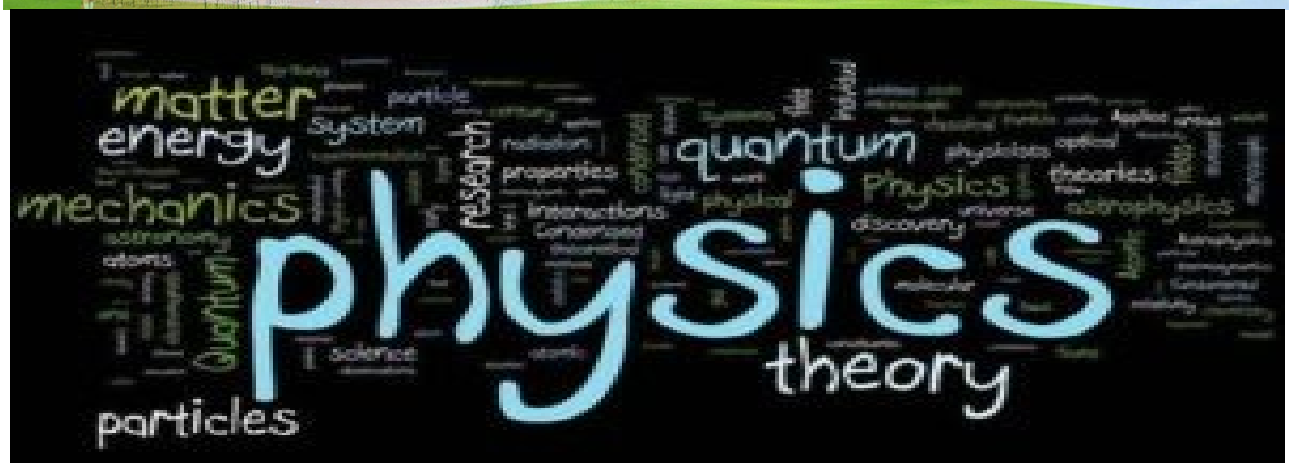
University Dept. Of Physics

Kolhan University, Chaibasa
कोलहान विश्वविद्यालय, चाईबासा



Choice Based Credit System (CBCS)

UNDERGRADUATE PROGRAMME
B. Sc. Physics (Pass Course & Subsidiary)
(Courses effective from Academic Year 2020-21)

B.Sc. Pass Under CBCS System

Semester	Subject Code	Full Marks	Total Marks	Credit	Total Credit
I	DSC-1A (Theory)	70	350	4	20
	DSC-1A (T/P)	30		2	
	DSC-2A (Theory)	70		4	
	DSC-2A (T/P)	30		2	
	DSC-3A (Theory)	70		4	
	DSC-3A (T/P)	30		2	
	AECC-1 (Eng./MIL Communication)	50		2	
II	DSC-1B (Theory)	70	350	4	20
	DSC-1B (T/P)	30		2	
	DSC-2B (Theory)	70		4	
	DSC-2B (T/P)	30		2	
	DSC-3B (Theory)	70		4	
	DSC-3B (T/P)	30		2	
	AECC-II (Environmental Science)	50		2	
III	DSC-1C (Theory)	70	350	4	20
	DSC-1C (T/P)	30		2	
	DSC-2C (Theory)	70		4	
	DSC-2C (T/P)	30		2	
	DSC-3C (Theory)	70		4	
	DSC-3C (T/P)	30		2	
	SEC-1 (GK & Current Affairs)	50		2	
IV	DSC-1D (Theory)	70	350	4	20
	DSC-1D (T/P)	30		2	
	DSC-2D (Theory)	70		4	
	DSC-2D (T/P)	30		2	
	DSC-3D (Theory)	70		4	
	DSC-3D (T/P)	30		2	
	SEC-2 (Personality Devevlopment)	50		2	
V	DSE-1A (Theory)	70	350	4	20
	DSE-1A (T/P)	30		2	
	DSE-2A (Theory)	70		4	
	DSE-2A (T/P)	30		2	
	DSE-3A (Theory)	70		4	
	DSE-3A (T/P)	30		2	
	SEC-III (History & Culture of Jharkhand)	50		2	
VI	DSE-1B (Theory)	70	350	4	20
	DSE-1B (T/P)	30		2	
	DSE-2B (Theory)	70		4	
	DSE-2B (T/P)	30		2	
	DSE-3B (Theory)	70		4	
	DSE-3B (T/P)	30		2	
	SEC-IV (Moral & Value Education)	50		2	
Total			**2100**		**120**

NB : GE and DSC papers in B.Sc. General Programme (Theory and Practical) are same.

LETTER GRADE AD GRADE POINT

1.1 Kolhan University adopts absolute grading method for awarding grades in a course.

1.2 The University implements a 10-point grading system with the following letter grades as given below:

Grades and grade Points

Letter Grade	Grade Point	Marks Percentage
O (Outstanding)	10	100%
A++ (Excellent)	9	90% to 99.99%
A+ (Extremely Good)	8	80% to 89.99%
A (Very Good)	7.5	75% to 79.99%
B+ (Good)	7	70% to 74.99%
B (Above Average)	6	60% to 69.99%
C (Average)	5	50% to 59.99%
P (Pass)	4	40% to 49.99%
F (Fail)	0	Less than 40%
Ab (Absent)	0	

1.3 A student obtaining Grade F shall be considered failed and will be required to reappear in the examination.

1.4 For non credit courses ‘Satisfactory’ or ‘Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

1.5 The Universities can decide on the grade or percentage of marks required to pass in a course and also the CGPA required to qualify for a degree taking into consideration the recommendations of the statutory professional councils such as AICTE, MCI, BCI, NCTE etc.

Note :

(a) Symbol ‘N’ in the grade column will indicate that the student has not appeared in the End-semester examination on account of low attendance.

(b) Symbol ‘X’ in the grade column will indicate that the student was absent in the end-semester examination.

(c) Marks sheet issued to a student getting grade F or symbols N or X in any of the courses shall be marked ‘Provisional’.

Symbol ‘U’ in the grade column will indicate that the student was found guilty of using unfair means in the examinations.

DISTRIBUTION OF MARKS IN UG PRACTICAL PAPERS

1. For Full marks 30 :			**Duration**
(Pass Marks 12)	Experiment	15	3 Hours
	Co-curricular activities and Regularity	05	
	Notebook & Viva-voce	10	
2. For Full marks 60 :			
(Pass Marks 24)	Experiment	30	4 Hours
	Co-curricular activities and Regularity	10	
	Notebook & Viva-voce	20	
3. For Full marks 90 :			
(Pass Marks 36)	Experiment	45	6 Hours
	Co-curricular activities and Regularity	15	
	Notebook & Viva-voce	30	

DISCIPLINE SPECIFIC CORE DSC-1A (Theory)

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DSC 1A: MECHANICS

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

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General Instruction for Students

Total Marks -70 Time-3 Hours

Group A is compulsory and will contain 10 objective type questions, each of 2 Marks, Gr. B is Short answer type and will have 8 questions of 5 Marks each out of which 4 are to be answered. Gr. C is Long answer type and will have 4 questions each of 15 Marks out of which any 2 are to be answered. Questions will be set from all the units in the paper and the distribution of the number of questions from each unit will be equal as far as practicable. If possible divide each paper in 4 units each of 15 Lecturers.

Vectors: Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. **(4 Lectures)**

Ordinary Differential Equations: 1st order homogeneous differential equations. 2^{nd} order homogeneous differential equations with constant coefficients. **(6 Lectures)**

Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. **(10 Lectures)**

Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. **(6 Lectures)**

Rotational Motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum. **(5 Lectures)**

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts. **(8 Lectures)**

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. **(6 Lectures)**

Elasticity: Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire – Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion – Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method. **(8 Lectures)**

Speed Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocity **(7 Lectures)**

Note: *Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate*

Reference Books:

- Core Physics for Class 11, S B Mathur & A Kumar, Bharati Bhawan, Patna
- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill.
- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHYSICS LAB : DSC-1A (T/P) : LAB: MECHANICS

60 Lectures

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1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Young's Modulus of a bar by method of bending.
4. To determine the Elastic Constants of a Wire by Searle's method.
5. To determine g by Bar Pendulum.
6. To determine g by Kater's Pendulum.
7. To study the Motion of a Spring and calculate (a) Spring Constant, (b) g.

Reference Books:

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

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DSC -1B (Theory) : ELECTRICITY AND MAGNETISM

(Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

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General Instruction for Students

Total Marks -70 Time-3 Hours

Group A is compulsory and will contain 10 objective type questions, each of 2 Marks, Gr. B is Short answer type and will have 8 questions of 5 Marks each out of which 4 are to be answered. Gr. C is Long answer type and will have 4 questions each of 15 Marks out of which any 2 are to be answered. Questions will be set from all the units in the paper and the distribution of the number of questions from each unit will be equal as far as practicable. If possible divide each paper in 4 units each of 15 Lecturers.

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

Electrostatics: Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. **(22 Lectures)**

Magnetism:

Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials. **(10 Lectures)**

Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. **(6 Lectures)**

Maxwell`s equations and Electromagnetic wave propagation: Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization. **(10 Lectures)**

Reference Books:

- Core Physics for Class 12, S B mathur & A Kumar, Bharati Bhawan, Patna.
- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education
- Electricity & Magnetism, J.H. Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J.Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

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DSC -1B (T/P) : LAB: ELECTRICITY AND MAGNETISM

60 Lectures

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1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer:
(i) Measurement of charge and current sensitivity
(ii) Measurement of CDR
(iii) Determine a high resistance by Leakage Method
(iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De'Sauty's bridge.
4. To study the Characteristics of a Series RC Circuit.
5. To study a series LCR circuit LCR circuit and determine its (a) Resonant frequency, (b) Quality factor
6. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q
7. To verify the Thevenin and Norton theorems
8. To verify the Superposition, and Maximum Power Transfer Theorems

Reference Books

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed.2011, Kitab Mahal

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DSC -1C (Theory) : THERMAL PHYSICS AND STATISTICAL MECHANICS
(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

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General Instruction for Students

Total Marks -70 Time-3 Hours

Group A is compulsory and will contain 10 objective type questions, each of 2 Marks, Gr. B is Short answer type and will have 8 questions of 5 Marks each out of which 4 are to be answered. Gr. C is Long answer type and will have 4 questions each of 15 Marks out of which any 2 are to be answered. Questions will be set from all the units in the paper and the distribution of the number of questions from each unit will be equal as far as practicable. If possible divide each paper in 4 units each of 15 Lecturers.

Laws of Thermodynamics: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. **(22 Lectures)**

Thermodynamical Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V, TdS equations. **(10 Lectures)**

Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases. **(10 Lectures)**

Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh- Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law. **(6 Lectures)**

Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity – Quantum statistics - Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics. **(12 Lectures)**

Reference Books:

- Core Physics for Class 11, S B Mathur & A Kumar, Bharati Bhawan, Patna.
- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
- A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
- Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and G.L. Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

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PHYSICS DSC-1C(T/P) LAB: THERMAL PHYSICS AND STATISTICAL MECHANICS

60 Lectures

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1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Reference Books:

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

DSC- 1D (Theory): WAVES AND OPTICS

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

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General Instruction for Students

Total Marks -70 Time-3 Hours

Group A is compulsory and will contain 10 objective type questions, each of 2 Marks, Gr. B is Short answer type and will have 8 questions of 5 Marks each out of which 4 are to be answered. Gr. C is Long answer type and will have 4 questions each of 15 Marks out of which any 2 are to be answered. Questions will be set from all the units in the paper and the distribution of the number of questions from each unit will be equal as far as practicable. If possible divide each paper in 4 units each of 15 Lecturers.

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. **(6 Lectures)**

Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. **(6 Lectures)**

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. **(5 Lectures)**

Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. **(12 Lectures)**

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer –theory and applications. **(6 Lectures)**

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula and its application to rectangular slit. **(6 Lectures)**

Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Single slit. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. **(10 Lectures)**

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. **(9 Lectures)**

Reference Books

- Core Physics for Class 11, S B Mathur & A Kumar, Bharati Bhawan, Patna
- Core Physics for Class 12, S B Mathur & A Kumar, Bharati Bhawan, Patna
- Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
- Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
- Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
- Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
- The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
- The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.

PHYSICS DSC-1D(T/P) :LAB

60 Lectures

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1. Familiarization with: Schuster`s focusing; determination of angle of prism.
2. To determine refractive index of the Material of a prism using sodium source.
3. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
4. To determine wavelength of sodium light using Fresnel Biprism.
5. To determine wavelength of sodium light using Newton's Rings.
6. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
7. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
8. To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

DISCIPLINE SPECIFIC ELECTIVE DSE-1A (Theory)

DSE: CLASSICAL DYNAMICS

(Credits: Theory-05, Tutorials-01)

Theory: 75 Lectures

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General Instruction for Students

Total Marks -70 Time-3 Hours

Group A is compulsory and will contain 10 objective type questions, each of 2 Marks, Gr. B is Short answer type and will have 8 questions of 5 Marks each out of which 4 are to be answered. Gr. C is Long answer type and will have 4 questions each of 15 Marks out of which any 2 are to be answered. Questions will be set from all the units in the paper and the distribution of the number of questions from each unit will be equal as far as practicable. If possible divide each paper in 4 units each of 15 Lecturers.

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

Classical Mechanics of Point Particles: Generalised coordinates and velocities. Hamilton's Principle, Lagrangian and Euler-Lagrange equations. Applications to simple systems such as coupled oscillators. Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, particle in a central force field. Poisson brackets. Canonical transformations. **(22 Lectures)**

Special Theory of Relativity: Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time-dilation, length contraction & twin paradox. Four-vectors: space-like, time-like & light-like. Four-velocity and acceleration. Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a fourvector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle. The Electromagnetic field tensor and its transformation under Lorentz transformations: relation to known transformation properties of **E** and **B**. Electric and magnetic fields due to a uniformly moving charge. Equation of motion of charged particle & Maxwell's equations in tensor form. Motion of charged particles in external electric and magnetic fields. **(38 Lectures)**

Electromagnetic radiation: Review of retarded potentials. Potentials due to a moving charge: Lienard Wiechert potentials. Electric & Magnetic fields due to a moving charge: Power radiated, Larmor's formula and its relativistic generalisation. **(15 Lectures)**

Reference Books:

- Classical Mechanics, H.Goldstein, C.P. Poole, J.L. Safko, 3rd Edn. 2002,Pearson Education.
- Mechanics, L. D. Landau and E. M. Lifshitz, 1976, Pergamon.
- Classical Electrodynamics, J.D. Jackson, 3rd Edn., 1998, Wiley.
- The Classical Theory of Fields, L.D Landau, E.M Lifshitz, 4th Edn., 2003, Elsevier.
- Introduction to Electrodynamics, D.J. Griffiths, 2012, Pearson Education.
- Classical Mechanics: An introduction, Dieter Strauch, 2009, Springer.
- Solved Problems in classical Mechanics, O.L. Delange and J. Pierrus, 2010, Oxford Press

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PRACTICAL DSE-1A(T/P) LAB: EXPERIMENTAL TECHNIQUES
60 Lectures

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1. Determine output characteristics of a LVDT & measure displacement using LVDT
2. Measurement of Strain using Strain Gauge.
3. Measurement of level using capacitive transducer.
4. To study the characteristics of a Thermostat and determine its parameters.
5. Study of distance measurement using ultrasonic transducer.
6. Calibrate Semiconductor type temperature sensor (AD590, LM35, or LM75)
7. Comparison of pickup of noise in cables of different types (co-axial, single shielded, double shielded, without shielding) of 2m length, understanding of importance of grounding using function generator of mV level & an oscilloscope.
8. To design and study the Sample and Hold Circuit.
9. Design and analyze the Clippers and Clampers circuits using junction diode
10. To plot the frequency response of a microphone.

using a Q-meter.

11. To measure Q of a coil and influence of frequency,

Reference Books:

• Electronic circuits: Handbook of design and applications, U. Tietze and C. Schenk, 2008, Springer
• Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1990, Mc-Graw
• Measurement, Instrumentation and Experiment Design in Physics & Engineering, M. Sayer and A. Mansingh, 2005, PHI Learning.

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DSE-1B (Theory) : NUCLEAR AND PARTICLE PHYSICS

(Credits: Theory-05, Tutorials-01)

Theory: 75 Lectures

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General Instruction for Students

Total Marks -70 Time-3 Hours

Group A is compulsory and will contain 10 objective type questions, each of 2 Marks, Gr. B is Short answer type and will have 8 questions of 5 Marks each out of which 4 are to be answered. Gr. C is Long answer type and will have 4 questions each of 15 Marks out of which any 2 are to be answered. Questions will be set from all the units in the paper and the distribution of the number of questions from each unit will be equal as far as practicable. If possible divide each paper in 4 units each of 15 Lecturers.

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. **(10 Lectures)**

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

(12 Lectures)

Radioactivity decay:(a) Alpha decay: basics of α-decay processes, theory of α- emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. (**12 Lectures)**

Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering). **(10 Lectures)**

Interaction of Nuclear Radiation with matter: Energy loss due to ionization (Bethe- Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. **(7 Lectures)**

Detector for Nuclear Radiations: Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector. **(10 Lectures)**

Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, concept of quark model, **(14 Lectures)**

Reference Books:

• Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
• Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
• Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
• Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
• Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
• Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
• Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
• Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
• Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007).
• Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991

PHYSICS DSE-1B (T/P) LAB: MEDICAL PHYSICS
60 Lectures

1. Understanding the working of a manual Hg Blood Pressure monitor and measure the Blood Pressure.
2. Understanding the working of a manual optical eye-testing machine and to learn eye-testing procedure.
3. Correction of Myopia (short sightedness) using a combination of lenses on an optical bench/breadboard.
4. Correction of Hypermetropia/Hyperopia (long sightedness) using a combination of lenses on an optical bench/breadboard.
5. To learn working of Thermoluminescent dosimeter (TLD) badges and measure the background radiation.
6. Familiarization with Geiger-Muller (GM) Counter and to measure background radiation.
7. Familiarization with Radiation meter and to measure background radiation.

Reference Books:

• Basic Radiological Physics, Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
• Christensen's Physics of Diagnostic Radiology: Curry, Dowdey and Murry - Lippincot Williams and Wilkins (1990)
• Physics of Radiation Therapy : F M Khan - Williams and Wilkins, 3rd edition (2003)
• The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
• The Physics of Radiology-H E Johns and Cunningham