SYLLABUS FOR

B.Sc. PHYSICS

(For the batches joining in 2018-2019 and afterwards)

Department of Physics

The Gandhigram Rural Institute-Deemed to be University

Gandhigram – 624 302

Dindigul District

Tamil Nadu

India

THE GANDHIGRAM RURAL INSTITUTE – DEEMED TO BE UNIVERSITY
B.Sc. Physics Programme – Choice Based Credit System (CBCS) (2018-2019) and afterwards

SCHEME								
Semester	**Course Code**	**Category**	**Title of Course**	**No. of Credits**	**Duration of ESE Hours**	**Marks**		
						CFA	**ESE**	**Total**
I	18TAMU0101/ 18HIDU0101 / 18MALU0101/ 18FREU0101	Language I	Tamil/Hindi/ Malayalam/French	3	3	40	60	100
	18ENGU 01X1	Language II	English	3	3	40	60	100
	18NSSU 0001/ 18FATU0001/ 18SPOU 0001	Foundation Course	NSS/ Fine Arts/Sports	1	-	-	-	-
	18PEYU0001	Foundation Course	Yoga	1	-	50	-	50
	18EVSU0001	Environmental Science	Environmental Science	3+1	-	40	60	100
	18PHYU0101	Core Course	Mechanics & Properties of Matter	3	3	40	60	100
	18PHYU0102**	Core Course	Practical – I**	1	3	60	40	100
	18MATU01A1	Allied Course	Allied Mathematics I	4	3	40	60	100
			Total	**20**		**310**	**340**	**650**
II	18TAMU0202/ 18HIDU0202 / 18MALU0202/ 18FREU0202	Language I	Tamil/Hindi/ Malayalam/French	3	3	40	60	100
	18ENGU02X2	Language II	English	3	3	40	60	100
	18CTAU0001/ 18CHIU0001/ 18CMAU001	Language -III	Core Tamil / Core Hindi/ Core Malayalam	2	3	20	30	50
	18GTPU0001	Foundation Course	Gandhi's Life, Thought and Work	2	2	20	30	50
	18EXNU0001	Foundation Course	Extension Education	2	-	-	-	-
	18ENGU00C1	Soft Skills	Communication and Soft Skills	2	-	-	-	-
	18PHYU0203	Core Course	Optics	3	3	40	60	100
	18PHYU0204		Practical – II	1	3	60	40	100
	18MATU02A2	Allied Course	Allied Mathematics II	4	3	40	60	100
			Total	**22**		**260**	**340**	**600**

III	18TAMU0303/ 18HIDU0303 / 18MALU0303/ 18FREU0303	Language I	Tamil/Hindi/ Malayalam/French	3	3	40	60	100
	18ENGU03X3	Language II	English	3	3	40	60	100
	18CTAU0002 /18CHIU0002	Language III	Core Tamil/ Core Hindi	2	3	20	30	50
	18SHSU0001	Part V	Shanthi Sena	1	2	20	30	50
	18CSAU03C1	Computer Skill	Introduction to Computer and Programming in C	3	3	40	60	100
		Computer Skill	C practical	1	2	30	20	50
	18PHYU0305	Core Course	Thermal Physics	3	3	40	60	100
	18PHYU0306**		Practical – III**	1	3	60	40	100
	18CHEU03A1	Allied Course	Allied Chemistry I	3	3	40	60	100
	18CHEU03A2		Allied Chemistry - Practical I	1	3	30	20	50
	18PHYU03F1	Compulsory Non Credit Course	Extension and Field Visit	-	-	-	-	-
	18EXNU03V1	VPP	Village Placement Programme	2	-	100		100
			Total	**23**		**460**	**440**	**900**
IV	18PHYU0407	Core Course	Analog and Digital Electronics	4	3	40	60	100
	18PHYU0408		Atomic Physics and Lasers	4	3	40	60	100
	18PHYU0409		Mathematical Physics	3	3	40	60	100
	18PHYU0410		Practical – IV	2	6	60	40	100
	18CHEU04A3	Allied Course	Allied Chemistry II	3	3	40	60	100
	18CHEU04A4		Allied Chemistry - Practical II	1	3	30	20	50
	18PHYU04EX	Major Elective	Major Elective I	3	3	40	60	100
		Non Major Elective	Non Major Elective I	3	3	40	60	100
			Total	**23**		**330**	**420**	**750**

V	18PHYU0511	Core Course	Electromagnetics	4	3	40	60	100
	18PHYU0512		Nuclear and Particle Physics	3	3	40	60	100
	18PHYU0513		Classical Mechanics & Relativity	4	3	40	60	100
	18PHYU0514**		Practical – V**	2	6	60	40	100
	18PHYU05EX	Major Elective	Major Elective II	3	3	40	60	100
		Non Major Elective	Non Major Elective II	3	3	40	60	100
	18PHYU05S1	Skill Based Elective		2	2	50	-	50
		Part III	Extension/ Field visit	-	-	-	-	-
Total				**21**		**310**	**340**	**650**
VI	18PHYU0615	Core Course	Solid State Physics	3	3	40	60	100
	18PHYU0616		Quantum Mechanics	4	3	40	60	100
	18PHYU0617		Spectroscopy	4	3	40	60	100
	18PHYU0618		Practical - VI	2	6	60	40	100
	18PHYU0619		Project (CFA 40 + External 40 + Viva 20)	0 + 4	-	40	40+20	100
	18PHYU06MX 18PHYU06MX	Modular Course on SRS (Any 2 Modules)	Modular Course I Modular Course II	2 2		50 50		50 50
		Part III	Extension/Field visit	-				
Total				**21**		**320**	**280**	**600**
Grand Total				**130**				

List of major elective (at least three to be provided)

18PHYU04E1	Solar Thermal & Renewable Energy Systems
18PHYU04E2	Introduction to Astrophysics
18PHYU04E3	Waves and Oscillations

List of major elective (at least three to be provided)

18PHYU05E4	Instrumentation
18PHYU05E5	Television Transmission & Receiver
18PHYU05E6	Micro Processor 8085 Programming

Skill Based Elective

18PHYU05S1	Instruments and Servicing
18PHYU05S2	Applied Optics
18PHYU05S3	Weather Forecasting

List of non-major elective (at least three to be provided)

18PHYU04N1	Solar Thermal & Renewable Energy Systems
18PHYU04N2	Physics of Sports
18PHYU04N3	Physics of Music

List of non-major elective (at least three to be provided)

18PHYU05N4	Instruments & Servicing
18PHYU05N5	Agricultural Physics
18PHYU05N6	Numerical Methods

List of modular courses (at least four to be provided)

18PHYU06M1	Statistical Mechanics
18PHYU06M2	Electric Circuit Analysis
18PHYU06M3	Optic Communication
18PHYU06M4	Radiation safety

Courses offered to the other Departments:

18PHYU01A1 / 18PHYU03A1	Allied Physics – I (Allied Physics for B.Sc., Mathematics and Chemistry Major)
18PHYU02A1 / 18PHYU04A1	Allied Physics – II (Allied Physics for B.Sc., Mathematics and Chemistry Major)
18AGPU0201	Fundamentals of Agricultural Physics (For B.Sc. Agriculture)
18PHYU01C1	Engineering Physics (For B.Tech)
18PHYU01C2	Engineering Physics Lab (For B.Tech)

B.Sc. Physics

SCHEME FOR MAJOR PHYSICS COURSES (2018-2019 AND AFTERWARDS)

Semester	Course Code	Course Title	No of Credits			Duration of ESE(Hrs)	Marks		Total
			L	P	T		CFA	ESE	
I	18PHYU0101	Mechanics & Properties of Matter	3	-	3	3	40	60	100
	18PHYU0102	Practical - I**	-	1	1	3	60	40	100
II	18PHYU0203	Optics	3	-	3	3	40	60	100
	18PHYU0204	Practical - II**	-	1	1	3	60	40	100
III	18PHYU0305	Thermal Physics	3	-	3	3	40	60	100
	18PHYU0306	Practical - III**	-	1	1	3	60	40	100
	18PHYU03F1	Extension / Field Visit	-	-	-	-	-	-	-
	18CSAU03C1	Introduction to Computer and Programming in C	3	1	4	3	40	60	100
IV	18PHYU0407	Analog and Digital Electronics	4	-	4	3	40	60	100
	18PHYU0408	Atomic Physics and Lasers	4	-	4	3	40	60	100
	18PHYU0409	Mathematical Physics	3	-	3	3	40	60	100
	18PHYU0410	Practical - IV**	-	2	2	3	60	40	100
	18PHYU04EX	Major Elective – I	3	-	3	3	40	60	100
		Non Major Elective - I	3	-	3	3	40	60	100
	18PHYU00F2	Extension / Field Visit	-	-	-	-	-	-	-
V	18PHYU0511	Electromagnetics	4	-	4	3	40	60	100
	18PHYU0512	Nuclear and Particle Physics	3	-	3	3	40	60	100
	18PHYU0513	Classical Mechanics & Relativity	4	-	4	3	40	60	100
	18PHYU0514	Practical - V**	-	2	2	3	60	40	100
	18PHYU05EX	Major Elective – II	3	-	3	3	40	60	100
		Non Major Elective - II	3	-	3	3	40	60	100
	18PHYU05S1	Skill Based Courses	-	1	1	3	50		50
VI	18PHYU0615	Solid State Physics	3	-	3	3	40	60	100
	18PHYU0616	Quantum Mechanics	4	-	4	3	40	60	100
	18PHYU0617	Spectroscopy	4	-	4	3	40	60	100
	18PHYU0618	Practical - VI**	-	2	2	3	60	40	100
	18PHYU0619	Project* (CFA-40, External -40 + viva-voce 20)	-	-	3		40	40+20	100
	18PHYU06MX	Modular Course-I	2	-	2	-	50	-	50
	18PHYU06MX	Modular Course-II	2	-	2	-	50	-	50
		TOTAL	**61**	**11**	**75**	**72**	**1230**	**1320**	**2550**
	* 25 marks to be awarded by external examiner for project and 25 marks for Viva-Voce jointly by supervisor and external examiner.								
	** For practical I & II ESE will be held at the end of II semester while for practical III & IV ESE will be held at the end of IV semester and for practical V & VI ESE will be held at the end of VI semester.								

GANDHIGRAM RURAL INSTITUTE – DEEMED UNIVERSITY
B.Sc., Physics Programme – Choice Based Credit System (CBCS)
Courses for the batches joining in 2018-2019 and afterwards

S.No	Category	Title of the Course	No. of Credits																				
			I Sem			II Sem			III Sem			IV Sem			V Sem			VI Sem			Total		
			L	P	T	L	P	T	L	P	T	L	P	T	L	P	T	L	P	T	L	P	T
01	Language I	Tamil/Hindi/ Malayalam/ French	3	-	3	3	-	3	3	-	3	-	-	-	-	-	-	-	-	-	9	-	9
02	Language II	English	3	-	3	3	-	3	3	-	3	-	-	-	-	-	-	-	-	-	9	-	9
03	Basic language	Hindi/Tamil	-	-		2	-	2	2	-	2	-	-	-	-	-	-	-	-	-	4	-	4
04	Foundation Course	NSS/Shanti Sena/Fine Arts/Sports	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
05	Foundation Course	Yoga	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
06	Foundation Course	Environmental Science	3	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	4
07	Foundation Course	Gandhian Thought	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
08	Foundation Course	Extension Education	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
09	Soft Skills		-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-		2	-	2
10	Computer Skills		-	-	-	-	-	-	4 (3+1)	-	4 (3HT+ 2HP)	-	-	-	-	-	-	-	-	-	4	-	4
11	VPP		-	-	-	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-	2	-	2
12	Compulsory Non Credit Course	Extension/ Field Visit	-	-	-	-	-	-	-	-	2 Hrs	-	-	2 Hrs	-	-	2 Hrs	-	-	-		-	-
13	Non Major Elective		-	-	-	-	-	-	-	-	-	3	-	3	3	-	3	-	-	-	6	-	6
14	Major Elective		-	-	-	-	-	-	-	-	-	3	-	3	3	-	3	-	-	-	6	-	6
15	Skill Based Elective		-	-	-	-	-	-	-	-	-	-	-	-	2	-	2	-	-		2	-	2
16	Modular Course on SRS(Any 2 Modules)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 2	- -	2 2	-	4	4
17	Allied Course		4	0	4 M	4	0	4 M	3 (3H)	1 (3H)	4 C	3 (3H)	1 (3H)	4 C	-	-	-	-	-	-	12	4	16
18	Core Course		3 (3H)	1 (3H)	4	3 (3H)	1 (3H)	4	3 (3H)	1 (3H)	4	11	2 (6H)	13	11	2 (6H)	13	11	2 (6H)	13	42	9	51
19	Project		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	4	-	4
		TOTAL	18	2	20	20	2	22	18	2	20	20	3	23	19	2	21	19	2	21	110	17	127
		Grand Total			20			22			20			23			21			21			127

B.Sc. Physics – I Semester

18PHYU0101 – Mechanics and Properties of Matter (3 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

.**Objectives:**

To impart knowledge about linear and rotational motion of bodies and gravitational forces among bodies.

To make them understand the principles and methods of finding the bulk properties of structural materials.

To know about the physical and flow properties of liquids

Specific learning outcomes: At the end of the course the student should be able to

CO-1: Specify the principles and types of collision between bodies.

CO-2: State the Newton's second law and conservation of angular momentum.

CO-3: Estimate the gravitational force near the earth surface and the energy of satellites.

CO-4: Design experiments to find the Young's modulus building materials.

CO-5: Differentiate between streamlined and turbulent motion of liquids.

CO-6: Know the properties of surface tension, viscosity and apply it in daily life situation.

UNIT – I: Impulse and Linear momentum – series of collisions – elastic collisions and inelastic collisions in one dimension – collision in two dimension – reactions and decay processes – Angular quantities as vectors – rotation with constant angular acceleration - linear and angular, variables – Kinetic energy of rotation – torque – Newton's second law – Newton's second law for rotation – work, power and the work – Kinetic energy theorem - angular momentum and its conservation. **(10 Lectures)**

UNIT – II : Newton's laws of gravitation and principle of superposition – gravitation near the earth's surface –gravitation inside the earth – gravitational potential energy – planets and satellites – orbits and energy of satellites.

(10 Lectures)

UNIT III: Bending of beams – bending moments – Cantilever: loaded at the free end when the beam weight is ineffective – depression of a beam supported at the ends: loaded cylindrical wire – torsional pendulum – Searle's method for the comparison of young's modulus and coefficient of rigidity modulus – columns, pillars and struts.

(9 Lectures)

UNIT – IV: Streamlines and equation of continuity – Bernoulli's equation: proof and applications – Velocity of efflux of liquid – Toricelli's theorem , Vena contractor, Venturimeter and pitot tube - Properties of Surface tension, Surface Tension by drop weight method and Capillary rise method – Applications.

(10 Lectures)

UNIT V: - Viscosity – Coefficient of viscosity – critical velocity – Reynolds number and its significance – Poiseuille's equation – experimental determination of viscosity : Poiseuille's method, Stokes method, Ostwald's viscometer, Rankine's method for air – Diffusion and osmosis – basic ideas. **(9 Lectures)**

BOOKS FOR STUDY

1. Fundamentals of Physics – VII Edn. David Halliday, Robert Resnick and Krane – Asian Books, New Delhi (1994)
   Unit I : Relevant section of Chapter 10, 11 and 12.
   Unit II : Relevant section of ibid Chapter 15.
2. Elements of properties of matter, - D.S. Mathur, Chapter 10, 11 and 12 and chaper 18. Reprinted in 1984, S. Chand & Co., New Delhi. Relevant section of XII & XIII and related problems.
3. Concept of physics by H.C.Verma, Bharati Bhawan publishers and distributors(2015).

Total 48 hours

B.Sc. PHYSICS – I SEMESTER

18PHYU0102 – Practical – I (0+1)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: To familiarize and make the students acquire knowledge and skills through basic measuring instruments and measurement techniques.

I. Basic Measurement Techniques, Errors of observation, Data Representation and Analysis

1. Vernier calipers & Vernier Microscope
2. Single Optic level & screw gauge
3. Measurement of length / a dimension using
    a. crude estimation
    b. un graduated scale
    c. graduated meter scale
    d. Vernier caliper
    e. Vernier microscope
    f. screw gauge
    g. single optic lever
4. Choice of instrument for measurement.
    a. Random Errors in observation
    b. Due to personal judgment: Period of oscillation of a simple pendulum.
    2. Due to fluctuation in the experimental conditions: resistance measurement at cold water temperature, at a slightly higher and at slightly lower temperature method of reducing random errors.
    c. Systematic Errors in observation due to
        1. Personal judgment : Parallax Error
        2. due to the instrument: Zero Error in meters, screw gauge etc.

    Backlash Error in Vernier microscope.

    3. due to experimental conditions: measurement of resistance at cold water temperature and higher temperature, method of reducing Systematic.
5. Estimation of errors of observation.
    a. in a single measurement
    b. in several measurement of the same quantity
        1. Estimation of standard deviation
        2. Effect of the number of readings on standard deviation.
6. Generation of linear and nonlinear data and graphical representation

a. Extension of a spring

b. Water flowing through a burette or cooling of a hot body.

7. Least square fit, arriving at empirical relations from an examination of the graph.
8. Study of Motion of a compound pendulum.

a. dependence of the period of oscillation on moment of Inertia, amplitude of oscillation, damping (viscous, frictional and electromagnetic)

b. determination of the acceleration due to gravity

9. Surface tension – Interfacial tension.
10. Coefficient of viscosity.

B.Sc. Physics – II Semester
18PHYU0203 – Optics (3 + 0)
(For the batches joining B.Sc., in 2018-2019 and afterwards)

Scope: To acquire knowledge on few basic physics optical phenomena and their corresponding theoretical aspects. Certain measuring techniques involving interference, diffraction and polarization are also imported.

UNIT – I: INTERFEROMETRY: Michelson Interferometer (MI) Circular fringes, and Localized fringes in MI. Applications of Michelson Interferometer – Multiple beam interference – the Fabry – Perot Interferometer, Interference filters and channeled spectra – Lummer–Gehrcke plate; Jamins' Interferometer, Jamins' compensator, Raylegh's refractometer. **(10 Lectures)**

UNIT – II: DIFFRACTION I: Classification: Fresnel and Fraunhofer; Zone plate; Theory of zone plate, Multiple foci of a zone plate, Comparison of a zone plate and convex lens, Intensity at a point due to a cylindrical wave front – Fresnel diffraction of a cylindrical wavefront at a straight edge; at a narrow obstacle; at a rectangular aperture; at a small circular aperture, Cornu's spiral. **(10 Lectures)**

UNIT – III: DIFFRACTION II : Comparison of Fraunhofer and Fresnel diffraction; Fraunhofer diffraction at a single slit; mathematical investigation of its intensity distribution; Fraunhofer Diffraction at two slits; Diffraction grating, theory of plane transmission grating, Secondary maxima and minima; Concave reflection grating-Focal curve and elementary theory of concave reflection grating.**(10 Lectures)**

UNIT – IV: RESOLVING POWER OF OPTICAL INSTRUMENTS: Resolving power, Rayleigh's criterion of resolution, Resolving power and magnifying power of a telescope and a microscope; Electron microscope; Phase contrast microscope, Resolving power of a prism, Dispersive power and resolving power of a grating. **(9 Lectures)**

UNIT – V : POLARIZATION : Birefringence, Nicol prism – its construction and theory – Elliptically and circularly polarized light; Theory ; Quarter and half-wave plates; Production of elliptically and circulary polarized light and their comparison; Fresnel's rhomb; Babinet's compensator; Analysis of elliptically polarized light Interference of polarized light; Double refraction Colours due to thin crystalline plates, Rotatory polarization; Fresnel's explanation; Calculation of the angle of rotation; Specific rotation; Laurent's polarimeter, Half Shade device; Lippich polarimeter, biquartz polarimeter.
(9 Lectures)

BOOKS FOR STUDY:

1) Fundamentals of Optics – Khanna & Gulati, R. Chand & Co., 14th Edn., New Delhi.
Unit I : Chapter 13, PP 282-312
Unit II : Chapter 14, PP 313-315, 321-342.
Unit III: Chapter 15, PP 353-382, 387-390
Unit IV: Chapter 16, 400-430
Unit V: Chapter 18, PP 456-475, Chapter 19, PP 476-487.
2) Textbook of Optics – Subramanyam and Brijlal, Publishers: S. Chand & Co.,

BOOKS FOR REFERENCE:

1. Optics – Ajoy Ghatak, 2nd Edition, Tata McGraw Hill Pub. Cpy. Ltd., New Delhi, 1992.
2. Introduction to Classical and Modern Optiocs-J.R. Meyer Arendt-2nd edition-PHI, 1984.
3. Fundamentals of Physics – V Edn. David Halliday, Robert Resnick and K.S.Krane–john Wiley & Sons New Delhi (2014) Relevant section of Chapter-19

Total 48 hours

Related Online Courses – MOOC

1) https://www.edx.org/course/waves-optics-ricex-phys201x
2) https://www.edx.org/course/optical-materials-devices-mitx-3-15-2x-0

PHYSICS – II SEMESTER

18PHYU0204 – Practical – II (0+1)

(For the batches joining B.Sc., in 2018-2019 and afterwards)

Scope: To expose the measuring skills on the fine apparatus to measure to magnitudes of properties on mechanical and optical areas.

1. Study of depression and deflection of a cantilever
    a. Variation of deflection / depression with distance from fixed end
    b. Young's modulus
2. Young's modulus – Non uniform bending
3. Young's modulus – Uniform bending
4. Young's modulus – Koenig's method
5. Familiarisation with spectrometer – Refractive Index of solid and liquid.
6. Dispersive power of the material of a prism
7. i-d curve
8. i- i' curve and Stoke's formula
9. Radius of curvature – Newton's rings
10. a. Thickness of a wire – Air wedge
    b. Wavelength of light – Biprism

B.Sc. Physics –III Semester
18PHYU0305 – Thermal Physics (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: The fundamental concepts on Thermal Physics is being exposed under various angles

UNIT – I : Kinetic theory of gases: Introduction – Pressure exerted by a gas – Deduction of gas laws on the basis of kinetic theory – Maxwell's law of velocity distribution – Calculation of RMS speed, most probable speed, average speed – Maxwell - Boltzmann law of velocity distribution– Degrees of freedom – Vibratory motion of molecules – Internal energy of a gas– Law of equi-partition of energy – Mean free path– Transport phenomena: viscosity, thermal conductivity and diffusion. **(9 Lectures)**

UNIT – II : Equation of state for real gases : Van der Waals equation – Critical constants in terms of Van der Waals constants – Reduced equation of states–Law of corresponding states – Joules experiments on inter molecular attraction – Discovery of intermolecular attraction – Porous plug experiment – Linde's process for liquefaction of air– liquefaction of hydrogen – liquefaction of Helium. **(10 Lectures)**

UNIT – III: First & Second law of thermodynamics: Introduction – Zeroth law of thermodynamics – Work done in a (i) Non-cyclic process; (ii) Cyclic process (iii)Isothermal process (iv)Adiabatic process (v) Isobaric process (vi) Isochoric process – Concept of point and path functions – Internal energy –First law of thermodynamics – Relation connecting P,V and T in an adiabatic process – Application of first law of thermodynamics to the specific heat– Second law of thermodynamics: Clausius & Kelvin – Planck statement of the second law – Heat engine – Carnot theorem – Refrigerator **(11 Lectures)**

UNIT – IV :– Thermodynamic scale of temperature –Applications of Second law of thermodynamics: Clausius-Clapeyron equation –Other thermodynamic work cycles: Rankine cycle – Otto cycle –Diesel cycle – Expressions for their efficiency –Heat engines in actual practice: Steam engine –Otto engine– Diesel engine–Zero point energy **(8 Lectures)**

UNIT – V : Entropy: Introduction – Definition of entropy – Entropy and adiabatics – Change of entropy in any reversible and irreversible cycle –Expression connecting two laws of thermodynamics – Entropy of a perfect gas – Entropy changes in simple reversible processes –T-S diagram – Thermodynamic functions –Internal energy – Enthalpy – Helmholtz function – Gibbs function – Maxwell's thermodynamic relations – TdS equations – Application–Joule-Kelvin coefficient **(10 Lectures)**

Total 48 hours

BOOKS FOR STUDY:

1. Heat and Thermodynamics by D.S. Mathur, Sultan Chand & Sons Educational publishers, NewDelhi, Fifth Edition
   Unit I : Chapter 6 : 207–253
   Unit II : Chapter 7: 268-278; 282-287 ; Chapter11: 429-433
   Unit III : Chapter 8: 305– 315, 316– 323
   Unit IV : Chapter 8: 323–328, 334–357
   Unit V : Chapter 9: 358–366 & 374–387;Chapter 10: 387–398 & 401–403

BOOK FOR REFERENCES :

1. Heat & Thermodynamics: M.W. Zemansky and R.H. Dittman – International edition.
2. A treatise on heat – Saha and Srivastava, Vth Edition.
3. Thermodynamics, Kinetic theory and Statistical thermodynamics III Edition – Sears and Salinger, Indian student's edition, Narosa Publications, New Delhi.
4. Fundamentals of Physics – VIIth Edn., - David Holliday, Robert Resnick and Krane
5. Heat and thermodynamics by D.S. Mathur, Sultan Chand, 1978.

Related online courses – MOOC courses:

1. https://www.edx.org/course/basics-transport-phenomena-delftx-tp101x-2
2. https://www.edx.org/course/thermodynamics-iitbombayx-me209-1x-1

B.Sc. PHYSICS – III SEMESTER

18PHYU0306 – Practical – III (0+1)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Basic measurement on electricity and advanced measurement on optics areas has been exposed

1. Study of Fraunhofer diffraction at single and double slits.
2. Wavelength of light – Diffraction grating
3. Cauchy's dispersion formula – Cauchy's constants
4. a. Verification of Brewster's law
   b. Study of rotatory power of materials – Laurent's half shade polarimeter.
5. Familarisation with the use of Voltmeter, Ammeter, Multimeter
   Voltage divider and current divider arrangements: series and parallel connections.
6. Verification of Kirchoff's laws and Thevenin's theorem.
7. Measurement of resistance and temperature Coefficient of resistance – Carey Foster's bridge
8. Potentiometer – measurement of low voltage – EMF of Thermocouple, calibration of low range voltmeter
9. Potentiometer – measurement of medium and high voltages – calibration of medium and high range voltmeters
10. Potentiometer – measurement of current, calibration of ammeter.

B.Sc. Physics – III Semester
18CSAU03C1 – Introduction to Computers and Programming in 'C'
(Theory and Practical) (3 + 1)
(For the batches joining B.Sc., in 2018-2019 and afterwards)

Scope: Fundamental language incorporation to the new learners of computer languages is introduced

UNIT I: History and development of computers – need for a programming language – history of programming language
C fundamentals: Introduction to C – Character set – data types – constants – identifiers – keywords – operators and expressions – co0mment – Input and Output functions in C. **(14 Lectures)**

UNIT II: Control Statements: while – do .. while …. For if ….else …. Switch – break and continue statements – go to statement. **(12 Lectures)**

UNIT III: Functions: Defining a function – accessing a function – passing arguments to a function – recursion. **(14 Lectures)**

UNIT IV: Array: defining an array – processing an array – single dimensional array – multidimensional array.
Pointers: Pointer declaration – passing pointers to a function – Dynamic storage allocation. **(12 Lectures)**

UNIT V: File handling – open – access modes – close. **(12 Lectures)**

Text Book:

Programming with C, B/S.Gottfried, Schaums outline Series, MC graw – Hill Publishing Company, 1990

Reference Book:

C Programming, E.Balagurusamy, Tata – McGraw Hill publishing, New Delhi

Suggested Practical will be designed by the Department of Computer Science.

B.Sc. Physics – IV Semester
18PHYU0407 – Analog and Digital Electronics (4 + 0)
(For the batches joining B.Sc., in 2018-2019 and afterwards)

Scope: The student will be able to design simple electronic circuits for the laboratory and home with the help of knowledge gained through this course.
Prerequisite: Knowledge of electric circuit analysis, semiconductors

UNIT – I : DEVICES : Transistor structure – action of a transistor – relation between currents in a transistor – sign conventions – transistor as an amplifier – three configurations: CE, CB & CC – transistor characteristics in CE configuration – relation between alpha and beta-comparison between the three configurations, reasons for the choice of CE configuration – basic CE amplifier- FET: construction, working and characteristics - single stage transistor amplifier-graphical method – calculation of gain - hybrid parameters – simplified model-amplifier analysis : Calculation of gain, input and output impedances. (13 Lectures)

UNIT – II: MULTISTAGE AMPLIFIERS: Gain of a multistage amplifier-decibel-coupling of two stages-RC coupling transformer coupling-frequency response of an RC coupled amplifier-bandwidth of an amplifier FEEDBACK AMPLIFIER: Concept of feedback – types of feedback – voltage gain with feedback – advantages of negative feedback – Oscillators: positive feedback amplifier as an oscillator-Hartley oscillator and Colpit's oscillator (no detailed derivation). (13 Lectures)

UNIT – III: OPAMP: General features – Virtual ground –inverting amplifier, non-inverting amplifier-voltage follower – summing amplifier –subtractor- integrator and differentiator – solution of simultaneous equations with two unknowns and harmonic oscillator problem. (13 Lectures)

UNIT – IV: LOGIC CIRCUITS: Universal NAND and NOR gates – combinational logic circuits – half and full adders – half and full subtractors - Boolean laws and theorems – Boolean relation for OR and AND operations – duality theorem – sum of products and product of sum methods – sum of product and product of sum equations – Karnaugh maps – truth table to Karnaugh map – 3 and 4 variable maps – pairs, quads and octets – Karnaugh simplification – overlapping – rolling the map – eliminating redundant graphs – don't care conditions. (13 Lectures)

UNIT – V: FLIP FLOPS AND COUNTERS: RS flip flops – clocked RS flip flop – D flip flop – edge triggered D flip flop – JK flip flop – JK master slave – Synchronous and asynchronous counters – 3 bit binary ripple counter – 3 bit up-down counter – synchronous counter – mod – 8 parallel binary counter – mod 3 counter – mod 5 counter – mod 10 decade counter – shift counters – 3 stage shift registers – mod 10 shift counter. (12 Lectures)

Text Books:

1. Bhargava NN, Kulshreshta DC and Gupta SC, Basic electronics and linear circuits, Tata McGraw Hill (1984),
Unit I : Chapter 5, page 126-161,168-173, Chapter 8, page 261-278
Unit II : Chapter 9, 302-320, Chapter 12, page 390-402 and Chapter 13, page 413-424.
2. Jacob Millman, Microelectronics: Digital and Analog Circuits and Systems, McGraw Hill, Singapore (1979).
Unit III: Chapter 16, page 569 – 573, 577 - 582
3. Donal P Leach. Albert Paul Malvino and Gautam Saha, Digital principles and applications, Seventh Edition, Mc Graw Hill, New Delhi (1986).
Unit IV: Chapter 2, page 48 – 56, Chapter 3, page 74- 101, Chapter 6, page 226 – 228
Unit V: Chapter 8, page 270 – 286, 288-289, Chapter 10, page 341 - 346, 349 – 356, 360 -367
(pin number and specific IC pin out details not included)

BOOKS FOR REFERENCE:

1. Digital Electronics, II Edition, W.H. Gothmann PHI, New Delhi (1991)
2. Digital Fundamentals, 3rd Edition, L.Floyd, Universal Book Stall, New Delhi (1998)
3. Digital Integrated Electronics, Herbert Taub and Donald Schilling, McGraw Hill, International Book Company, 11th Edition (1985)

Total 64 hours

B.Sc. Physics –IV Semester
18PHYU0408 – Atomic Physics and Lasers (4 + 0)
(For the batches joining B.Sc., in 2018-2019 and afterwards)

Scope: The development of Physics concepts are introduced in the order of the development of concepts. Also the advanced level optics utilization principles are introduced in the form of lasers.

UNIT – I: Particle properties of waves: Electromagnetic Waves – Black body radiation – Photoelectric Effect – What is Light – Compton Effect. Waves Properties of Particle: De Broglie waves – waves of Probability – The general formula for waves – Phase and group Velocities – Particle Diffraction. **(13 Lectures)**

UNIT – II: X-rays: Waves nature of X-rays – Diffraction of X-rays by crystals – Bragg's Law: reflection of X-rays – experimental methods of measuring μ for X-rays; Scattering of X-rays – Polarization of X-rays. **(12 Lectures)**

UNIT – III :Atom Models: Alkali Spectra – Space quantization and normal Zeeman effect – Electron spin – vector model of atom – Doublet structure of the alkali spectral lines – Fine structure of the hydrogen spectral terms – Pauli's exclusion principle; periodic classification of elements – Arrangement of electrons in atoms – Energy levels of complex atoms – Anamalous Zeeman effect – Paschen – Back effect - Stern and Gerlach's experiment – Stark effect. **(13 Lectures)**

UNIT – IV: Lasers: Introduction – The Fiber Laser – The Ruby Laser – The He-Ne Laser – Optical Resonators – Einstein Coefficients and Optical Amplification – The Line –Shape Function – Typical Parameters for a Ruby laser – Monochromaticity of the Laser Beam **(13 Lectures)**

UNIT – V: Fiber Optic communication: Introduction – some historical remarks – Total Internal Reflection – The Optical Fiber – Why Glass Fibers? – The Coherent Bundle – The numerical Aperture – Attenuation in Optical Fibers – Single Mode and Multimode Fibers – Pulse Dispersion in Optical Fibers – Dispersion and Maximum Bit Rates – Waveguide Dispersion – Dispersion Compensating Fibers – Fiber – Optic Sensors. **(13 Lectures)**

BOOKS FOR STUDY

01. Concepts of Modern Physics -Arthur Beiser, Tata McGraw-Hill Publishing Company Limited,Sixth edition.
Unit I -page number 53-79 and 93-106.
02. Atomic Physics – J.B.Rajam, S.Chand & Company Ltd.,(2004)
Unit II - Page Number: 267-304 .
03. Atomic Physics (Modern Physics) – S.N.Ghoshal, S.Chand & Company Ltd.,(2004)
Unit III: Page Number: 100-141 .
04. Optics, Ajoy Ghatak,– (2005) by Tata Mc Graw-Hill, 2nd Edition 2005.
Unit IV: Chapter 23, Pages 23.3- 23.36.
Unit V : Chapter 24, Pages 24.3-25.3,

Total 64 hours

B.Sc. Physics – IV Semester

18PHYU0409 – Mathematical Physics (3+0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Basic mathematical tools which re to be utilized in physics problems are introduced.

UNIT – I: Differentiation of vectors – Scalar and vector point functions – gradient, divergence and curl of vector fields – vector integration – line integrals – surface integrals – volume integrals – divergence theorem – Stokes theorem and related problems. **(10 Lectures)**

UNIT – II: Types of matrices – rank of a matrix – inverse of a matrix – eigenvalues and eigenvectors – diagonalisation – characteristic equation and Cayley Hamilton theorem. **(9 Lectures)**

UNIT – III: Second order linear homogeneous differential equations – solution by power series method Partial differential equation – important partial differential equations in Physics relevant problems – solutions by the separation of variables. **(10 Lectures)**

UNIT – IV: Special functions: Bessel functions: generating functions – recurrence relations - Legendre differential equation – Power series solution – Legendre polynomials – generating functions – recurrence relations. **(10 Lectures)**

UNIT – V: Beta – Gamma functions, Fourier series and Fourier transforms and applications.

(9 Lectures)

BOOK FOR STUDY:

1. Mathematical Physics, H.K.Dass, Fourth revised edition 2003.
   - Unit I : Pages 336-389
   - Unit II : Pages 196 - 199, 250 – 259 and PP 271 - 277,
   - Unit III : Pages 601 – 604, and 637-664,
   - Unit IV : Pages 548-551, 562 – 573, 581 - 594
   - Unit V : Pages 778 – 782, 861 – 874, 1086 - 1101

BOOKS FOR REFERENCE:

1. Introduction to Mathematical Physics – Charley Harper – PHI India.
2. Mathematical Physics – P.K. Chattopadhyoy – Wiley Eastern Ltd.,
3. Advanced engineering Mathematics – Erwin Kreyzik – Wiley Ltd.

Total 48 hours

B.Sc. Physics – IV SEMESTER

18PHYU0410 – Practical – IV (0+2)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Instruments in sophistication measurements in electricity, thermal physics are introduced

1. Measurement of temperature using various principles expansion of solids, liquids and gases, resistance thermocouple-Selection of thermometer for different purposes.
2. Measurement of heat energy-method of mixtures-Specific heat capacity of solids, liquids – Latent heat of fusion of ice and latent heat of vaporization of water – Barton's correction.
3. Cooling curve for wax / naphthalene – Melting point.
4. Measurement of heat energy – Electrical method – specific heat capacity of solids and liquids-Barton's correction.
5. Study and Measurement of Calorific value of fuels, - Bomb Calorimeter
6. Thermal conductivity of a good conductor – Lee's Disc method
7. Thermal conductivity of a good conductor – Forbe's method
8. Verification of Stefan's law.
9. Figure of merit of a Table galvanometer
10. Conversion of a galvanometer into an ammeter and voltmeter and their calibration.
11. Figure of merit of a suspended coil galvanometer
12. Suspended coil Galvanometer –
    1. Measurement of low voltage – emf of Thermocouple.
    2. Measurement of current – conversion into milli voltmeter
    3. Measurement of resistance
13. Ballistic galvanometer
    1. Figure merit and measurement of charge
    2. Capacitance of a capacitor
    3. Self inductance of a coil
    4. Mutual inductance between a pair of coils
    5. High resistance by leakage
    6. Measurement of current and resistance
14. Measurement of time constants of circuits – LR, CR

B.Sc. Physics –IV Semester

18PHYU04E1 – (Major Elective-I) / (18PHYU04N1 Non Major Elective-I)

Solar Thermal and Renewable Energy Systems (3+ 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Various forms of solar energy utilization concepts have been introduced

UNIT – I : Solar Radiation and its Measurement – Solar constant – Solar Radiation at the Earth's surface, Solar Radiation Geometry – Measurements and Data. Estimation of average Solar Radiation and Solar radiation on tilted surfaces. **(9 Lectures)**

UNIT – II : Solar Energy Collectors: Physics principles of the conversion of solar radiation into heat – Flat Plate Collector (FPC) – Performance analysis of FPC – concentrating collector (CC) – advantages and disadvantages of CC over FPC – selective coatings, photo voltaic cell. Application of Solar Energy : Solar water heating – space heating – space cooling – solar electric power generation – agricultural and industrial process heat – Solar distillation – solar pumping – solar furnace – solar cooking. **(10 Lectures)**

UNIT – III : Wind energy: Basic principles of wind energy conversion: Nature of the wind – the power in the wind – forces on the blades and thrust on turbines – wind energy conversion (WEC) – basic components of wind energy conversion – classification of types of WEC systems – advantages and disadvantages of WECs. **(9 Lectures)**

UNIT – IV : Biomass: Introduction – biomass conversion technologies – photosynthesis – biogas generation – factors affecting bio digestion on generation of gas - classification and types of biogas plants – advantages and disadvantages of floating drum plant and fixed dome type plant. **(10 Lectures)**

UNIT – V : Geothermal and OTEC : Introduction – nature of geothermal fields – geothermal sources – hydrothermal (convective resources) – basic ideas of vapor dominated systems – liquid dominated systems – advantages and disadvantages of geothermal energy over other energy forms – applications of geothermal energy, OTEC : Introduction – Basic ideas of OTEC – methods of OTEC power generation – Open cycle and closed cycle system. **(10 Lectures)**

BOOKS FOR STUDY:

1. Non-Conventional energy sources – G.D. Rai, Khanna Publishers – Fourth edition (1997)

BOOKS FOR REFERENCE:

1. Solar energy principles of thermal collection and storage – S.P. Sukhatme, TMC – 1984
2. Renewable energy sources and conversion technology – N.K. Bansal, M. Kleemann and M. Melinn
3. Solar Energy Hand Book – John F. Kreider and F. Kreith, McGraw Hill Book Company, (1981)

Total 48 hours

B.Sc. Physics –IV Semester

18PHYU04E2 – (Major Elective-I) Introduction to Astrophysics (3 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: The overall introduction to Astrophysics area has been exposed**.**

UNIT I: Astronomical Instruments: Light and its Properties-The Earth's Atmosphere and the Electromagnetic Radiation-Optical Telescopes-Radio Telescopes-The Hubble Space Telescope(HST)-Astronomical Spectrographs-Photographic Photometry-Photoelectric Photometry-Spectrophotometry-Detectors and Image Processing. **(8 Lectures)**

UNIT II: Distances of stars: Stellar Magnitude Sequence-Absolute Magnitude and the Distance Modulus-The Bolometric Magnitude-Different Magnitude Standards: The UBV system and six-colour Photometry-Radiometric Magnitudes-The colour-index of a star-Luminosities of Stars-Stellar Parallax (Trignometric) and the Units of Stellar Distances-Stellar Positions: The Celestial Coordinates-Stellar Motions-The Solar Motion and the Peculiar Velocities of Stars-The Velocity Dispersion-Statistical Parallax-Moving Cluster Parallax. **(10 Lectures)**

UNIT III: Radio Galaxies: Techniques of Identification of Radio Objects-Structures of Radio Galaxies-Classification of Radio Galaxies and Their Typical Characteristics-Energy Processes in Radio Galaxies-Radio Galaxies in Evolutionary Sequence-Some Important Radio Galaxies-Seyfert Galaxies Quasars:The Discovery-Radio Properties-Optical Properties-The Red Shift of Quasars-Active Galactic Nuclei.
(10 Lectures)

UNIT IV: Milky way Galaxy: Rotation of the Galaxy: Differential Rotation-Determination of the Rotation Parameters in the Solar Neighborhood-Radio Observation of the Galaxy at 21-cm Wave Length-The Rotation Curve of the Galaxy: The General Rotation Law-Density Distribution of Gas and Spiral Structure of the Galaxy: Radio and Optical Data-The General Structure of the Galaxy-The Mass of the Galaxy-Magnetic Field in the Galaxy-Cosmic Rays-Continuous Radio Emission in the Galaxy. **(10 Lectures)**

UNIT V: Cosmology: Redshift and the Expansion of the Universe -Matter Density in the Universe and the Deceleration Parameter - The Cosmological Principle - Fundamental Equations of Cosmology - The Current Theories: Some Important Models of the Universe-Observational Tests of Cosmological Models - The Cosmic Microwave Background Radiation. **(8 Lectures)**

BOOKS FOR STUDY:

An Introduction to AstroPhysics - Baidyanath Basu,Tanuka Chattopadhyay,sudhindra Nath Biswas, Second Edition(2010), PHI Learning Private Limited.

Unit I : Chapter 1 Pages 1to26
Unit II : Chapter 3 Pages 56 to 76
Unit III : Chapter 19 & 20 Pages 506 to 535
Unit IV : Chapter 16 Pages 390 to 426
Unit V : Chapter 21 Pages 536 to 565

BOOKS FOR REFERENCE

1. A beginner's guide to the universe - Chaisson, E. and McMillan, S., 1998. Astronomy:. Prentice Hall.
2. Fundamental astronomy - Karttunen, H., Kröger, P., Oja, H., Poutanen, M. and Donner, K.J. eds., 2016. . Springer.
3. Astrophysics: stars and galaxies - Abhyankar, Krishna Damodar. Universities Press, 2002.
4. Mathematical cosmology and extragalactic astronomy. Segal, Irving Ezra.Vol. 68. Academic Press, 1976.
5. James Binney – Astrophysics a very short introduction – Oxford university press
6. Extragalacic astronomy and Cosmology – An introduction . Peter Schneider , Springer
7. An introduction to modern astrophysics.Carroll, Bradley W., and Dale A. Ostlie. Cambridge University Press, 2017.
8. Cosmology ,Weinberg, Steven.. Oxford University Press, 2008.
9. Aspects of astronomy. Culver, R. B. (1998). Fort Worth: Harcourt Brace Custom.
10. Astronomy: A physical perspective. Kutner, M.L., 2003.Cambridge University Press.
11. Astrophysics of the Solar System, K.D. Abhyankar. 1999, University press
12. Introductory Astronomy & Astrophysics. Zeilik, Michael. 1998 Brooks/Cole / Thomson Learning,
13. Vedic Astronomy Hole, P. V.. Nagpur: Shri Babasaheb Apte Smarak Samitee, 1990.
14. New horizons in astronomy . Brandt, J. C., & Maran, S. P. (1979).. San Francisco: Freeman.
15. Astronomy by R.B.Culver, Barnes and Noble books 1979.
16. Discovery of Astronomy- Robert D.Chapman, W.H.Freeman and Co,(1978).

B.Sc. Physics –IV Semester
18PHYU04E3 (Major Elective-I) Waves and Oscillations (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Objectives:

To impart knowledge about waves and oscillations and sound.
To make them to understand the principles and methods of finding the properties.

Specific Learning outcomes: At the end of the course the student should be able to

CO-1 Understand the concept of SHM

CO-2 Explain the free forced and damped vibration

CO-3 Acquire the knowledge of wave motion

CO-4 Know the properties of sound

CO-5 Apply the knowledge to ultrasonic services

UNIT I: Simple Harmonic Motion, Characteristics of S.H.M., Differential equation of S.H.M., K.E., P.E. and Total Energy of a vibrating particle, Energy of Vibration, Oscillations with one degree of freedom, Linearity and superposition principle, Simple pendulum, Compound pendulum, Bar pendulum, LC Circuit, Lissajous figures, Composition of two SHM(s) of frequency ratio 2:1, Experimental methods for obtaining Lissajous figures, Uses of Lissajous figures **(10 Lectures)**

UNIT II: Free, Forced and Resonant Vibrations: Free Vibrations, Undamped Vibrations, Damped Vibrations, Damped S.H.M. in an electrical circuit, Forced Vibrations, Resonance and Sharpness of Resonance, Phase of Resonance, Quality Factor, Examples of Forced and Resonant Vibrations.

(9 Lectures)

UNIT III: Wave motion, Characteristics of wave motion, Transverse wave, motion, Longitudinal wave motion, Differential equation of wave motion, Particle velocity, Wave velocity, Principle of superposition, Interference of Sound waves, Quicke's tube Seebeck's tube, Beats, Decibel, Doppler effect, Applications. **(10 Lectures)**

UNIT IV: Reflection of Sound, Reflection of a plane wave at plane surface, Experimental determination of reflection of sound, Whispering Galleries, Echo, Applications, Refraction of plane wavefront at plane surface, Experimental demonstration of refraction of sound, Diffraction of sound, Fresnets Assumptions, Intensity of sound at a point due to plane wavefront, Dopper effect, Applications. **(9 Lectures)**

UNIT V: Ultrasonics, Production of ultrasonics by magnetostriction and piezoelectric methods, detection of ultrasonic waves, Acoustic grating, Applications of ultrasonic waves. **(10 Lectures)**

Books for Study

1. Brijlal & Subramanyam "Waves & Oscillations", S.Chand & Co., 1974,
   Unit I : Pages: 1-30, 37-38, 45, 56-63
   Unit II : Pages : 65-83
   Unit III : Pages :82-88, 92-93, 135-141, 211 to 220)
   Unit IV : Pages :192-198, 202-209
   Unit V : Pages : 282-293

Reference Books:

1. Sound, M.Narayanamurti, N.Gosakan and T.Rajagopalan, The National Publishing Co, Madras, First Edition, 1978.
2. A Textbook of Sound with Theory of Oscillation and Waves, D.R.Khanna and R.S.Bedi, Atma Ram & Sons, Delhi, 1984

Total 48 hours

B.Sc. Physics –IV Semester
18PHYU04N2 (Non Major Elective-I) Physics of Sports (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Applications of Physics concepts on various sports phenomena are introduced

UNIT – I : INTRODUCTION: Distribution of mass in Human body – forces in muscles and bones – elastic properties – work, energy and power of the body – sizes – strength and food requirements – calculation of calorific content needed for each sports person. **(9 Lectures)**

UNIT – II : RUNNING AND JUMPING : Basic ideas about distance – velocity and speed –acceleration, acceleration due to gravity – angular distance , speed and angular acceleration. Analysis Of Track Techniques: Starting, running , hurdling, stride length, frequency, sprint length, frequency and sprint start. Analysis Of Field Techniques: Standing broad jump, running broad jump, pole vault-techniques involved-guiding principles–(video demonstration of track and field events and the techniques).
(9 Lectures)

UNIT – III : BATS AND BALLS LINEAR KINETIC : Inertia-mass –force-momentum – Newton's laws of motion – friction – impulse – impact – oblique impact – elasticity – impact on fixed surface, moving bodies. Analysis Of Cricket / Base Ball: Impact – moment of inertia – spin – size of the ball-size of the bat – batting – stride – swing – bunting. Analysis Of Tennis Techniques: Grip- striking – serve – direction of flight of ball – guiding principles (video demonstrations of the above events). **(10 Lectures)**

UNIT – IV: DIFFERENT PROJECTILES IN SPORTS: Projectiles – horizontal and vertical motion-range of projectile – trajectory – Analysis of throwing events: techniques involved in speed of release, angle of release and reverse in shot-put, discus, javelin and hammer throw-analysis of broad jump-basket ball shooting and foot ball kicking (video demonstration of projectiles in sports) – guiding principles – analysis of basket ball techniques : Dribbling and passing . **(10 Lectures)**

UNIT – V: THE GYMNASTICS AND ADVENTURE SPORTS : Eccentric force-moment – equilibrium – centre of gravity – weight – rotator and circular motion – Analysis of Gymnastics activities: Techniques of lift-rotation-take off – landing for long horse vault, parallel bar etc., - Analysis of rope climb , tight rope walking , skipping – car race, boat race, cycle race – guiding principles (video demonstration). Swimming And Diving: Basic ideas of flotation – buoyant force – centre of buoyancy – specific gravity - relative motion – fluid resistance – conservation of momentum – Analysis of swimming techniques – starting – racing – turn different strokes – diving techniques (video demonstration) Other Factors Influencing Performance: Air resistance – spin or gyration – available force – human characteristics – effects of gyroscopic action – guiding principles. **(10 Lectures)**

BOOKS FOR STUDY

1. The Biomechanics of Sports Techniques, Third edition, Hay.G.James – Relevant portion of chapters 3 to 10 & 12, 13 to 17.
2. Scientific Principles of Coaching, Second Edition – Relevant portion of chapters 5, 7 to 14, 16 to 18.
3. General Physics with Bioscience Essays, Marion and Nornyak, Second Edition– Chapters 1.2, 2.5, 2.8, 3.4, 4.2, 5.3, 7.3.

Total 48 hours

B.Sc. Physics –IV Semester
18PHYU04N3 (Non Major Elective-I) Physics of Music (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Applications of Physics concepts on various musical phenomena are introduced

UNIT – I: BASIC IDEAS OF SOUND: Wave motion – types of waves-simple Harmonic motion – Properties of sound waves – reflection, refraction, diffraction and interference of sound velocity of sound-standing waves-Beats-Resonance. **(9 Lectures)**

UNIT – II : BASIC IDEA OF MUSIC : The ear-pitch loudness and quality of musical notes-just noticeable difference in pitch-barrel hearing-aural or combination tones-subjective tones-subjective music-vibrato and tremolo-pitch range of musical instruments-quality – Fourier's theorem-musical scales and frequency ratios-choosing a musical scale, Carnatic, Hindustani and Western systems. **(10 Lectures)**

UNIT – III: MUSICAL INSTRUMENTS : String instruments-frequency of stretched strings-longitudinal vibration in strings-plucked, bowed and struck stringed instruments-one example for each from Carnatic Hindustani and western. Wind Instruments modes of oscillation in open and closed pipes-Different types of wind instruments-examples from Carnatic and western. Vibrations in Stretched Membranes and Plates. Drums, cymbals etc. **(10 Lectures)**

UNIT – IV: ELECTRONICS OF MUSIC Microphones (carbon & crystal) – pickup – Loud speaker, Amplifiers. Addition of sound -santoors. **(9 Lectures)**

UNIT – V: ELECTRONIC SYSTEMS: Tape recording and play back equalizers, Recording and reproduction of sound in cine films. Acoustic of Buildings: Aoustics-Reverberation and Reverberation time – Acoustic measurements: Acoustic intensity level – Acoustic pressure level-Factors affecting the acoustics of buildings – sound distribution in an Auditorium – Requisites for good acoustics.
(10 Lectures)

BOOKS FOR STUDY:

1. Physics of Musical sounds – Askill.J
2. Physics for you - Johnson. K
3. Waves - Berkely
4. Sound and Ultra sound - Freeman I.M.
5. Home Science Physics - Renganayakiamma
6. Musical Instruments of India - Krishnasami. S
7. Text book of Sound - Brijlal and Subramanyam
8. Instrumentation and Analysis – Nakra and Choudry.

Total 48 hours

B.Sc. Physics –V Semester
18PHYU0511 – Electromagnetics (4 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: To give an insight on the concept of field and a thorough understanding of Mathematical tools and methods involving in electric and magnetic fields.

UNIT – I: Electrostatic fields in vacuum: Electric field outside and inside macroscopic bodies, Gauss's law, the average potential over a spherical surface, Poisson and Laplace equations, conductors, calculation of electric field produced by a simple charge distribution, Field due to a uniform spherical charge distribution – Calculation of electric field inside and outside the charges, Coulombs law – Electric dipole, potential energy of a charge distribution, energy density in an electric field. **(13 Lectures)**

UNIT – II : Electrostatic fields in dielectric medium : Electric polarization, electric field at an exterior point, bound charge densities of surface and volume charge distribution, polarization current density, electric field at an interior point, electric field intensities due to distant and near dipoles, the local field electric susceptibility, divergence of electric field intensity and electric displacement, relative permittivity and Poisson's equation for dielectrics, free and bound charge densities, calculation of electric field involving dielectrics, dielectric insulated parallel plate capacitor, free charge density, bound charge density and electric displacement at a dielectric conductor boundary, dielectric sphere with a point charge at its centre. **(13 Lectures)**

UNIT – III : Steady currents and nonmagnetic materials: Magnetic forces, magnetic induction B, Biot-Savart law – magnetic induction due to a current flowing in a long straight wire, forces between two long parallel wires, circular loop. The force on a point charge moving in a magnetic field – Hall effect in semiconductors, divergence of the magnetic induction, vector potential – long straight wire, pair of long parallel wires curl of the magnetic induction, ampere's circuital law-long cylindrical conductor, long solenoid , short solenoid. **(13 Lectures)**

UNIT – IV : Magnetic Induction and magnetic energy: Faraday's law of induction – expanding loop. Faraday induction law – differential form – Induced electric field intensity in terms of vector potential – electromotance induced in a loop by a pair of long parallel wires carrying a variable current, induced electromotance in a moving system- electromotance induced in a fixed loop in a time dependent magnetic field, electromotance induced in a loop rotating in a fixed magnetic field inductance and electromotance, mutual inductance, self inductance of a long solenoid, mutual inductance between two coaxial solenoids, coefficient of coupling. **(13 Lectures)**

UNIT – V: Maxwells equations: Differential form – Integral form – Duality-Lorentz"s Lemma - Non-homogeneous equations for E and B. **(12 Lectures)**

BOOK FOR STUDY :

Electromagnetic fields and Waves – Paul Lorrain and Dale Corson, II Edn. CBS Publishers and Distributors (1986),

Unit 1. Pages 40-81

Unit 2. Pages 91-115

Unit 3 Pages 292 – 323

Unit 4. Pages 332 - 364

Unit 5 : Pages 439 to 450

BOOKS FOR REFERENCE:

1. Electromagnetic waves and Radiating systems, II Edn. Edward C. Jordon & Keith G.. Balmain, Prentice Hall of India Pvt. Ltd., New Delhi (1993).
2. The Feynman Lectures on Physics, Vol.2 Feynman, Leighton and Sands Narosa Publishing House, 1964, Reprint (1993).

Total 64 hours

Related Online Courses - MOOC

1) https://www.edx.org/course/dian-ci-xue-electromagnetism-tsinghuax-uphys3x
2) https://www.edx.org/course/electricity-and-magnetism-magnetic-fields-and-forces
3) https://www.edx.org/course/electricity-and-magnetism-electrostatics
4) https://www.edx.org/course/preparing-ap-physics-c-electricity-georgetownx-phyx152x-1
5) https://www.edx.org/course/apr-physics-2-part-2-electricity-ricex-advphy2-2x-0

B.Sc Physics – V semester

18PHYU0512- Nuclear and Particle Physics (3+0)

(For the batches joining B.Sc in 2018-2019 and afterwards)

Unit-I: THE CONSTITUENTS OF NUCLEUS AND SOME OF THEIR PROPERTIES: Introduction- Rutherford scattering an estimation of the nucleus size- measurement of nuclear radius- constituents of the nucleus and their properties- discovery of neutrons- nuclear spin, moments and statistics- Alpha decay, Beta decay and Gamma decay (Qualitative explanation only)

Unit-II: RADIOACTIVITY: Introduction- properties of radioactive rays - The law of radioactive decay - unit of activity - Radioactive growth and decay - ideal equilibrium, transient equilibrium and secular equilibrium - radioactive series-radioactive isotopes of lighter elements - Artificial radioactivity - determination of the age of the earth - carbon dating-archaeological time scale - illustrative examples.

Unit-III: PARTICLE ACCELERATORS, NUCLEAR REACTIONS, NUCLEAR MODELS AND REACTORS

PARTICLE ACCELERATORS:

Low energy cyclic accelerators: cyclotron (fixed frequency)- variable energy cyclotron- betatron- linear accelerator(electron linear accelerators only)– synchrotron(synchro cyclotron only)

NUCLEAR REACTIONS:

Types of nuclear reactions- conservation laws- nuclear reaction kinematics- nuclear transmutations: transmutation of alpha particles, transmutation of protons, transmutation of neutrons- nuclear fission & fusion- atom bomb and hydrogen bomb.

NUCLEAR MODELS AND REACTORS:

Nuclear models: liquid drop model and shell model only - nuclear reactors - general design of a nuclear reactors(basic reactors) swimming fool reactor, fast breeder reactor - chain reactions-fissile materials.

Unit-IV: DETECTION AND MEASUREMENTS OF NUCLEAR RADIATIONS**:** Introduction- ionization chamber-Geiger Muller counter- scintillation counter- cloud chamber-bubble chamber-nuclear emulsions.

Unit-V: COSMIC RAYS AND ELEMENTARY PARTICLES:

COSMIC RAYS**:**

Introduction- secondary cosmic rays- geomagnetic effects: effects of sea level and low altitudes- effects at high altitudes- interpretation of geomagnetic effects- absorption of cosmic rays- energy of mass measurements of secondary cosmic rays- showers- Cosmic ray primaries-Origin of cosmic rays

ELEMENTARY PARTICLES:

Introduction - classification of elementary particles - fundamental interactions: Gravitational interaction - electromagnetic interaction - weak interaction - strong interaction; conservation laws: conservation of linear momentum, conservation of angular momentum, conservation of energy, conservation of charge, conservation of lepton number, conservation of baryon number, conservation of isospins, conservation of strangeness, conservation of hypercharge, conservation of charge conjugation, conservation of parity-properties of elementary particles (basic properties only): electron ,positron and positronium - proton and antiproton - neutron and antineutron – neutrino and antineutrino, mesons - K-mesons-quarks.

Books for study:

1. Nuclear Physics An Introduction by S.B.Patel (New age international (P) Ltd publishers- New Delhi-(2^{nd} Edition)).

   Unit I : Pages 112-132

   Unit II : Pages 57-66,70-87

2. Nuclear physics by D.C. Dhayal (Himalaya Publishing House-Fifth revised & enlarged edition

   Unit III: Pages 482-491,501-505, 401-408, 358-360, 360-362, 578-579, 585, 592-594, 626-628, 633-636, 638, 649
   Unit IV: 129-133,143-148,148-152,156-159,159-162,165-168
   Unit V : 674-683,686-688,690-691, 692-705,707-712,713-714,725,745

B.Sc. Physics –V Semester

18PHYU0513 – Classical Mechanics & Relativity (4 + 0)

(For the batches joining B.Sc., in 2018-2019 and afterwards)

Scope: Physics of massed particles movement are introduced

UNIT – I : LAGRANGIAN DYNAMICS: Introduction – basic concepts – constraints: Holonomic constraint – Nonholonomic constraint – some more examples of holonomic and nonholonomic constraints – force of constraints – difficulties introduced by the constraints and their removal – Generalized coordinates – principle of Virtual work – D'Alembert's principle – Lagrange's equations from D'Alembert's principle – procedure for formation of Lagrange's equation – Lagrange's equations in presence of Non-conservative forces – Generalized potential – Lagrangian for a charged particle moving in an electromagnetic field (Gyroscopic forces) – Hamiltonian's principle and Lagrange's equations. **(12 Lectures)**

UNIT – II : VARIATIONAL PRINCIPLES: Introduction – the calculus of variations and Euler-Lagrange's equations – deduction of Hamiltonian's principle from D'Alembert's principle – modified Hamiltonian's principle – deduction of Hamiltonian's equations from modified Hamiltonian's principle(or variational principle) – deduction of Lagrange's equations from variational principle for non-conservative systems (Holonomic constraints). **(12 Lectures)**

UNIT – III : TWO BODY CENTRAL FORCE PROBLEM: Reduction of two-body central force problem to the equivalent one-body problem – central force and motion in a plane – equations of motion under central force and first integrals – differential equation for an orbit - inverse square law of force – Kepler's law of plantery motion and their deduction: deduction of the Kepler's first law – deduction of the Kepler's second law – deduction of the Kepler's third law(period of motion in an elliptical orbit) – stability and closure of orbit under central force – artificial satellites – Virial theorem. **(12 Lectures)**

UNIT – IV: NONINERTIAL AND ROTATING COORDINATE SYSTEMS: Non-inertial frames of reference – fictitious or Pseudo force – centrifugal force – uniformly rotating frames – free fall of a body on Earth's surface – Foucault's pendulum. **(14 Lectures)**

UNIT – V: SPECIAL THEORY OF RELATIVITY – LORENTZ TRANSFORMATION: Introduction – Galilean transformation – principle of relativity – transformation of force from one inertial system to another - covariance of the physical laws – principle of relativity and speed of light – the Michelson-Morley experiments – Ether hypothesis – postulates of special theory of relativity -Lorentz transformation – consequence of Lorentz transformations: length contraction – simultaneity – time dilation – addition of velocities. **(14 Lectures)**

BOOKS FOR STUDY :

Classical Mechanics by J.C.UPADHAYA Himalaya Publishing House second revised edition.

Unit- I : Page no 27-53.
Unit– II : Page no 138-149.
Unit- III: Page no 103-125.
Unit- IV: Page no 320-329.
Unit- V : Page no 334-353.

Books for References:

1. Classical Mechanics-H. Goldstein – II Edition, Narosa Publishing House, New Delhi – 1995
2. Mechanics – Schaum's series : Third Edition Chapter VII P

Total 64 hours

B.Sc. Physics- V SEMESTER

18PHYU0514 – Practical – V (0+2)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Hands on training on sophisticated and ordinary instruments operation and their uses have been exposed

1. Study of CRO and its uses and study of Function generator.Testing of diodes, transistors.
2. Factors affecting induced emf in a coil and factors that determine the secondary emf & current in coupled coils – CRO
3. AC circuits – phase lead, phase lag and impedance
4. Measurement of inductance and capacitance – AC Bridges Maxwell and Owen.
5. Simple wiring
6. Study of Hysteresis of magnetic material
7. LCR circuits – series and parallel resonance – sharpness resonance and Q factor.
8. Study of motors
9. Maintenance, reassembling and Servicing of
    a. Balances
    b. Telescopes
    c. Microscopes
    d. Rheostats
    e. Galvanometers, Ammeters & Voltmeters
10. Hands on training in using simple tools
11. Voltage multipliers-diodes, Characteristic of a Transistor CE-mode-measurement of h parameters-load line
12. FET characteristics – measurement of parameters and load line
13. Design and study of a power supply with filter circuit
14. Design and study of a regulated power supply.
15. Design and study of a single stage voltage amplifier – BJT & FET.
16. Design and study of Hartley and Colpitt's oscillators
17. Study of Transducers.

B.Sc. Physics –V Semester

18PHYU05E4 – (Major Elective-II) Instrumentation (3 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Measuring instruments in mechanical. Electrical and electronics category and their working principles are introduced

Unit I: Basics 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. 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. **(10 Lectures)**

Unit II: 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.

(10 Lectures)

Unit III: Signal Generators and Analysis Instruments: Block diagram, explanation andspecifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. **(8Lectures)**

Unit IV: Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic(balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. **(10 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 MultimeterBlock diagram and working of a digital multimeter. Workingprinciple of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. **(10 Lectures)**

Reference Books:

- A text book in Electrical Technology - B L Theraja - S Chand and Co.
- Performance and design of AC machines - M G Say ELBS Edn.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Logic circuit design, Shimon P. Vingron, 2012, Springer.
- 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

Total 48 hours

18PHYU05E5 – (Major Elective-II) Television Transmission & receiver (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Academic and practical knowledge on TV functioning and its servicing skill are incorporated.

UNIT – I: Elements of a Television System : Picture transmission – sound transmission – picture reception – sound reception – picture synchronization – Basic monochrome transmitter and receiver – gross structure, image continuity, number of scanning lines, flicker, fine structure, total gradation – composite video signal – horizontal synchronization details – vertical synchronization details – function of vertical pulse train . **(8 Lectures)**

UNIT – II: Signal Transmission: AM: Channel band – vestigial side band transmission – transmission efficiency – complete channel band width – reception of vestigial side band signals - demerits of vestigial side band transmission –FM: FM Channel band width –channel band width for colour transmission – Television signal stands – monochrome picture tube – beam deflection screen phosphor-face plate-picture tube characteristics – picture tube circuit controls. **(10 Lectures)**

UNIT – III: **Camera principle** – photoelectric effect – image storage principle – electron scanning beam – video signal electron multiplier – image orthicon – Videocon – plumb icon – CCD.
TV receiver- Block diagram-antenna-RF section – IF section – vestigial side band correction – choice of IF – sound separation – sound section – sync processing – vertical deflection – EHT supply. **(10 lectures)**

UNIT – IV : **Colour Television** : Compatibility – natural light – colour perception – three colour theory – luminance, Hue and saturation – colour TV camera – luminance signal – production of colour difference voltage – compatibility considerations – Delta gun picture tube – purity and convergence PIL colour picture tube pin cushion correction- Auto Degaussing circuit – grey scale tracking. **(10 lectures)**

UNIT – V: **Television applications**: Cable television MATV & CATV – closed circuit (CCTV) theatre television – Video tape recording play back – Television via satellite.
Fault finding: Trouble shooting in monochrome receivers. **(10 lectures)**

BOOKS FOR STUDY:

1. Monochrome and Colour Television 22nd Reprint R.R. Gulati, Wiley Eastern (1993).
(Page 5-48, 50-81, 82-96, 131-148, 540 – 555, 558-568, 576-580, 184-203 and 722-723).

Total 48 hours

18PHYU05E6 – (Major Elective-II) Microprocessor 8085 Programming (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Microprocessor Architecture and Program construction, operation through Assembly language are Provided.

UNIT–I: MICROPROCESSOR ARCHITECTURE & MICROCOMPUTER SYSTEM AND INTRODUCTION TO 8085 ASSEMBLY LANGUAGE PROGRAMMING: Microprocessor architecture and its operations – Microprocessor initiated operations and 8085 bus organization – Internal data operations and the 8085 registers –Peripheral or externally initiated operations –Memory – Flip-Flop as a storage element – Memory map and Address – Memory Address of a 1K Memory chip –8085 Programming model – Instructions classification – Instructions and data format – Executing a simple program – Over view of the 8085 instruction set. **(12 Lectures)**

UNIT–II: INTRODUCTION TO 8085 INSTRUCTIONS: Data transfer operations – Arithmetic operations – Logic operations–Branch operations–Writing assembly language programs–
Debugging a program.
(10Lectures)

UNIT – III : PROGRAMMING TECHNIQUES WITH ADDITIONAL INSTRUCTIONS: Programming techniques – looping – counting and indexing – Additional data transfer and 16 bit arithmetic instructions –Arithmetic operations related to memory – Logic operations – Rotate – Compare – Dynamic debugging.
(10 Lectures)

UNIT – IV : COUNTERS AND TIME DELAYS : Counters and Time delays – Hexadecimal counter – Zero to Nine counter – Generating pulse waveforms – Debugging counter and time delay programs.
STACK AND SUBROUTINES: Stack – Subroutine – Traffic signal controller –Restart, conditional call and return instructions – Advanced subroutine concepts. **(8 Lectures)**

UNIT – V : GENERAL PURPOSE PROGRAMMABLE PERIPHERAL DEVICES: The 8255A Programmable Peripheral Interface – Interfacing Keyboard and Seven Segment Display. **(8 Lectures)**

BOOKS FOR STUDY:

1. Microprocessor Architecture, Programming and Applications with the 8085– R.S. Gaonkar, Wiley Eastern, Fourth edition, New Delhi.

Unit I : Chapter 2 Pages: 25–63 and Chapter 5 Pages 139–159
Unit II : Chapter 6 Pages: 161–211
Unit III : Chapter 7 Pages: 213–260
Unit IV : Chapter 7 Pages: 213–260
Unit V : Chapter 15 Pages: 445–471

BOOKS FOR REFERENCE:

1. Introduction to microprocessors- II – A.P. Mathur (1988) Edn., TMH, New Delhi.
2. 8080A / 8085 assembly language programming – L.A. Leventhal
3. 8080A / 8085 assembly language subroutines – L.A.Leventhal and W. Saville.

Related online courses – MOOC courses:

1. https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-inputoutput
2. https://www.edx.org/course/embedded-systems-shape-the-world-multi-threaded-interfacing

B.Sc. Physics – V Semester

18PHYU05S1– (Skill Based Course) / 18PHYU05N4 – (Non Major Elective-II) /

Instruments and Servicing (3 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Laboratory instruments and gadgets principle and operations and troubleshooting instruments are introduced.

UNIT – I : GENERAL IDEAS: DC power supply : fault finding and servicing – characterization of a power supply-use of measuring instruments; voltmeter, ammeter and ohm meter and multi tester understanding and testing for the correctness of specifications for instruments (audio oscillator, cathode ray oscilloscope, voltmeter and ammeter). **(10 Lectures)**

UNIT – II : INSTRUMENTS IN THE PHYSICS LABORATORY : Theory and measurements with (i) meter bridge (ii) potentiometer (Comparison of emfs, resistances, measurement of potentials) fault finding in metre bridge and potentiometer circuits – power measurement using tree voltmeters – transformers principle, reflected impedance and winding & transformers. **(10 Lectures)**

UNIT – III : INSTRUMENTS IN THE PHYSICS LABORATORY II: Moving coil / iron galvano meters: theory and characterization – conversion of a galvanometer into an ammeter/voltmeter and their calibration-ballistic galvanometer: construction, working (alignment) and characterization, measurement of : absolute capacity, High resistance by leakage of a capacitor and mutual inductance. **(10 Lectures)**

UNIT – IV: RADIO AND TELEVISION: Principles of radio transmission – simple receiver super heterodyne receiver and its servicing – basics of television receiver with a block diagram-simple fault finding in TV receivers and precautions to be adopted-high voltage measurement-magnetic tape recording principle and block diagram for the same-fault finding and servicing. **(10 Lectures)**

UNIT – V: ELECTRICAL DEVICES AND OTHERS: Earthing-tube light circuit and servicing – Emergency lamp and its operation-UPS (block diagram) – simple ideas about a digital clock – alarm and sleep – frequency meter (block diagram) – Item counter – automatic street light operation. **(8 Lectures)**

Book for Study:

Modern Electronic Instrumentation and measurement techniques, A.D. Helfrick and W.D.Cooper, Prentice-Hall of India, New Delhi, 2002. Relevant portions

Total 48 hours

B.Sc. Physics – V Semester

18PHYU05N5 – (Non Major Elective-II) Agricultural Physics (3 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Basics of physics related to agriculture area is exposed.

Unit I: Basic concepts of physics - Importance of physics related to agriculture- physical laws – Brownian movement – Tyndoll effect – Raman Effect – Spectroscopy – Adhesion and Cohesion properties – relevant to agriculture. **(5 lectures)**

Unit II: Soil physics- soil moisture movement – physical classification of soil moisture – soil air movement – thermal diffusion in soils – thermal properties of soils – heat capacity – heat conductivity – specific heat **(5 lectures)**

Unit III: Nanophysics - nano particles – physical properties of nanoparticles – Moore's law – semi conductors – diode – biosensors – quantum dots – working principles of Transmission Electron microscope – Scanning Electron Microscope – Scanning Tunneling Microscope – their applications **(5 lectures)**

Unit IV: Soil – plant - water continuum – capillary movement of water in soil and plant – tortousity of water in soils – Hysterisis effect – osmosis – diffusion **(5 lectures)**

Unit V: Physical constraints in agriculture – soil constraints – impermeability of soil – compaction methods – physical constants of soils – Soil physics as a factor in soil management. **(5 lectures)**

Practical

1. Estimation of moisture in soil and plant samples
2. Optical methods
3. Electrical and thermal properties of agro materials
4. Physical methods to prepare nanoparticles
5. Application of TEM in identifying nanofertilizers
6. Application of SEM in identifying nanoparticles
7. Visit to Nanotechnology laboratory
8. Working principle of basic Physical instruments
9. Capillary movement of water
10. Estimation of pore space in soil particles
11. Determination of bulk and particle density of soil particles
12. Detection and measurement of radio activity using Geiger Muller Counter
13. Visit to an Isotope Laboratory**(26 hours)**

Reference Books:

1. William Lambe, T. and Robert V.Whitman. 1979. Soil Mechanics. Wiley Eastern Ltd. New Delhi.
2. Helmut Kohnke, 1979. Soil Physics. Tata McGraw-Hill Publishing Company Ltd. New Delhi.
3. Biswas, T.D. and Mukherjee, S.K. 1997. Text book of soil science. Tata McGraw-Hill Publishing Company Ltd. New Delhi.
4. Chinnamuthu, C.R., B.Chandrasekaran and C.Ramasamy, 2007. Nanotechnology Applications in Agriculture. TNAU Offset & Printing Press, Directorate of Open and Distance Learning, TNAU, Coimbatore.

B.Sc. Physics – V Semester
18PHYU05N6 – (Non Major Elective-II) Numerical Methods (3 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Application of Mathematical tools are embedded

UNIT – I : Interpolation; Differences – relation between differences and derivatives – differences of a polynomial – Newton's formula for forward interpolation – Backward interpolation – Central differences – Gauss's forward formula – backward formula and Sterling's interpolation formula. **(10 Lectures)**

UNIT – II: Numerical differentiation – Numerical integration: General quadrature formula – Simpson's rule – Weddle's rule – Trapezoidal rule – curve fitting: principles of least squares – fitting a straight line, a parabola and exponential curve. **(10 lectures)**

UNIT – III: Numerical algebra and Transcendental equation: finding approximate values of the roots – Iteration method – Bisection method – Newton Raphson method – Regula Falsi method. **(10 lectures)**

UNIT – IV: Solution to simultaneous linear equation: Back substitution – Gauss elimination method – Gauss – Jordon method – iterative methods – Gauss –Jacoby's iteration method, Gauss – Seidal Iterative method. **(10 lectures)**

UNIT – V: Numerical solution of ordinary differential equations (ODE): Taylor's series method of ODE Euler's method – modified Euler's method – Runge-Kutta method of ODE. Solving simple problems using Computers. **(8 lectures)**

BOOKS FOR STUDY AND REFERENCE

Numerical Mathematical Analysis – James B- Scarborough – Sixth Edn., Oxford and IBH Publishing Co., Pvt., Ltd., (1996)

Numerical Methods – A. Singaravelu , Meenakshi Publications, 1992.

Total 48 hours

B.Sc. Physics – V Semester

18PHYU05S2– (Skill Based Course) APPLIED OPTICS (2 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

THEORY: 32 Lectures

Theory includes only qualitative explanation.

Sources and Detectors **(9 Periods)**

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

Fourier Optics **(7 Periods)**

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

Holography (7 **Periods)**

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

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, Fibre optic sensors: Fibre Bragg Grating

Reference Books:

- 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.
- 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

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B.Sc. Physics – V Semester

18PHYU05S3– (Skill Based Course) WEATHER FORECASTING (2 + 0)

(For the batches joining B.Sc. in 2018-2019 and afterwards)

Theory: 32 Lectures

The aim of this course is not just to impart theoretical knowledge to the students but to enable them to develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

Introduction to atmosphere: Elementary idea of atmosphere: physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature, with height; air temperature; requirements to measure air temperature, temperature sensors: types; atmospheric pressure: its measurement; cyclones and anticyclones: its characteristics. **(9 Lectures)**

Measuring the weather: Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring wind speed and direction; humidity, clouds and rainfall, radiation: absorption, emission and scattering in atmosphere; radiation laws. **(5 Lectures)**

Weather systems: Global wind systems; air masses and fronts: classifications; jet streams; local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes. **(4 Lectures)**

Climate and Climate Change: Climate: its classification; causes of climate change; global warming and its outcomes; air pollution; aerosols, ozone depletion, acid rain, environmental issues related to climate. **(6 Lectures)**

Basics of weather forecasting: Weather forecasting: analysis and its historical background; need of measuring weather; types of weather forecasting; weather forecasting methods; criteria of choosing weather station; basics of choosing site and exposure; satellites observations in weather forecasting; weather maps; uncertainty and predictability; probability forecasts.

(8 Lectures)

Reference books:

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
4. Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
5. Why the weather, Charls Franklin Brooks, 1924, Chpraman & Hall, London.
6. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

B.Sc. Physics –VI Semester
18PHYU0615 – Solid State Physics (3 + 0)
(For the batches joining B.Sc.in 2018-2019 and afterwards)

Scope: Basics of crystal properties are exposed.

Unit I: Crystal Physics : Introduction- lattice points and space lattice-basis and crystal structure – Unit cells and lattice parameters -- unit cells versus primitive cell- crystal systems – crystal symmetry – the twenty three symmetry elements in cubic crystal-to show that five-fold rotation axis is not compatible with a lattice – combination of symmetry elements- Rotation-Inversion axis – translation symmetry elements – Space groups – the Bravais space lattices – Metallic crystal structure - Relation between the density of crystal Material and Lattice constants in a cubic lattice - Other cubic structures.

(10 Lectures)

Unit II: X-Ray diffraction: Directions, Planes and Miller Indices – Important features of Miller indices of crystal Planes - important planes and directions in a cubic crystal – distribution of atoms in the atomic plane of simple cubic crystal- Reciprocal Lattice
Braggs Law – Braggs X-ray Spectrometer - Powder Crystal method - Rotating Crystal Method.

(9 Lectures)

Unit III :Thermal Properties of Solids: Introduction - Lattice specific heat – Classical theory - Einstein's theory of Specific Heat – Debye's theory of Specific Heat – vibrational modes of a continuous medium – density of vibrational modes – Debye approximation. 5 **(9 Lectures)**

Unit IV: Superconductivity – Survey of superconductivity – Joule heating – An account of the mechanism of superconductors – Effect of Magnetic field – A.C. Resistivity – Critical currents – Meissner Effect – Thermal properties – The Energy Gap – mechanical effects – The penetration depth – Type I and Type II superconductors – London Equations.

(**10 Lectures**)

Unit V: Physics of Semiconductors: Introduction – The Band structure of Semiconductors – Intrinsic semiconductors – Conductivity and temperature – Statistics of electrons and holes in intrinsic semiconductors – statistics of extrinsic semiconductors – mechanism of current conduction in semiconductors. **(10 Lectures)**

Book for Study

1. Solid State Physics by S.O. Pillai , New Age International Publishers, V Edn (2002)
   - Unit I : Pages 100 to 127.
   - Unit II : Pages 127 to 138, and Pages 154 to 166.
   - Unit III : Pages 375 to 395
   - Unit IV : Pages 400 to 425
   - Unit V : Pages 595 to 640.

Book for references:

1) Introduction to Solid State Physics by C. Kittel , Wiley Eastern (1984)
2) Elements of Solid State Physics by Ali Omar , Addison Wesley(1998)

Total 48 hours

B.Sc. Physics –VI Semester
18PHYU0619 – Quantum Mechanics (4 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Application of quantum mechanics as a tool to solve fundamental physics problems

Unit I: Origin of the Quantum Theory:Limitation of classical physics- Planck`s quantum hypothesis-Einstein`s theory of photoelectric effect-Compton effect- quantum theory of specific heat-Bohr theory of Hydrogen atom-existence of stationary states-Wilson- Sommerfeld quantisation rule –Elliptic orbit of Hydrogen atom-the Harmonic oscillator-the rigid rotator-particle in a box-the correspondence principle-the Stern-Gerlach experiment –inadequacy of Quantum theory. **(13 Lectures)**

Unit II: Wave Mechanical Concepts:Wave nature of particle –the uncertainty principle – the principle of superposition-wave packet-time dependent Schrodinger equation – interpretation of wave function—Eherenfest theorem – time independent Schrodinger equation-Stationary states-admissibility condition on the wave function. **(13 Lectures)**

Unit III: Genral Formalism of Quantum Mechanics: Linear operator – eigen function and eigenvalues - Hermitian operator- postulates of quantum mechanics - simultaneous measurability of observables - general uncertainty relation – relevant problems. **(13 Lectures)**

Unit IV: One Dimensional Energy Eigenvalue Problems: Square-well potential with rigid walls - square well potential with finite walls - square potential barrier - alpha emission – linear harmonic oscillator: Schrodinger method. **(13 Lectures)**

Unit V: Three Dimensional Energy Eigenvalue Problems: particle moving in a spherically symmetric potential – system of two interacting particles –hydrogen atom – Hydrogenic orbitals –three dimensional square well potential. **(12 Lectures)**

Book for study

1. Quantum Mechanics by G.Aruldhas (PHI) -2006
- Unit I : Pages: 1 to 21 of chapter 1.
- Unit II : Pages 22 to 48 of chapter 2.
- Unit III : Pages 53 to 62 of chapter 3.
- Unit IV : Pages 81 to 90 and pages 95 to 100.
- Unit V : Pages 114 to 130 and 132 of chapter 5.

References:

1. Quantum Mechanics by J.L. Powell and B. Crasemann, Oxford & IBH Publishing (1961).
2. A Text book of Quantum Mechanics by P.M.Mathews and K.Venkatesan, TMH (1971)

Total 64 hours

B.Sc. Physics –VI Semester
18PHYU0617 – Spectroscopy (4 + 0)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Exposure of various spectroscopic techniques are introduced.

UNIT – I: Spectra of Atoms; Hydrogen Spectrum – Angular Momentum – Larmor Precession – Energy of a Magnetic Moment in a Magnetic Field – The Vector Atom Model – Spin-Orbit Interaction – Spectra of Alkali Atoms – Angular Momentum of Many Electron Atoms – Energy Levels and Spectral Transitions of Helium – Spectral Terms of Equivalent Electrons – Normal Zeeman Effect – Anomalous Zeeman Effect – Paschen-Bach Effect – Influence of Nuclear Spin-Hyperfine Structure – Stark Effect – Rydberg Atoms – Lamb Shift – Characteristic X-Ray Spectra – Moseley's Law – Molecular Orbital Method. **(12 Lectures)**

UNIT – II: Visible spectroscopy: Theory of spectrophotometry and colorimetry –Lambart's law – Beer's law – Deviation from Beer's law – Instrumentation: Source- Filters and monochromators –Sample cells – Detection – photo electric colorimeters – single beam and double beam instruments – quantitative analysis. **(10 Lectures)**

UNIT – III: Infrared Spectroscopy: The vibrating diatomic molecule – Energy of a diatomic molecule – simple harmonic oscillator – Anharmonic oscillator – Diatomic vibrating rotator – vibrations of polyatomic molecules – fundamental vibrations and their symmetry – Overtones and combination frequencies – Double and single beam I.R. spectrophotometer operation. **(12 Lectures)**

UNIT – IV: Raman Spectroscopy : Quantum and classical theory of Raman effect – Pure rotational Raman spectra of linear molecules – Rule of mutual exclusion – Vibrational Raman spectra – Rotational fine structure – structure determination from Raman and IR Spectroscopy – Techniques and Instrumentation. **(12 Lectures)**

UNIT – V: Electronic Spectroscopy: Electronic Spectra of diatomic molecules - The Born – Oppenheimer Approximation – Vibrational Coarse Structure – Franck-Condon Principle – Dissociation Energy and Dissociation Products – Rotational Fine Structure of Electronic-Vibration Transitions – Fortrat Diagram – Pre dissociation. **(12 Lectures)**

BOOKS FOR STUDY :

1. Molecular structure and Spectroscopy, G.Aruldhas, Prentice Hall of India Private Limited, New Delhi – 110 001, Third Printing.
   Unit I : Page No: 56 – 91

2. Fundamentals of Molecular Spectroscopy, C.N. Banwell and M.Mc. Cash, IVth Edition, Tata McGraw Hill (1996).

   Unit-III : Pages:55–66; 71–75; 91–93, chapter 3.

   Unit- IV: Pages:100–106; 112, 113–116; 119–124 .

Total 58 hours

B.Sc. Physics – VI Semester
18PHYU0618 – Practical – VI (0+2)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

1. Photography – Developing and printing
2. CDS – Photographing arc spectra-Hartmann's formula
3. Solar Spectrum – Spectrometer
4. Rydberg's constants.
5. Ellipic and hyperbolic frings – Determination of Elastic constants
6. Determination of Plank's constant
7. Determination of charge of an electron
8. Design of regulated power suppliers – IC 723, IC 7805 and study of regulation
9. Study of Basic Logic gates – Transistor and IC version
10. OPAMP – 741 as amplifier, inverting, non-inverting – Unit gain buffer. Integrator, differentiator, summer, solution of equations, wave form generator
11. Multi vibrators – Transistor, OPAMP and IC 555.
12. Study of 555 Timer
13. Study of trouble shooting in some simple electronic circuits
14. Michelson interferometer
15. Study of Doppler Effect
16. Verification of Boolean relations DeMorgan's theorem – Combinational Logic
17. Half adder, full adder and half subtractor

B.Sc., (Physics) – VI Semester
18PHYU06M1 (Modular Course - I/II) Statistical Mechanics (0+2)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: An exposure on dealing with large number of particles in the form of probability concept has been introduced.

UNIT – I : Statistical Mechanics : Microstate and macrostate – thermodynamic probability – Bose-Einsterin, Fermi – Dirac, Maxwell - Boltzmann statistics – Bose-Einsterin, Fermi – Dirac and Maxwell - Boltzmann - Distribution function. The partition function.

(12 Lectures)

UNIT II : Application of Statistical Mechanics: Distribution of molecular velocities – Experimental verification – Einstein's theory of specific heat capacity of a solid – Debye theory of specific heat capacity of solids – Black body radiation – The electron gas. **(12 Lectures)**

BOOKS FOR STUDY :

Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W.Sears and Gerhadd L. Salinger – Third Edition, Narosa Publishing House.

Unit I : Pages: 302–337 of chapter 11.

Unit II : Pages: 354–366 of chapter 12, and Pages: 386–398;407–416 of chapter 13

B.Sc. Physics – VI Semester
18PHYU06M2 (Modular Course - I/II) Electric Circuit Analysis (0+2)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Electrical network theorem and electrical component properties are exposed.

UNIT – I : Network Theorem: Thevenin's theorem – Norton's theorem – Superposition theorems - Maximum power transfer theorem – solving networks using theorems- current through the galvanometer in an unbalanced Wheatstone's bridge – sensitivity of Wheatstone's bridge – Carey Foster's bridge – Calibration of Carey Foster's bridge – Kelvin's double bridge. Ballistic Galvanometer – its theory and damping correction. **(10 Lectures)**

UNIT – II : Transient Phenomena: Growth and decay of current in an LR circuit-time constant – charging and discharging of a capacisot through a resistor – CR and LCR circuits measurement of High resistance by leakage – mutual inductance between a pair of coils – self inductance by Rayleigh's bridge.

AC CIRCUIT THEORY : AC quantities as vectors – LR, CR, LCR series and paralalel circuits – resonance, sharpness of resonance – Q factor of a coil, power in AC circuits – AC bridges – Maxwell's bridge – Schering bridge – De Sauty's bridge – Anderson's bridge. **(14 Lectures)**

BOOKS FOR STUDY:

Electricity and magnetism – K.K. Tiwari, S. Chand and Co.,
Unit I
Electricity and Magnetism by K.K. Tiwari
Pages: 769–790 of chapter 18; Pages: 311–323 of chapter 8;
Pages: 344–353 of chapter 9
Electricity and Magnetism by Sehgal-Chopra-Sehgal
Pages: 2.143–2.147 of chapter 5

Unit-II

Electricity and Magnetism by Sehgal-Chopra-Sehgal
Pages: 2.278–2.298 of chapter 10
Electricity and Magnetism by K.K. Tiwari
Pages: 453–456; 468–506 of chapter 11.
Pages: 706–745 of chapter 16; 754–760 of chapter 17

Total 24 hours

B.Sc. Physics – VI Semester
18PHYU06M3 (Modular Course -I/II) Optic Communication (0+2)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: Laser properties and its applications are introduced.

UNIT I : Properties of laser light, Q-Switching and mode locking: single mode and multimode lasers : Lamb Dip, mode locking of multimode lasers, Q-Switching – Ammonia maser, Gas lasers, Solid State Lasers, Dye Lasers, Semiconductor lasers, Non linear optics : Second Harmonic generation, Phase matching, Self focusing of light. **(10 Lectures)**

UNIT II : FIBRE OPTICS : Introduction – Nature of light, basic optical laws, optical fibre modes and configurations; Fibre types, Rays and modes, step index fibre structure, Ray-optics representation, wave representation, wave equation for step index fibres, model equation, Modes in Step-Index fibers, linearly polarized modes, Power flow in step-index fibres, single mode fibres – propagation modes, Graded-Index fibre structure – Numerical aperture and modes, Attenuation : absorption, Scattering losses, bending losses, Core and Cladding losses, Fibre Optic cables – Fibre optic communication system and its advantages – Specific applications on Fiber Optics. **(14 Lectures)**

Books for Study

1.Lasers and Non linear Optics, B.B. Laud, Wiley Eastern Ltd., New Delhi, 1992,

Unit I Chapter 13 : PP 178 – 188.

2. Optical fibre communication, Gerd Keiser, McGraw Hill, International edns, New York 1991, Unit II Chapter 2, Chapter2 PP 16-59, 73 – 75, 85 – 96.

BOOKS FOR REFERENCES:

1. Optics, Ajoy Ghatak, Tata McGraw Hill, New Delhi, 1995.
2. Lasers, Theory and Applications, A.K. Ghatak & K. Thiagarajan, Macmillan India Ltd., Delhi 1984.

B.Sc. Physics – VI Semester
18PHYU06M4 (Modular Course I/II) Radiation Safety (0+2)
(For the batches joining B.Sc. in 2018-2019 and afterwards)

Scope: The aim of this course is for awareness and understanding regarding radiation hazards and safety. The list of laboratory skills and experiments listed below the course are to be done in continuation of the topics.

Unit I : Interaction of Radiation with matter: Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons - Photo-electric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles – Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation. Beta Particles – Collision and Radiation loss (Bremsstrahlung),Interaction of Neutrons - Collision, slowing down and Moderation.

(10 lectures)

Radiation safety management: Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

(10 lectures)

Unit II : Radiation detection and monitoring devices: Radiation Quantities and Units: Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose. Annual Limit of Intake (ALI) and derived Air Concentration (DAC). **Radiation detection:** Basic concept and working principles of gas detectors (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), Scintillation Detector (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry.

(10 lectures)

Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

2. Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
3. Study of counting statistics using background radiation using GM counter.
4. Study of radiation in various materials (e.g. KSO_4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
5. Study of absorption of beta particles in Aluminum using GM counter.
6. Detection of a particles using reference source & determining its half life spark counter
7. Gamma spectrum of Gas Light mantle (Source of Thorium)

Reference Books:

1. W.E.Burcham and M. Jobes – Nuclear and Particle Physics - Longman (1995)
2. G.F.Knoll, Radiation detection and measurements.
3. Thermoluninescense Dosimetry, Mcknlay, A.F., Bristol, Adam Hilger (Medical Physics Handbook 5)
4. W.J.Meredith and J.B.Massey, "Fundamental Physics of Radiology". John Wright and Sons, UK, 1989.
5. J.R.Greening, "Fundamentals of Radiation Dosimetry", Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
6. Practical Applications of Radioactivity and Nuclear Radiation, G.C. Lowental and P.L.Airey, Cambridge University Press, U.K., 2001.
7. A.Martin and S.A. Harbisor, an Introduction to Radiation Protection, John Willey & Sons, Inc. New York, 1981.
8. NCRP, ICRP, ICRU, IAEA, AERB Publications.
9. W.R. Hendee, "Medical Radiation Physics", Year Book – Medical Publishers Inc. London, 1981.

SEMESTER – I (Maths Major) / SEMESTER – III (Chemistry Major)

Allied Physics for B.Sc. Mathematics and Chemistry Major

18PHYU01A1 / 18PHYU03A1 Allied Physics – I (3+0)

(For the batches joining B.Sc., in 2018-2019 and afterwards)

Objectives: To impart basic knowledge needed to work with the major subject that the students are studying

Specific Objectives of learning (SOL): At the end of the course the student should be able to gain enough knowledge to effectively learn the subjects in which they will be majoring

UNIT I : ACCELERATION DUE TO GRAVITY AND GRAVITATION: Acceleration due to gravity-compound pendulum-interchangeability of centres of suspension and oscillation-determination of 'g' using a bar pendulum-determination of radius of gyration. Factors affecting the values of 'g" - effect of rotation - altitude - depth.

Gravitaion: Kepler's laws (No mathematical derivation) - Newton's law- density of Earth- mass of the Earth and the Sun- Gravitational Field-Gravitational Potential- Potential energy- Gravitational potential at a point distance 'r' from a body of mass-Gravitational potential outside a spherical shell and a solid sphere. Inertial and gravitational mass. **(12 Lectures)**

UNIT II: VISCOSITY AND SURFACE TENSION: Stream lined and turbulent motion – coefficient of Viscosity – Poiseuille's flow – Experimental determination of coefficient of viscosity – motion in a viscous medium – Stoke's law – comparison of viscosities – Ostwald Viscometer. Surface tension – Explanation – surface film and surface energy – Free energy of a surface – Excess of pressure inside the drops and bubbles – Rise of a liquid in a capillary tube – Experimental determination of surface tension – Jaeger's method, Drop weight method and capillary rise method. **(10 Lectures)**

UNIT III: SOUND: Velocity of longitudinal waves in gases – Newton's law of velocity of sound--Laplace's correction – Effect of density ,humidity and wind - velocity of sound in water and in air-measurement of sound intensity-idea of decibel.

Ultrasonics: Production- Magnetostriction Method -Piezo-electric Effect- determination of velocity-Acoustic Grating-Applications of ultrasonics (any two) **(10 Lectures)**

UNIT IV : Interference – Condition for interference – Young's experiment – Fresnel biprism – Bi-mirror – Lloyd's single mirror – Fringes with while light – Colours of thin films – Reflected and transmitted systems – Newton's rings – Air wedge – Testing of planeness of a surface. **(10 Lectures)**

UNIT V : Polarisation – Reflection and Refraction – Brewster's law – Double refraction – Nicol prism and its uses – Rotation of plane of polarization – specific rotatory power and saccharimetry.**(6 Lectures)**

Total 48 hours

Books for Study:

1. Elements of Properties of matter - D.S. Mathur
2. Fundamentals of Optics - Khanna and Gulati
3. A text book on Sound - Khanna and Bedi
4. Optics - Ajoy Ghatak
5. A text book of Optics- Subrahmanyam and Brij Lal
6. A text book of Sound - Subrahmanyam and Brij Lal
7. Properties of Matter- Subrahmanyam and Brij Lal

BOOKS FOR REFERENCE:

Physics – V Edition. Volume I David Halliday, Robert Resnick – Jearl Walker – Asian Books,

SEMESTER – I (Maths Major) / SEMESTER – III (Chemistry Major)
Allied Physics for B.Sc. Mathematics and Chemistry Major
18PHYU02A3 / 18PHYU04A3 Allied Physics – I (0+2)

PRACTICAL
(For the batches joining B.Sc. in 2018-2019 and afterwards)

1. Measuring instruments – Vernier caliper , Screw gauge , Vernier microscope
2. Single optic lever – measurements of thickness.
3. Surface tension – capillary rise method.
4. Viscosity – Poiseuille's method.
5. Bending of beams – cantilever, uniform and non-uniform bending.
6. Newton's law of cooling- verification, specific heat of liquid.
7. Specific heat of solid/ liquid method of mixture.
8. Lee's disc experiment – thermal conductivity of poor conductor.
9. Joule's law – specific heat of liquid.
10. Comparison of magnetic moments – field aiding, field opposing.
11. Meter bridge – resistance of coil, specific resistance.
12. Figure of merit of table galvanometer.
13. Focal length of long focus convex lens, concave lens.
14. Spectrometer – refractive of prism and liquid.
15. Compound pendulum – determination of g and radius of gyration.
16. Diode characteristics
17. Transistor characteristics.

SEMESTER – II (Maths Major) / SEMESTER – IV (Chemistry Major)

Allied Physics for B.Sc., Mathematics and Chemistry Major

18PHYU02A2 / 18PHYU04A2

Allied Physics – II (3+0) (For the batches joining B.Sc., in 2018-2019 and afterwards) Objectives: To impart basic knowledge needed to work with the major subject that the students are studying Specific Objectives of learning (SOL): At the end of the course the student should be able to gain enough knowledge to effectively learn the subjects in which they will be majoring

UNIT I: DC AND AC CIRCUITS :

DC CIRCUITS: Kirchoff's law on voltages and currents – maximum power transfer theorem Wheatstone's bridge – Carey Foster's bridge – capacitors action, parallel plate and cylindrical capacitors – parallel and series connection of capacitors – energy stored in capacitors

AC CIRCUITS: Peak, mean and rms values of ac – relation between current and voltage in capacitors and inductors – transformers: reflected impedance, losses in transformers – RC , LR circuits, and LCR circuits.

UNIT II: ANALOG AND DIGITAL ELECTRONICS :

Semiconductor electronics-Diode-Zener diode-Half and Full wave rectifiers-ideas of filters-Transistors-biasing of a transistor-input and output characteristics-single stage CE amplifier and its frequency response-Feed- back and its effects-oscillators-Colpitt's and Hartley oscillator.

Logic gates - their symbol and truth table-Universal gates NAND and NOR -Boolean Identities - De Morgan's theorem-Half-Adder and Full-Adder-solving Boolean equations using laws and theorems.

UNIT III: Particle properties of waves-Black body radiation-Photoelectric effect-Compton effect-de Broglie wave-phase and group velocities-wave nature of X-ray- Diffraction of X-ray by crystal-Bragg's Law. Vector atom model- fine structure of Hydrogen spectrum-Pauli's exclusion principle-Stern and Gerlack experiment.

UNIT IV: Becquerel rays- α, β, γ properties- laws of radioactivity- decay constant- half life – mean life – carbon dating – age of the earth – basic ideas of equilibrium in radioactivity – discovery of neutron – properties – nuclear fission and fusion reactions – liquid drop model (qualitative treatment only) – nuclear reactor – fissile materials – moderators – chain reactions – application of radioisotopes, medicine and agricultural – accelerators- linear accelerators- cyclotron – synchro cyclotron – detector: ionization chamber – G.M. Counter.

UNIT – V: Lasers: Introduction-Einstein coefficients – Light amplification – Threshold condition – Cavity resonator – Pumping – Ruby – He-Ne – Dye laser and diode laser –Basic ideas on optical communication – Optical fiber and types – Losses – Sources and detectors - Laser application in medicine industry and metrology.

Books for study:

1. Electricity and Magnetism with Electronics – K.K. Tiwari.
2. Concepts of Modern Physics, Arthur Beiser Tata McGraw Hill Co
3. Atomic Physics, J.B.Rajam, S.Chand Co
4. Modern Physics – Seghal, Chopra, Seghal, S. Chand, New Delhi.
5. Basic electronics and linear circuits – Bhargava Kulshreshtha and Gupta – TTTI Publications, Chandigarh
6. Digital Principles – Malvino and Leach, McGraw Hill.
7. Nuclear physics by D.C. Dhayal (Himalaya Publishing House-Fifth revised & enlarged edition

II SEMESTER
18AGP00201 - FUNDAMENTALS OF AGRICULTURAL PHYSICS (2+1)

Unit I:

Basic concepts of physics - Importance of physics related to agriculture- physical laws – Brownian movement – Tyndoll effect – Raman Effect – Spectroscopy – Adhesion and Cohesion properties – relevant to agriculture **(6 Lectures)**

Unit II:

Soil physics- soil moisture movement – physical classification of soil moisture – soil air movement – thermal diffusion in soils – thermal properties of soils – heat capacity – heat conductivity – specific heat. **(6 Lectures)**

Unit III:

Nanophysics - nano particles – physical properties of nanoparticles – Moore's law – semi conductors – diode – biosensors – quantum dots – working principles of Transmission Electron microscope – Scanning Electron Microscope – Scanning Tunneling Microscope – their applications **(7 Lectures)**

Unit IV:

Soil – plant - water continuum – capillary movement of water in soil and plant – tortousity of water in soils – Hysterisis effect – osmosis – diffusion. **(6 Lectures)**

Unit V:

Physical constraints in agriculture – soil constraints – impermeability of soil – compaction methods – physical constants of soils – Soil physics as a factor in soil management. **(5 Lectures)**

Practical

1. Estimation of moisture in soil and plant samples
2. Optical methods
3. Electrical and thermal properties of agro materials
4. Physical methods to prepare nanoparticles
5. Application of TEM in identifying nanofertilizers
6. Application of SEM in identifying nanoparticles
7. Visit to Nanotechnology laboratory
8. Working principle of basic Physical instruments
9. Capillary movement of water
10. Estimation of pore space in soil particles
11. Determination of bulk and particle density of soil particles
12. Detection and measurement of radio activity using Geiger Muller Counter
13. Visit to an Isotope Laboratory

Reference Books:

1. William Lambe, T. and Robert V.Whitman. 1979. Soil Mechanics. Wiley Eastern Ltd. New Delhi.
2. Helmut Kohnke, 1979. Soil Physics. Tata McGraw-Hill Publishing Company Ltd. New Delhi.
3. Biswas, T.D. and Mukherjee, S.K. 1997. Text book of soil science. Tata McGraw-Hill Publishing Company Ltd. New Delhi.
4. Chinnamuthu, C.R., B.Chandrasekaran and C.Ramasamy, 2007. Nanotechnology Applications in Agriculture. TNAU Offset & Printing Press, Directorate of Open and Distance Learning, TNAU, Coimbatore.