KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-04/BOS /Physics (UG) /20-21 995 Date: 16 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Physics UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 05, dt. 29.07.2020.
3. Special Faculty Res. No. 12, dt. 11.08.2020.
4. Special Academic Council Res. No. 37, dt. 21.08.2020.
5. Vice-Chancellor's order dated -07-10-2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Physics UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

15/10/2020
(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Physics (UG), Dept. of Physics, K.U.Dharwad.
2. The Chairman, Dept. of Physics, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fwcs to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analysist, Computer Unit Exam Section, K.U.Dharwad.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. Programme

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DRAFT SYLLABUS FOR

PHYSICS (Optional)

subject

AS DISCIPLINE SPECIFIC COURSE (DSC) , DISCIPLINE SPECIFIC ELECTIVE (DSE)and SKILL ENHANCEMENT COURSE (SEC)

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

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Effective from 2020-21

Karnatak University, Dharwad

CBCS syllabus for Under Graduate Programme in Physics (optional)

Effective from 2020-21

Semester	Theory/ Practical	Subject Code	Total Teaching hours perweek	Total Teaching hours per Semester	Duration of Exams.	Internal Assessment Marks	Semester end Exam Marks	Total Marks	Credits
I	Theory	DSC PHYT:101	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC PHYP:102	04 hrs	52	03 hrs	10	40	50	02
II	Theory	DSC PHYT:201	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC PHYP:202	04 hrs	52	03 hrs	10	40	50	02
III	Theory	DSC PHYT:301	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC PHYP:302	04 hrs	52	03 hrs	10	40	50	02
IV	Theory	DSC PHYT:401	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSC PHYP:402	04 hrs	52	03 hrs	10	40	50	02
V	Theory	DSE PHYT:501A **OR** PHYT:501B	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSE PHYP:502	04 hrs	52	03 hrs	10	40	50	02
	Practical	SEC-1E PHYP:503	04hrs	52	03hrs	10	40	50	02
		SEC-2E PHYP:504	04hrs	52	03hrs	10	40	50	02
VI	Theory	DSE PHYT:601A **OR** PHYT:601B	04 hrs	60	03 hrs	20	80	100	04
	Practical	DSE PHYP:602	04 hrs	52	03 hrs	10	40	50	02
	Practical	SEC-1F PHYP:603	04hrs	52	03hrs	10	40	50	02
		SEC-2F PHYP:604	04hrs	52	03hrs	10	40	50	02
Total			56 hours	880 hours	42hours	220	880	1100	44

*Creditmeanstheunitbywhichthecourseworkismeasured. One hoursession of Lecture per week for16 weeks amounts to1 credit. Four hour ssession of Practicals per week for 16weeks amounts to 2 credits persemester.

**Student has to choose only one elective(DSE)during his/her fifth and sixth semester.

Discipline Specific Course(DSC), Discipline Specific Elective and Skill Enhancement Course Topics under CBCS in Physics.

Sem	Type	Course
1	DSC PHYT:101	**Mechanics and properties of Matter** Newtonian Mechanics, Classical Mechanics, Special Theory of Relativity, Gravitation and Elasticity
	DSC PHYP:102	**Practicals 1**
2	DSC PHYT:201	**Thermal Physics and Fluid Mechanics** Thermodynamics, Kinetic theory of gases, Statistical Physics, Radiation, Astrophysics, Surface Tension and Viscosity
	DSC PHYP:202	**Practicals 2**
3	DSC PHYT:301	**Electrostatics and Electricity** Dielectrics, Transients, Alternating Current, Electrical instruments and measurements, Electromagnetic induction and Thermoelectricity
	DSC PHYP:302	**Practicals 3**
4	DSC PHYT:401	**Electromagnetic theory and Optics** Electromagnetic theory, Geometrical optics, Interference, Diffraction and Polarisation
	DSC PHYP:402	**Practicals 4**
5	DSE PHYT:501A **OR** PHYT:501B	**Modern Physics-I** Quantum Mechanics, Spectroscopy and Nuclear Physics **OR** **Modern Physics-II**
	DSE PHYP:502	**Practicals 5**
	SEC-1E PHYP:503	**Basic instrumentation skills-I** **Practicals 6**
	SEC-2E PHYP:504	**Basic instrumentation skills-II** **Practicals7**
6	DSE PHYT:601A **OR** PHYT:601B	**Solid State Physics and Electronics-I** Crystal structure, Specific heats, Semiconductors, Magnetic Materials, Superconductivity, BJT, FET, IC's, Digital electronics and Communication. **OR** **Solid State Physics and Electronics-II**
	DSE PHYP:602	**Practicals8**
	SEC-1F PHYP:603	**Applied Physics-I** **Practicals9**
	SEC-2F PHYP:604	**Applied Physics-II** **Practicals10**

Question Paper Pattern

B.Sc. I, II, III, IV & V and VI Sem (CBCS)

Subject: PHYSICS

I) Maximum Marks = 80

II) Question paper is divided into four parts such as PART A, PART B, PART C and PART D.

III) Each PART is set for 20 marks.

IV) Equal weightage may be given to all the topics.

V) The pattern of questions in each part is given below.

PART A: TWO MARKS Questions

1. This part should contain 12(Twelve) questions covering all the topics of syllabus.
2. Each Question carries 2 Marks.
3. Students are required to answer any 10 questions.
4. Questions are of short answer type/simple problems involving one or two steps/ Drawing circuit/Ray diagram.
5. Minimum 3 Questions in this part should be of problem solving type.
6. Multiple choice Questions should be avoided.
7. Total Marks for Part A: 2x10 =20

PART B: FIVE MARKS Questions

1. This part should contain 06(Six) questions covering all the topics of syllabus.
2. Each Question carries 5 Marks.
3. Students are required to answer any 4 questions.
4. Questions are of descriptive type/derivation type/Shortnote type.
5. Questions on Numerical problems should not be asked in this part.
6. Total Marks for Part B: 5x4 = 20

PART C: FOUR MARKS Questions

1. This part should contain 08(eight) Numerical problems covering all the topics of syllabus.
2. Each Question carries 4 Marks.
3. Students are required to answer any 5 questions.
4. Total marks for Part C: 4x5=20

PART D: TEN MARKS Questions

1. This part should contain 04(four) questions covering all the topics of syllabus.
2. Each Question carries 10 Marks.
3. Students are required to answer any 2 questions.
4. Questions are of descriptive type/derivation type/Shortnote type/long answer type only.
5. Questions on Numerical problems should not be asked in this part.
6. Wherever necessary each Question may be split into two or 3 sub questions as required by paper setter.
7. Total Marks for part D: 10x2 = 20

Note: This is main structure of question paper. Question paper setter may be permitted to make small modification while giving equal weightage to topics in descriptive type and numerical type questions.

B.Sc.I,II,III,IV,V and VIsemester (CBCS)

Scheme of evaluation for practical examinations in physics

1. Basicformulawithdescriptionofquantities, Units&Natureofgraph.	-04Marks.
2. CircuitDiagram/RayDiagram/Schematicdiagram with properlabeling.	-04Marks.
3. TabularColumnwithQuantitieiesandUnitMentioned.	-04Marks.
4. Experimental Skills.	-04Marks.
5. Recordingofobservations	-08Marks
6. Calculationsanddrawing graph	-06Marks
7. AccuracyofResult	-02Marks
8. Viva-Voce	-04Marks
9. Completed &CertifiedJournal	-04Marks
10.Total	-40 Marks

Scheme of evaluation for calculation type experiments

1. BasicFormulawithdescription	-05Marks
2. TabularColumn	-05Marks
3. CalculationofRequiredQuantitiesfor a dataset1	-10Marks
4. CalculationofRequired Quantitiesfora dataset-2	-10Marks
5. AccuracyofResult	-02Marks
6. Viva-Voce	-04Marks
7. Completed&CertifiedJournal	-04Marks
8. Total	-40 Marks

CBCS syllabus w.e.f. 2020-21
B.Sc. FIRST SEMESTER
Optional Subject: PHYSICS(DSC-PHYT:101)
Mechanics and properties of Matter
(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Newtonian Mechanics:

Frames of References(5 hours):

Inertial frames, Galilean transformation equations (derivation), Invariance of Newton's Laws under Galilean Transformations, Invariance of the laws of conservation of momentum and energy under Galilean transformations, Non-inertial frames and fictitious force(in brief), rotating frame of reference, concept of the Coriolis force and mention of its expression.

Linear Momentum (10 hours):

Linear Momentum, Law of conservation of linear momentum for a system of particles, Centre of mass of a system of particles, Position coordinates of the Centre of Mass, Motion of center of mass, collision between two particles which stick together (inelastic collision, one dimentional) and do not stick together (elastic collision, two dimensional) in laboratory frame of reference and in the centre of mass frame of reference , Conservation of linear momentum in case of variable mass: examples i) Single stage rocket (expression for velocity neglecting the weight) ii) Double stage rocket(derivation for final velocity).

Angular momentum(5 hours):

Angular momentum and its relation to angular velocity, Torque and its relation to angular velocity, Relation between angular momentum and Torque, Law of conservation of angular momentum, Work done by a Torque, Central force, Kepler's second law of Planetary motion (derivation).

Classical Mechanics(15 hrs):

Constraints (Holonomic, Non-holonomic,Scleronomic, and Rheonomic constraints with examples), Degrees of freedom, space point and configuration space, virtual displacement andprinciple of virtual work, Generalized co-ordinates, Generalised velocity and generalized force, D'Alembert's Principle, Derivation of Lagrange's equation of motion using D'Alembert's Principle (For holonomic case), some applications of the Lagrangianmethod: Newton's equation of motion from Lagrange equations, Simple pendulum, Atwood's machine & Linear Harmonic Oscillator.Qualitative discussion on Hamiltonian formulation.

Special Theory of Relativity (10 hours):

The Michelson-Morley experiment, Significance of negative result. Postulates of special theory of relativity. The Lorentz transformationequations (Derivation), Length contraction, Time dilation, Simultaneity, Twin paradox, Addition of velocities, Variation of mass with velocity, Mass-Energy Equivalence (with derivation).Space-Time diagram: Minkowski'sfour dimensional space-time.

Gravitation (5 hours):

Newton's Law of Gravitation. Determination of Gravitational constant by Cavendish's method. Density and mass of the Earth. Satellite in circular orbit andGeosynchronous orbits. Weightlessness. Basic idea of global positioning system(GPS). Qualitative discussions on applications of artificial satellites.

Elasticity (6 hours):

Stress, Strain, Elastic limit, Hooke's law, Modulii of elasticity for isotropic materials, Relation between elastic constants (Derivation), Poisson's Ratio, Work done for unit Volume in stretching a wire, Bending of Beams- Neutral surface, Neutral axis, Plane of Bending, Bending Moment, Expression for bending moment (Derivation), uniform bending (mention formula), Theory of light cantilever (Derivation), Torsion expression for the couple per unit twist.

Cathode Ray Oscilloscope(4 hours, without numerical problem):

Introduction to CRO, Basic diagram of CRT: Brief introduction to Electron Beam,Operating voltage, Deflecting plates,Deflecting voltages, Phosphor Screen. Block diagram of CRO: Brief mention of functions of Verticle and Horizontal Amplifier, Delay Line, Time Base, Trigger Circuit, Power supply and brief explanation of waveform display. Mention of uses of CRO.

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference books:

1. Mechanics (VI-Edition) - J.C.Upadhyay –Ramprasad & Sons,Agra, 2005.
2. Mechanics (XX-Edition) – D.S.Mathur- S. Chand & Company Ltd., New-Delhi, 2007.
3. Mechanics & Electrodynamics (XVII-Edition, Course- 1 & 2) – Brijlal, Subramanyam & Jivan Seshan, S. Chand & Company Ltd., New-Delhi, 2008.
4. Properties of Matter (XIII-Edition) – Brijlal & Subramanyam, Eurasia Publishing House Pvt. Ltd., New-Delhi, 2001.
5. Elements of Properties of Matter (XXVIII-Edition), D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 2005.
6. Physics , Vol. No.I (V-Edition)– Resnick, Halliday & Krane – John Wiley & Sons Inc., New-York, Singapore, 2005.
7. Berkely Physics, Vol. No.I – ABC Publications, Bangalore & New-Delhi.
8. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004.
9. Principles of Physics (V-Edition)- Serway& Jewett , THOMSON
   BROOKS/COLE.
10. Classical Mechanics(X Ed)- Takwale and Puranik-Tata.McGraw Hill,Newdehli,1989.
11. Classical Mechanics(XIV ed)- Gupta,Kumar & Sharma.
12. Classical Mechanics(XVII ed)- Goldstein-Narosa Publishing Newdehli,1998.
13. Introduction to Relativity- R.Resnik.
14. Relativistic Mechanics- Gupta and Kumar.
15. Physics For Degree Students B. Sc. First Year, S. Chand & Company.
16. Electronics Instrumentation by H S Kalasi.
17. B.Sc. practical Physics – C.L.Arora.
18. Advanced practical Physics – Samir Kumar Ghosh.
19. Advanced practical Physics – Worsnop and Flint.

List of first semester Physics(DSC-PHYP:102)Experiments:

1. Estimation of errors(Average deviation, Standard deviation, standard error and Probable error) in the experimental determination of physical quantities like length, diameter, thickness, time, mass, temperature and resistance from the given data. And also fit the given data to a straight line graph and calculate from the given observations Standard deviation, standard error and Probable error.
2. To study (i) the law of conservation of linear momentum, (ii)the law of conservation of kinetic energy and (iii) to calculate coefficient of restitution using one dimensional apparatus of two hanging spheres.
3. Moment of Inertia of the Fly-Wheel.
4. Bar pendulum/Kater's Pendulum.
5. Verification of Parallel axes theorem of Moment of Inertia using Bar Pendulum.
6. Y- by bending using Cantilever.
7. Modulus of Rigidity of a wire using disc/ Maxwell's needle.
8. To find Youngs modulus, modulus of rigidity and poisson's ratio for the material of a wire by Searle's method.
9. To determine gravitational constant 'G'by Cavendish Method.
10. Use of CRO – Measurement of AC and DC voltage. Measurement of frequency of sine and square waves.
11. Problem based learning in physics: Problems on classical mechanics, gravitation (especially on satellite communication), special theory of relativity, rigid body dynamics and center of mass of different bodies.
12. Simulation experiments(if any demonstration purpose only).
13. Use of both analog and digital Multimeters for measuring(a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electricalfuses. (Demonstration purpose only).

Note:

1. **Experiments are of four hours duration.**
2. **Minimum of Eight experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2020-21
B.Sc. SECOND SEMESTER
Optional Subject: PHYSICS(DSC-PHYT:201)
Thermal Physics and Fluid Mechanics
(Credits:Theory-04, Practicals-02) Theory: 60Hours

Thermodynamics (15 hours):

Review of basic concepts.

Heat engines: Otto engine, Otto cycle and expression for efficiency. Diesel engine, Diesel cycle, expression for efficiency and Carnot's theorem.

Entropy: Concept of entropy, change in entropy in reversible and irreversible processes, entropy-temperature diagram, second law of thermodynamics.

Enthalpy, Helmoltz, Gibbs and Internal energy functions, Relation among these functions.

Maxwell's Thermodynamical relations(with derivation). Applications of Maxwell's Thermodynamical relations: (i) to derive Clausius-Clapeyron's latent heat equation and (ii) Joule-Thomson expansion.

Kinetic theory of gases(10 hours):

Maxwell's law of distribution of velocities (qualitative) & its experimental verification by Zartman and Ko method. Expressions for Average, r.m.s. & most probable velocities(with derivation). Qualitative discussions on Mean free path, mention of Clausius and Maxwell's expressions for mean free path. Transport phenomena — Brief discussion on Viscosity, Thermal conductivity and Diffusion. Expressions for Coefficient ofViscosity, Coefficient of Thermal conductivity and Coefficient of Diffusion (with derivations) and relation between them.Theory of Brownian motion, Einstein's expression for coefficient of Diffusion from the knowledge of mean square displacement and partial pressure difference(with derivation), Determination of Avogadro's number by Perrin method.

Statistical Physics (5 hours):

Introduction to statistical Physics, Statistics of identical particles – Derivation for distribution functions in case of Maxwell-Boltzmannstatistics, Bose-Einsteinstatistics and Fermi-Dirac statistics and the comparision between them.

Radiation(7 hours):

Concept of Radiation and Radiation pressure(qualitative), Stefan's law & its derivation using radiation pressure. Laboratory method for determination of Stefan's constant. Wein's displacement law(with derivation), Rayleigh-Jeans's law (qualitative), Planck's law of radiation & its derivation. Ferry's total radiation Pyrometer.

Astrophysics (8hours):

Units of stellar distances: light year and Parsec,luminosities of stars, absolute and apparent magnitude,relation between absolute,apparent magnitude and distance. Expression for radius of the star. Spectral classification of stars: E. C. Pickering classification (Harvard classification). H-R diagram, main sequence stars, general properties of main sequence stars.Surface temperature of star and its color, linear density model of star, expression for average temperature of star, binary stars, stellar masses. Evolution of stars to white dwarfs, different stages, formation of neutron stars and black holes (qualitative).

Fluid Mechanics(15 hours):

Surface Tension:Review of basics of Surface Tension. Pressure difference across a liquid surface: Excess pressure inside a spherical liquid drop and Excess pressure inside a soap Bubble. Derivation of relation between radius of curvature, pressure and Surface tension.Angle of Contact: Case of two liquids in contact with each other and with air, case of solid, liquid and air in contact. Theory of Rise of liquid in a capillary tube. Experimental determination of surface tension by Jeager's method with relevant theory.

Viscosity: Viscosity of a liquid, Expression for co-efficient of viscosity, Expression for Critical velocity, Significance of Reynold's number.Derivation of Poiseuille's equation. Experimental determination of co-efficient of viscosity for a liquid by Poiseuille's method. Motion of a spherical body in a viscous medium: Expression for co-efficient of viscosity fromStoke's law, Theory of Rotation Viscometer.

Note:

1. **Number of teaching hours per week are hour.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference books:

1. Kinetic Theory of Gases(I-Edition) – V.N.Kelkar – Ideal Book Service, Pune, 1967.
2. Kinetic Theory of Gases(II-Edition) – R.S.Bhoosnurmath – IBH Prakashana, Bangalore, 1981.
3. Heat & Thermodynamics and Statistical Physics(XVIII-Edition) – Singhal, Agarwal & Satyaprakash – Pragati Prakashan, Meerut, 2006.
4. Heat & Thermodynamics and Statistical Physics(I-Edition) – Brijlal , Subramanyam & Hemne - S. Chand & Company Ltd., New-Delhi, 2008.
5. Heat and Thermodynamics (I-Edition) – D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 1991.
6. A Treatise on Heat – Shaha and Srivatsava.
7. A text book of heat - J.B.Rajam.
8. Properties of Matter (XIII-Edition) – Brijlal & Subramanyam, Eurasia Publishing House Pvt. Ltd., New-Delhi, 2001.
9. Elements of Properties of Matter (XXVIII-Edition), D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 2005.
10. Physics , Vol. No.I (V-Edition)– Resnick, Halliday & Krane – John Wiley & Sons Inc., New-York, Singapore, 2005.
11. Berkely Physics, Vol. No.I – ABC Publications, Bangalore & New-Delhi.
12. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004
13. Introduction to Astrophysics(XV ed)- Baidyanath Basu-Prantice Hall of India-2006.
14. Astrophysics(III ed)- K.D.Abhyankar-Universities Press India Pvt. Ltd. 2009.
15. Introduction to Astrophysics and Astronomy- M. Zeilik, Gregory and Smith.
16. B.Sc. practical Physics – C.L.Arora.
17. Advanced practical Physics – Samir Kumar Ghosh.
18. Advanced practical Physics – Worsnop and Flint.

List of second semester Physics(DSC-PHYP:202) Experiments:

1. To study the adiabatic expansion of a gas and hence to find the value of ratio of specific heat (γ) at constant pressure to specific heat at constant volume for air using Clement and Desorme's apparatus.
2. Lee's method of determination of thermal conductivity of a bad conductor.
3. Verification of Stefan's Law (Electrical method).
4. 'J' by continuous flow method.
5. Determination of thermal conductivity of copper by Searle's method.
6. Determination of Stefan's constant.
7. Surface Tension by Jeager's method.
8. Surface Tension by Quincke's method.
9. H-R Diagram: Study of classification of stars and stellar evolution.
10. To determine the Coefficient of Viscosity of water by Capillary Flow method (Poiseuille'smethod).
11. Use of CRO- Study of Lissajous figures and determination of Phase Shift using CR network by continuous wave method and Lissajous figures.
12. Problem based learning in physics: Problems on entropy, heat engines, fluid mechanics and statistical physics.

Note:

1. **Experiments are of four hours duration.**
2. **Minimum of Eight experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2021-22
B.Sc.THIRD SEMESTER
Optional Subject: PHYSICS(DSC-PHYT:301)
Electrostatics and Electricity
(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Dielectrics(10 hours):

Introduction to dielectric materials with examples.

Concepts of scalar and vector fields with examples, Properties of vector fields: flux and circulation, flux of an electric field, Gauss law of electrostatics in vacuum and in dielectric medium.

Dielectric in an electric field, electric polarization (P), electric displacement(D), electric susceptibility(χ) and atomic polarizability(α), relation between D,E and P. Boundary condition at a dielectric surface(Derivation), Expression for force between two charges in a dielectric medium separated by a distance, Expression for Stored energy in a dielectric medium, dielectric medium in a capacitor, dielectric constant and its determination for liquids and solids by Hopkinson's method. Mention of Clausius–Mosotti equation and its limitations.

Transient currents (8 hours):

Theory of growth & decay of current through RL circuit. Theory of charging & discharging of capacitor through RC circuit. Time constants of RL & RC circuits. Measurement of high resistance by leakage method.

Alternating current, AC bridges and Filters(15 hours):

Operator j, Argand diagram. LCR series ciruit – Expression for current, impedence & phase (using j–operator method). Condition for resonance, resonant frequency, Band width, quality factor & their relation (qualitative).

LCR parallel circuit (Series L-R in parallel with C) - Expression for admittance & condition for resonance (using j-operator method). Comparison between series & parallel resonant circuits.

A.C. Bridge, Measurement of inductance, Theory of Maxwell's bridge and Anderson's bridge. Measurment of capacity by de Sauty's method.

Theory of Low pass and high pass constant K–type filters.

Network theorems(5 hours):

Current and voltage sources, Thevenin and Norton's Theorems.

Power Supplies (5 hours): Power Supplies with filters (C, L, LC and π-section), Ripple factor(mention expression).

Electrical instruments, measurements and Electromagnetic induction(10 hours):

Theory of moving coil galvanometer to be ballistic & dead beat. Charge and current sensitivity and their relationship, correction for damping. Measurement of capacitance of a capacitor using Ballistic Galvanometer by absolute method.

Brief discussions on Faraday's laws and Lenz's law, self and mutual inductance. Determination of self inductance (L) by Rayleigh's method and mutual inductance by direct method with necessary theory.

Thermoelectricity (7 hours):

Seebeck effect, Variation of thermo emf with temperature, neutral temperature & temperature of inversion. Thermoelectric series. Peltier effect, Thomson effect. Thermoelectric laws. Derivation of the relations $\pi = T (de/dT)$ and $\sigma_a - \sigma_b = T (d^2e/dT^2)$. Taitdiagram and its uses.Applications of Thermoelectricity, Qualitative discussion on different types of Thermocouples (J-type, K-type and RTD type).

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference books:

1. Fundamentals of Electricity and Magnetism – Basudev Ghosh – Books & Allied New Central Book Agency, Calcutta, 2009.
2. Electricity and magnetism- D.N. Vasudev- S.Chand Publication, New Dehli.
3. Electricity and Magnetism- B.S.Agarwal- S.Chand Publication,New Dehli.
4. Electricity and magnetism- Brij lal &Subramasnyam.
5. Electricity and magnetism and Atomic physics vol-I – John Yarwood.
6. Electricity and magnetism – A.N.Matveer-Mir publisher,Moscow 1986.
7. Introduction to electrodynamics- D.J.Griffith(3^{rd} ed)Prentice Hall of India,New Dehli.
8. Vector Analysis-Hague
9. Electricity and Magnetism- D.Chattopadhya& Rakshit.
10. Electricity and magnetism- K.K.Tiwari
11. Fundamentals of electricity and magnetism- D.N.Vasudev.
12. Electricity and Magnetism- Segal and Chopra
13. Text book of Electrical Technology, Vol. 1 – B.L. Theraja and A.K Theraja.
14. B.Sc. practical Physics – C.L.Arora.
15. Advanced practical Physics – Samir Kumar Ghosh.
16. Advanced practical Physics – Worsnop and Flint.

List of third semester Physics(DSC-PHYP:302) Experiments:

1. Determination of dielectric constant of a liquid.
2. Calibration of Ballistic Galvanometer (BG): Determination of the constants of B.G.
3. Measurement of capacity by absolute method, using B.G.
4. Verification of Thevenin and Norton's theorem using ladder network.
5. Study of low pass filter.
6. Full wave bridge rectifier with LC-section and π-section filter.
7. Determination of coefficient of self-inductance (L) by Rayleigh's method/ Anderson's bridge method.
8. Measurement of emf of a thermocouple at various temperatures and verification of any one law of thermoelectric effect.
9. Calibration of a spectrometer.
10. Dispersive curve and dispersive power of a prism.
11. Polarimeter
12. Diffraction at a wire or aperture using laser.

Note:

1. **Experiments are of four hours duration.**
2. **Minimum of Eight experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2021-22
B.Sc.FOURTH SEMESTER
Optional Subject: PHYSICS(DSC-PHYT:401)

Electromagnetic theory and Optics

(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Electromagnetic theory(10 hours):

Concept of fields and their classification.Thegradientofascalarfield. Thedivergenceandcurlofavectorfield.Thephysicalsignificanceofgradient, divergenceandcurl.Gauss,Green's andStokes theorems.

Maxwell'sequations: Amperes circuital law and its drawback, continuity theorem. Derivation of Maxwell's equations in differential forms, mention of integral forms & their physical significance. Derivation of general plane wave equations in free space. Transverse nature of radiation. Poynting theorem (Discussion without derivation).

Geometrical Optics (8 hours):

Cardinal points: Cardinal points of aoptical system. Equivalent focal length of two thin lenses separated by a distance. location of cardinal points of a thick lens (derivation). Experimental determination of cardinal points of a lens system using Searle's Goniometer and Turn Table(Nodal slide).

Occulars and Aberrations(5 hours):

Huygen's eye piece:Construction, Theory and cardinal points. Ramsdeneye piece:Theory and cardinal points.

Spherical & chromatic aberrations. Methods to reduce spherical aberrations (qualitative). Condition for achromatism of two thin lenses (i) in contact and (2) separated by a distance.

Interference(15hours):

Interference due to division of wave front: Fresnel's biprism. Detemination of wavelength of monochromatic light & thickness of a thin film using biprism.

Interference due to division of amplitude:

The colours of thin films. Interference phenomenon with a plane parallel thin film:in case of reflected light and transimitted light(with derivation). Interference using wedge shaped film . Theory of Newton's rings. Determination of wavelength of monochromatic light by Newton's rings. Michelson interferometer: Principle, construction and working. Formation of circular & straight fringes (qualitative). Determination of wavelength of monochromatic light using Michelson interferometer.

Diffraction (15 hours):

Introduction to diffraction and classification of diffraction phenomena.

Fresnel diffraction: Fresnel‘s treatment of the wavefront and Fresnel assumptions. Theory of half period zones considering plane wavefronts.Zone plate:construction, theory and expression for focal length. Comparison between zone plate and convex lens.

Fraunhofferdiffraction: Fraunhoffer diffraction at a single slit, at a double slit and N slits with detailed theory (Geometrical method). Diffraction grating. Theory of Plane transmission grating. Dispersive power of grating.Rayleigh’s criterion for resolution. Distinction between Fresnel diffraction and Fraunhoffer diffraction.Comparision of grating and Prism spectra.

Polarisation (7 hours):

Review of basics of polarization. Malus law. Huygen’s theory of double refraction. Positive and negative crystals.Theory of circularly & elliptically polarized light.Production of circularly and elliptically polarized light. Wave plates: quarter wave plate and half wave plate. Optical activity, Fresnel’s explanation of optical rotation, analytical treatment and specific rotation. Laurent’s Half Shade Polarimeter: Construction and working.

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference books:

1. Principles of Optics (I-Edition) – B.K.Mathur – New Gopal Printing Press, 1962.
2. Fundamentals of Optics (V-Edition) – Khanna & Bedi – R. Chand & Co., New-Delhi, 1971.
3. A Text book of Optics (I-Edition) – Brijlal & Subramanyam - S. Chand & Company Ltd., New-Delhi, 2006.
4. Fundamentals of optics- Khanna and Gulati.
5. Optics (IV-Edition) – Ajay Ghatak –Tata Mc Graw-Hill, New-Delhi, 2006
6. Fundamentals of Optics (III-Edition) – Jenkins & White - Mc Graw-Hill, 1957.
7. Geometrical Optics (I-Edition) – D.P.Acharya – Oxford & IBH Pub. Co., New-Delhi,1970.
8. Optics & Spectroscopy (VI-Edition) – Murugeshan, Kirutiga & Shivaprasath - S. Chand & Company Ltd., New-Delhi, 2006.
9. Geometrical Optics – A. Verstraeten.
10. Introduction to electrodynamics- D.J.Griffith(3^{rd} ed)Prentice Hall of India,New Dehli.
11. Vector Analysis- Hague
12. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004.
13. B.Sc. practical Physics – C.L.Arora.
14. Advanced practical Physics – Samir Kumar Ghosh.
15. Advanced practical Physics – Worsnop and Flint.

List of fourth semester Physics(DSC-PHYP:402) Experiments:

1. Goniometer
2. Turn table
3. Newton's rings
4. R.P. of a prism/R.P. of grating.
5. Biprism: Determination of wavelength of monochromatic light.
6. Michelson interferometer
7. Determination of wavelength of laser light by Young's double slit method.
8. Study of elliptically polarized light using polariser-analyser setup and sodium vapour source.
9. Determination of high resistance by leakage method, using B.G.
10. Determination of coefficient of mutual inductance by direct method/Carey-Foster's method.
11. Verification of Thevenin and Norton's theorem using Wheatstone's bridge (unbalanced)
12. Study of high pass filter.

Note:

1. **Experiments of four hours duration.**
2. **Minimum of Eight experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2022-23
B.Sc. FIFTH SEMESTER
Optional Subject: PHYSICS(DSE-PHYT:501A)

Modern Physics-I(Elective 1)

(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Quantum Mechanics (15 hours):

Brief discussion on failure of classical physics to explain black body radiation, Photoelectric effect, Compton effect, stability of atoms and spectra of atoms.

Compton Scattering: Expression for energy of the scattered photon, kinetic energy of the recoil electron and Compton shift(with derivation).

Matter Waves: de Broglie hypothesis. Expression for group velocity and Phase velocity of matter waves. G.P.Thomson's experiment and its significance.

Uncertainty principle: Statement and illustration by Gamma ray microscope and diffraction of electrons at a single slit.

Wave Mechanics: Setting up of time independent Schrodinger's equation. Physical interpretation of wave function. Eigen function and Eigen values. Expression for energy: Particle in a one-dimensionalinfinite potential well(derivation), mention of expression in three dimensions, degeneracy and Particle in a finite potential well (qualitative). Concept of potential barrier and quantum mechanical tunneling. Qualitative discussion on quantum treatment of Linear Harmonic Oscillator.

Atomic Spectra(15 hours):

Vector-Atom model. The Pauli exclusion principle. Electron configuration in aatom with some examples. Studies on LS and jj Coupling schemes in case of one valence electron and two valence electron atoms.Spectral terms and their arrangement following Hund's and n+l rules. Selection rules for transitions. Principal, Sharp, diffuse and fundamental spectral series for Sodium(Na) element.

Magnetic field effect on light: Magnetic moment due to orbital and spin motion. Stern-Gerlach Experiment. Larmor precession. Normal and Anomalous Zeeman effect. Expression for Zeeman shift (using quantum theory). Theory of anamolous Zeeman effect and expression for Lande 'g' factor.Energy level diagram for sodium D lines in a weak magnetic field.

Molecular spectra(8 hours):

Different types motions (electronic, vibration and rotation) in a molecule. Molecular energy distribution in the electromagnetic spectrum. General features of band spectra compared to atomic spectra. The diatomic molecule as a rigid rotator: Energy, energy levels andspectra(with derivation). Diatomic molecule as a non-rigid rotator(qualitative).

Lasers: (4 hours):

Einstein's theory of spontaneous emission, stimulated emission and stimulated absorption. Conditions for laser action. Types of lasers:Theory, construction and working of Gas lasers (He-Ne) and Diode laser. Applications of Lasers.

Raman effect: (3 hours):

Rayleigh's Scattering and Raman Scattering. Quantum theory of Raman effect.Applications of Raman effect.

Nuclear Physics: (15 hours):

Nuclear forces: Properties of nuclear forces, Meson Theory of nuclear forces.

Nuclear models: Liquid-drop model: Semi-emperical mass formula and explanation of the terms, nuclear fission on the basis of liquid-drop model. Shell model(qualitative), Magic numbers.

Nuclear Reactions: Types of nuclear reactions with examples. Energy balance in Nuclear reactions and the Q-value. Brief discussions on compound nucleus formation in nuclear reactions.

Alpha decay: Gammow's theory of Alpha decay(Without derivation). Derivation of expression for alpha disintegration energy. Range of Alpha particles. Experimental determination of range of alpha particles. Geiger-Nuttal relation and its significance(qualitative). Alpha particle spectra with examples.

Beta decay: Types of beta decay with examples.The neutrino Theory of Beta decay(qualitative). Decay scheme of Tl-204.

Gamma decay: Origin of Gamma rays**.** Decay schemes of Cs-137, Na-22, Mn-54 and Co-57. Mention different types of interaction of gamma radiation with matter.

Detectors and Accelerators:

Detectors:Variation of pulse height with applied voltage in gas filled detector. Brief explanation of Ionisation chamber and Proportional counter. Theoretical and experimental studies on Characteristics and dead time of Geiger-Muller counter.

Accelerators:Theory, construction and working of Linear accelerators and Cyclotron.

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference books:

1. Quantum Mechanics vol 1 and vol 2(I ed)- Shrivatsav-Pragati Prakashan, Meerat,1977
2. Quantum Mechanics- Gupta,Kumar& Sharma- Jayprakashnath &Co,Meerat,2004
3. Quantum Mechanics(I ed)- Powell-Oxford& IBH Publishing,NewDehli,Bombay,Culkatta,1961
4. Quantum Mechanics - Pauling& Wilson.
5. Moden Physics- Duggal and Chabra.
6. Modern physics- R. Murugeshan-- S.Chand Publication,New Dehli.
7. Introduction to modern physics- Ritchmeyer,Kennerd& Lauritser-TMH Publishing NewDehli
8. Perspective of modern physics(VI ed)- A.Baiser- Tata McGraw Hill,Newdehli.2002
9. Modern physics- J.B.Rajam
10. Introduction to atomic spectra(IV ed)- H.E.White- McGraw Hill,Newdehli,2004
11. Molecular spectra and molecular structure– G.Herzberg
12. Modern spectroscopy – J.Michael Hollas
13. LASERs and Non linear Optics- B.B.Laud
14. Nuclear Physics(IV ed)- D.C.Tayal-Himalaya Publishing House,1982
15. Fundamentals of Nuclear Spectroscopy- Basswell- Tata McGraw Hill,Newdehli,2004
16. Nuclear physics- I.Kaplan
17. B.Sc. practical Physics – C.L.Arora.
18. Advanced practical Physics – Samir Kumar Ghosh.
19. Advanced practical Physics – Worsnop and Flint.

CBCS syllabus w.e.f. 2022-23
B.Sc. FIFTH SEMESTER
Optional Subject: PHYSICS(DSE-PHYT:501B)

Modern Physics-II(Elective 2)

(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Fundamentals of Quantum Mechanics (10hours): Brief discussion on failure of classical physics to explain black body radiation, Photoelectric effect, Compton effect, stability of atoms and spectra of atoms.

Matter Waves: de Broglie hypothesis. Expression for group velocity and Phase velocity of matter waves. Davisson - Germer experiment with result and its significance.

Uncertainty principle: Statement and illustration by Gamma ray microscope and diffraction of electrons at a single slit.Mention of Time-Energy Uncertainty relation and Angular Momentum- Angular position Uncertainty relation.

Necessity of Quantum Mechanics, basics of Schrodinger Formulation and Heisenberg Formulation (matrix method) of Quantum mechanics.

Wave Mechanics (10hours): Wave packet; Derivation of Group and phase velocity of wave packet. Setting up of one-dimensional time dependent Schrodinger equation for free particle and hence Schrodinger equation for particle in a force field drivable from potential. Mention of three-dimensional time dependent Schrodinger equation. Setting up of time independent Schrodinger's equation from time dependent equation. Physical interpretation of wave function, Normalization condition, Probability current density, Expectation value, Eigenfunction and Eigenvalues.

Applications of time independent Schrodinger equation to one dimensional systems(12hours): Eigenvalues and Eigenfunctions of particle in one dimensional infinite square well potential (Derivation).Mention of Eigenvalues and Eigenfunctions of particle in three dimensional infinite square well potential, Concept of degeneracy. Eigenvalues and Eigenfunctions of Particle in a one-dimensional finite square potential well (Qualitative). Particle passing through Step Potential: derivation of transmission and reflection coefficients. Qualitative discussion on quantum treatment of Linear Harmonic Oscillator(One dimensional), concept of zero point energy. Comparison of eigenvalues of particle in infinite potential well and Linear Harmonic Oscillator.

Applicationsofquantummechanics tonuclearandparticlephysics(10 hours): Quantum properties of nuclei and particles; Quantum mechanical tunneling and its applications to alpha decay; Study of nuclear potentials and quantum states of nuclei using deuteron (theory of deuteron); Scattering of free nucleons; Shell model of the nucleus (Including spin-orbit coupling).

Heisenberg Formulation(8hours) : Vector representation of a state, Ket Vector, Bra Vector, Dirac Notation, Linear vector space and correspondence between Ket and Bra. Orthogonal property and Normalization. Linear Operators; Addition, multiplication and scalar product, scalar multiplication, Dynamical variables, Eigenvalues and Eigenvectors.

Atoms in Magnetic Fields (10 hours): Electron Angular Momentum. Space Quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton. Normal and Anomalous Zeeman Effect.

Reference Books:

1. The development of Quantum mechanics" 1933 Nobel Lecture by Werner Heisenberg.
2. The fundamental idea of wave mechanics" 1933 Nobel Lecture by Erwin Schrödinger
3. Quantum Mechanics vol 1 and vol 2(I ed)- Shrivatsav-Pragati Prakashan,
4. Quantum Mechanics- Gupta,Kumar& Sharma-Jayprakashnath&Co,
5. Quantum Mechanics(I ed)- Powell-Oxford& IBH Publishing, NewDehli,
6. Quantum Mechanics - Pauling& Wilson.
7. Moden Physics- Duggal andChabra.
8. Foundation of Quantum Mechanics by A B Gupta;
9. Modern physics- R. Murugeshan-- S.ChandPublication,NewDehli.
10. Introduction to modern physics- Ritchmeyer,Kennerd&Lauritser-TMH
11. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan,
12. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2nd Edn., 2002,Wiley.

13. Quantum Mechanics, Leonard I. Schiff, 3rd Edn. 2010, Tata McGrawHill.
14. Quantum Mechanics, G. Aruldhas, 2nd Edn. 2002, PHI Learning ofIndia.
15. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and BartlettLearning.
16. Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge UniversityPress
17. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons,Inc.
18. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005
19. Quantum Mechanics, Walter Greiner, 4th Edn., 2001,Springer
20. Physics of nuclei and particles, Volume 1 : Pierre Marmier and Eric Sheldon.
21. Introductory nuclear physics: Kenneth S. Krane; John Wiley and sons, 1988.
22. Introduction to nuclear physics: Herald A. Enge; Addisoin - Wesley, 1983.
23. Introductory nuclear physics: Samuel S. M. Wong; Prentice - Hall, 1996.
24. Nuclear Physics - Theory and experiment: R. R. Roy and B. P. Nigam.
25. Atomic spectra – H.E.White.

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

List of fifth semester Physics(DSC-PHYP:502) Experiments common to both Elective 1 and Elective 2:

1. Millikan's oil drop method to determine electron charge.
2. Determination of specific charge (e/m) of an electron by Thomson's method.
3. Study of hydrogen spectrum - determination of Rydberg constant
4. Ionisation potential of Xenon/Mercury
5. Planck's constant using Photo cell /LED
6. Analysis of molecular spectra (Rotational spectra)
7. Study of Divergence of Laser Beam using Photo Diode
8. Characteristics of GM counter and GM tube (dead time).
9. Attenuation of β- radiation (absorption coefficient of aluminium)
10. Attenuation of Gamma rays in lead using GM tube and Cs-137 source.
11. DC hybrid parameters of BJT.
12. CE- amplifier.

Note:

1. **Experiments are of four hours duration.**
2. **Minimum of Eight experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2022-23

B.Sc. FIFTH SEMESTER

Skill Enhancement Course(SEC) in Physics(SEC-PHYP:503)

BASIC INSTRUMENTATION SKILLS -I

(Credits: -02) Total practical Teaching hours: 60 Hours

1. To observe the loading effect of a table top multimeter while measuring voltage across a low resistance and highresistance and To observe the limitations of a multimeter for measuring high frequency voltage andcurrents.
2. Measurement of time period, frequency, average period using universal counter/ frequencycounter.
3. Measurement of distortion of a RF signal generator using distortion factormeter.
4. Converting the range of a given measuring instrument (voltmeter,ammeter)
5. Basics of wiring-Star and delta connection.
6. AC and DC motors.
7. Basics and working of Voltage Stabilisers.
8. Design and construct telescope refraction/reflection type.
9. Measurement of refractive index of transparent liquid using Searle's Goniometer.
10. Soldering and desoldering techniques: Use discrete components to assemble a given circuit on general/specific PCB.

Note:

1. **Experiments are of four hours duration.**
2. **Minimum of seven experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2022-23

B.Sc. FIFTH SEMESTER

Skill Enhancement Course(SEC) in Physics(SEC-PHYP:504)

BASIC INSTRUMENTATION SKILLS -II

(Credits: -02) Total practical Teaching hours: 60 Hours

1. To measure Q of a coil and its dependence on frequency, using a Q-meter.
2. Measurement of rise, fall and delay times using aCRO.
3. Measurement of R, L and C using a LCR bridge/ universalbridge.
4. Basicsoftransformers. Winding a coil /transformer.
5. Basics of Relays, Fuses and disconnect switches, Circuit breakers and Overload devices.
6. Basics and working of Refrigerators.
7. Basics and working of Different types of batteries.
8. Design and construct Eye-piece.
9. Construct circuits (electrical circuits with switch) to verify the truth table of OR, AND, NAND and NOR gates.
10. Design of a mobile battery charger.

Note:

11. **Experiments are of four hours duration.**
12. **Minimum of seven experiments to be performed.**
13. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2022-23
B.Sc. SIXTH SEMESTER
Optional Subject: PHYSICS(DSE-PHYT:601A)

Solid State Physics and Electronics-I(Elective 1)

(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Solid state Physics:

Crystal structure, Crystal diffraction and Specific heat of solids(15 hours):

Crystal structure: Lattice, lattice translational vectors, basis of crystal structure, Types of unit cells, Co-ordination numbers, Bravais lattices, Seven crystal Systems, Miller indices, expression for inter-planar spacing, crystal structure of NaCl and CsCl.

Crystal diffraction: X-ray spectrum(Continuous & Characteristic), Bragg's law, Bragg's X-ray spectrometer.

Specific heat of solids: Experimental facts; classical theory, Einstein's and Debye's theory of lattice specific heats(qualitative).

Free electron theory of metals, Semiconductors, Magnetic materials and Superconductivity(15 hours):

Free electron theory of metals: Classical free electron model, expressions for electrical and thermal conductivity, Wiedemann-Franz law, failure of classical free electron theory.

Semiconductors: Intrinsic and extrinsic semiconductors.Expressionfor electrical conductivity in case of intrinsic semiconductors. Hall effect and expressions for Hall co-efficient. Applications of Hall effect.

Magnetic materials : Classification of Magnetic materials.Classical Langevin's theory of diamagnetism and paramagnetism. Determination of paramagnetic susceptibility by Gouy's method. Ferromagnetism and Weiss Theory of Ferromagnetism. Ferromagnetic domain. Nuclear Magnetic Resonance:Expression for resonance frequency.

Superconductivity : Occurrence of superconductivity. Destruction of superconductivity by magnetic field. Meissner effect. Type-I and Type-II super conductors. Isotope effect. BCS theory of superconductivity(Qualitative).Applications of superconductors.

Electronics:

Bipolar Junction Transistors, JFET and Integrated Circuits (ICs)(15 hours):

Bipolar Junction Transistors:BJT characterisitics in CE mode, DC load line analysis. Operating point. BJT biasing methods: Mention different types of biasing in CE mode. Analysis of Voltage Divider method with derivation I_c and V_{CE}. DC h-parameters and their determination , mention of h- parameter model of transistor , analysis of single stage RC coupled CE amplifier using h-parameter, Expression for current gain and Voltage gain, Input impedance and output impedance, frequency response, Brief explanation of positive and negative feedback. Transistor as an oscillator, Hartley and Phase shift oscillators (Qualitative only).

JFET: Types, characteristics and parameters of JFET. JFET as an amplifier (CS mode, qualitative).

Integrated Circuits (ICs): Brief discussion on Fabrication of IC's, types of ICs, IC555 internal configuration; operation of Timer 555 as Astablemultivibrator (qualitative.

Digital Electronicsand **communication(15 hours):**

Digital Electronics: Review of basics of number systems. Boolean algebra, truth tables, basic theorems, Basic and Universal gates.Demorgan's theorems.

Communication :classification of radio waves; Types of radio wave propagation, radio waves propagation through ionosphere. Critical frequency, critical angle, MUF, virtual height, secant law.

Modulation and Demodulation: Need of modulation, types of modulation,

Amplitudemodulation(AM): modulation index, frequency spectrum of AM, AM modulator using BJT (emitter modulation).

Frequency Modulation (FM):modulation index, FM spectrum,Carson's rule,applications of FM, Comparison between FM &AM**.**Demodulation: Need for demodulation, AM detection using PIN diode (qualitative). Super heterodyne receiver (Block diagram).

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference books:

1. Solid State Physics- C.Kittel-Wishey Publishing
2. Solid state physics(I ed)- A.J.Dekkar-McMillan,NewDehli,2003
3. Solid state physics(I ed)- Keer-New age international Pvt. Limited.2002
4. Solid state physics- Kumar And Gupta
5. Solid state physics- Kumar and Gupta and Saxena
6. Solid state physics – S.O.Pillai
7. Basic electronics and solid state physics- B.L.Theraja- S.Chand Publication,New Dehli
8. Basic Electronics- B.L.Theraja- S.Chand Publication,New Dehli
9. Integrated Electroniics- Millmans Ans Halkias-McGraw Hill,Newdehli
10. Electronic devices and circuits- Allan Mottersed-.McGraw Hill,Newdehli
11. Basic Electronics linear circuits,TTTI- Bhargav&etal-Bharat Book Prakashan Dharwad
12. Electronics communication system- Kennedy& Davis.
13. B.Sc. practical Physics – C.L.Arora.
14. Advanced practical Physics – Samir Kumar Ghosh.
15. Advanced practical Physics – Worsnop and Flint.

CBCS syllabus w.e.f. 2022-23
B.Sc. SIXTH SEMESTER
Optional Subject: PHYSICS(DSE-PHYT:601B)

Solid State Physics and Electronics-II(Elective 2)

(Credits:Theory-04, Practicals-02) Theory: 60 Hours

Crystal Structure(12 hours): Solids: Amorphous and Crystalline Materials.Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

Elementary Lattice Dynamics(10 hours): Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law

Magnetic Properties of Matter(10hours): Dia-, Para-, Ferri- and Ferromagnetic Materials. 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.

Elementary band theory(10 hours): Kronig Penny model. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect,Hallcoefficient.

Superconductivity(3hours): Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors,. Isotope effect.

Electronics(15 hours):

Bipolar Junction Transistors, JFET and Integrated Circuits (ICs):

Bipolar Junction Transistors:BJT characterisitics in CE mode, DC load line analysis. Operating point. BJT biasing methods: Mention different types of biasing in CE mode. Analysis of Voltage Divider method with derivation I_c and V_{CE}. DC h-parameters and their determination , mention of h- parameter model of transistor , analysis of single stage RC coupled CE amplifier using h-parameter, Expression for current gain and Voltage gain, Input impedance and output impedance, frequency response, Brief explanation of positive and negative feedback. Transistor as an oscillator, Hartley and Phase shift oscillators (Qualitative only).

JFET: Types, characteristics and parameters of JFET. JFET as an amplifier (CS mode, qualitative).

Integrated Circuits (ICs): Brief discussion on Fabrication of IC's, types of ICs, IC555 internal configuration; operation of Timer 555 as Astable multivibrator (qualitative).

Note:

1. **Number of teaching hours per week are four.**
2. **Total teaching hours are inclusive of solving numerical problems on all the topics.**
3. **Preference may be given to solve maximum number of numerical problems.**

Reference Books:

1. Solid State Physics- C.Kittel-Wishey Publishing
2. Solid state physics(I ed)- A.J.Dekkar-McMillan,NewDehli,2003
3. Solid state physics(I ed)- Keer-New age international Pvt. Limited.2002
4. Solid state physics- Kumar And Gupta
5. Solid state physics- Kumar and Gupta and Saxena
6. Solid state physics – S.O.Pillai
7. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006
8. Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-GrawHill
9. Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976.
10. Solid State Physics, Rita John, 2014, McGrawHill
11. Solid-state Physics, H. Ibach and H Luth, 2009,Springer
12. Elementary Solid State Physics, 1/e M. Ali Omar, 1999, PearsonIndia
13. Solid State Physics, M.A. Wahab, 2011, NarosaPublications
14. Basic electronics and solid state physics- B.L.Theraja- S.ChandPublication,NewDehli
15. Basic Electronics- B.L.Theraja- S.ChandPublication,NewDehli
16. Integrated Electroniics- Millmans Ans Halkias-McGraw Hill,Newdehli
17. Electronic devices and circuits- Allan Mottersed-.McGrawHill,Newdehli
18. Basic Electronics linear circuits,TTTI- Bhargav&etal.
19. Electronics communication system- Kennedy& Davis.
20. B.Sc. practical Physics – C.L.Arora.
21. Advanced practical Physics – Samir Kumar Ghosh.
22. Advanced practical Physics – Worsnop and Flint.

List of sixth semester Physics(DSC-PHYP:602) Experiments common to both Elective 1 and Elective 2:

1. Analysis of x-ray diffraction spectra
2. Hall effect
3. Determination of energy gap of semiconductor (Ge) by four probe method.
4. BH curve
5. Application of LDR: using BJT as Switch .
6. Study of Voltage Regulator 78XX / 79XX& Construction of Dual Power Supply using 78XX and 79XX.
7. Hartely Oscillator Using BJT / Phase Shift Oscillator Using BJT.
8. FET Amplifier.
9. D'Morgan's theorems & verification of Boolean expressions using IC 7400.
10. AstableMultivibrator (using 555 timer).
11. Generation of A M wave using BJT(emitter modulation or collector modulation) / IC AD633 : Study of modulation index.
12. Study of A M detector using PIN Diode / 1N4007 for different modulation frequencies

Note:

1. **Experiments of four hours duration.**
2. **Minimum of Eight experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2022-23
B.Sc. SIXTH SEMESTER

Skill Enhancement Course(SEC) in Physics(SEC-PHYP:603)
APPLIED PHYSICS-I
(Credits: -02) Total practical Teaching hours: 60 Hours

Experiments On Applied Optics:

1. Construction, working and characteristics/applications of LED.
2. Construction, working and characteristics/applications of IRsensor.
3. Construction, working and experimental determination of numerical aperture of an opticalfibre.

Experiments OnMedical Physics:

4. Understanding the working of a manual / Digital Hg Blood Pressure monitor and measure the BloodPressure.
5. Correction of Myopia (short sightedness) using a combinationof lenses on an opticalbench/breadboard.
6. Familiarization with Radiation meter and to measure backgroundradiation.

Experiments OnRenewable Energy And Energy Harvesting:

7. Conversion of thermal energy into voltage using thermoelectricmodules.

Experiments on applied Electronics:

8. Experiments on Diac/Triac and SCR as a power controlling device.
9. Baiscs of op-amp and its application to Construct and test multirange DC ammeter using op-amp.
10. Construct and test DC voltmeter using FET.

Note:

1. **Experiments of four hours duration.**
2. **Minimum of seven experiments to be performed.**
3. **Any new experiment may be added to the list with the prior approval from the BOS.**

CBCS syllabus w.e.f. 2022-23
B.Sc. SIXTH SEMESTER

Skill Enhancement Course(SEC) in Physics(SEC-PHYP:604)
APPLIED PHYSICS-II
(Credits: -02) Total practical Teaching hours: 60 Hours

Experiments On Applied Optics:

1. Construction, working and characteristics/applications of LDR.
2. PhotovoltaicCell/ Solar cell characteristics and its application.
3. To study the variation of the bending loss in a multimodefibre

Experiments On Medical Physics:

4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an opticalbench/breadboard.
5. Familiarization with the Use of a VascularDoppler.

Experiments On Renewable Energy And Energy Harvesting:

6. Demonstration of Training modules on Solar energy, wind energy,etc.
7. Conversion of vibration to voltage using piezoelectricmaterials

Experiments on applied Electronics

8. Construct and test capacitance meter using operational amplifier and microammeter.
9. UJT as relaxation oscillator.
10. Construct and test multirange DC voltmeter using Operational amplifier.

Note:

1.Experiments of four hours duration.
2.Minimum of seven experiments to be performed.
3.Any new experiment may be added to the list with the prior approval from the BOS.