derivation); Fermi-Dirac distribution function and Fermi energy; Expression for Fermi energy and Kinetic energy at absolute zero(derivation). Hall Effect in metals

6 Hours

Superconductivity : Introduction – Experimental facts – Zero resistivity – The critical field – The critical current density – Meissner effect, Type I and type II superconductors– BCS Theory (qualitative); Applications - SQUIDs. **3 hours**

Unit-3: Semiconductor Physics

Distinction between metals, semiconductors and insulators based on band theory. Intrinsic semiconductors - concept of holes – effective mass - expression for carrier concentration(derivation for both holes and electrons) and electrical conductivity – extrinsic semiconductors – mention of expressions for carrier concentrations and conductivity – impurity states in energy band diagram and the Fermi level.

Formation of P-N junction, depletion region, Biased P-N junction, variation of width of the depletion region, drift and diffusion current –expression for diode current.

6 hours

Special Diodes: Zener diode – characteristics and its use as a voltage regulator.

Photo diodes, Solar cells and LED (principle, working and applications). **4 hours**

Transistors: Transistor action, Characteristics (CE mode), DC Biasing , Load line analysis (Operating Point, Fixed Bias – Forward bias of Base – Emitter, collector – emitter loop, transistor saturation, Load line analysis ; Voltage divider bias – Transistor saturation, Load line analysis)

Transistor as an amplifier(CE mode); . H-parameters **5 hours**

References :

1. Astronomy : Fundamentals and Frontiers – **Jastrow & Thompson,** John Wileyand Sons 4th Revised ed (**1984**)
2. Chandrashekhar and his limit – **G. Venkataraman,** University press, reprint (**1997**)
3. An introduction to Astrophysics – **Baidyanath Basu,** PHI 2nd ed (**2010**)
4. Astrophysics Concepts, ***M. Herwit***: John Wiley, (**1990**).
5. Astrophysics. ***Krishnaswamy*** (ed)New Age Publishers,(**1996**)
6. Introduction to solid State Physics, ***Charles Kittel***, VII edition, (**1996**)
7. Solid State Physics- **A J Dekker**, MacMillan India Ltd, (**2000**)
8. Elementary Solid State Physic, **J P Srivastava**,PHI,(**2008**)
9. Essential of crystallography**, M A Wahab**, Narosa Publications (**2009)**
10. Solid State Physics-**F W Ashcroft and A D Mermin**-Saunders College (**1976**)
11. Solid State Physics-**S O Pillai**-New Age Int. Publishers (**2001**)

PHYSICS – 504, PRACTICAL PHYSICS – V(B)

1. Parallax Method – Distance of objects using trigonometric parallax.
2. HR Diagram & the physiMisra and Misra, Physics Lab. Manual, South Asian publishers (**2000**)
3. Gupta and Kumar, Practical physics, Pragati prakashan, (**1976**)
4. Ramalingom & Raghuopalan : A Lab. Course in Electronics
5. Bharagav et al : Electronics, TTI tata MacGraw Hill 33rd Reprint (**2002**)cal properties of stars.
6. Analysis of stellar spectra.
7. Determination of temperature of a star (artificial) using filters.
8. Analysis of sunspot photographs & solar rotation period.
9. Mass luminosity curve – Estimation of mass of a star.
10. Mass of binary stars.
11. Resistivity of a material by four probe method.
12. Determination of Lorentz Number
13. Semiconductor temperature sensor.
14. Temperature coefficient of resistance and energy gap of thermistor.
15. LED characteristics and spectral response.
16. LDR characteristics – dark resistance – saturation resistance.

17. Solar cell characteristics – Open circuit voltage – short circuit current – efficiency.
18. Study of Hall effect in a metal.
19. Characteristics of LASER diode.
20. Spectral response of a photodiode and its I – V characteristics.
21. Analysis of X-ray diffraction pattern obtained by powder method to determine properties of crystals.
22. Determination of Fermi energy of a metal.
23. Determination of thermal conductivity of a metal by Forbe's method.
24. Measurement of heat capacity of metals.

Note: A minimum of EIGHT experiments must be performed.

References :

1. IGNOU : Practical Physics Manual IGNOU publications
2. Saraf : Experiment in Physics Vikas publicatios
3. S.P. Singh : Advanced Practical Physics
4. Melissons : Experiments in Modern Physics.
5. Misra and Misra, Physics Lab. Manual, South Asian publishers (**2000**)
6. Gupta and Kumar, Practical physics, Pragati prakashan, (**1976**)
7. Ramalingom & Raghuopalan : A Lab. Course in Electronics
8. Bharagav et al : Electronics, TTI tata MacGraw Hill 33rd Reprint (**2002**)

Syllabus for VI Sem. B.Sc. (Physics) Paper VII – Phy T601:

ATOMIC, MOLECULAR AND NUCLEAR PHYSICS

UNIT I : ATOMIC AND MOLECULAR PHYSICS (15 HOURS)

Vector Model of the Atom

Review of Bohr's theory of hydrogen atom, Sommerfeld's modification of the Bohr atomic model (qualitative). Spatial quantization and spinning electron. Different quantum numbers associated with the vector atom model, Spectral terms and their notations, Selection rules, Coupling schemes(*l*-s and j-j coupling in multi electron systems), Pauli's Exclusion Principle, Expression for maximum number of electrons in an orbit. Spectra of alkali elements (sodium D-line), Larmor precession, Bohr magneton, Stern-Gerlach Experiment **.** Zeeman Effect- Experimental study, theory of normal and anomalous Zeeman effect based on quantum theory. **10 hours**

Molecular Physics: Pure rotational motion, Spectrum and selection rules; Vibrational motion, vibrational spectrum and selection rules; Rotation-Vibration spectrum; Scattering of light-Tyndall scattering, Rayleigh scattering and Raman scattering. Experimental study of Raman effect, Quantum theory of Raman effect - Applications . **5 hours**

UNIT II : RADIOACTIVE DECAY, DETECTORS AND ACCELERATORS (15 HOURS)

Alpha particle scattering : Rutherford's theory of alpha scattering (assuming the path to be hyperbolic) **2 hours**

Radioactive Decay : Laws of radioactive decay, half – life, mean life, decay constant; theory of successive disintegration (expression for number of atoms of n^{th} element in the chain – Bateman equations); radioactive equilibrium (secular and transient - cases of long lived parent, short lived parent, daughter and parent of nearly equal half – life).

3 hours

Alpha decay : Range and energy, Geiger- Nuttal law , Characteristics of alpha spectrum, Gamow's theory of alpha decay [Barrier height, tunneling effect, $\lambda = Pf$ f is the frequency of collision of nucleon with the potential barrier; P is the probability of transmission through the barrier); Barrier

penetrability factor (p)$e^{-\sqrt{\frac{2\mu}{\hbar^2}}\int_{r_0}^{r_i}\sqrt{V(r)-E}dr}$ (no derivation)]

Derivation of Q-value-of alpha decay; Exact energy of alpha particle emitted

3 hours

Beta decay : Types of beta decay (electron, positron decay and electron capture) Characteristics of beta spectrum and Pauli's neutrino hypothesis **2 hours**

Detectors : Variation of ionization current with applied voltage in a gas counter, Proportional counter, GM Counter (Construction, working, characteristics, efficiency and quenching)

3 hours

Particle accelerators : Linear accelerator, Cyclotron, Betatron **2 hours**

UNIT III : NUCLEAR REACTIONS AND PARTICLE PHYSICS

NUCLEAR REACTIONS : Types of reactions, Conservation laws in nuclear reactions with examples, derivation of Q – value for reactions using the energy – momentum conservation, exoergic and endoergic reactions, threshold energy , reaction rate, reaction cross – section, concept of direct and compound reactions, resonance reaction; Power reactors

8 hours

ELEMENTARY PARTICLES : Classification of elementary particles, Fundamental interactions (Gravitational, Electromagnetic, Weak, strong – range, relative strength, particle interactions for each);

Symmetries and Conservation Laws (momentum, energy, charge, parity, lepton number, baryon number, isospin, strangeness and charm); Concept of Quark Model, Color quantum number and gluons; **7 hours**

Reference Books:

1. Concepts of Modern Physics, Beiser 3rd edition, Student edition, New Delhi (1981).
2. Introduction to Atomic Physics – H.E. White
3. Introduction to Modern Physics – H.S. Mani, G.K. Mehta-West Press (1989).

4. Principles of Modern Physics, A.P. French, John Wiley, London (1958).
5. Modern Physics - S.N. Ghoshal, Part 1 and 2 S. Chand and Company (1996).
6. Physics of the Atom, Wehr et. al. McGraw Hill
7. Atomic and Nuclear Physics, S. N. Ghoshal: Vol. II. (2000).
8. Alpha, beta and gamma spectroscopy, K. Seighbahn: Vol. I and II, John Wiley (1967)
9. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
10. Nuclear Physics, D C Tayal, Himalaya Publishing House, 5th Edition
11. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
12. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
13. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons 2nd revised ed (**2008**)
14. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi(**2008**)
15. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, (2004).
16. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, (**2000**).
17. Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., (**1991**)

PHYSICS – 602, PRACTICAL PHYSICS – VI(A)

1. Study of hydrogen spectrum.
2. Sommerfeld's fine structure constant determination.
3. Determination of e/m by Thomson's method.
4. Characteristics of GM counter.
5. Determination of half-life of K^{40}.
6. Millikan's Oil drop experiment
7. Analysis of band spectrum of PN molecule.
8. Analysis of rotational spectrum of nitrogen.
9. Analysis of rotational vibrational spectrum of a diatomic molecule (HBr).
10. Absorption spectrum of $KMnO_4$.
11. B – H Curve using Oscilloscope
12. Verification of Curie – Weiss Law
13. To verify and design AND, OR, NOT and XOR gates using NAND gates
14. To convert a Boolean Expression into Logic Gate Circuit and assemble it using logic gate ICs.
15. Digital Half-adder & Full-adder circuits using logic gate ICs.

16. Half Subtractor & Full Subtractor, using logic gate ICs

Note : A minimum of EIGHT experiments must be performed.

References :

1. IGNOU : Practical Physics Manual
2. Saraf : Experiment in Physics Vikas Publications
3. S.P. Singh : Advanced Practical Physics
4. Melissons : Experiments in Modern Physics
5. Misra and Misra, Physics Lab. Manual, South Asian publishers, 2000
6. Gupta and Kumar, Practcal physics, Pragati prakashan, 1976

Syllabus for VI Sem. B.Sc. (Physics) Paper VIII – Phy T603:

ELECTRONICS, MAGNETIC MATERIALS, DIELECTRICS AND QUNTUM MECHANICS – II

UNIT I : OPAMPS

Operational amplifiers

Block Diagram of an OPAMP, Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Open loop configuration - Limitations, Gain Bandwidth Product, Frequency Response, CMRR, Slew Rate and concept of Virtual Ground **2 hours**

Feedback concepts, Advantages of feedback, types of feedback, Expression for Gain; OPAMP as a feedback amplifier – Non – Inverting and Inverting amplifier, Modification of input and output impedances with feedback ; Voltage follower; Differential amplifier with feedback;

2 hours

Linear Applications - frequency response of Low pass, high pass and band pass filters (first order), inverting summing amplifier, ideal Differentiator, Integrator;

2 hours

OPAMP Oscillators

Positive Feedback concept - oscillator operation –Barkhausen Criterion; Types of oscillator circuits (Qualitative); Phase shift oscillator and Wien bridge oscillator (using op amp).

2 hours

DIGITAL ELECTRONICS

Number Systems : binary, octal, hexadecimal (interconversions); Number codes : BCD, Gray Code (conversions to other systems); Signed Numbers; Arithmetic using Radix and Radix -1 complement.

2 hours

Logic gates and truth tables : OR gate, AND gate; Inverter (the NOT function); NAND and NOR; exclusive OR; exclusive NOR. **1 hour**

Boolean laws and theorems – simplification of SOP equations; Realization of AND, OR, NOT using universal gates NAND and NOR; **2 hours**

Combination logic: Adders (full and half adder) and Subtractors (half) **2 hours**

UNIT II – Magnetic Properties of Matter and Dielectrics

Magnetic Properties of Matter

Review of basic formulae : Magnetic intensity, magnetic induction, permeability, magnetic susceptibility, magnetization (M), Classification of Dia – , Para –, and ferro – magnetic materials;

3 hours

Classical Langevin Theory of dia – and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss, Hard and Soft magnetic materials

5 hours

Dielectrics : Static dielectric constant, polarizability (electronic, ionic and orientation), calculation of Lorentz field (derivation), Clausius-Mosotti equation (derivation), dielectric breakdown, electrostriction (qualitative), electrets. Piezo electric effect, cause, examples and applications.

7 hours

UNIT-III : Quantum mechanics-II

The concept of wave function, physical significance of wave function. Development of time dependent and time independent Schrodinger's wave equation. Max Born's interpretation of the wave function. Normalization and expectation values, Quantum mechanical operators, Eigen values and Eigen functions. Applications of Schrodinger's equation – free particle, particle in one dimensional box- derivation of Eigen values and Eigen function – extension to three dimensional box; Development of Schrodinger's equation for One dimensional Linear harmonic oscillator, Rigid rotator, Hydrogen atom – mention of Eigen function and Eigen value for ground state.

15 hours

References

1. OPAMPS and Linear Integrated Circuits, **Ramakant A Gayakwad**, PHI Learning Private Limited, 4th Edition
2. Operational Amplifiers with Linear Integrated Circuits, **William D Stanley**, Pearson, 4th Edition
3. Electronic Devices and Circuit Theory**, Robert Boylestead and Louis Nashelsky**, PHI Learning Private Limited, 10th Edition
4. Digital Principles and applications, **Leach and Malvino**, MC – Graw Hill, 5th Edition
5. Introduction to solid State Physics, ***Charles Kittel***, VII edition, (**1996**.)
6. Solid State Physics- **A J Dekker**, MacMillan India Ltd, (**2000**)
7. Elementary Solid State Physic, **J P Srivastava**,PHI,(**2008**)
8. Essential of crystallography**, M A Wahab**, Narosa Publications (**2009**)
9. Solid State Physics-**F W Ashcroft and A D Mermin**-Saunders College (**1976**)
10. Solid State Physics-**S O Pillai**-New Age Int. Publishers (**2001**)
11. Quantum Mechanics, ***B.H. Bransden and C.J. Joachain***, 2nd Edition, Pearson Education (**2004**)

12. Introduction to Quantum Mechanics, ***David J. Griffiths***, 2nd Edition, Pearson Education, (**2005**)
13. Modern Quantum Mechanics, ***J.J. Sakurai***, Pearson Education, (**2000**)
14. Principles of Quantum Mechanics, ***Ghatak and Lokanathan***, Macmillan, (**2004**)

2004PHYSICS – 604, PRACTICAL PHYSICS – VI(B)

1. Low pass filter using Op-amp
2. High pass filter using Op-amp
3. Band pass filter using Op-amp
4. Op-amp inverting and non – inverting amplifier – ac or dc
5. OPamp as a differential amplifier – COMMON MODE AND DIFFERENTIAL MODE
6. Op-amp-summing amplifier – ac and dc,
7. OPamp as integrator and differentiator.
8. Phase shift oscillator using op –amp
9. Wien-bridge Oscillator using op – amp
10. To design an Astable Multivibrator of given specifications using 555 Timer
11. Determination of dielectric constant.
12. Determination of dipole moment of organic liquid
13. Verification of inverse square law using GM counter (with a radioactive source).
14. Determination of mass absorption coefficient of gamma rays.

Note : A minimum of EIGHT experiments must be performed.

References :

1. IGNOU : Practical Physics Manual
2. Saraf : Experiment in Physics, Vikas Publications
3. S.P. Singh : Advanced Practical Physics
4. Melissons : Experiments in Modern Physics
5. Misra and Misra, Physics Lab. Manual, South Asian publishers, (**2000**)
6. Gupta and Kumar, Practical physics, Pragati prakashan, (**1976**)

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