DEPARTMENT OF PHYSICS

UNDERGRADUATE PROGRAMME

(B.Sc. PROGRAM WITH PHYSICS)

(Courses effective from Academic Session 2016-2017)

SYLLABI OF COURSES TO BE OFFERED

(Core Courses, Elective Courses & Ability Enhancement Courses,
As per Ordinance 22 (B) and UGC Guidelines)
and - 2017

SCHOOL OF MATHEMATICAL AND PHYSICAL SCIENCES

DOCTOR HARISINGH GOUR VISHWAVIDYALAYA

SAGAR (M.P.) 470003

B.Sc. PROGRAM WITH PHYSICS

under

CHOICE BASED CREDIT SYSTEM

PREAMBLE

Physics is the most basic of the natural sciences. It is concerned with understanding the world on all scales of length, time, and energy. The methods of physics are diverse, but they share a common objective to develop and refine fundamental models that quantitatively explain observations and the results of experiments. The discoveries of physics, exemplified by the laws of physics, rank among the most important achievements of human inquiry, and have an enormous impact on human culture and civilization.
The story of physics has been of people who thought outside the box. From Galileo and Newton in the 1600s to Einstein and Feynman in the 20th century, the progress of science in answering fundamental questions about the Nature is rooted in a different way of approaching things. A scientific way to test the validity of a physical theory, using a methodical approach to compare the implications of the theory in question with the associated conclusions drawn from experiments and observations conducted to test it.

The B.Sc. Programme in Physics is a rigorous study program at Undergraduate level covering both the depth and breadth of all relevant areas, and provides substantial research training. It is designed to impart a thorough knowledge of the fundamental principles of the several branches of physics, as mathematically and experimentally demonstrated; and also to execute with their own hands various experiments to have hands-on experience with the tools and methods of physics, not simply with the concepts. The program aims to train future generations of physicists with specialization in the frontier areas of research.

Besides training the future generations of physicists, the programme aims at imparting training in instrumentation and communication skills for all round development of students.

The programme consists of 24 credits in core area of physics, 12 credits for elective courses in physics and four (8) credits for Skill enhancement Course which is optional. Thus, a total of 36 credits are required to complete the B.Sc. Programme in Physics.

S.No.	Nature of Courses	Credits
1.	Core Courses	24
2.	Departmental Elective Courses	12
3.	Skill Enhancement Courses (Optional)	8
	Total	**44 Credits**

[A] Scheme of Examination :

S.No.	**Nature of Exam**	**Marks**
1.	Mid Semester Examination	20
2.	Internal Assessment	20
3.	End Semester Examination	60
	Total	**100**

[B] Assessments :

i) Internal Assessment:

a) Theory :

Each theory course must clearly mention the methodology of assessment i.e. assignment, presentation, group discussion etc depending on the number of students in the class and feasibility of adopting a particular methodology. The distribution of marks for internal assessments shall be as follows;

(i)	Evaluation of the assignment,	:	
	presentation , group discussion etc	:	15 Marks
(ii)	Attendance	:	05 Marks

The marks for attendance shall be awarded as follows :

(i)	75 % and Below	:	00 Mark
(ii)	>75 % and upto 80 %	:	01 Mark
(iii)	>80 % and upto 85 %	:	02 Marks
(iv)	>85 % and upto 90 %	:	03 Marks
(v)	>90 % and upto 95 %	:	04 Marks
(vi)	>95 % and	:	05 Marks

The introductory note must also mention that to be eligible to appear in End Semester Examination a student must appear in Mid Semester Examination and internal Assessment.

b) Practical/ Lab Courses :

(i)	Performing and getting the experiment checked regularly and incorporating the suggestion in the practical note book	:	15 Marks
(ii)	Attendance	:	05 Marks

The marks for attendance shall be as follows :

(i)	75 % and Below	:	00 Mark
(ii)	>75 % and upto 80 %	:	01 Mark
(iii)	>80 % and upto 85 %	:	02 Marks
(iv)	>85 % and upto 90 %	:	03 Marks
(v)	>90 % and upto 95 %	:	04 Marks
(vi)	>95 % and	:	05 Marks

[C] End Semester Examination for Practical/ Lab Courses :

It will consist of 60 marks as follows :

(a)	Assessment of performance in the Experiment	:	50 Marks
(b)	Viva-Voce of Experiment	:	10 Marks

Attendance: 75 % attendance in a course is mandatory for a student to appear in end semester examination.

B.Sc. Programme in Physics
Session 2016-2017
Course structure

Semester – I		L	T	P	C
PHY CC 111	Mechanics	4	0	0	4
PHY CC 112	Mechanics Lab.	0	0	2	2

Semester – II

PHY CC 211	Electricity and Magnetism	4	0	0	4
PHY CC 212	Electricity and Magnetism Lab.	0	0	2	2

Semester – III

PHY CC 311	Thermal Physics And Statistical Mechanics	4	0	0	4
PHY CC 312	Thermal Physics And Statistical Mechanics Lab.	0	0	2	2
PHY SE 311	Electrical Circuits And Network Skills	0	0	2	2

Semester – IV

PHY CC 411	Waves and Optics	4	0	0	4
PHY CC 412	Waves and Optics Lab.	0	0	2	2
PHY SE 411	Basic Instrumentation Skills	0	0	2	2

Semester –V

PHY SE 511	Applied Optics	0	0	2	2
PHY EC 511	Digital and Analog Circuits And Instrumentation	4	0	0	4
PHY EC 512	Digital and Analog Circuits And Instrumentation Lab.	0	0	2	2
PHY EC 513	Solid State Physics	4	0	0	4
PHY EC 514	Solid State Physics Lab.	0	0	2	2

Semester – VI

PHY SE 611	Renewable Energy And Energy Harvesting	0	0	2	2
PHY EC 611	Embedded System: Introduction to Microcontrollers	4	0	0	4
PHY EC 612	Embedded System: Introduction to Microcontrollers Lab.	0	0	2	2
PHY EC 613	Nuclear and Particle Physics	6	0	0	6

- *Students have to "Opto" any one Elective Courses form (PHY EC 511, 512 or PHY EC 513, 514) in V Semester and from (PHY EC 611, 612 or PHY EC 613) in VI Semester respectively.*
- *Skill Enhancement Course are Optional.*

B.Sc.: I Semester

Session: 2016-2017

		L	T	P	C
PHY CC 111	**MECHANICS**	4	0	0	4

Theory: 60 Lectures **Credits: 04**

UNIT - I

Vectors: Vector algebra: Scalar and vector products, Derivatives of a vector with respect to a parameter.

Ordinary Differential Equations: 1st order homogeneous differential equations, 2nd order homogeneous differential equations with constant coefficients. **(Lectures-10)**

UNIT - II

Law of Motion: Frames of reference, Newton's Laws of motion, Dynamics of a system of particles, Centre of Mass.

Momentum and Energy: Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.

Rotational Motion: Angular velocity and angular momentum, Torque, Conservation of angular momentum. **(Lectures-14)**

UNIT - III

Gravitation: Newton's Law of Gravitation, Motion of a particle in a central force field (motion in a plane, angular momentum is conserved, areal velocity is constant), Kepler's Laws (statement only), Satellite in circular orbit and applications, geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Physiological effects on astronauts. **(Lectures-12)**

UNIT - IV

Elasticity: Hooke's Law – Stress-strain diagram- Elastic moduli-Relation between elastic constants – Poisson's Ration-Expression for Poisson's ration 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 and moment of inertia – q,η and σ by Searle's method. Viscous flow of fluids, coefficient of viscosity, Stocke's low and expression for terminal velocity. **(Lectures-12)**

UNIT - V

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

Special Theory of Relativity: Constancy of speed of light, Postulates of Special Theory of Relativity. Length contraction; Time dilation; Relativistic addition of velocities **(Lectures-12)**

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

Essential Readings :

- University Physics, FW Sears, MW Zemansky and HD Young13/e, 1986. Addison Wesley.
- Mechnics Berkeley Physics course, v.1: Charles Kittel, et.AL. 2007, Tata McGraw-Hill.

Suggested Readings :

- Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

B.Sc.: I Semester
Session: 2016-2017

		L	T	P	C
PHY CC 112	**MECHANICS LAB**	0	0	2	2

Credits: 02

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

Essential Reading :

- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Suggested Readings:

- 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.

Note: Other practical of equivalent level can be added.

B.Sc.: II Semester
Session: 2016-2017

		L	T	P	C
PHY CC 211	**ELECTRICITY AND MAGNETISM**	4	0	0	4

Theory: 60 Lectures **Credits: 04**

UNIT - I

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 Stokes's theorem of vectors (statement only). **(Lectures-12)**

UNIT - II

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 charges 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. **(Lectures-12)**

UNIT - III

Dielectric & Steady Currents : medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Steady current, current density J, non-steady current and continuity equation, Kirchoff's law (statement only) and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits. **(Lectures-12)**

UNIT - IV

Magnetism:

Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field, Magnetic vector potential, Ampere's circuital law.

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-para-and ferro-magnetic materials. **(Lectures-12)**

UNIT - V

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.

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. **(Lectures-12)**

Essential Readings :

- 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.

Suggested Readings:

- Electricity and magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.

B.Sc.: II Semester
Session: 2016-2017

		L	T	P	C
PHY CC 212	**ELECTRICITY AND MAGNETISM LAB**	0	0	2	2

Credits: 02

1. To use a Multimeter for measuring (a) Resistance, (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. Measurement of field strength B and its variation in a Solenoid (Determine dB/dx).
5. To study the characteristics of a Series RC Circuit.
6. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality factor.
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem.
10. To verify the Superposition and maximum power transfer theorem.

Essential Reading :

- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Suggested Readings:

- 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.

Note: Other practical of equivalent level can be added.

B.Sc. III Semester

Session 2016-2017

		L	T	P	C
PHY CC 311	**THERMAL PHYSICS AND STATISTICAL MECHANICS**	4	0	0	4

Theory: 60 Lectures **Credits: 04**

UNIT - I

Laws of Thermodynamics:

Thermodynamic Description of system: 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 & C_V, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient. **(12 Lectures)**

UNIT - II

Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics. **(12 Lectures)**

UNIT - III

Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for (C_P – C_V), C_P/C_V, TdS equations. **(12 Lectures)**

UNIT - IV

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. **(12 Lectures)**

UNIT - V

Statistical Mechanics: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics. **(12 Lectures)**

Essential Readings :

- 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.
- Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 13

Suggested Readings :

- Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

B.Sc. III Semester
Session 2016-2017

		L	T	P	C
PHY CC 312	**THERMAL PHYSICS AND STATISTICAL MECHANICS LAB**	0	0	2	2

Credits: 02

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 and Charlton'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.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Essential Readings

- 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.

Suggested Readings:

- 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

Note: Other practical of equivalent level can be added.

B.Sc. III Semester
Session 2016-2017

		L	T	P	C
PHY SE 311	**ELECTRICAL CIRCUITS AND NETWORK SKILLS**	**0**	**0**	**2**	**2**

Theory: 30 Lectures **Credits: 02**

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode

UNIT - I

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter. **(5 Lectures)**

UNIT - II

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. **(6 Lectures)**

UNIT - III

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **(7 Lectures)**

UNIT - IV

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) **(6 Lectures)**

UNIT - V

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board.

(6 Lectures)

Essential Readings :

- A text book in Electrical Technology - B L Theraja, A K Theraja, s. Chand & Co. Volume II,2005

Suggested Reading :

- Performance and design of AC machines - M G Say, CBS Publisher, 3rd Edition 2002

B.Sc. IV Semester
Session 2016-2017

		L	T	P	C
PHY CC 411	**WAVES AND OPTICS**	**4**	**0**	**0**	**4**

Theory: 60 Lectures **Credits: 04**

UNIT - I

Superposition of Two Collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats).
Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. **(12 Lectures)**

UNIT - II

Waves Motion- General: Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity.
Sound: Simple harmonic motion - forced vibrations - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound -Decibels - Intensity levels - musical notes - musical scale. **(12 Lectures)**

UNIT - III

Sound and Interference of light : Acoustics of buildings: Reverberation and time of reverberation - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.
Interference: Interference: Division of amplitude and division of 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. **(12 Lectures)**

UNIT - IV

Types of Fringes and Michelson's Interferomenter : Fringes of equal inclination (Haidinger Fringes); Newton's Rings: measurement of wavelength and refractive index.
Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference. **(12 Lectures)**

UNIT -V

Diffraction and Polarization: Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge.
Polarization: Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization. **(12 Lectures)**

Essential Readings :

- Physics for degree students – CL Arora and Dr. P.S. Hemne, S-Chand 2nd Revised Ed.., 2013, New Delhi
- Optics – Dr. SP Singh & Dr. J.P. Agrawal, Pragati Prakashan, 2009.
- Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill

Suggested Readings:

- Principles of Optics, B.K. Mathur, 1995, Gopal Printing
- Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication
- University Physics. FW Sears, MW Zemansky and HD Young 13/e, 1986. Addison-Wesley

B.Sc. IV Semester
Session 2016-2017

		L	T	P	C
PHY CC 412	**WAVES AND OPTICS LAB**	**0**	**0**	**2**	**2**

Credit : 02

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda_2 - T$ Law.
3. To study Lissajous Figures
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
6. To determine Dispersive Power of the Material of a given Prism using Mercury Light
7. To determine the value of Cauchy Constants of a material of a prism.
8. To determine the Resolving Power of a Prism.
9. To determine wavelength of sodium light using Fresnel Biprism.
10. To determine wavelength of sodium light using Newton's Rings.
11. To determine the wavelength of Laser light using Diffraction of Single Slit.
12. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating
13. To determine the Resolving Power of a Plane Diffraction Grating.
14. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

Essential Reading:

- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

Suggested Readings:

- 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

Note: Other practical of equivalent level can be added.

B.Sc. IV Semester

Session 2016-2017

		L	T	P	C
PHY SE 411	**BASIC INSTRUMENTATION SKILLS**	**0**	**0**	**2**	**2**

Theory: 30 Lectures **Credits: 02**

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

UNIT - I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

(6 Lectures)

UNIT - II

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. **AC millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter**,** specifications and their significance. **(6 Lectures)**

UNIT - III

Cathode Ray **Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance**)** .

Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working. **(6 Lectures)**

UNIT - IV

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(5 Lectures)**

UNIT - V

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. **(7 Lectures)**

The test of lab skills will be of the following test items:

1. Use of an oscilloscope.
2. CRO as a versatile measuring device.
3. Circuit tracing of Laboratory electronic equipment,
4. Use of Digital multimeter/VTVM for measuring voltages

5. Circuit tracing of Laboratory electronic equipment,
6. Winding a coil / transformer.
7. Study the layout of receiver circuit.
8. Trouble shooting a circuit
9. Balancing of bridges

Laboratory Exercises:

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q- meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. Measurement of distortion of a RF signal generator using distortion factor meter.
8. Measurement of R, L and C using a LCR bridge/ universal bridge.

Open Ended Experiments:

1. Using a Dual Trace Oscilloscope
2. Converting the range of a given measuring instrument (voltmeter, ammeter)

Essential Readings :

- A text book in Electrical Technology - B L Theraja, A.K. Theraja - S Chand and Co. Volume II, 2005
- Performance and design of AC machines - M G Say CBS Publisher 3rd Edition 2002.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Logic circuit design, Shimon P. Vingron, 2012, Springer.

Suggested Readings :

- Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
- Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill
- Electronic circuits: Handbook of design and applications, U.Tietze, Ch.Schenk, 2008, Springer
- Electronic Devices, 7/e Thomas L. Floyd, 2008, Pearson India

B.Sc. V Semester
Session 2016-2017

		L	T	P	C
PHY SE 511	**APPLIED OPTICS**	**0**	**0**	**2**	**2**

Credits: 02

THEORY: 30 Lectures

Theory includes only qualitative explanation. Minimum five experiments should be performed covering minimum three sections.

UNIT - I

(i) Sources and Detectors

Lasers, Spontaneous and stimulated emissions, Theory of laser action, Einstein's coefficients, Light amplification, Characterization of laser beam, He-Ne laser, Semiconductor lasers. **(06 Lectures)**

UNIT - II

(ii) Fourier Optics (6 Periods)

Concept of Spatial frequency filtering, Fourier transforming property of a thin lens.

(04 Lectures)

UNIT - III

b. Fourier Transform Spectroscopy

Fourier Transform Spectroscopy (FTS) is a powerful method for measuring emission and absorption spectra, with wide application in atmospheric remote sensing, NMR spectrometry and forensic science.

(07 Lectures)

UNIT - IV

(iii) Holography (6 Periods)

Basic principle and theory: coherence, resolution, Types of holograms, white light reflection hologram, application of holography in microscopy.

(06 Lectures)

UNIT - V

(iv) Photonics: Fibre Optics (9 Periods)

Optical fibres and their properties, Principal of light propagation through a fibre, The numerical aperture, Attenuation in optical fibre and attenuation limit, Single mode and multimode fibres.

(07 Lectures)

Experiments on Lasers:

a. Determination of the grating radial spacing of the Compact Disc (CD) by reflection using He-Ne or solid state laser.
b. To find the width of the wire or width of the slit using diffraction pattern obtained by a He-Ne or solid state laser.
c. To find the polarization angle of laser light using polarizer and analyzer
d. Thermal expansion of quartz using laser

Experiments on Semiconductor Sources and Detectors:

a. V-I characteristics of LED
b. Study the characteristics of solid state laser
c. Study the characteristics of LDR
d. Photovoltaic Cell
e. Characteristics of IR sensor

Experiments on Fourier Optics:

a. Fourier optic and image processing

1. Optical image addition/subtraction
2. Optical image differentiation
3. Fourier optical filtering
4. Construction of an optical 4f system

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Experiment:

To study the interference pattern from a Michelson interferometer as a function of mirror separation in the interferometer. The resulting interferogram is the Fourier transform of the power spectrum of the source. Analysis of experimental interferograms allows one to determine the transmission characteristics of several interference filters. Computer simulation can also be done.

Experiments on Holography and interferometry:

1. Recording and reconstructing holograms
2. Constructing a Michelson interferometer or a Fabry Perot interferometer
3. Measuring the refractive index of air
4. Constructing a Sagnac interferometer
5. Constructing a Mach-Zehnder interferometer
6. White light Hologram

Experiments on Photonics: Fibre Optics

a. To measure the numerical aperture of an optical fibre
b. To study the variation of the bending loss in a multimode fibre
c. To determine the mode field diameter (MFD) of fundamental mode in a single-mode fibre by measurements of its far field Gaussian pattern
d. To measure the near field intensity profile of a fibre and study its refractive index profile
e. To determine the power loss at a splice between two multimode fibre

Essential Readings :

- Fundamental of optics, F. A. Jenkins & H. E. White, 1981, Tata McGraw hill.
- LASERS: Fundamentals & applications, K.Thyagrajan & A.K.Ghatak, 2010,Tata McGraw Hill
- Fibre optics through experiments,M.R.Shenoy, S.K.Khijwania, et.al. 2009, Viva Books
- Nonlinear Optics, Robert W. Boyd, (Chapter-I), 2008, Elsevier.

Suggested Readings :

- Optics, Karl Dieter Moller, Learning by computing with model examples, 2007, Springer.
- Optical Systems and Processes, Joseph Shamir, 2009, PHI Learning Pvt. Ltd.
- Optoelectronic Devices and Systems, S.C. Gupta, 2005, PHI Learning Pvt. Ltd.
- Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., 1996, Cambridge Univ. Press

B.Sc. V Semester

Session 2016-2017

		L	T	P	C
PHY EC 511	**DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTATION**	**4**	**0**	**0**	**4**

Theory: 60 Lectures **Credits: 04**

UNIT- I

Digital Circuits : Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.

De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

Binary Addition. Binary Subtraction using 2's Complement Method).Half Adders and Full Adders and Subtractors, 4-bit binary Adder-Subtractor. **(14 Lectures)**

UNIT-II

Semiconductor Devices and Amplifiers: Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

(12 Lectures)

UNIT-III

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff, and Saturation Regions. Current gains α and β. Relations between α and β. Load Line analysis of Transistors. DC Load line and Qpoint. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers. **(14 Lectures)**

UNIT-IV

Instrumentations : Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.

(08 Lectures)

UNIT - V

Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation

(12 Lectures)

Essential Readings :

- Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
- Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
- Microelectronic Circuits, M.H. Rashid, 2nd Edn.,2011, Cengage Learning.
- Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning

Suggested Readings :

- Digital Principles & Applications, A.P. Malvino, D.P. Leach & Saha, 7th Ed.,2011, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.
- Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
- OP-AMP and Linear Digital Circuits, R.A. Gayakwad, 2000, PHI Learning Pvt. Ltd.

B.Sc. V Semester

Session 2016-2017

		L	T	P	C
PHY EC 511	**DIGITAL AND ANALOG CIRCUITS AND INSTRUMENTS LAB**	**0**	**0**	**2**	**2**

Credit : 02

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

Essential Readings:

- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
- Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

Suggested Readings :

- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.

Note: Other practical of equivalent level can be added.

B.Sc. V Semester
Session 2016-2017

		L	T	P	C
PHY EC 513	**SOLID STATE PHYSICS**	**4**	**0**	**0**	**4**

Theory: 60 Lectures **Credits: 04**

UNIT - I

Crystal Structure: Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. **(12 Lectures)**

UNIT - II

Elementary Lattice Dynamics: Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. 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 **(12 Lectures)**

UNIT - III

Magnetic Properties of Matter: 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. **(12 Lectures)**

UNIT - IV

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. **(12 Lectures)**

UNIT - V

Elementary band theory and Superconductivity: Kronig Penny model. Band Gaps. Conductors, Semiconductors and insulators. P and N type Semiconductors. Conductivity of Semiconductors, mobility, Hall Effect, Hall coefficient.

Superconductivity: Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect.

(12 Lectures)

Essential Readings :

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India
- Introduction to Solids, Leonid V. Azaroff, 2004, Tata Mc-Graw Hill
- Solid State Physics, Neil W. Ashcroft and N. David Mermin, 1976, Cengage Learning

Suggested Readings :

- Solid State Physics, Rita John, 2014, McGraw Hill
- Solid-state Physics, H. Ibach and H Luth, 2009, Springer
- Elementary Solid State Physics, 1/e M. Ali Omar, 1999, Pearson India
- Solid State Physics, M.A. Wahab, 2011, Narosa Publications

B.Sc. V Semester
Session 2016-2017

		L	T	P	C
PHY EC 514	**SOLID STATE PHYSICS LAB**	**0**	**0**	**2**	**2**

Credit : 02

2. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)
3. To measure the Magnetic susceptibility of Solids.
4. To determine the Coupling Coefficient of a Piezoelectric crystal.
5. To measure the Dielectric Constant of a dielectric Materials with frequency
6. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)
7. To determine the refractive index of a dielectric layer using SPR
8. To study the PE Hysteresis loop of a Ferroelectric Crystal.
9. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis.
10. To measure the resistivity of a semiconductor (Ge) crystal with temperature by fourprobe method (from room temperature to 150 ^{o}C) and to determine its band gap.
11. To determine the Hall coefficient of a semiconductor sample.

Essential Suggested :

- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal, New Delhi
- Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

Suggested Readings :

- 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

Note: Other practical of equivalent level can be added.

B.Sc. VI Semester

Session 2016-2017

		L	T	P	C
PHY SE 611	**RENEWABLE ENERGY AND ENERGY HARVESTING**	**0**	**0**	**2**	**2**

Credits: 02

Theory: 30 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to provide them with exposure and hands-on learning wherever possible

UNIT - I

Fossil fuels and Alternate Sources of energy: Fossil fuels and Nuclear Energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems. **(6 Lectures)**

UNIT - II

Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, **(6 Lectures)**

UNIT - III

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(6 Lectures)**

UNIT - IV

Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. **(3 Lectures)**

Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy,

Geothermal Energy: Geothermal Resources, Geothermal Technologies. **(6 Lectures)**

UNIT - V

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Carbon captured technologies, cell, batteries, power consumption

Environmental issues and Renewable sources of energy, sustainability. **(6 Lecture)**

Demonstrations and Experiments

1. Demonstration of Training modules on Solar energy, wind energy, etc.
2. Conversion of vibration to voltage using piezoelectric materials
3. Conversion of thermal energy into voltage using thermoelectric modules.

Essential Readings :

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi,2011
- Solar energy - M P Agarwal - S Chand and Co. Ltd.,1983
- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.,1996
- Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004, Oxford University Press, in association with The Open University.

Suggested Readings :

- Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009

B.Sc. VI Semester

Session 2016-2017

		L	T	P	C
PHY EC 611	**EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS**	**4**	**0**	**0**	**4**

Theory: 60 Lectures **Credits: 04**

UNIT - I

Embedded system introduction: Introduction to embedded systems and general purpose computer systems, architecture of embedded system, classifications, applications and purpose of embedded systems, challenges and design issues in embedded systems, operational and non-operational quality attributes of embedded systems, elemental description of embedded processors and microcontrollers.

(12 Lectures)

UNIT - II

Review of microprocessors: Organization of Microprocessor based system, 8085μp pin diagram and architecture, concept of data bus and address bus, 8085 programming model, instruction lassification, subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts.

(12 Lectures)

UNIT - III

8051 microcontroller: Introduction and block diagram of 8051 microcontroller, architecture of 8051, overview of 8051 family, 8051 assembly language programming, Program Counter and ROM memory map, Data types and directives, Flag bits and Program Status Word (PSW) register, Jump, loop and call instructions. **(12 Lectures)**

UNIT - IV

8051 I/O port programming: Introduction of I/O port programming, pin out diagram of8051 microcontroller, I/O port pins description and their functions, I/O port programming in 8051, (Using Assembly Language), I/O programming: Bit manipulation. **(12 Lectures)**

UNIT - V

Programming of 8051: 8051addressing modes and accessing memory using various addressing modes, assembly language instructions using each addressing mode, arithmetic & logic instructions, 8051 programming in C:- for time delay and I/O operations and manipulation, for arithmetic & logic operations, for ASCII and BCD conversions. **(12 Lectures)**

Essential Readings:

- Embedded Systems: Architecture, Programming & Design, R. Kamal, 2008, Tata McGraw Hill
- The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.
- Embedded Microcomputor System: Real Time Interfacing, J.W. Valvano, 2000, Brooks/Cole
- Embedded Systems and Robots, Subrata Ghoshal, 2009, Cengage Learning

Suggested Readings :

- Introduction to embedded system, K.V. Shibu, 1st Edition, 2009, McGraw Hill
- Microcontrollers in practice, I.Susnea and M.Mitescu, 2005, Springer.
- Embedded Systems: Design & applications, 1/e S.F. Barrett, 2008, Pearson Education India
- Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011,Cengage Learning

B.Sc. VI Semester
Session 2016-2017

		L	T	P	C
PHY EC 612	**EMBEDDED SYSTEM: INTRODUCTION TO MICROCONTROLLERS LAB**	**0**	**0**	**2**	**2**

Credit : 02

Following experiments using 8051:

2. To find that the given numbers is prime or not.
3. To find the factorial of a number.
4. Write a program to make the two numbers equal by increasing the smallest number and decreasing the largest number.
5. Use one of the four ports of 8051 for O/P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.
6. Program to glow first four LED then next four using TIMER application.
7. Program to rotate the contents of the accumulator first right and then left.
8. Program to run a countdown from 9-0 in the seven segment LED display.
9. To interface seven segment LED display with 8051 microcontroller and display 'HELP' in the seven segment LED display.
10. To toggle '1234' as '1324' in the seven segment LED.
11. Interface stepper motor with 8051 and write a program to move the motor through a given angle in clock wise or counter clockwise direction.
12. Application of embedded systems: Temperature measurement, some information on LCD display, interfacing a keyboard.

Essential Readings :

- Embedded Systems: Architecture, Programming & Design, R. Kamal, 2008, Tata McGraw Hill
- The 8051 Microcontroller and Embedded Systems Using Assembly and C, M.A. Mazidi, J.G. Mazidi, and R.D. McKinlay, 2nd Ed., 2007, Pearson Education India.

Suggested Readings:

- Embedded Microcomputor System: Real Time Interfacing, J.W. Valvano, 2000, Brooks/Cole
- Embedded System, B.K. Rao, 2011, PHI Learning Pvt. Ltd.
- Embedded Microcomputer systems: Real time interfacing, J.W.Valvano 2011,Cengage Learning

Note: Other practical of equivalent level can be added.

B.Sc. VI Semester
Session 2016-2017

		L	T	P	C
PHY EC 613	**NUCLEAR AND PARTICLE PHYSICS**	**6**	**0**	**0**	**6**

Theory: 75 Lectures, 15 Tutorials **Credits: 06**

UNIT - I

General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), 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. **(15 Lectures)**

UNIT - II

Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Fermi gas model, evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of nuclear force. **(15 Lectures)**

UNIT - III

Radioactivity decay:(a) Alpha decay: basics of α-decay processes, theory of α- emission, Gamow factor, Geiger Nuttall law, (b) β-decay: positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission. **(15 Lectures)**

UNIT - IV

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).

Detector for Nuclear Radiations: GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors for charge particle and photon detection (concept of charge carrier and mobility). **(15 Lectures)**

UNIT - V

Particle Accelerators: Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

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, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

(15 Lectures)

Essential Readings :

- 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 Elementary Particles, D. Griffith, John Wiley & Sons 2nd Edition 2008.

Suggested Readings :

- Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi, 1984.
- 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).
- Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991).

B.Sc. III Semester (Physics)
Session - 2017
PHY CC 312 **THERMAL PHYSICS AND STATISTICAL MECHANICS LAB**

Credits: 02

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 a bad conductor by Lee and Charlton's disc method.
6. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
7. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
8. Study of the thermo EMF characteristics of Copper-Iron Thermocouple.
9. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge

Essential Readings

- 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.

Suggested Readings:

- 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