Students Admitted in the Year 2022-23 ONLY

updated on 22.06.2023

ANNAMALAI UNIVERSITY

203. B. Sc. Physics

Programme Structure and Scheme of Examination (under CBCS)
(Applicable to the candidates admitted in Affiliated Colleges
in the academic year 2022 -2023 ONLY)

Course Code	Part	Study Components & Course Title	Hours/ Week	Credit	Maximum Marks		
					CIA	ESE	Total
		SEMESTER – I					
22UTAML11	I	Language Course - I : Tamil-I	5	3	25	75	100
22UENGL12	II	English Course - I : Communicative English I	5	3	25	75	100
22UPHYC13	III	Core Course – I: Properties of Matter and Sound	5	4	25	75	100
22UPHYC14		Core Course – II : Heat and Thermodynamics	5	4	25	75	100
		Core Practical – I : Practical - I	3	-	-	-	-
22UMATA01		Allied Course - I : Paper -1, Mathematics-I	5	3	25	75	100
22UENVS18	IV	Environmental Studies	2	2	25	75	100
		Total	**30**	**19**			**600**
		SEMESTER – II					
22UTAML21	I	Language Course - II : Tamil-II	5	3	25	75	100
22UENGL22	II	English Course - II : Communicative English II	5	3	25	75	100
22UPHYC23	III	Core Course – III : Mechanics	4	4	25	75	100
22UPHYP24		Core Practical – I : Practical - I	3	4	40	60	100
22MATA02		Allied Course - I : Paper -2, Mathematics-II	5	3	25	75	100
22UPHYE26		Internal Elective – I	3	3	25	75	100
22UVALE27	IV	Value Education	2	1	25	75	100
22USOFS28		Soft Skill	1	1	25	75	100
22UNMSD01		Effective English	2	2	25	75	100
		Total	**30**	**24**			**900**
		SEMESTER – III					
22UTAML31	I	Language Course – III : Tamil-III	5	3	25	75	100
22UENGL32	II	English Course – III : English Through Literature-I	5	3	25	75	100
22UPHYC33	III	Core Course – IV : Optics and Spectroscopy	4	4	25	75	100
		Core Practical – II : Practical - II	3	-	-	-	-
22UCHEA01		Allied Course - II : Paper -1, Allied Chemistry - I	4	3	25	75	100
		Allied Course – II : Allied Chemistry Practical - 1	3	-	-	-	-
22UPHYE37		Internal Elective – II : (1 or 2 or 3)	2	3	25	75	100
		Mobile Cellular Technology					
		Laser Physics					
		Weather Forecasting					
22UPHYN38	IV	Non-Major Elective – I :	2	2	25	75	100
22UPHYS39		Skill Based Subject – I : Basic Electrical Technology	2	2	25	75	100
		Total	**30**	**20**			**700**

		SEMESTER – IV					
22UTAML41	I	**Language Course - IV: Tamil-IV**	5	3	25	75	100
22UENGL42	II	English Course – IV : English Through Literature-II	5	3	25	75	100
22UPHYC43	III	Core Course – V : Electricity and Electromagnetism	5	4	25	75	100
22UPHYP44		Core Practical – II : Practical - II	3	4	40	60	100
22UCHEA02		Allied Course – II : Paper – 2, Chemistry - II	4	3	25	75	100
22UCHEAP01		Allied Course - II : Allied Chemistry Practical - 1	3	2	40	60	100
22UPHYN47	IV	Non-Major Elective – II :	2	2	25	75	100
22UPHYS48		Skill Based Subject – II : Electronics Technology	3	2	25	75	100
22UNMSD02		MS-Office Essentials		2	25	75	100
			30	**25**			**900**
		SEMESTER – V					
22UPHYC51	III	Core Course – VI : Atomic and Molecular Physics	4	4	25	75	100
22UPHYC52		Core Course – VII : Relativity and Quantum Mechanics	4	4	25	75	100
22UPHYC53		Core Course – VIII : Analog Electronics	4	4	25	75	100
22UPHYC54		Core Course – IX : Digital Electronics	4	4	25	75	100
		Core Practical – III : General Experiments	3	-	-	-	-
		Core Practical – IV : Electronics Experiments	3	-	-	-	-
22UPHYE58		Internal Elective – III : (1 or 2 or 3)	3	3	25	75	100
		Material Science					
		Mathematical Methods					
		Medical Physics					
22UPHYS59	IV	Skill Based Subject – III : Astrophysics	3	2	25	75	100
22UGENS57		**Gender Studies**	2	1	25	75	100
		Total	**30**	**22**			**700**
		SEMESTER – VI					
22UPHYC61	III	Core Course – X : Solid State Physics	4	4	25	75	100
22UPHYC62		Core Course – XI : Nuclear and Particle Physics	4	4	25	75	100
22UPHYC63		Core Course – XII : Applied Electronics	4	4	25	75	100
22UPHYC64		Core Course – XIII : Microprocessor and its Applications	4	4	25	75	100
22UPHYP65		Core Practical – III General Experiments	4	3	40	60	100
22UPHYP66		Core Practical – IV Electronics Experiments	4	3	40	60	100
22UPHYE68		Internal Elective – IV : (1 or 2 or 3)	3	3	25	75	100
		Nano Physics					
		Radiation Safety					
		Molecular Biophysics					
22UPHYS69	IV	Skill Based Subject – IV : Instrumentation Techniques	3	2	25	75	100
		SDC – III: PBL - Salesforce Certified Associate	2	2	25	75	100
22UEXTA67	V	**Extension Activities**		1	100	-	100
		Total	**30**	**30**			**1000**
		Grand Total	**180**	**140**			**4800**

Internal Elective Courses

22UPHYE26-1	Internal Elective - I	Renewable Energy Sources
22UPHYE26-2		Fundamentals of Physics
22UPHYE26-3		Basics of Data Communication and Programming in C
22UPHYE37-1	Internal Elective - II	Mobile Cellular Technology
22UPHYE37-2		Laser Physics
22UPHYE37-3		Weather Forecasting
22UPHYE58-1	Internal Elective – III	Material Science
22UPHYE58-2		Mathematical Methods
22UPHYE58-3		Medical Physics
22UPHYE68-1	Internal Elective - IV	Nano Physics
22UPHYE68-2		Radiation Safety
22UPHYE68-3		Molecular Biophysics

Allied Courses

22UPHYA01	Theory	Allied Physics - I
22UPHYA02	Theory	Allied Physics - II
22UPHYP01	Practical	Allied Physics Practical - I

Non-Major Elective Courses (NME)

(Department of Physics offers the following NME to other Departments)

22UPHYN38	Environmental Physics
22UPHYN47	Physics for daily Life

Skill Development Courses under "Naan Mudhalvan" Scheme

S. No	Title of SDC	Credit
1	Effective English	2
2	Office Fundamentals	2
3	PBL Salesforce Certified Associate	2

Credit Distribution

Part	Study Components	Papers	Credits	Total Credits	Marks	Total Marks
Part I	Languages	4	3	12	100	400
Part II	Communicative English & English	4	3	12	100	400
Part III	Core Courses	13	4	52	100	1200
	Core Practical	4	4	16	100	400
	Allied Courses	4	3	12	100	400
	Allied Practical	1	2	2	100	100
	Internal Electives	4	3	12	100	400
Part IV	Environmental Studies	1	2	2	100	100
	Value Education	1	1	1	100	100
	Soft Skill	1	1	1	100	100
	Gender Studies	1	1	1	100	100
	Non-Major Electives	2	2	4	100	200
	Skill Based Courses	4	2	8	100	400
	Skill Development Courses (Naan Mudhalvan)	3	2	6		
Part V	Extension Activities	1	1	1	100	100
		45		**142**		**4500**

SEMESTER – I CORE – I PART – III	22UPHYC13: PROPERTIES OF MATTER AND SOUND	CREDITS: 4 HOURS: 5/W

COURSE OBJECTIVES

1. To expound the fundamentals of elastic properties of solids.
2. To understand the surface properties of liquids and the experimental methods.
3. To explain the viscous properties of liquids and gases, Poiseuille's formula.
4. To elaborate the SHM, resonance phenomena, determination of frequency and loudness.
5. To get an idea of the ultrasonics generation method, reverberation, acoustics of buildings and use in oil and gas industry.

Unit I: Elasticity: **14 Hours**

Elasticity –- Hooke's law – Elastic moduli – Poisson's ratio – Beams – bending of beams – Expression for bending moment – Cantilever - Theory of uniform and non – uniform bending - Determination of Young's modulus - Koenig's method – Torsion of a body – Expression for couple per unit twist – Work done in twisting a wire – Torsional oscillations of a body - Rigidity modulus by dynamic torsion method (Torsional pendulum) and static torsion method.

Unit II: Surface Tension: **14 Hours**

Surface tension – definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – work done in increasing the area of a surface – Excess pressure inside a curved liquid surface – Excess pressure inside a spherical and cylindrical drops and bubbles - drop weight method - angle of contact - Quincke's method.

Unit III: Viscosity: **10 Hours**

Viscosity – Coefficient of viscosity – Streamlined and turbulent motion – critical velocity – Rate of flow of liquid in a capillary tube – Poiseuille's formula – viscosity of highly viscous liquid - terminal velocity - Stoke's method - Ostwald Viscometer - viscosity of gas - Mayer's formula.

Unit IV: Sound: **12 Hours**

Simple Harmonic Motion – Composition of two S.H.M in a straight line - at right angles -Lissajous's figures - Free, Damped, Forced vibrations - Resonance - Laws of transverse vibration of strings – Sonometer - Determination of AC frequency using sonometer - Decibels – Loudness and Intensity levels.

Unit V: Ultrasonics and Acoustics: **10 Hours**

Ultrasonics – Production – Piezoelectric crystal method – Magnetostriction method – Properties and Applications - Acoustics of building – Reverberation - Sabine's Reverberation formula (No derivation) - Factors affecting acoustics of building - Sound distribution in an auditorium - Requisites for good acoustics - application of sound in oil industry: seismic survey and sonic Log

COURSE OUTCOMES

On completion of the course, the student would have learnt the following:

1. Theory of Elasticity and bending of beams, Couple per unit twist of a wire, Torsional pendulum ideas.
2. have knowledge on surface properties of liquids and its determination methods.
3. Understood the viscous behaviour of liquids and gasses.
4. understood the Physics of sound and its applications
5. Learned the method of producing ultrasonic waves and its applications. The concepts of acoustic comfort and the theories used in building acoustics, use of sound in oil industry

Text Books

1. Mathur D.S, (2004) *Elements of properties of matter*, S. Chand & Co.,
2. Murugesan R. (2004) *Properties of matter* S. Chand & Co.,
3. Brijlal and Subramanian (2006) *Properties of matter* S. Chand & Co.,
4. Khanna D.R. and Bedi. R.S (1969) *Textbook of Sound,* Atmaram and sons
5. Subrahmanyam N and Brijlal (1995) *A Textbook of Sound,* Vikas Publishing House Second revised edition

Supplementary Readings

1. Gulati, H.R. (1982) *Fundamentals of General Properties of Matter*, S. Chand & Co., New Delhi.
2. Halliday D, Resnick and Walker J (2001), *Fundamentals of Physics*, 6th Edition, Wiley, New York.
3. Schlumberger (1991), *Basic Principles of logging,* Schlumberger Wireline & Testing, Texas

Web Resources

1. https://www.pdfdrive.com/schlumberger - log - interpretation - principles – applications pdf - e20509665.html

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	2	2
CO3	3	2	3	3	2
CO4	2	3	2	2	3
CO5	3	2	3	3	3

1- LOW, 2- MODERATE, 3- HIGH

SEMESTER – I CORE – II PART – III	22UPHYC14: HEAT AND THERMODYNAMICS	CREDIT:4 HOURS: 5/W

COURSE OBJECTIVES

1. To get an idea about the specific heat capacity and its determination.
2. To understand the kinetic theory of gases and gas laws.
3. To get acquainted with transmission of heat and radiation laws.
4. To understand the low temperature Physics and Superconductivity.
5. To learn the thermodynamic system and its laws.

Unit-I: Specific Heat **12 Hours**

Specific heat capacity - Principle of method of mixtures - Specific heat capacity of liquid by method of mixtures - Newton's law of cooling - Specific heat capacity of a liquid by the method of cooling - Specific heat capacity of a liquid by Callender and Barne's method - Specific heat capacity of gases - Meyer's relation between C_P and C_v.

Unit -II: Kinetic theory of gases **12 Hours**

Kinetic theory of gases - Expression of pressure of gas - Boyle's law - Charle's law - Perfect gas equation - Mean free path - Expression for mean free path - Maxwell's velocity distribution law - Transport phenomena - Diffusion - Law of equipartition energy - Application to specific heat of gases.

Unit - III: Transmission of Heat **12 Hours**

Conduction - Coefficient of thermal conductivity - thermal conductivity of a good conductor - Forbe's method–thermal conductivity of a poor conductor - Lee's disc method - Convection and examples - Black body radiation - Wien's distribution law - Rayleigh - Jeans Law - Plank's Law - Stefan - Boltzmann law - determination of Stefan's constant - laboratory method

Unit - IV: Low Temperature Physics **12 Hours**

Joule-Kelvin effect - Porous plug experiment - liquefaction of hydrogen - liquefaction of helium - Kammerling - Onne's method - Helium I and II - Lambda point - Superconductivity - Type I and II superconductors - Meissner effect - applications of superconductors.

UNIT - V: Thermodynamics **12 Hours**

Thermodynamic system - Zeroth law, First and Second law of thermodynamics - Carnot engine - working and efficiency - Carnot's theorem - Thermodynamic scale of temperature - Thermodynamic and perfect gas scale - Third law of thermodynamics - Entropy - Change in entropy in a reversible/ irreversible process - Temperature entropy diagram - Entropy of perfect gas

COURSE OUTCOMES

1. After the completion this Course, the student would acquire the following:
2. Get an idea about the specific heat capacity and its determination methods.
3. Understood the kinetic theory of gases and gas laws.
4. Get acquainted with transmission of heat process and radiation laws.
5. Understood the method of generating low temperature and Superconductivity.
6. Learnt the thermodynamic system and its associated laws.

Text Books

1. Brij Lal and N Subrahmanyam (2016), *Heat Thermo dynamics* S Chand & Company Pvt Ltd, New Delhi.
2. Murugeshan R and Kiruthiga Siva prasad (2002), *Thermal Physics*, S Chand & Co., New Delhi.

Supplementary Readings

1. Mathur D S (2008), *Heat and Thermo dynamics***,** S Chand & Company Pvt Ltd.
2. Rajam J B (1990), *Heat and thermodynamics*, S Chand & Co., New Delhi.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	2	3	3	2	2
CO3	3	2	3	3	2
CO4	2	3	2	2	3
CO5	3	2	3	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER -I ALLIED- I	22UMATA01: MATHEMATICS – I	HRS/WK –5 CREDIT – 3/W

(For B.Sc Physics, Chemistry, Statistics and Computer Science)

COURSE OBJECTIVES

To acquire knowledge on finding roots of the Transcendental and Algebraic equations by Numerical methods, applications of matrices and Numerical methods for solving Simultaneous Linear equations. To understand the Computations of Eigen values ,Eigen vectors, differential calculus ,the evaluation of double and Triple integrals for finding Area and Volume.

UNIT-I: SOLUTIONS OF TRANSCENDENTAL AND ALGEBRAIC EQUATIONS

Iteration method**,** Bisection method, Newton's method - Regula Falsi method, Horner's method (without proof) (Simple problems only)

Unit-II: SOLUTIONS OF SIMULTANEOUS EQUATIONS

Gauss Elimination method- Gauss Jordan method-Gauss Seidel Iterative method-Gauss Jacobi method (Restricted to three variables only) (Simple problems only)

UNIT-III: MATRICES

Characteristic equation of a square matrix– Eigen values and eigen vectors – Cayley – Hamilton theorem [without proof] – Verification and computation of inverse matrix-

UNIT-IV: DIFFERENTIAL CALCULUS

n-th derivatives – Leibnitz theorem [without proof] and applications – Jacobians– Curvature and radius of curvature in Cartesian co-ordinates and polar co-ordinates.

UNIT-V: APPLICATION OF INTEGRATION

Evaluation of double, triple integrals – Simple applications to area, volume and centroid.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1) Attain knowledge on finding Approximate root for polynomial equations using Numerical methods.
2) Develop the skills of finding solutions of Simultaneous Linear equations.
3) Adopt techniques in solving problems involving Matrices
4) Provide skills on finding curvature and radius of curvature in Cartesian and polar co-ordinates.
5) Understand the applications of double and Triple integration in real life situation.

Text Books

1) A.Singaravelu "Numerical Methods" Meenakshi Publications
   Unit-I: Chapter 2
   Unit-II: Chapter 2
6) P. Duraipandian and Dr. S. Udayabaskaran. 1997, "Allied Mathematics" , Vol I & II. Chennai: Muhil Publishers.
   Unit-III: Sec(1.1.1,1.1.2,1.2,1.4.3),
   Unit-IV: Sec(2.7,4.1,4.1.1,4.2),
   Unit-V: Chap:3(3.4,3.4.1,3.5,3.5.1,3.5.2,3.6)

Supplementary Readings

1) P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
7) S.P.Rajagopalan and R.Sattanathan (2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
8) P. R. Vittal (2003), "Allied Mathematics", Chennai: Marghan Publications.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	2	3	3	3	2

1-Low 2-Moderate 3- High

SEMESTER – II CORE – III PART – III	22UPHYC23: MECHANICS	CREDIT: 4 HOURS: 4/W

COURSE OBJECTIVES:

1. To learn the laws of conservation and collision of bodies
2. To understand and calculate the moment of inertia of different bodies
3. To know the laws of gravitation, variation of 'g' and gravitational field
4. To learn the central force motion, centre of mass, variable mass systems
5. To understand the friction, centre of gravity and flow of fluids

Unit I: Laws of Motion **14 Hours**

Laws of conservation of energy, linear momentum and angular momentum - work energy theorem - work done by gravitational force - work done by spring force - potential energy - conservative and non-conservative forces - potential energy curve– Collision – Elastic and inelastic collision – (Fundamental laws of impact) – Newton's law of impact – coefficient of restitution – Impact of a smooth sphere on a fixed plane – Direct impact between two smooth spheres – Oblique impact between two smooth spheres – Calculation of final velocities of the spheres – Loss of K.E due to impact.

Unit II: Dynamics of Rigid body **10 Hours**

Moment of inertia – Theorems of perpendicular and parallel axes – M.I of a circular ring, disc, solid sphere, hollow sphere and cylinder about all axes – Compound pendulum – theory – equivalent simple pendulum – reversibility of centers of oscillation and suspension – determination of g and k

Unit III: Gravitation **12 Hours**

Newton's law of gravitation – Kepler's laws of gravitation – Determination of G - Boy's method – Mass and density of earth – Acceleration due to gravity – Variation of g with altitude, depth and rotation of earth - Value of g at poles and equator. Gravitational field – Gravitational potential – Gravitational potential due to spherical shell – Gravitational potential due to a solid sphere (inside and outside)

Unit IV: Central Force Motion **12 Hours**

Angular velocity, angular momentum and K.E of rotation – Torque and angular acceleration – Relation between them – Expression for acceleration of a body rolling down an inclined plane without slipping. Center of mass –velocity and acceleration of centre of mass – determination of motion of individual particle-– system of variable mass. Rocket motion- Satellite

Unit V: Statics and Hydrodynamics **12 Hours**

Friction-laws of friction-angle of friction-cone of friction-Centre of gravity-solid and hollow tetrahedron-solid and hollow hemisphere –Centre of pressure – vertical rectangular lamina – vertical triangular lamina. Hydrodynamics - Equation of continuity– Pitot's tube and Venturimeter – Euler's equation of unidirectional flow – Torricelli's theorem – Bernoulli's theorem and its applications.

COURSE OUTCOME

After the completion of the Course the student would understand the following:

1. The laws of conservation and collision of bodies
2. Calculate the moment of inertia of rigid body systems
3. Laws of gravitation, variation of 'g' and gravitational field and potential
4. The central force motion, centre of mass and variable mass systems
5. The friction, centre of gravity and flow of fluids

Text Books

1. Narayanamoorthy *Mechanics – Part I and II*, National Publishing Company.
2. MathurD.S. (2001) *Mechanics*, S. Chand & Co., 2nd Edition.
3. Duraipandian P, Laxmi Duraipandian, Muthamizh, Jayapragasam, (1988),
4. *Mechanics*, S. Chand & Co., New Delhi.
5. Murugeshan R (2001), *Properties of Matter*, S. Chand & Co., New Delhi.

Supplementary Readings

1. Halliday, Resnick, and Walker (2001) *Fundamentals of Physics*, 6th edition, Wiley, NY.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	2	3	2	3
CO4	2	3	2	3	3
CO5	3	2	3	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER – I & II CORE PRACTICAL – I PART – III	22UPHYP24: PRACTICAL - I	CREDIT: 4 HOURS: 3/W

COURSE OBJECTIVES

To understand and learn the measurement of

1. Elastic properties of solids.
2. Physical properties of liquids
3. Thermal properties of matter
4. Optical and electrical properties of materials and semiconductors
5. Frequency of vibration, relative density, and acceleration due to gravity

List of Experiments (Any 15 Experiments only)

1. Compound Pendulum - Determination of 'g' and 'k'.
2. Young's modulus - non uniform bending -Pin and microscope.
3. Young's modulus - uniform bending – Pin and microscope.
4. Young's modulus cantilever – depression - dynamic method-Mirror, Scale and Telescope.
5. Rigidity modulus -Torsional Pendulum -without masses.
6. Rigidity modulus and moment of inertia -Torsional Pendulum - with identical masses.
7. Rigidity modulus -Static torsion -Mirror, Scale and telescope.
8. Surface tension and Interfacial surface tension - drop weight method.
9. Coefficient of viscosity of liquid - Graduated burette - Radius of capillary tube by using microscope.
10. Specific heat capacity of liquid -Newton's law of cooling.
11. Sonometer - Frequency of Tuning fork.
12. Sonometer - Relative density of a solid and liquid.
13. Focal length - R and μ of a convex lens [focal length i) u-v and ii) conjugate foci method; Radius of curvature by telescope method].
14. Focal length - R and μ of a concave lens [focal length i) in contact and ii) auxiliary lens method; Radius of curvature by Boy's method].
15. Spectrometer - Solid prism- Refractive index of material of a prism.
16. Spectrometer - Hollow prism – Refractive index of a liquid.
17. Potentiometer - Calibration of low range voltmeter.
18. Potentiometer - Internal resistance of a Cell.
19. Study of Characteristics of the Junction diode – Determination of knee voltage
20. Study of Characteristics of the Zener diode – Determination of reverse breakdown voltage

COURSE OUTCOMES

The student will be learnt to determine the following physical properties:

1. Elastic properties of solids.
2. Physical properties of liquids
3. Thermal properties of matter
4. Optical and electrical properties of materials and semiconductors
5. Frequency of vibration, relative density, and acceleration due to gravity

Text Books

1. Ouseph, C.C. Rao, U.J. Vijayendran,V. (2018), *Practical Physics and Electronics*, S. Viswanathan, Printers & Publishers Private Ltd, Chennai
2. Srinivasan, M.N, Balasubramanian,V, Ranganathan, R. (2015) *A Text Book of Practical Physics,* Sultan Chand & Sons, New Delhi

Supplementary Readings

1. Samir Kumar Ghosh (2000) *A Textbook of Advanced Practical Physics*, NCBA Kolkatta
2. Chattopadyay, D. Rakshit, P.C. (2011), *An Advanced Course in Practical Physics*, NCBA, Kolkatta,
3. Arora, C.L, *B.Sc. Practical Physics*,S. Chand and Company, New Delhi.
4. Khandelwal,V, *A Laboratory Manual of Physics for Undergraduate Classes*, Vani Publications.
5. Saraf. B. et al, *Physics through Experiments*, Vikas Publications.
6. Harnaam Singh., *B.Sc., Practical Physics*, S. Chand and Company, New Delhi.
7. Tayal, D C, *University Practical Physics*, Himalaya Publishing House.
8. Gupta & Kumar, *Practical Physics*, Pragati Prakashan, Meerut

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	2
CO2	2	3	2	3	2
CO3	3	2	3	2	2
CO4	3	3	2	2	3
CO5	2	2	3	2	3

Correlation Level: 1-Low, 2-Moderate, 3-High

SEMESTER -II ALLIED- II	22UMATA02: MATHEMATICS – II	HRS/WK – 4 CREDIT – 4/W

(For B.Sc Physics, Chemistry, Statistics and Computer Science)

COURSE OBJECTIVES

To expand trigonometric functions, solving partial differential equations and learn about vector differentiation and integration, also too familiar with physical interpretation of divergence and curl of a vector. Learning Finite differences and applications of Interpolations in real life situations.

UNIT-I:TRIGONOMETRY

Expansions of $\sin^n\theta$, $\cos^n\theta$, $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ – Expansions of $\sin\theta$, $\cos\theta$, $\tan\theta$ in terms of θ – Hyperbolic and inverse hyperbolic functions – Logarithms of complex numbers.

Unit-I: Chap: 6 (6.1,6.1.1-6.1.3,6.2,6.2.1-6.2.3,6.3,6.4)

UNIT-II: PARTIAL DIFFERENTIAL EQUATIONS

Formation-complete integrals and general integrals-Four standard types-Lagranges equations.

Unit-II: Chap:6 (6.1,6.1.1,6.2,6.3,6.4).

UNIT-III: VECTOR DIFFRENTIATION

Vector functions- Derivative of a vector function- Scalar and vector point functions- Gradient of a scalar point function- Gradient- Directional derivatives –Unit vector normal to a surface – angle between the surfaces-divergence, curl.

Unit-IIISec(8.1,8.1.1,8.2,8.3,8.3.1,8.3.2,8.4,8.4.1,8.4.2,8.4.3,8.4.4).

UNIT-IV: VECTOR INTEGRATION

Green's theorem in the plane- Gauss divergence theorem- Stoke's theorem [without proofs].

Unit-IV: Sec(8.6.1, - 8.6.3).

UNIT-V: FINITE DIFFERENCES

Operator E, Relation between Δ, ∇ and E – Interpolation – Newton – Gregory forward & backward formulae for interpolation-Lagrange's interpolation formula for unequal intervals(without proof) .

Unit-V: Sec(5.1,5.2).

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1) Attain knowledge on finding the expansions of trigonometric functions and concept of hyperbolic and inverse hyperbolic functions.
9) Provide a basic knowledge of Partial Differential equations and develops knowledge on handle practical problems.
10) Adopt techniques in solving problems involving vector and scalar functions
11) Provide skills on finding derivatives and gradients on vector differentiation and Integration.
12) Understand the applications of differentiation and integration in real life situation.

Text Books

2) P. Duraipandian and S. Udayabaskaran (1997), "Allied Mathematics", Vol I & II. Chennai: Muhil Publishers.

Unit-I: Chap: 6 (6.1,6.1.1-6.1.3,6.2,6.2.1-6.2.3,6.3,6.4), Vol I,
Unit-II: Chap:6 (6.1,6.1.1,6.2,6.3,6.4), Vol II,
Unit-IIISec(8.1,8.1.1,8.2,8.3,8.3.1,8.3.2,8.4,8.4.1,8.4.2,8.4.3,8.4.4),Vol I,
Unit-IV:Sec(8.6.1, - 8.6.3), Vol I,
Unit-V:Sec(5.1,5.2), Vol II.

Supplementary Readings

1) P. Balasubramanian and K. G. Subramanian. 1997, "Ancillary Mathematics", Vol I & II. New Delhi: Tata McGraw Hill.
2) S.P.Rajagopalan and R.Sattanathan (2005), "Allied Mathematics", Vol I & II. New Delhi: Vikas Publications.
3) P. R. Vittal (2003), "Allied Mathematics", Chennai: Marghan Publications.
4) P.Kandhasamy, K. Thilagavathy (2003), "Allied Mathematics" Vol I & II, New Delhi: Tata McGraw Hill.

OUTCOME MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	2
CO2	3	2	3	3	2
CO3	3	3	3	3	2
CO4	3	3	3	3	2
CO5	2	3	3	3	2

1-Low 2-Moderate 3- High

SEMESTER: II PART: III	22UPHYE26 – 1: RENEWABLE ENERGY SOURCES	CREDIT: 3 HOURS: 3/W

COURSE OBJECTIVES

1. To provide an understanding of the present energy crisis and various available energy sources.
2. To understand the harvesting of solar energy.
3. To know the basics of photovoltaic system and its applications.
4. To learn about the biogas and biomass energy.
5. To understand the alternative energy sources and their details.

UNIT I: Introduction to Energy Sources **Hours: 9**

World's reserve of Commercial energy sources and their availability - India's production and reserves - Conventional and non - conventional sources of energy, comparison – Coal- Oil and natural gas –applications - merits and demerits.

UNIT II: Solar Thermal Energy **Hours: 9**

Solar constant -Solar spectrum - Solar radiations outside earth's atmosphere –at the earth surface - on tilted surfaces - Solar Radiation geometry - Basic Principles of Liquid flat plate collector –Materials for flat plate collector - Construction and working - Solar distillation–Solar disinfection - Solar drying - Solar cooker(box type) - Solar water heating systems – Swimming pool heating.

UNIT III: Photovoltaic Systems **Hours: 9**

Introduction - Photovoltaic principle - Basic Silicon Solar cell - Power output and conversion efficiency - Limitation to photovoltaic efficiency - Basic photovoltaic system for power generation - Advantages and disadvantages - Types of solar cells - Application of solar photovoltaic systems- PV Powered fan – PV powered area - lighting system – A Hybrid System.

UNIT IV: Biomass Energy **Hours: 9**

Introduction - Biomass classification - Biomass conversion technologies - Bio - gas generation - Factors affecting bio - digestion - Working of biogas plant - floating and fixed dome type plant- advantages and disadvantage of -Bio - gas from plant wastes - Methods for obtaining energy from biomass - Thermal gasification of biomass - Working of downdraft gasifier - Advantages and disadvantages of biological conversion of solar energy.

UNIT V: Wind Energy and Other Energy Sources **Hours: 9**

Wind Energy Conversion - Classification and description of wind machines, wind energy collectors - Energy storage - Energy from Oceans and Chemical energy resources - Ocean thermal energy conversion - tidal power, advantages and limitations of tidal power generation - Energy and power from waves- wave energy conversion devices - Fuel cells - and application of fuel cells - batteries advantages of battery for bulk energy storage - Hydrogen as alternative fuel for motor vehicles.

COURSE OUTCOMES

After Completion of the course, the student would have learnt the ideas listed below

1. Knowledge of Conventional and non-conventional energy sources.
2. Understand the solar energy and the harvesting methods.
3. Gain knowledge about power generation and solar cells.
4. Acquainted with the conversion of biogas and its application.
5. Familiar with the alternative types of energy and their advantages.

Text Books

1. Kothari D.P, SingalK.C. and Rakesh Ranjan, 2008, *Renewable energy sources and emerging Technologies,* Prentice Hall of India,
2. Sukhame,S.P. *Solar Energy - principles of thermal collection and storage,* Tata McGraw Hill Publishing Company Ltd.

Supplementary Readings

1. Chetan Singh Solanki, 2011,*Solar Photovoltaics Fundamentals, Technologies and Applications,* 2ndEdition, PHI Learning Private Limited.
2. Rai G. D, 2010,*Non-conventional Energy sources,* 4th Edition, Khanna Publishers.
3. Jeffrey M. Gordon 2013, *Solar Energy: The State of the Art,* Earthscan.
4. Kalogirou S.A., 2013,*Solar Energy Engineering: Processes and Systems, 2nd Edition,* Academic Press.
5. Zobaa A. F and Ramesh Bansal, 2011, *Handbook of Renewable Energy Technology,* World Scientific.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	2	2	2	3	2
CO4	2	3	3	2	3
CO5	3	2	2	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: II PART: III	22UPHYE26–2: FUNDAMENTALS OF PHYSICS	CREDIT: 3 HOURS: 3/W

COURSE OBJECTIVES

1. To know the units, dimensions and measurement of various physical quantities.
2. To acquire knowledge on different states of matter and conversion between them.
3. To know different types of energy.
4. To know about pressure, temperature and their simple measuring devices.
5. To understand principles of mirrors and lenses

Unit I: Units and Measurements **9 Hours**

S.I. Units – Measurements of length, mass, time and other physical quantities - Dimensional formula for area, volume, density, velocity, acceleration, momentum and force– Impulse – Torque – couple – angular momentum - Uses of dimension.

Unit II : States of matter **9 Hours**

Matter – Solid, Liquid, Gas and Plasma – Application of Plasma – change of state – specific heat capacity – specific heat capacity of gas - latent heat of fusion and vaporisation - specific latent heat of ice and steam.

Unit III :Energy **9 Hours**

Kinds of energy – Mechanical energy, Thermal energy, Optical energy, Sound energy, Electrical energy, atomic and nuclear energy, (Examples) – Conservation of energy – work energy theorem.

Unit IV: Pressure and Temperature **9 Hours**

Pressure – atmospheric pressure – Fortin barometer – Aneroid barometer - Concept of heat and temperature – Centigrade, Fahrenheit and Rankine scale – relation between temperature scales - Mercury thermometer – Error and corrections in mercury thermometers – Platinum wire resistance thermometer

Unit V : Mirror and lens **9 Hours**

Mirror – Laws of reflection – total internal reflection –Image formation (Concave and Convex mirror) - Lens –Laws of refraction –Image formation (Concave and Convexlens) – Defects of eye and rectification – Rayleigh, Mie, Tyndall and Raman scattering of light.

COURSE OUTCOMES

Students studying Fundamentals of Physics course would have learnt the following:

1. units and dimensions of various fundamental physical quantities
2. different states of matter and conversion between them.
3. types of energy and its conservation.
4. pressure and temperature and their measurement using simple devices.
5. principle and use of mirrors, lenses and scattering of light.

Text Books

1. Narayan Rao, (1998), B V, First *Year B. Sc. Physics*, New Age International (P) Lt.

Supplementary Readings

1. Halliday, D, Resnick R and Walker J, (2011), *Fundamentals of Physics*, Wiley India, Pvt Ltd.
2. Mathur,D S (2002), *Mechanics*, S. Chand&Co. Mathur, D S (2002), *Properties of matter*, S.Chand&Co., Brijlal and Subramanian, (2006), *Properties of matter*, S.Chand&Co., Rai, G D, *Solar energy utilization,* Khanna Publishers. Subramanyam and Brijlal (2004), *A textbook of Optics*, S. Chand and co., 22nd Edition.
3. Murugeshan, R (2008), *Optics and Spectroscopy*, S. Chand and co., 6th Edition.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	2	2
CO3	2	3	2	3	2
CO4	3	2	3	3	3
CO5	2	3	2	2	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: II PART: III	22UPHYE26-3: BASICS OF DATA COMMUNICATION AND PROGRAMMING IN C	CREDIT: 3 HOURS: 3/W

COURSE OBJECTIVES

1. To learn the different aspects of digital data communication and networks
2. To understand the art of multiplexing signals and its advantages and applications.
3. To get to know the ideas about broadband, layers, repeaters, bridges and gateway
4. To get acquainted with the keywords, operators, expressions and functions in C program.
5. To study the input and output, branching, loop, arrays etc., in C program.

Unit I:Data Communication

Hours: 9

Introduction to Data Communication - Network, protocols and standards standard organizations - line configuration - topology- transmission mode - classification of network.

Unit II: Transmission

Hours: 9

Parallel and serial transmission - Interface standards - modems-guided media types of error - Multiplexing - Types of Multiplexing - Multiplexing application Telephone system – ether net.

Unit III: Network Access

Hours: 9

Analog and digital network: Access to ISDN-broadband ISDN-X.25 Layers-Atm – Repeaters – Bridges – Routers – Gateway - TCP/IP Network - World Wide Web.

Unit IV:Introduction to Programming in C

Hours: 9

Basic structure of C Program – character set – identifiers and keywords constants and variables - data types – operators and expressions – Relational, Logical and Assignment operators – increment and decrement operators – Arithmetic expressions – Mathematical functions.

Unit V: Preliminaries And Functions

Hours: 9

Data input and output – getchar, putchar, scan f, print f, gets, puts functions – Decision making – branching and looping – if, if-else, else if ladder, switch, break, continue, goto – while, do while – for, nested loops – Arrays (one dimensional and two dimensional) – declaration – initialization – simple programs.

COURSE OUTCOMES

After finishing this course, the student will be knowing:

1. the different aspects of digital data communication and networks
2. the art of multiplexing signals and its advantages and applications.
3. The ideas about broadband, layers, repeaters, bridges and gateway
4. the keywords, operators, expressions and functions in C program.
5. the input and output, branching, loop, arrays etc., in C program.

Text Books

1. Balagurusamy.E, (2008), Programming in ANSI C, Second Edition, Tata McGraw Hill.
2. Brijendra Singh, Data, Communications, and Computer Networks, second edition, PHI

Supplementary Readings

1. Kamthane Ashok.N, (2013), Programming in C, 2nd Edition, Pearson Education.
2. Yashvant P. Kanetkar, (2008), Let us C, 8th Edition, Infinity science press.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	2	3	2	3	3
CO4	3	3	3	3	2
CO5	3	2	3	2	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER:III CORE COURSE - IV PART: III	22UPHYC33: OPTICS AND SPECTROSCOPY	CREDIT: 4 HOURS: 4/W

COURSE OBJECTIVES:

1. To understand the concept of lenses and its aberrations.
2. To know the meaning of the term interference of light.
3. To gain knowledge about diffraction of light.
4. To know the importance of polarization nature of light.
5. To understand the functioning of optical instruments.

Unit I: Geometrical optics **Hours: 12**

Lens – Spherical aberration in lenses – Methods of minimizing spherical aberration – chromatic aberration in lenses – condition for achromatism of two thin lenses (in and out of contact) – Aplanatic lens –Dispersion – Angular and Chromatic dispersion – combination of prisms to produce i) dispersion without deviation ii) deviation without dispersion –Direct vision spectroscope – Ramsden and Huygens Eyepieces.

Unit II: Interference **Hours: 12**

Conditions for interference – Theory of interference fringes – interference due to reflected light (thin films) – Anti-reflection (AR) coating - wedge shaped thin film – theory – determination of diameter of a thin wire by Air wedge – test for optical flatness – Newton's rings by reflected light – Determination of wavelength of light - Michelson's Interferometer – theory and its Application (Measurement of wavelength).

Unit II: Diffraction **Hours: 12**

Fresnel's diffraction – Rectilinear propagation of light – zone plate – action of zone plate - diffraction at circular aperture – opaque circular disc – Fraunhofer diffraction at single slit – Double slit – Plane diffraction grating – theory of plane transmission grating - experiment to determine wavelength (Normal incidence method) – resolving power – Rayleigh's criterion for resolution – resolving power of a prism - resolving power of grating.

Unit IV: Polarization **Hours: 12**

Double refraction – Nicol Prism – Nicol Prism as polarizer and analyzer – Huygens's explanation of double refraction in uniaxial crystals– Plane, elliptically and circularly polarized light – Quarter wave plates and Half wave plates – Production and detection of plane, circularly and elliptically polarized light- Optical activity – Fresnel's explanation of optical activity – Specific rotatory power – Laurent's half shade polarimeter.

Unit V: Spectroscopy **Hours: 12**

Infrared spectroscopy – sources and detector – uses – ultraviolet spectroscopy – sources – quartz spectrograph - applications - Raman Spectroscopy – Quantum theory of Raman effect – applications – Nuclear magnetic resonance.

COURSE OUTCOMES

On Completion of the course, the learner would well acquaint with the following:

1. The knowledge of geometric optics and aberrations in lens system helps in the practical design of optical systems and instruments.
2. The study of phenomena interference, thin films and its applications.
3. The knowledge about diffraction, Single Slit and Double Slit diffraction patterns.
4. Polarization lays the foundation for an understanding of concepts of Nicol Prism.
5. The knowledge of Spectroscopy helps to extract the dynamic information about the molecule.

Text Books:

1. Subramanyam and Brijlal (*2004*), *A Textbook of Optics,* S. Chand and co, 25th Edition, New Delhi.
2. Murugeshan R (2008), *Optics and Spectroscopy S.* Chand and co., 6th Edition, New Delhi,
3. Gupta S.L Kumar V and Sharma R.C(1997) *Elements of Spectroscopy* PragatiPrakashan, 13th Edition, Meerut.
4. Aruldhass G (2007), *Molecular Structure and Spectroscopy,* PHI Pvt Ltd, II Edition, New Delhi.

Supplementary Readings:

1. Sathyaprakash, Ratan PrakashanMandhir (1990), *Optics,* VII Edition, New Delhi.
2. *Banewell C.N* (2006) *Introduction to Molecular Spectroscopy,* TMH publishing co. IV Edition, New Delhi.
3. AjoyGhatak (2009), *Optics,* (TMH), New Delhi, Fourth edition.
4. Singh & Agarwal(2002), *Optics and Atomic Physics,* Pragati Prakashan Meerut, Nineth editio.
5. Halliday, Resnick, and Walker(2001) *Fundamentals of Physics,* Wiley, 6thEdition, New York.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	2	2
CO3	3	2	2	3	3
CO4	2	3	2	2	3
CO5	3	2	3	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: III PART: III	22UCHEA01: ALLIED CHEMISTRY-I	CREDIT: 3 HOURS: 4/W

COURSE OBJECTIVES

1) To impart wide knowledge about Metallurgy.
2) To invoke the knowledge in basic concepts of chemistry.
3) To provide a knowledge on chemical kinetics.
4) To Familiarize the students about Industrial Chemistry.
5) To inculcate interest in Nuclear chemistry.

Unit – I: METALURGY **HOURS: 9**

Metallurgy – Introduction – Metals – Occurrence of Metals – Minerals and Ores – Difference between Minerals and Ores – Minerals of Iron, Aluminium and Copper – Concentration of Ores – Froth Floatation process, Magnetic separation, Calcination, Roasting, Smelting, Flux.

Reduction of Mineral to Metal – Aluminothermic process – Refining of Metals – Electrolysis, Van Arkel and Zone refining.

UNIT – II: FUNDAMENTAL CONCEPTS **HOURS: 9**

Fundamental concepts – Bonding – Nature of bounds – Ionic, Covalent, Coordinate and Hydrogen bonds – Cleavage bonds - Homolytic and Heterolytic Fission – Electrophiles, Nucleophiles and Free Radicals. Types of Organic Reactions – Substitution, Addition Elimination, Rearrangement - Definition & Examples.

Isomerism – Optical Isomerism – Lactic and Tartaric acid – Geometrical Isomerism – Maleic and Fumaric Acid.

UNIT – III: CHEMICAL KINETICS AND PHOTOCHEMISTRY **HOURS: 9**

Chemical Kinetics – Rate of a reaction – Order and Molecularity – Definition & Differences – First Order rate equation – Derivation – Half life period – Catalysis – Catalyst – Autocatalyst – Enzyme Catalyst – Promoters – Catalytic poisons – Homogeneous and Heterogenous Catalysis – Differences – Industrial application of Catalysis.

Photochemistry – Grotthus – Draper law – Stark Einstein's law – Quantum yield – Photosynthesis.

UNIT-IV: FUELS **HOURS:9**

Fuels – Classification of Fuels – Calorific Value of Fuels - Water gas, Semi water gas, Carburetted Water gas and Producer gas – Composition and Uses

Non-Conventional Fuels-Need Of Solar Energy-Bio Fuels-Oil gas,Natural gas and LPG-Uses

UNIT – V: NUCLEAR CHEMISTRY **HOURS: 9**

Nuclear Chemistry-Introduction-Fundamental Particle of Nucleus-Isotopes, Isobars, Isotones and Isomers-Definition and Examples-Nuclear Binding Energy, Mass Defect and N/P ratio-Nuclear Fission and Nuclear Fusion(Elementary Idea)-Applications of Radioisotopes in Medicine, Agriculture and Industries-Carbon dating.

Metallic bond-Band theory-Conductors, Insulators and Semiconductors - types.

COURSE OUTCOMES

1) Acquire thorough Knowledge about Metallurgy and Fundamental concepts in Organic chemistry.
2) Acquire an idea about Chemical Kinetics.
3) Identify the Importance of Nuclear chemistry and Metallic Bond.
4) Acquire Knowledge on Photochemistry
5) Extensive Knowledge about Fuels.

TEXTBOOKS: (IN API STYLE)

1) P.L. Soni, 2014, Text Book of Inorganic Chemistry, Sultan Chand & Sons, 29th edition, New Delhi.
6) P.L.Soni, H.M.Chawla, 2014, Text book Of Organic Chemistry,Sultan Chand & Sons, New Delhi.
7) Arun Bahl, B.S.Bahl, 2019, A Text Book Of Organic chemistry, Sultan &Sons, 22nd Edition, New Delhi.
8) M.K. Jain, S.C.Sharma, 2012, Modern Organic Chemistry, Vishal Publishing Company, 4th Edition, New Delhi.

Supplementary Readings

1) B.R. Puri, L.R.Sharma, K.C.Kailia, 2016, Principles of Inorganic Chemistry, Vishal Publishing Company, 33rd Edition, New Delhi.
9) Samuel Glasstone, David Lewis, 1963, Elements Of Physical chemistry, Palgrave Macmillan, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	3
CO2	2	3	3	3	3
CO3	3	2	3	3	2
CO4	3	3	2	2	3
CO5	3	3	3	3	2

(1-Low, 2-Moderate, 3-High)

SEMESTER: III PART:III Internal elective – II (1)	22UPHYE37-1: MOBILE CELLULAR TECHNOLOGY	CREDIT: 3 HOURS: 24/W

COURSE OBJECTIVES

1. To learn the background information about cellular system.
2. To study the various mobile standards.
3. To teach the chip level information of mobile phones.
4. To expose the idea about trouble shooting of problems in mobile phones.
5. To acquire the knowledge about mobile service tools.

UNIT- I: THE CELLULAR SYSTEM **9 Hours**

Background - The cellular concept - interference Vs capacity - cell splitting - sectorisation - The cellular system - mobile location, in call handover and power control in cell planning - TACS standard - The cellular network - Base stations, - MSC - services.

UNIT - II: MOBILE STANDARDS **9 Hours**

Smart Phones (Android, IOS, Windows) APPs - Mobile Software (PC suite) - WPAN standards - IrDA, Bluetooth, 1G, 2G standards, 2.5G applications. 3G devices and applications. Network Protocols

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UNIT- III: CHIP LEVEL STUDY **9 Hours**

Block Diagrams -Schematic Diagrams - Chip Level Information of Mobile - Phones - BGA -SMD Reworking Station - Soldering lead -Soldering paste -De-Soldering wire - Identification of IC's - Assembling & Disassembling of Smart Phones.

UNIT- IV: TROUBLE SHOOTING **9 Hours**

Causes for various problems & Troubleshooting of Problems in a Smartphone - Network Problems - Display Problems -Touch Problems - Sim Card Problems - Charging problems - Battery Problems - Software Problems -IMEI information - Problems related to mobile phone handsets - replacement of Various components ICS.

UNIT- V: MOBILE SERVICE TOOLS **9 Hours**

Ultrasonic Cleaner – Computer Connectors – SIM Card Reader – Memory Card Reader – Mobile Virus – Virus Prevention – Removing Virus – Health Hazards with Mobiles – SAR.

COURSE OUTCOMES

After completion of the above course material the student would have learnt the following:

1. understand the cellular communication system.
2. know the smart phones and various mobile standards like 1G,2G, etc.
3. chip level information and soldering and de-soldering the various components.
4. the network problems and SIM card problems and to learn the trouble shooting process.

5. know how to use the ultrasonic cleaner, mobile virus and other service tools.

Text Books:

Unit 1 to Unit 5

1. Manahar Lotia, 2017, *Modern Mobile phone Introduction & Servicing*, BPB Publications.

Supplementary Readings:

1. Manahar Lotia, 2017, Modern Mobile Phone Repair using Computer Software & Service Devices , BPB Publications.
2. Manahar Lotia, 2017, Modern Mobile Phone Unlocking & Utility Codes For GSM &CDMA Phones, BPB Publications.
3. Digit Magazine, Mobile Telephony, Jasubhai Digital Media Publications.
4. Raj Pandya, Mobile & Personal Communication Systems & Services, PHI Publications
5. William C. Y. Lee,1995, Mobile Cellular Telecommunications (Analog & Digital Systems), McGraw Hill, New Delhi.
6. Andy Dornan, 2002, The Essential Guide to Wireless Communications &Applications, Prentice Hall, New Delhi,

E-Materials:

1. https://www.slideshare.net/priyahada/cellular-concepts-41556741
2. https://www.youtube.com/watch?v=whYljse4Abc
3. https://electronics.howstuffworks.com/cell-phone7.htm
4. https://www.youtube.com/watch?v=IvWYk3FAVak
5. https://www.youtube.com/watch?v=eRe_nD2t0Hk
6. https://en.wikipedia.org/wiki/Rework_(electronics)
7. https://www.mobiledic.com/android-tips/sim-card-can-not-be-detected.html
8. https://www.youtube.com/watch?v=MZz5zrNnAec (Tamil video)
9. https://www.youtube.com/watch?v=JmDz0HozvVU

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	2	2	3	3
CO3	3	3	3	2	2
CO4	2	3	3	3	3
CO5	2	2	2	2	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: III PART: III Internal Elective – II (2)	22UPHYE37- 2: LASER PHYSICS	CREDIT: 3 HOURS: 24/W

COURSE OBJECTIVES

1. To learn the principle of Laser and its characteristics
2. To explore the different types of Lasers
3. To know the various applications of Laser in Industry
4. To discuss the uses of Laser in Medical field
5. To understand the application of laser in telecommunication

Unit 1: Fundamentals of LASER **9 Hours**

Spontaneous emission – Stimulated absorption and emission – Meta stable state –Population inversion – Pumping – types of pumping- main parts of Laser- principle of Laser- Laser Characteristics- Directionality – Divergence - Intensity – Coherence – Monochromaticity

Unit 2: Production of LASER **9 Hours**

Classification of lasers – Solid State Lasers – Ruby Lasers - Nd : YAG laser – Gas lasers– Helium – Neon laser – CO2 laser – Semiconductor lasers – Diode laser

Unit 3: Industrial Applications of LASER **9 Hours**

Laser cutting – Welding – Drilling – Hologram – Recording and reconstruction of hologram -Laser in material processing – Laser in electronic industry – Laser in nuclear energy-LIDAR

Unit 4: Lasers in Medicine **9 Hours**

Lasers in Surgery – Lasers in ophthalmology – Lasers in cancer treatment - Laser in dentistry-Laser angioplasty - Endoscopy

Unit 5: Lasers in Communication **9 Hours**

Optic fibre communication – Total internal reflection – single mode fibres- fibre attenuation- optical window- band width - Block diagram of fibre optic communication system –Wavelength Division Multiplexing - Advantages of fibre optic communication.

COURSE OUTCOMES

After finishing the Course, the student should be able to

1. explain the principle of Laser and its characteristics
2. explore the different types of Lasers
3. illustrate the various applications of Laser in Industry
4. discuss the uses of Laser in Medical field
5. understand the application of laser in telecommunication

Text Books:

1. Avadhanulu, N. 2001, *An introduction to LASERS*, S. Chand & Company.

Supplementary Readings:

1. William T. Silfvast, 1998, *Laser fundamentals*, University Press, Published in South Asia by Foundation books, New Delhi,
2. ThyagarajanK. and Ghatak,A.K. 1984, *LASER Theory and Application*, Mc Millan, India Ltd.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	2	3
CO3	3	3	2	2	2
CO4	2	2	3	3	2
CO5	3	3	2	2	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: III PART: III Internal Elective-II (3)	22UPHYE37-3: WEATHER FORECASTING	CREDITS: 3 HOURS: 24/W

COURSE OBJECTIVES

1. To learn about the elementary idea of atmosphere, atmospheric pressure etc.
2. To study how to measure wind speed, direction, rainfall etc.
3. To teach the different weather systems and hurricanes
4. To explain the climate and environmental issues related to climate
5. To give and idea about weather forecasting

UNIT I : INTRODUCTION TO ATMOSPHERE 9 Hours

Elementary idea of atmosphere - physical structure and composition - compositional layers 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.

UNIT II: MEASURING THE WEATHER 9 Hours

Wind - forces acting to produce wind - wind speed direction - units - measuring wind speed and direction - humidity - clouds and rainfall - radiation - absorption - emission and scattering in atmosphere - radiation laws.

UNIT III: WEATHER SYSTEMS 9 Hours

Global wind systems - air masses and fronts - classifications - jet streams - local thunderstorms - tropical cyclones - classification - -naming tropical cyclones tornadoes - hurricanes

UNIT IV - CLIMATE AND CLIMATE CHANGE 9 Hours

Climate - its classification - causes of climate change - global warming and its outcomes - air pollution - aerosols - ozone depletion - acid rain - environmental issues related to climate.

UNIT- V - BASICS OF WEATHER FORECASTING 9 Hours

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.

COURSE OUTCOMES

After finishing this course, the students are imparted with the idea of -

1. the atmosphere and its physical structure and also the variation of pressure and temperature with height.
2. the measurement of wind speed, direction, humidity, rainfall and the radiation laws.
3. the global wind systems, thunderstorms and cyclones.
4. the classification of climate, ozone depletion, acid rain and environmental hazards due to climate change.

5. the analysis and historical background of weather forecasting, predictability, probability of forecasts.

Text Books:

Unit 1 to Unit 5

1. Chandrasekar, *Basics of AtmosphericScience*, PHI Learning Pvt Ltd, New Delhi, 2010.
2. Howard J Critchfield, *General Climatology*, Prentice Hall of India, Pvt Ltd, New Delhi, 1975.

Supplementary Readings:

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

E-Materials:

1. https - //en.wikipedia.org/wiki/Atmosphere
2. https - //www.youtube.com/watch?v=6LkmD6B2ncs
3. https - //www.youtube.com/watch?v=jTWwnUIygc8
4. https - //weatherstationguide.com/measure-wind-speed/
5. https - //en.wikipedia.org/wiki/Thunderstorm
6. https - //en.wikipedia.org/wiki/Cyclone
7. https-//www.toppr.com/guides/science/winds-storms-and-cyclones/thunderstorms-and-cyclones/
8. https - //climatekids.nasa.gov/weather-climate/
9. https - //en.wikipedia.org/wiki/Climate
10. https - //en.wikipedia.org/wiki/Weather_forecasting
11. https - //www.skymetweather.com/15-days-rainfall-forecast-for-india/
12. https - //www.youtube.com/watch?v=Q4-Ufqv6kLo (Tamil video)

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	3	2
CO3	2	2	2	2	2
CO4	3	3	3	3	3
CO5	2	2	2	2	3

CORRELATION LEVELS - 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: III **PART: IV** **Non-Major** **Elective - I**	**22UPHYN38** **ENVIRONMENTAL PHYSICS**	**CREDIT: 2** **HOURS: 2/W**

Course Objectives:

1. To get to know the knowledge about atmosphere, weather and cyclones.
2. To understand the reasons for climate change and global warming.
3. To analyze the need and usage of non-conventional energy resources.
4. To learn the concepts of radiation detection.
5. To realize the importance of radiation safety measures.

Unit- I: Atmospheric Physics **Hours: 6**

Basics of the structure and composition of atmosphere - Layers of atmosphere - Measurement of atmospheric pressure and temperature - Weather patterns - Weather analysis and forecasting - Characteristics of cyclones and anti-cyclones.

Unit- II: Climate Change **Hours: 6**

Climate - Definition and classification - Basic reasons for climate change - Greenhouse effect and gases -Effects of global warming - Ozone depletion - Acid rain.

Unit- III: Energy Resources **Hours: 6**

Need for non-conventional energy resources- Solar water heater - Solar cell -Merits and Demerits of Solar energy - Wind energy conversion systems - Biomass energy - Biogas generation - Industrial applications.

Unit- IV: Radiation Detection **Hours: 6**

Nuclear reactions - nuclear fission and fusion - Interaction between energetic particles and matter - Ionization Chamber - Proportional counter - Geiger Muller Counter - Wilson cloud chamber - Diffusion cloud chamber - Bubble chamber - nuclear emulsions - Scintillation counter - Cerenkov counter.

Unit- V Environmental Pollution **Hours: 6**

Definition Causes, effects and control measures of: Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal Pollution, Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution.

Course Outcomes:

After completing the course, the student would have learnt the following:

1. The layers of atmosphere and can measure some parameters and understand the behaviour of cyclones.
2. the details of climate, greenhouse effect and global warming.
3. the different renewable energy sources and their applications.
4. detect the nuclear radiation with different instruments.
5. save ourselves from nuclear radiation hazards.

Text Books:

1. Frederick Lutgens K, Edward J Tarbuck, Dennis Tasa, *Atmosphere- An Introduction to Meteorology*, Prentice Hall of India.
2. Ghadekar, S.R. 2001, *Meteorology*, Agromet Publishers.
3. Anup Chatterjee, *Global Warming and Climate Change*, Global publications.
4. Khan, B.H. *Non-Conventional Energy Resources*, McGraw Hill Publications.
5. Agarwal, *Renewable and Sustainable Energy Sources*,
6. Murugesan, R. Kiruthiga Sivaprasath, 2007, *Modern Physics*, S. Chand &Co, New Delhi,
7. Ghoshal, S.N. 2006, *Nuclear Physics*, S. Chand & Co, New Delhi,
8. Trivedi R.K. and P.K. Goel, *Introduction to air pollution,* Techno-Science Publications

Supplementary Readings:

1. Joshi, *I*.C. 2014, *Aviation Meteorology*, Himalayan Books.
2. Devanathan, V. 2013, *Nuclear Physics*, Narosa Publishing House, New Delhi.
3. Kothari, D.P. Singal. K. C. & Rakesh Ranjan, 2008, *Renewable Energy Sources and Emerging Technologies*, Prentice Hall of India pvt. Ltd., New Delhi.
4. Martin. A. and Harbisor, S. A. 1981, *An Introduction to Radiation Protection*, John Wiley & Sons.
5. John M. Wallace, Peter Hobbs, V, *Atmospheric Science - An Introductory Survey*, Elsevier Publishers
6. NCRP, ICRP, ICRU, IAEA, AERB publications

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	2	2
CO3	3	2	2	3	2
CO4	2	3	2	2	3
CO5	3	2	3	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: III PART: IV Skill Based Subject – I	22UPHYS39: BASIC ELECTRICAL TECHNOLOGY	CREDIT: 2 HOURS: 2/W

COURSE OBJECTIVES

1. To know the basic principles of electricity.
2. To explore the different kinds of cells and batteries.
3. To state the different theorems for DC circuits and know the function of DC
4. generator/motor.
5. To acquire the basic ideas of alternating voltage and current.
6. To know the principle of transformers and motors.

UNIT- I Basic electricity principles **6 HOURS**

Voltage, Current, Resistance, and Power - Ohm's law - Resistors Series, parallel - combinations - Series - Parallel combinations - Charge - Coulomb's law - Capacitors - Capacitance of capacitor–AC Electricity - Application of fuse - MCB, ELCB - relays - Electrical Safety - Safety Precautions of Electricity - Electric Shock - Preventive measures of Electrical Shock.

UNIT – II Cell and batteries **6 HOURS**

Dry Cell - Voltaic Cell - Daniel cell - Leclanche cell - Secondary Cell and its Classification - Lithium Ion Battery - Disparity between Lead Acid Battery and Lithium Ion Battery - UPS Battery - Solar cell - Principle and design.

UNIT – III DC Circuits **6 HOURS**

Kirchhoff's Current and Voltage Law - Wheatstone's bridge - Source conversion - Superposition theorem - Thevenin's theorem - Joule's law of electric heating - Electric power - D.C generator - Construction and working - D.C motor - Speed of a D.C motor.

UNIT - IV AC Fundamentals **6 HOURS**

Generation of Alternating voltages and alternating currents - Equations of the alternating voltages and currents - Simple waveforms - Cycle - Time Period - Frequency - Amplitude - Different forms of emf equation - Phase - Phase difference - RMS, Average and Peak values - RLC circuit in series - Resonance in RLC circuit - Graphic representation of series resonance - Single phase and three phase connections - Star and delta connection.

UNIT – V Transformers & motors **6 HOURS**

Transformer - Step up and Step down transformers - Construction and working - Losses in a transformer - Efficiency of a transformer - Types of a transformers - AC generator/alternator -Principle and construction - Single phase and three phase induction motors - Principle and construction

COURSE OUTCOMES

After completing the course, the student will be able to

1. know principle of Voltage, Current, Resistance, Ohm's law and Electrical safety.
2. distinguish between cells and batteries and able to explain the different types of batteries.
3. understand the Wheatstone's bridge, Thevenin and Norton's theorem and also to describe the function of DC generator and motor.
4. know the fundamentals of alternating currents and voltages and to differentiate the single phase and three phase connections.
5. acquire the principle and construction of transformers and its types and also able to demonstrate the function of AC generator.

Text Books:

Unit - 1 to Unit - 5

1. Theraja, B.L, (2008), *Fundamentals of Electrical Engineering and Electronics*, S. Chand & Company Ltd., New Delhi.
2. Theraja, B.L, Theraja, A.K, (2007) *A Textbook of Electrical Technology,* Volume I & II, S. Chand & Company Ltd., New Delhi,

Supplementary Readings

1. Mehta V.K. and Rohit Mehta (2009), *Basic Electrical Engineering*, S. Chand & Company Ltd., New Delhi,
2. TN State Board, *Basic Electrical Engineering - Vocational Theory - Plus One Textbook* -TN State Board

E – Materials:

1. https://www.electrical4u.com/
2. https://www.youtube.com/watch?v=WtymNvcBdIU
3. https://www.atlantictraining.com/blog/15-safety-precautions-electricity/
4. https://www.explainthatstuff.com/solarcells.html
5. https://www.youtube.com/watch?v=L_q6LRgKpTw
6. https://www.youtube.com/watch?v=3rOvQ3qFZpI
7. https://en.wikipedia.org/wiki/Wheatstone_bridge
8. https://www.electronics-tutorials.ws/accircuits/series-resonance.html
9. https://www.youtube.com/watch?v=smXF1UeN0EI (Tamil video)
10. https://www.youtube.com/watch?v=hXLA5sdT9Cs
11. http://www.circuitstoday.com/transformer

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
CO2	2	3	3	2	2
CO3	3	2	2	3	3
CO4	2	3	3	2	3
CO5	3	2	2	3	3

CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: IV CORE COURSE - V PART: III	22UPHYC43: ELECTRICITY AND ELECTROMAGNETISM	CREDIT: 3 HOURS: 5/W

COURSE OBJECTIVES:

1. To provide comprehensive knowledge and understanding of electrostatics and applications
2. To acquire adequate knowledge of Kirchhoff's law, magnetic induction and their applications.
3. To get idea about electromagnetic induction, self-inductance and mutual inductance.
4. To understand the growth and decay of current in a circuit containing L, C, and R and their AC behaviour.
5. To get acquainted with the electromagnetic waves and Maxwell's equations and their significance.

UNIT I Electrostatics 12 Hours

Coulomb's Law – Electric field-Electric field due to a point charge - Electric flux - Gauss's Law and its applications: Electric Field due to a uniformly charged sphere, hollow cylinder – Electric Potential – Potential at a point due to a point charge and uniformly charged conducting sphere – Principle of a capacitor– Capacity of a spherical and cylindrical capacitors – Energy stored in a charged capacitor–Loss of energy on sharing of charges between two capacitors – Capacitors in series and parallel

UNIT II Current Electricity and Magnetic effects of current 12 Hours

Kirchhoff's laws- Wheatstone bridge - sensitiveness of the bridge - Carey Foster bridge – theory – determination of temperature coefficient of resistance.

Biot-Savart law-magnetic induction at a point on the axis of a circular coil carrying current – Amperes circuital law - magnetic field inside a long solenoid - Lorentz force on a moving charge - torque on a current loop in a uniform magnetic field -Moving coil Ballistic galvanometer-theory - experiment to find charge sensitivity and absolute capacity of a capacitor - calibration of ammeter and voltmeter (low and high ranges) using a potentiometer.

UNIT III:ElectromagneticInduction 12 Hours

Laws of electromagnetic induction- self- induction– self- inductance of a long solenoid - determination of self inductance by Anderson's and Rayleigh's methods – mutual induction – mutual inductance between two co-axial solenoids – experimental determination of mutual inductance– co-efficient of coupling-energy store dinacoil-eddycurrents - uses - search coil-induction coil and its uses

UNIT IV: DC and AC Circuits **12 Hours**

Growth and decay of current in LC, LR and CR circuits with d.c. source – determination of high resistance by leakage–growth and decay of charge in LCR circuit – conditions for the discharge to be oscillatory– frequency of oscillation.

Inductance in an AC circuit-Capacitance in an AC circuit – AC through an inductance and resistance in series - capacitance and resistance in series – LCR series resonance circuit -sharpness of resonance - parallel resonance circuit -power in an AC circuit - Wattless Current - power factor.

UNITV: Maxwell's Equation &Electromagnetic waves 12 Hours

Introduction - Maxwell's equations - Displacement current- Electromagnetic waves in free space - Hertz experiment for production and detection of EM waves- Wave equations for Electric field and Magnetic field- Poynting vector – monochromatic planewaves – EM waves in a matter – Reflection and Transmission at normal incidence and oblique incidence - Polarization by reflection.

COURSE OUTCOMES

On completion of course students will be able to:

1. explain the basic laws of electrostatics and their applications to capacitor.
2. understood the use of Kirchhoff's law, magnetic induction and their applications.
3. Describe the laws of electromagnetic induction, self-inductance and mutual inductance.
4. Understand the phenomena of the growth and decay of current in a circuit containing L, C, and R and their AC behaviour.
5. get acquainted with the electromagnetic waves and Maxwell's equations and its implications.

Text Books:

1. Brij Lal & Subramanyam M, (2005), *Electricity and Magnetism,* Ratan Prakashan Mandir Publishers
2. Murugeshan R, (2017), *Electricity and Magnetism*, S Chand & Co, New Delhi

Supplementary Readings**:**

1. Vasudeva D.N. *Electricity and Magnetism* (Twelfth revised edition)
2. Tiwari K.K(2007) *Electricity and Magnetism* S.Chand & Co.
3. TayalD.C. *Electricity and Magnetism*, Himalaya Publishing Co.
4. Purcell, E.M. *Electricity and Magnetism* Berkley Physics Course,Vol.2 (Mc Graw-Hill)
5. Halliday D, Resnick R, and WalkerJ, (2011) *Fundamentals of Physics - Electricity and Magnetism*, Wiley India, Pvt Ltd.
6. David J. Griffith (2012), *Introduction to Electro dynamics*, PHI, New Delhi.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	2	2
CO3	2	3	2	3	2
CO4	2	3	2	2	3
CO5	3	2	3	2	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: III & IV CORE PRACTICAL – II PART: III	22UPHYP44: PRACTICAL - II	CREDITS: 4 HOURS: 3/W

CORE OBJECTIVES

This Practical course enables the students

1. To determine elasticity for given material.
2. To calculate wavelength and refractive index.
3. To calibrate the ammeter and calculate the figure of merit.
4. To learn to calculate magnetic Induction and moment.
5. To acquire skill to handle digital devices.

List of Experiments (Any 12 Experiments only)

1. Young's modulus non-uniform bending – Optic lever.
2. Young's modulus uniform bending - Optic lever.
3. Searle's double bar pendulum- Determination of Young's modulus, Rigidity modulus
4. and Poisson's ratio
5. Sonometer - Frequency of AC mains - Steel and Brass wires.
6. Spectrometer – Dispersive power of prism
7. Spectrometer –(i – d) curve - μ of a Prism.
8. Spectrometer -Grating – Determination of N and **λ** - Normal incidence method.
9. Air wedge – Determination of Thickness of a thin wire.
10. Potentiometer - Calibration of Ammeter.
11. Potentiometer – Determination of specific resistance of a wire.
12. Figure of merit – using Table Galvanometer.
13. Deflection magnetometer - Determination of M and B_H - Tan A and Tan B.
14. Deflection magnetometer and Vibration magnetometer - Determination of M and B_H
15. Tan C position.
16. Potentiometer – comparison of emf of two cells
17. BG- Comparison of capacitances of capacitors.
18. Voltage regulator - Bridge Rectifier - Using a Zener diode.
19. Voltage regulator - Bridge Rectifier - Using IC 7805.
20. Transistor Characteristics - Common Emitter mode.
21. Transistor Characteristics - Common Base mode.
22. Logic gates - AND, OR and NOT (using discrete components).
23. Logic Gates – AND, OR, and NOT (using ICs)

COURSE OUTCOMES

On completion of the course students will have the following capabilities:

1. Develop the skill to calculate material properties.
2. Calibrate ammeter and specific resistance of wire.
3. Usage of Ballistic Galvanometer to compare emfs of cells
4. Learn to construct voltage regulator
5. Construct and check the operation of digital logic gates with discrete components and ICs.

Text Books:

1. Ouseph, C.C. Rao, U.J. Vijayendran, V. (2018.) *Practical Physics and Electronics,* S. Viswanathan, Printers & Publishers Private Ltd, Chennai.
2. Srinivasan, M.N. Balasubramanian, S. Ranganathan, R. (2015) *A Textbook of Practical Physics,* Sultan Chand & Sons, New Delhi.

Supplementary Readings:

1. Samir Kumar Ghosh (2000) *A Textbook of Advanced Practical Physics*, NCBA, Kolkata,
2. Chattopadyay, D. Rakshit, P.C. *An Advanced Course in Practical Physics,* NCBA,

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	2	3	2	3	2
CO3	3	2	3	2	2
CO4	3	3	3	2	3
CO5	2	2	3	2	2

CORRELATION LEVEL: 1-LOW, 2-MODERATE, 3-HIGH

SEMESTER: IV PART - III	22UCHEA02: ALLIED CHEMISTRY-II	CREDIT: 3 HOURS: 4/W

COURSE OBJECTIVES

1) Make the students familiar with Coordination Chemistry.
2) To acquire thorough knowledge about Carbohydrates and proteins.
3) Enable the students to acquire knowledge in Electrochemistry.
4) To have an idea about paint and varnishes.
5) To create about knowledge in medicinal chemistry.

UNIT - I **HOURS: 12**

COORDINATION CHEMISTRY

Coordination Chemistry-Introduction-Nomenclature of Coordination Compounds-Ligands, Central Metal Ion, Complex Ion, Coordination Number-Definition and Examples-Werner theory of Coordination Compounds-Biological role of Haemoglobin and Chlorophyll.

Industrial Chemistry- Fertilizers and Manures-Bio fertilizers-Organic Manures and their importance-Role of NPK in Plants-Urea, Potassium Nitrate and Superphosphate of Lime-Preparation and uses.

UNIT – II **HOURS: 12**

CARBOHYDRATES AND AMINOACIDS

Carbohydrates-Classification—Glucose-Preparation and Properties of Glucose-Structure of Glucose (Elucidation Not Necessary)-Starch and Cellulose-Occurrence, Properties and uses.

Amino Acids and Proteins-Classification of Amino Acids-Essential and Non Essential Amino Acids-Preparation of Amino Acid-Gabriel Phthalimide Synthesis – Iso electric Point of Amino Acid-Proteins-Classification of Proteins based on Physical Properties and Biological Functions-Primary and Secondary Structure of Proteins (Elementary treatment only).

UNIT – III **HOURS: 12**

ELECTROCHEMISTRY

Electrochemistry-Specific and Equivalent Conductance-their determination-Variation of Specific and Equivalent Conductance on Dilution-Ostwald's dilution law-Kohlrausch law-Conductivity Measurement-Conductometric Titrations.

pH and Buffer,Importance of pH and Buffers in living systems-Buffer solution and Buffer action-Buffer-Definition-pH determination by Indicator Method.

UNIT – IV

PAINTS AND GLASS **HOURS: 12**

Paint-Component of paint- Requisites of a Good Paint-Varnishes-Definition-Types and Composition-Safety Matches-Introduction-Contents in Match sticks and Match Box-Industrial making of Safety Matches.

Glass-Composition, Manufacture, types and uses.

UNIT- V **HOURS: 12**

DRUG CHEMISTRY

Drugs-Sulpha Drugs-Preparation and Uses of Sulpha pyridine and Sulpha diazine-Mode of action of sulpha Drugs-Antibiotics-Uses of Penicillin, Chloramphenicol and Streptomycin-Drug abuse and their Implication.

Chemotherapy-Definition-Analgesics, Antipyretics, Antiseptics, Tranquilizers and Sedatives-Explanation with two Examples-Anaesthetics-Local and General Anaesthetics.

COURSE OUTCOMES

1) Wide Knowledge about Coordination Chemistry.
6) Identify the importance of Carbohydrates, Amino acids and Proteins.
7) Acquire Knowledge about the action of drugs.
8) Able to understand about Paint and Varnishes.
9) Able to understand the concepts of pH and Buffers in living systems.

TEXTBOOKS

1) R.Gopalan, 2012, Text book Of Inorganic Chemistry, Universities Press, 1st Edition, Hyderabad.
10) P.L.Soni, H.M.Chawla, 2014, Text Book Of Organic Chemistry, Sultan Chand and Sons, 29th Edition, New Delhi.
11) Arun Bahl, BS.Bahl, 2019, A Text Book Of organic Chemistry, Sultan Chand and Sons, 22nd Edition, New Delhi.
12) P.C.Jain, M.Jain, 2019, Engineering Chemistry, Dhanpat Rai& sons, 17th Edition, New Delhi.
13) Jayashree Ghosh, 2015, A Text Book Of Pharmacuetical Chemistry, Sultan Chand and Sons, New Delhi.

Supplementary Readings

1) R.Gopalan, P.S.Subramanian, K.Rengarajan, 1991, Elements of Analytical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi.
2) B.R.Puri, L.R.Sharma, K.C.Kailia, 2016, Principles Of Inorganic Chemistry, Vishal Publications, 33rd Edition, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	3
CO2	2	3	3	3	3
CO3	3	2	3	3	2
CO4	3	3	2	2	3
CO5	3	3	3	3	2

(1-Low, 2-Moderate, 3-High)

SEMESTER: IV PART: III	22UCHEAP01: ALLIED CHEMISTRY PRATICALS	CREDIT:2 HOURS: 3/W

COURSE OBJECTIVES

1) To help the students to develop the skills in Titrimetric Analysis.
2) To learn the basic analytical method.
3) To know about various indicators and their significance.
4) To impart knowledge about primary standard solution.
5) To enhance knowledge about stoichiometric relationship for standardization.

VOLUMETRIC ANALYSIS

1) A. Acidimetry and alkalimetry
2) Strong Acid Vs Strong Base.
3) Weak Acid Vs Strong Base.
4) Strong Acid Vs Weak base.
5) Determination of hardness of Water.
2) B. Permanganometry
6) Estimation of Oxalic acid.
7) Estimation of Ferrous Sulphate.
3) C. Iodometry
8) Estimation of Potassium dichromate.
9) Estimation of Potassium Permanganate.

COURSE OUTCOMES

1) Able to understand the techniques of Titrimetric Analysis.
2) Acquire knowledge in Analytical skills.
3) Analyse the given unknown solution and assess its normality.
4) Evaluate the amount of substance from the normality.
5) Predict the hardness of water samples using EDTA.

TEXTBOOKS

1) V.Venkateswaran, R.Veeraswamy, A.R.Kulandaivelu, 1997, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2nd edition, New Del
2) Anbusrinivasan.P, 2021 Allied Chemistry Practicals – Volumetry and Organic Analysis, Shri Publications, 1st Edition, Chidambaram, Tamil Nadu, India.
3) A.O.Thomas, 1999, Practical Chemistry, Scientific book Centre,7th Edition, Cannanore, Kerala

Supplementary Readings

1) Sundaram, Krishnan, Raghavan, 1999, Practical Chemistry (Part III), S.Viswanathan Co. Pvt Ltd, 2nd Edition, Kannur.
2) B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, 2005, Vogel's Text Book of Practical Chemistry, 5th Edition, Pearson Education, New Delhi.

Outcome Mapping

	PO1	PO2	PO3	PO4	PO5
CO1	2	3	2	3	3
CO2	2	3	3	3	3
CO3	3	2	3	3	2
CO4	3	3	2	2	3
CO5	3	3	3	3	2

(1-Low, 2-Moderate, 3-High)

SEMESTER: IV **PART: IV** **Non-Major Elective-II**	**22UPHYN47** **PHYSICS FOR DAILY LIFE**	**CREDITS: 2** **HOURS: 2/W**

Course Objectives

1. To understand the basics of measurements and mechanics.
2. To learn the principle of Pressure cooker, Refrigerator and Air-conditioner.
3. To know the construction and working of domestic electrical appliances.
4. To study the fundamentals of laser and its applications.
5. To understand the different biomedical instruments.

UNIT- I: MEASUREMENTS & MECHANICS 6 Hours

Fundamental quantities - System of Units - CGS - FPS - MKS and SI - Vernier caliper - Screw gauge and their utility-Newton's law of motion- Lever mechanism – Pulleys - Force -Weight - Work - Energy - Power - Horsepower - Circular Motion - Banking of curved tracks.

UNIT-II: THERMO AND HYDRODYNAMICS 6 Hours

Variation of boiling point with pressure - Pressure cooker - First and Second law of thermodynamics - Refrigerator - Air Conditioner - Principle and construction - Bernoulli Theorem-Applications.

UNIT - III: ELECTRICAL APPLIANCES 6 Hours

Electric iron Box - Electric Fan - Construction and Working of Ceiling and Table fans - Water Heater -Types - Function - Wet Grinder - Mixer Grinder - Principle and Design.

UNIT- IV: LASER 6 Hours

Power of a Lens-Human eye - Defects of vision – Laser - Spontaneous emission - Stimulated emission - Meta stable state - Population inversion -Pumping - Laser Characteristics- Ruby Laser - Applications of Laser-Laser cutting - Welding- Drilling -Lasers in Surgery - Lasers in ophthalmology.

UNIT- V: MEDICAL INSTRUMENTS 6 Hours

Digital thermometer - Digital BP apparatus - One touch Glucometer – thermal scanner - pulse oximeter - pH meter - BMI calculator – Ventilator Principle - description - function and recording of ECG - EMG and EEG - artificial pacemaker.

Course Outcomes:

After completion of the course, the student should be able to understand

1. the basics of measurements and mechanics in daily life
2. the principle of Pressure cooker, Refrigerator and Air conditioner.
3. the construction and working of domestic electrical appliances.
4. the fundamentals of laser and its applications.
5. the different biomedical instruments used in clinics.

Text Books:

Unit 1 & 2

1. Subrahmanyam N and BrijLal, *Principles of Physics*, S. Chand &Co., Ltd, Chennai.
2. Plus one *Physics* Book, TN state Board and NCERT Books.
3. Jayaraman D, Ilangovan K, 2016, *Thermal Physics Statistical Mechanics*, S. Viswanathan, Printers & Publishers Private Ltd, Chennai.
4. BrijLal and N Subrahmanyam, 2016, *Heat and Thermodynamics*, S Chand & Company Pvt Ltd, New Delhi.

Unit 3

1. Bali, S.P. 2005, *Consumer Electronics*, Pearson Education, New Delhi.
2. TN State Board, *Basic Electrical Engineering, Vocational Theory, Plus One Textbook*, TN State Board.

Unit 4

1. Murugeshan, R. 2016, *Optics & Spectroscopy*, S. Chand Co. Ltd, New Delhi.

Unit 5

1. Arumugam M, 2011, *Biomedical Instrumentation*, Anuradha Publications, Kumbakonam.
2. Yuvaraj, V. 2020, *Instrumentation Techniques*, Sri Krishna Publications.

Reference Books

1. Hallidy D. Rensick, R. and Walker, J. 2001, *Fundamentals of Physics*, 6th Edition, Wiley, NY.
2. Brij Lal and N Subrahmanyam, 2016, *Heat and Thermodynamics* , S Chand & Company Pvt Ltd, New Delhi .
3. R. Murugeshan, 2016, *Optics & Spectroscopy*, S. Chand Co. Ltd, New Delhi.

CO – PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	2	2	3
CO3	2	2	2	3	2
CO4	3	3	2	2	3
CO5	3	2	3	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: IV PART: IV SKILL BASED SUBJECT - II	22UPHYS48: ELECTRONICS TECHNOLOGY	CREDIT: 2 HOURS: 3/W

COURSE OBJECTIVES

1. To get acquainted with the specific skills in the testing of components.
2. To illustrate the functions and working of different power supply system and voltage regulation methods.
3. To know the principle and working of different domestic electrical and electronics appliances
4. To understand the various standard sockets, cables and modern communication standards.
5. To get to know the instruments and application in diagnosis, therapeutic treatment and imaging fields

UNIT- I ; Testing of discrete components 6 Hours

Resistors - types - Characteristics - Colour coding - resistors in series and parallel - Capacitors - types - Capacitor in Series and Parallel - Multimeter - Analog and Digital - How to Use a Multimeter - Testing of Voltage - Current Continuity (Testing of Fuse) - Resistance - Diode and Transistor - Design of Bread board - Soldering Technique used in PCBs.

UNIT- II : Power supply 6 Hours

Power Supply Unit - Parts of Power Supply - Regulated power supply - Zener diode voltage regulator - IC Voltage - Regulators - Inverter - Uninterrupted power supply (UPS) - Switched mode power supply (SMPS) - Cathode Ray Oscilloscope (CRO) and measurement of time period and frequency - Function generator.

UNIT- III: Domestic appliances 6 Hours

Electric iron Box - Construction and Working of Ceiling and Table fans - Water Heater - Types - Function - Mixer Grinder - Principle and Design - Microwave Oven - Washing Machine - Function - Types - Semi and Fully Automatic - Top and Front loading - Fuzzy logic washing machine technology – Refrigerator - Air Conditioner - Principle and Design.

UNIT - IV: Mass and media communication 6 Hours

USB - Various Types of USB Cable and Connectors - VGA - AV port - HDMI - DVI - S Video and Display port - Bluetooth - Wi-fi and Li-fi - Direct broadcast satellite (DBS) - DTH - Radar System.

UNIT – V: Bio - Medical instrumentation 6 Hours

Principle, description, function and recording of ECG, EMG and EEG - artificial pace maker - simulators - Heart lung machine –ventilators and nebulizers - Kidney dialysis machine- pH meter - Blood pressure meter – Thermal scanner and pulse oximeter.

COURSE OUTCOMES

After finishing the course, the student would have learnt the following:

1. get acquainted with the specific skills in the testing of components.
2. the functions and working of different power supply system and voltage regulation methods.
3. the principle and working of different domestic electrical and electronics appliances
4. understood the various standard sockets, cables and modern communication standards.
5. The principle of operation of instruments in diagnosis, therapeutic treatment and imaging fields and their applications

Text Books:

Unit - 1

Theraja,B.L. (2007) *A Textbook of Electrical Technology*, S. Chand & Co., New Delhi

Unit - 2

1. AbrahamI, Switching Power Supply Design, Keith Billings, Taylor Morey, McGraw Hill.

Unit-3

1. TN State Board (2021). Basic Electrical Engineering -Vocational Theory-Plus One Textbook,TN State Board.

Unit-4

1. Jeyasri V. Arokiasamy (2009), *Mobile Communications*, Technical Publications
2. John Vivianand Peter Maurin (2008), *The Media of Mass Communication*, Pearson Education Canada

Unit-5

1. Arumugam M (2011), *Biomedical Instrumentation*, Anuradha Publications, Kumbakonam

Supplementary Readings:

1. NagrathI.J. and Kothari D. P, (1997), *Electrical Machines*, Tata McGraw Hill,
2. Singh M. D., Khanchandani (2006) K. B. *Power Electronics*, Tata McGraw Hill.
3. Texas Instruments, *Fundamentals of Power Supply Design:* Technology from the Unitrode
4. Robert A. Mammano, 2017, Power Supply Design Seminars,Texas Instruments.
5. Bali, S.P. 2005, *Consumer Electronics*, Pearson Education, New Delhi.
6. Gulati, R.R. *Modern Television Practice Principles, Technology & Servicing,* New
   a. Age International, 2007.
7. Ibrahim, K. F. 2007,*Newness Guide to Television and Video Technology,* Elsevier.
8. Richard Wise and Routledge,2005, *Multimedia: A Critical Introduction.*
9. Metha, V.K. 2001, *Principles of Electronics,* S Chand & Co., New Delhi.
10. Bagad,V. S. 2009, *Radar System,* Technical Publications.

11. Yuvaraj, V. 2020, *Instrumentation Techniques*, Sri Krishna Publications.
12. Webster, 2007, *Bioinstrumentation,* John Wiley & Sons.

E- Materials

1. https://www.electronicsforu.com/
2. https://learnabout-electronics.org/
3. https://www.scienceabc.com/innovation/usb-type-c-different-usb-type-type-b.html
4. https://www.electronics-tutorials.ws/supplies/power-supplies-for-beginners-part-1.html
5. https://electronicspost.com/basic-electronics-tutorials/
6. https://www.electrical4u.com/
7. https://lecturenotes.in/subject/199/analytical-instrumentation-ai
8. https://blog.beaconstac.com/2016/05/li-fi-vs-wi-fi-vs-ibeacon-ble-technology/
9. https://www.makeuseof.com/tag/video-cables-explained-difference-vga-dvi-hdmi-ports/
10. https://www.ses.com/differences-between-dth-and-dtt
11. https://www.ifixit.com/Guide/How+To+Use+A+Multimeter/25632#s64987
12. http://electrotel.com.ar/handbook-of-analytical-instruments-r-s-khandpur-download-full-version.pdf
13. https://sidneymayireg.files.wordpress.com/2017/04/
14. https://en.wikipedia.org/wiki/Electrocardiography
15. https://www.youtube.com/watch?v=YbBSf8bnYgw
16. https://www.youtube.com/watch?v=1ndqOnjxAU0 (Tamil video)

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
CO2	2	3	3	2	2
CO3	3	2	2	3	3
CO4	2	3	3	2	3
CO5	3	3	2	3	3

CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: V CORE COURSE - VI PART: III	22UPHYC51 ATOMIC AND MOLECULAR PHYSICS	CREDIT:4 HOURS: 4/W

COURSE OBJECTIVES:

1. To study the properties of cathode and positive rays, experiments for specific charge and mass spectrographs
2. To know the structure of the atom and to understand the spectral lines.
3. To understand effects of magnetic field on atomic spectra
4. To acquire the knowledge about photoelectric effect and derive the Einstein's photoelectric equation.
5. To get to know the various energy levels viz., rotational, vibrational etc. And to understand the principle of Infrared spectroscopy, Raman effect and Laser

UNIT I : Cathode and positive rays (12 Hours)

Properties of cathode rays - Mass of an electron - Determination of the electronic charge: Milikan's oil drop method - Dunnington's method for determining e/m - Properties of positive rays - Positive ray analysis - Thomson's parabola method - Aston's Mass spectrograph - Bain Bridge Mass spectrograph

UNIT II : Atomic structure (12 Hours)

Rutherford's Experiments on scattering of α - particle - Theory of α - particle Scattering - Rutherford formula - Bohr Atom Model - Spectral series of hydrogen atom - Bohr Correspondence Principle - Critical potentials - Experimental determination of critical potentials - Drawbacks of Bohr Atom model - Sommerfeld's relativistic atom model - Vector atom model - Quantum numbers associated with the vector atom model - Coupling schemes

UNIT III: Effects of magnetic field on atomic spectra (12 Hours)

Pauli's exclusion principle - Periodic table - Magnetic dipole moment due to orbital motion of the electron - Magnetic dipole moment due to spin - Optical spectra - Fine structure of H_α line - Zeeman effect - Larmor's theorem - Quantum mechanical explanation of Zeeman effect - Anomalous Zeeman effect – Paschen - Back effect - Stark effect.

UNIT IV : Photoelectric effect (12 Hours)

Introduction - Lenard's method to determine e/m - Richardson and Compton experiment - Experimental investigations on the photoelectric effect - Laws of photoelectric emission - Einstein's photoelectric equation - determination of Planck's constant - Photo - emissive cell - Photo - voltaic cell - Photoconductive cell - Applications of photoelectric cells

UNIT V : Molecular physics (12 Hours)

Theory of the origin of pure rotational spectrum of a molecule - Non - Rigid Rotator - energy of diatomic molecule - Vibrating diatomic molecule as a harmonic oscillator - IR spectrometer – Instrumentation - Molecular vibrations of water molecule (H_2O) - Raman effect - Characteristics of Raman lines -

Quantum theory of Raman effect - Raman spectrum of Nitrous oxide (N_2O) - Laser - Characteristics - Stimulated Emission - Population Inversion - Optical Pumping - He - Ne laser - Applications of Laser.

COURSE OUTCOMES

After completing this course, the learner would be capable of:

1. knowing the properties of cathode and positive rays, the experiments for finding the specific charge, and the principle and working of mass spectrograph.
2. understanding the structure of the atom and the spectral lines.
3. analyzing the effects of magnetic field on atomic spectra
4. understanding photoelectric effect and derive the Einstein's photoelectric equation.
5. recognizing various energy levels viz., rotational, vibrational etc. And learned the principle of Infrared spectroscopy, Raman effect and Laser

Text Books:

Unit 1 to Unit 4

Murugeshan R.and KiruthigaSivaprasath (2016) ModernPhysics, S. Chand &

CO. Ltd, New Delhi,

Theraja, B.L. (2016), Modern Physics, S. Chand & CO Ltd, New Delhi,

Unit 4 and Unit 5

Murugeshan R. and KiruthigaSivaprasath, (2016) Modern Physics, S. Chand & CO. Ltd, New Delhi,Murugeshan, R. (2016) Optics & Spectroscopy, S. Chand & Co. Ltd, New Delhi,

Reference Books

1. Rajam, J.B. 2009, Atomic Physics, S. Chand & Co Ltd., New Delhi.
2. Sehgal, Chopra and Sehgal, Modern physics, Sultan Chand & Sons, New Delhi.
3. Ghoshal, S. N. 2004, Atomic Physics, S. Chand & Co Ltd., New Delhi.
4. Arora, C.L. 1992, Modern Physics and Electronics, S. Chand & Co Ltd., New Delhi.
5. Banwell, C.N. 2017, Fundamentals of Molecular Spectroscopy, McGraw Hill Education Fourth edition.
6. Aruldhas, G. 2005, Molecular structure and Spectroscopy, Prentice Hall of India,NewDelhi.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	3
CO2	3	3	2	2	2
CO3	2	2	3	3	2
CO4	3	2	2	3	3
CO5	3	2	3	2	3

CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: V CORE COURSE - VII PART: III	22UPHYC52 RELATIVITY AND QUANTUM MECHANICS	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

This course enables the students:

1. To Understand the fundamentals of relativity and general theory of relativity.
2. To acquire knowledge about concepts of matter waves, phase and group velocity
3. To understand the Heisenberg's uncertainty principle
4. To derive Schrodinger time independent, dependent wave equation and application to various cases.
5. To interpret the concepts of operators and angular momentum in quantum mechanics.

UNIT I : Relativity **Hours: 11**

Frame of references – Galilean transformations – The Michelson-Morley Experiment – Special Theory of relativity - Lorentz Transformation equations - Length contraction – Time dilation – Twin paradox – Addition of velocities- relativity of simultaneity – Variation of mass with velocity – Mass-Energy equivalence – Introduction to general theory of relativity (Qualitative only)

UNIT II : Wave Mechanics **Hours: 11**

Inadequacies of classical mechanics – Dual nature of waves – Matter waves – de Broglie wavelength – Expression for de Broglie wave length – Phase velocity and group velocity – Relation between phase and group velocity – Davisson and Germer's experiment – G.P. Thomson's experiment.

UNIT III: Schrodinger Equations **Hours:12**

Physical Significance of wavefunction – Properties of wave function – Normalised wave function – Schrodinger time independent wave equation – time dependent wave equation – Eigen values and Eigen functions – Expectation values - Heisenberg's Uncertainty Principle – Illustration using Gama ray microscope – Diffraction of a beam of electrons

Unit IV: Solutions of Schrodinger wave equation **Hours: 14**

Free particle – Particle in a box – Potential well finite depth (one dimension only) - Linear Harmonic oscillator – Energy levels - Rigid rotator – Hydrogen atom (separation of variables)

Unit V: Operators and Angular momentum in quantum mechanics **Hours: 12**

Postulates of quantum mechanics - Operators – Hermitian operator – Properties of Hermitian operator – orbital angular momentum and total angular momentum operators and their commutation relations only – Ladder operators– Spin angular momentum – Auxiliary operators – Pauli's spin matrices.

COURSE OUTCOMES

On completion of the course the students would have:

1. obtained knowledge in concepts of special and general theory of relativity
2. obtained idea about dual nature of matter
3. ability to derive Schrodinger wave equation and understood Heisenberg's uncertainty principle.
4. Understood the application of Schrodinger's wave equations.
5. get expose to operators and their commutation relations.

Text books

1. MurugeshanR. and KiruthigaSivaprasath(2008),*Modern Physics*, S. Chand &Co.
2. Brijlal Subramanyam,(1990), *Mechanics and Relativity*S.Chand& Co., New Delhi.
3. Gupta, Kumar and sharma*Quantum Mechanics*, JaiPrakash Nath Publications.
4. Sathyaprakash, *Quantum Mechanics*, Pragati Prakashan, Meerut.
5. Thankappan, V.K.(2003), *Quantum Mechanics*, New Age International (P) Ltd.PublishersNew Delhi.

Supplementary readings:

1. Mathews P.M.and VenkatesanS. (2005),*A Textbook of Quantum mechanics*, Tata McGraw Hill, New Delhi.
2. Chopra K.Kand AgrawalG.C. (1998), *Quantum mechanics*, Krishna Prakasam Media(P) Ltd., Meerut First Edition.
3. Beiser A. (2002), *Concepts of Modern Physics*, Tata McGraw Hill, 6thedition, NewDelhi.
4. Mani H. S. and Mehtha G. K. (1998), *Introduction to Modern Physics*, Affiliated East-West Press.
5. AjoyGhatak and Loganathan *Quantum mechanics,* Macmillan India Pvt. Ltd.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	3
CO2	3	3	2	2	2
CO3	2	2	3	3	2
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CO5	2	2	2	2	3

CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: V CORE COURSE – VIII PART: III	22UPHYC53: ANALOG ELECTRONICS	CREDIT: 4 HOURS : 60/W

Course Objectives:

1) To understand the fundamental principles of semiconductors, p-n junction and special diodes
2) To acquire knowledge on transistor, its Characteristics and transistor amplifier
3) To understand the feedback principle, oscillators, and multivibrators
4) To understand the operation and significance of some special semiconductor devices
5) To acquire knowledge on Operational Amplifier and its applications

Unit I: Semiconductor diodes: Hours: 12

PN junction theory - V-I characteristics of a PN junction diode - Half wave rectifier - Full wave rectifier -Bridge rectifier - Efficiency - filters - capacitor filter- choke input filter- pi filter - Zener diode - equivalent circuit - voltage regulator - LED - V-I characteristics – advantages - applications - photo diode - characteristics - applications.

Unit II: Transistor Amplifier Hours: 12

Transistor - Modes of operations -Characteristics of CB & CE - Two port representation of a transistor - h parameter - AC equivalent circuit using h parameters - analysis of amplifiers using h parameters (CE only) - RC coupled amplifier - transformer coupled amplifier - power amplifier - classification of amplifiers - Class A, Class B and Class C - Push pull amplifier – Emitter follower.

Unit III: Oscillators and Multivibrators Hours: 12

Feedback principle - negative feedback effect and Barkhaussen criterion - Phase shift and Wien Bridge oscillators using transistors – Expression for frequency- Multivibrators- Astable, Monostable and Bistable multivibrators using transistors.

Unit IV: Special Semiconductor Devices Hours: 12

Clipping and clamping circuits - Differentiating circuit - Integrating circuit - Working and Characteristics of FET, MOSFET- MOS Capacitor - UJT - UJT relaxation oscillator - SCR - SCR as a switch and rectifiers (half wave and full wave)

Unit V: Operational Amplifier Hours: 12

Operational Amplifier- characteristics - parameters - Inverting amplifier – non-inverting amplifier - Voltage follower - Adder - Subtractor - Integrator – Differentiator- log and antilog amplifier - comparator - square wave generator - Schmitt trigger.

COURSE OUTCOMES

On completion of the course the students will be able to:

1. work with semiconductors, p-n junction and special diodes
2. know the transistor, its Characteristics and transistor amplifier
3. apply feedback principle, understand oscillators and multivibrators
4. understand the operation and importance of some special semiconductor devices
5. acquire idea on Operational Amplifier IC and its applications

Books for Study:

1. Gupta and Kumar (2002), *Handbook of Electronics*, Pragati Prakashan, Meerut.
2. Mehta,V.K. Rohit Mehta (2006), *Principles of Electronics* S. Chand & Co.
3. Bagde M. K. and Singh S.P.(1990), *Elements of Electronics*, S. Chand & Co., New Delhi.
4. SubramanyamA. (1997), *Applied Electronics*, National Publishing Co.
5. Ramakant A. Gayakwad, (1994), *OP - AMPs and Linear Integrated Circuits*, Prentice Hall of India.

Books for Reference:

1. Mittal. G.K. (1993), *Electronic Devices*, G.K. Publishers Pvt. Ltd.,
2. Theraja, B.L. (2008), *Basic Electronics* S. Chand & Co.,
3. Ambrose and Vincent Devaraj, *Solid State Electronics*, Meera Publication.
4. Sedha, R.S. (1990), *Applied Electronics*, S. Chand & Co.
5. MilmanHalkias, *Integrated Electronics*, McGraw Hill

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	3	3	3	3	2
CO3	2	2	2	2	2
CO4	3	3	3	3	3
CO5	2	3	2	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: V CORE COURSE - IX PART: III	22UPHYC54 DIGITAL ELECTRONICS	CREDIT: 4 HOURS: 60/W

COURSE OBJECTIVES:

1. To understand the various number systems and their significance
2. To know the concepts of Boolean Algebra and basic logic gates.
3. To introduce the simplification methods of Boolean expression.
4. To get the idea of Karnaugh map simplification.
5. To acquire knowledge on combinational logic circuits.
6. To know the sequential logic systems, Shift registers and counters
7. To understand the working of DAC and ADCs

Unit I : Number System and Logic Gates **12 Hours**

Binary, Octal, Decimal and Hexadecimal number systems – interconversions - Basic logic gates – Universal gates.–Boolean algebra – Fundamental concepts – Boolean theorems – Duality theorem – De Morgan's theorem

Unit II : Simplification of Logic Expressions **12 Hours**

Introduction to combinational logic – SOP and POS forms of expressions – Minterms and Maxterms – Reducing Boolean expressions using Boolean laws – Karnaugh map, pairs, quads and octets– Karnaugh map simplification (2, 3 and 4 variable).

Unit III : Combinational Logic Circuits (CLC) **12 Hours**

Half adder – Full adder – Half subtractor – Full subtractor – 2's complement adder, Subtractor circuit – BCD adder – Decoder – Encoder – Multiplexer – Demultiplexer.

Unit VI : Sequential Logic Circuits **12 Hours**

R-S flipflop – Clocked R-S-flipflop - level and edge trigger - D-flipflop, T-flipflop, J-K flipflop - Master-slave flipflop - Shift register - Ring counter – Ripple and Synchronous counter –modulus counters - Decade counter.

Unit V : D/A and A/D Converter **12 Hours**

Construction and working of D/A Converter: Binary weighted resistor and R-2R Ladder methods D/A accuracy and resolution - A /D Converter: Counter type ADC - Successive approximation - Dual slope A /D Converter - simultaneous conversion - A/D accuracy and resolution

COURSE OUTCOMES

1. On completion of this course, the student will get acquainted with the following ideas:
2. various number systems and their significance, number conversions and the theorems of Boolean Algebra and basic logic gates.
3. the simplification methods of Boolean expression by algebra and K map
4. knowledge on combinational logic circuits, arithmetic, encoder, decoders etc.,
5. the different varieties of Flipflops, Shift registers and counters.

6. the working principle of DAC and ADCs, various methods and their parametrs

Text Books:

1. Albert Paul Malvino,(1983), *Digital Computer Electronics*, Tata-McGraw Hill,
2. Tokhein, (1994), *Digital Electronics*, Schaum Series,
3. Jain,R.P. (2006), *Modern Digital Electronics*, Tata McGraw Hill.
4. Vijayendran, V. (2005), *Introduction to Integrated Electronics,* S. Viswanathan
5. (Printers and Publishers) Pvt. Ltd., Chennai.

Supplementary Readings:

1. Taub and Schilling, (2004), *Digital Integrated Electronics*, McGraw Hill.
2. Gothmann, (2008), *Digital integrated Electronics*, McGraw Hill.
3. Milman and Halkias, *Integrated Electronics,* International Edition, McGraw Hill
4. Floyd, *Digital Fundamentals,* Pearson Education, 8th edition
5. Thomas L. Floyd,(1998), *Digital Fundamentals*Universal Book Stall, New Delhi.
6. Nagrath, I.J. (1999), *Electronics - Analog and Digital*, Prentice Hall of India,NewDelhi

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	3
CO2	2	3	3	3	2
CO3	3	2	3	3	2
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CO5	3	2	3	2	3

CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: V PART: III	22UPHYE58 - 1 Internal Elective - III (1) MATERIALS SCIENCE	CREDIT: 3 HOURS: 3/W

COURSE OBJECTIVES

1. To know the classification of engineering materials and properties.
2. To discuss the mechanical and thermal behaviour of materials.
3. To acquire the knowledge on polymers, ceramics and nanomaterial.
4. To study the basics of smart materials.
5. To learn the idea of energy storage materials.

UNIT - I: ENGINEERING MATERIALS AND CHEMICAL BONDING (9 HRS)

Classification of engineering materials - levels of structure - structure - property relationship in materials - stability and metastability - bond energy - bond type and bond length - ionic and covalent bonding - Metallic bonding - secondary bonding - lattice energy - Born Haber cycle - cohesive energy - variation in bonding character and properties.

UNIT - II: MECHANICAL AND THERMAL BEHAVIOUR OF MATERIALS (9 HRS)

Elastic behaviour - atomic model of elastic behaviour - young's modulus - Poisson's ratio - shear modulus - bulk modulus - composite materials - the modulus as a parameter of design - rubber like elasticity - plastic deformation - tensile - yield strength - toughness - elongation - hardness - impact strength - stress - strain curve - Heat capacity, thermal conductivity, thermal expansion of materials.

UNIT - III: POLYMERS, CERAMICS AND NANOMATERIAL (9 HRS)

Polymers - Polymerization mechanism - Polymer structures - Deformation of polymers - Behaviour of polymers - Ceramics - Ceramic phases - Structure - classes - Effect of structure on the behaviour of ceramic phases - composites - Nanomaterial - Need and origin of nano - Introductory ideas of 1D, 2D and 3D nanostructured material - Synthesis of oxide nanoparticles by sol - gel method - fullerenes - Carbon nanotubes - Fabrication and structure of carbon nanotubes

UNIT - IV: SMART MATERIALS (9 HRS)

Definition of smart materials - Types - Piezoelectric materials - Materials for MEMS and NEMS - Ferro fluid - Magnetic shape memory alloys (MSMAs) - Shape memory alloy (SMA) - One Way and Two way memory effect - Dielectric elastomers (DEs).

UNIT - V: ENERGY STORAGE MATERIALS (9 HRS)

Solar cells: Organic solar cells - Polymer composites for solar cells - Polymer membranes for fuel cells - Acid/ alkaline fuel cells - design of fuel cells - Carbon Nanotubes for energy storage - Hydrogen Storage in Carbon Nanotubes.

COURSE OUTCOMES

After completing this course, the student would be able to understand the

1. origin engineering materials and its classification, bonding character and its properties
2. mechanical properties like elastic behavior and thermal properties like heat capacity, thermal conductivity etc.
3. basics of polymers, ceramics and nanomaterial.
4. definition and types of smart materials.
5. energy storage materials.

Text Books

1. Raghavan V, (2012), *Materials science and engineering - A First Course*, 5th Ed, Prentice Hall India, New Delhi,
2. ArumugamM (1990), *Materials Science*, Anuradha Agencies,

Supplementary Readings:

1. Rajendran V, (2001), *Material Science*, Tata McGraw Hill Ltd, New Delhi,
2. Avadhanulu,M.N (2014), *Material science*, S. Chand & Company, New Delhi,
3. Narula G.K, Narula, K.S. Gupta V.K. (1994), *Materials Science*, Tata McGraw Hill Publishing, New Delhi,
4. Gandhi, M V and Thompson B S, (1992), *Smart Materials and Structures*, Chapman & Hall.

E – Materials:

1. https://www.learnpick.in/prime/documents/ppts/details/729/classification - of - engineering - materials - part - 1
2. https://www.youtube.com/watch?v=5hJhRFCUilo
3. https://www.youtube.com/watch?v=iegJ76DS3lc
4. https://nptel.ac.in/content/storage2/courses/112108150/pdf/Web_Pages/WEBP_M15.pdf
5. https://plastics.americanchemistry.com/plastics/The - Basics/
6. https://study.com/academy/lesson/what - are - polymers - properties - applications - examples.html
7. https://internetofthingsagenda.techtarget.com/definition/micro - electromechanical - systems - MEMS
8. https://en.wikipedia.org/wiki/Microelectromechanical_systems
9. https://www.iitk.ac.in/reach/2008/Energy/REACH2008 - SolarCells - SundarIyer.pdf
10. https://www.youtube.com/watch?v=zMLrhgSAPHc
11. https://www.youtube.com/watch?v=4Homfj_ne0Q (Tamil video)

OUTCOME MAPPING

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CO1	3	3	3	3	3
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CO5	2	3	2	2	3

Correlation Levels: 1 - Low, 2 - Moderate, 3 - High

SEMESTER: V PART: III	22UPHYE58 - 2 Internal Elective – III - (2) MATHEMATICAL METHODS	CREDIT: 4 HOURS: 3/W

COURSE OBJECTIVES

1. To acquire knowledge about the concept of errors and roots of equations.
2. To familiarize with the concept of matrix and linear equations.
3. To have some basic idea about interpolation.
4. To know the numerical differentiation and integration.
5. To acquire idea about differential equations.

UNIT I: Errors and Root of Equations (12 hrs.)

Numeric Analysis - numbers and their accuracy - errors - measurement of errors - round off error - truncation error - absolute error - relative error - percentage error - inherent error - accumulated error - general error formulae - convergence - Roots of equations - Iteration method - Maclaurin's series method - Newton-Raphson method - Von-Moises formula - Bisection method.

UNIT II: Matrix and Linear Equations (9 hrs.)

Introduction - pivotal condensation method - system of linear equations - Gauss Elimination method - Gauss Seidel Iteration method - Gauss Jordan elimination method - Matrix Inversion method.

UNIT III: Interpolation and Approximation (8 hrs.)

Linear Interpolation –Quadratic Interpolation - Lagrange's Interpolation – Richardson's Extrapolation –Aitken's iterated Interpolation

UNIT IV: Numerical Differentiation and Integration (8 hrs.)

Numerical differentiation - approximation of derivatives using interpolation polynomials - Taylor series method - Numerical Integration - trapezoidal rule - Simpson's 1/3 and 3/8 rules

UNIT V: Differential Equations (8 hrs.)

Introduction - Euler's method (Adams Bash forth first order method) - backward Euler method - Taylor' s series method - Runge - Kutta method - predictor corrector methods

COURSE OUTCOMES

1. Students can explain the concept of errors.
2. Summarize the concept of matrix and linear equations.
3. Explain the concept of interpolation.
4. Able to explain the concept of numerical differentiation and integration.
5. Analyze the importance of differentials equations.

Text Books:

1. Sastry S.S.(2000), *Introductory methods of numerical analysis*, Prentice Hall of India, New Delhi

2. Singaravelu,A. (2001), *Numerical methods,* Meenakshi Agency, Chennai

3. Venkataraman, M.K. (1997) *Numerical method in Science and Engineering*, PHI, New Delhi

Supplementary Readings:

1. R. Murugesan, (1999), *Mechanics and Mathematical methods,* S. Chand & Co, New Delhi
2. P. Kandasamy, K. Thilagavathy and K. Gunavathy, (2002), *Numerical methods,* S. Chand & Co.

OUTCOME MAPPING

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CO1	3	3	3	3	3
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CO3	2	3	3	2	2
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CO5	2	2	2	2	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: V PART: III	22UPHYE58-3 Internal Elective – III – (3) MEDICAL PHYSICS	CREDITS: 3 HOURS: 3/W

COURSE OBJECTIVES

This course enables the students

1. To impart basic knowledge about transducers.
2. To develop understanding of basic medical devices.
3. To have a better understanding of X-rays in medicine.
4. To learn to apply medical physics concepts in Imaging.
5. To acquire ideas of nuclear medicine and recent medical devices.

UNIT I : Transducers **Hours: 7**

Transducers – Classification of Transducers – Active Transducer – Magnetic Induction type – Piezo-Electric type – Photovoltaic type – Thermoelectric type – Passive Transducer – Resistive Transducer– Effect and sensitivity of the bridge – Capacitive transducer – Linear variable differential transformer (LVDT).

UNIT II : Medical Instrumentation **Hours : 10**

Pressure system of the body – Blood pressure measuring device-sphygmomanometer – Digital Blood pressure measuring system - Photoplethysmography - Temperature measuring sensor – CCD device - Electro Cardiograph (ECG) – Block Diagram- ECG leads – Unipolar and Bipolar leads – ECG recording set up – Ventilator and its mode (block diagrams only)

UNIT III: X-Ray in Medicine **Hours: 9**

X-Rays – Production of X-rays – Coolidge Tube – X-ray generator – Radiation units – Exposure - Absorbed dose - Units : Rad, Gray and Relative biological effectiveness - effective dose- Rem-Sievert Radiation detectors – Dosimeters – Pocket dosimeters.

UNIT – VI Medical Imaging **Hours: 10**

Ultrasound – Physics of Doppler effect with applications- Modes – A and B-TM Scans – X-ray diagnostics and imaging -Computed Tomography – CT scan. Principle – Function – Display – Detectors – Physics of nuclear magnetic resonance – NMR – MRI- Imaging.

UNIT – V Nuclear Medicine **Hours: 9**

Diagnostic Nuclear medicine – Therapeutic Nuclear medicine – Interaction between radiation and Matter – Thyroid uptake system and gamma camera – Principle, function and Display – Radioisotope Imaging equipment – Single Photon and Positron Emission Tomography- PET – Scan.

COURSE OUTCOMES

On completion of the course students

1. Develop basic understanding of concepts of medical devices.
2. Obtain knowledge of working of basic medical instruments.
3. Know about radiation and radiation measuring devices.
4. Learn the Key factors of Medical Imaging Systems
5. Acquire knowledge nuclear medical instruments and recent sophisticated instrument PET.

Text books:

1. Lesile Cromwell (1980) Biomedical instrumentation and Measurement, Prentice Hall,.
2. KhandhpurR S (2014) Hand book of Biomedical Instrumentation, 3rd Edition..
3. Arumugam M (2013) Biomedical Instrumentation, Anuradha Publisher,

Supplementary Reading:

1. John G Webster(2009) *Biomedical Instrumentation*, John Wiley Publications, 4th Edition.
2. Thayalan K, *Basic Radiological Physics*, Jayapee brothers Medical Publishing PVT

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
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CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: V PART: III Skill Based Subject - III	22UPHYS59: ASTROPHYSICS	CREDIT: 2 HOURS: 3/W

COURSE OBJECTIVES

1. To understand the basics of astronomy.
2. To know about the telescope and its types.
3. To learn about the physical properties of planets.
4. To understand the star formation.
5. To understand the galaxy and its types.

Unit 1: Basic of Astronomy **Hours: 6**

Birth of Modern Astronomy – Geocentric and Heliocentric theories –– Kepler's laws of planetary motion – Newtonian gravitation – Celestial sphere – Planets – Terrestrial and Jovian planets (Planets individual description is not required in detail) – Asteroids - Meteorites – Comets.

Unit 2: Telescope **Hours: 6**

Introduction – Elements of telescope – Properties of images – Types of Optical telescopes – Refracting and Reflecting telescopes- Radio telescope – Spectrograph – Limitations – Photographic photometry – Photoelectric photometry – Spectrophotometry – Detectors and image processing.

Unit 3: Planets **Hours: 6**

Sun – Physical properties – Composition – Core – Nuclear Reactions – Photosphere – Chromosphere – Corona – Sunspots – Sunspot cycle – Solar Wind – Auroras – space weather effects – History of the Earth – Temperature of a planet – The atmosphere – Pressure and Temperature distribution – Magnetosphere – Eclipses – Solar and Lunar Eclipses.

Unit 4: Stars **Hours: 6**

Classification of Stars – The Harvard Classification system – Luminosity of a Star – Hertzsprung-Russel Diagram – Stellar evolution using the HR diagram – Theoretical evolution of stars – White Dwarfs – Neutron Stars - Black holes – Event horizon – Basic physics of Black Holes.

Unit 5: Galaxy **Hours: 6**

Galaxy nomenclature – Types of Galaxies – Spiral – Elliptical – irregular galaxies – Milky Way Galaxy and its structure – Rotation and Mass Distribution – Rotation curve and Doppler shift – Star clusters – Galactic clusters – Pulsars – Cosmological Models – Big bang theory – Steady state theory – Hubble's law – Olber's paradox.

COURSE OUTCOMES

On completion of the course, the student would have learnt the concepts listed below**:**

1. Gain knowledge about planets and comets.
2. Understand about the spectrophotometry and imaging process of telescope.
3. Knowledge of nuclear reaction of sun and eclipses.
4. Gain knowledge about classifications of star and its evolution.
5. Knowledge of Milky way structure and Big bang theory.

Text Books:

1. Niclolas. A. Pananides and Thomas Arny, (1979), *Introductory Astronomy,* Addison Wesley Publ. Co.
2. Mujiber Rahman,A. *Concepts to Astrophysics,* SciTech Publications, Chennai.
3. BaidyanathBasu, Tanuka Chattopadhyay, Sudhindra Nath Biswas (2013)*An Introduction to Astrophysics* 11th editionPHI Learning Private Limited

Supplementary Readings:

1. Abell, Morrison and Wolf, 1987, *Exploration of the Universe,* 5th ed., Saunders College Publ.
2. Carrol and Ostlie, 2007, *Introduction to Modern Astrophysics,* 2nd ed., Pearson International.
3. William J. Kaufmann, III, 1993, *Universe* Freeman & Company, W. H.
4. Abhyankar, K.D. 2001,*Astrophysics: Stars and Galaxies*Universities Press

OUTCOME MAPPING

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CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI CORE COURSE: X PART: III	22UPHYC61 SOLID STATE PHYSICS	CREDIT: 4 HOURS: 4/W

COURSE OBJECTIVES

1. To understand different types of bonding in solids
2. To understand the crystal structures and diffraction phenomenon on them.
3. To understand the magnetic and dielectric properties of crystalline structures.
4. To acquire knowledge on the basics of magnetic phenomena on materials and various types of magnetizations.
5. To know the phenomenon of superconductivity on the materials.

UNIT I: Bonding in Solids (10 hrs.)

Types of bonds in crystals - Ionic, covalent, Metallic, Vander Waal's and Hydrogen Bonding - Bond energy of sodium chloride molecule - variation of inter atomic force with inter atomic spacing - cohesive energy - cohesive energy of ionic solids - application to sodium chloride crystal - evaluation of Madelung constant for sodium chloride.

UNIT II: Crystal Structure and Crystal Diffraction (15 hrs.)

Crystal Lattice - Primitive and unit cell - seven classes of crystal - Bravais Lattice - Miller Indices - Structure of crystals - Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure - Sodium Chloride, Zinc Blende and Diamond Structures.

Crystal Diffraction – Bragg's law - Experimental methods - Laue method, powder method and rotating crystal method - Reciprocal lattice - Intensity and structure factor.

UNIT III: Magnetic Properties (10 hrs.)

Spontaneous Magnetization – Weiss Theory – Temperature dependence of Magnetization - classical Theory of Diamagnetism – Weiss theory of Para magnetism – Ferromagnetic domains – Bloch wall – Basic ideas of anti - ferromagnetism – Ferrimagnetisms – Ferrites in computer Memories.

UNIT IV: Dielectric Properties (10 hrs.)

Band theory of solids –classification of insulators, Semiconductors, conductors – Dielectrics - Polarization – frequency and temperature effects on polarization - dielectric loss - Clausius Mossotti relation - determination of dielectric constants.

UNIT V: Super Conductivity (15 hrs.)

Introduction - General Properties of Superconductors - effect of magnetic field - Meissner effect - effect of current - thermal properties - entropy - specific heat - energy gap - isotope effect - London equations - AC & DC Josephson effects - applications - Type–I and Type–II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory - Application of Superconductors - High TC superconductors.

COURSE OUTCOMES

On completion of the course, the learner would be knowing the points listed below

1. the nature and behaviour of bonding in solids
2. how crystalline materials are studied using diffraction techniques
3. the behavior of solids with their magnetic properties.
4. the concept of dielectric properties in solids
5. the importance of superconducting materials in engineering applications.

Text Books:

1. Pillai,S.O. (2002), *Solid State Physics* New Age International (P) Ltd.
2. Dekker,A. J.(1985), *Solid State Physics,* Macmillan India.
3. Kittel, (2003), *Introduction to Solid State Physics*, Willey Eastern Ltd.
4. Arumugam,M.(2002), *Materials Science*, Anuradha Agencies Publishers.

Supplementary Readings:

1. Gupta,HC*Solid State Physics,* Vikas Publishing House Pvt. Ltd., New Delhi.
2. Singhal,R L(2003)*Solid State Physics*Kedarnath Ramnath& Co., Meerut.
3. Raghavan,V. (2004), *Materials Science and Engineering*, Prentice Hall of India PrivateLimited, New Delhi.

OUTCOME MAPPING

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CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI CORE COURSE – XI PART: III	22UPHYC62 NUCLEAR AND PARTICLE PHYSICS	CREDITS: 4 HOURS: 4/W

COURSE OBJECTIVES

This course enables the students

1. To impart knowledge about nuclear properties and nuclear models
2. To understand the concept of radioactivity.
3. To have a better understanding of matter interacting at nuclear level.
4. To understand the design of detectors and particle accelerators.
5. To acquire ideas about elementary particles.

UNIT I :Properties of Nuclei and Nuclear Models **Hours: 12**

Introduction to nucleus- Constituents of nuclei - Nuclear mass – Nuclear size – Binding energy - Mass defect - Binding energy/mass number curve - significance - Packing fraction - stability of nucleus – Nuclear spin - Nuclear magnetic moment - Nuclear forces – Yukawa potential.

Nuclear models- Liquid drop model - Semi - empirical mass formula - shell model and its features.

UNITII: Radioactivity **Hours:14**

Fundamental laws of radioactivity- half - life - Average life – strength of radioactive sample - successive transformation - α rays - properties - α - decay - Geiger Nuttall law – Gamow's theory of α - decay – β - rays - properties - β - decay – continuous β - spectrum - Inverse β - decay - Neutrino hypothesis – electron capture - γ rays – properties - Nuclear isomers - gamma ray logging – density porosity log – compensated neutron log - their uses in mineral prospecting

UNIT III: Detectors and Particle Accelerators **Hours: 10**

Detectors – Ionization chamber – G. M. counter – Scintillation Counter – Wilson Cloud chamber- Bubble chamber – Linear accelerators – Cyclotron – Betatron - Synchrocyclotron - Synchrotron.

Unit IV: Nuclear Reactions and Nuclear reactors **Hours :14**

Nuclear reactions- Types of nuclear reactions – Q value of nuclear reaction – Cross section of nuclear reactions.

Nuclear Fission- Energy released per nucleon in fission – Nuclear chain reaction – Multiplication factor – Nuclear materials - Nuclear reactor – Types of reactors – Atom bomb - Nuclear reactors in India – Nuclear Fusion – P - P cycle – Thermonuclear reactions - Hydrogen bomb.

Unit – V Elementary Particles **Hours : 10**

Classification of elementary particles- Particles and Antiparticles – Pions and Muons - K - Mesons – Hyperons - Fundamental interactions – Elementary particle quantum numbers – Conservation laws and Symmetry – Quark model.

COURSE OUTCOMES

On completion of the course students would have understood the following:

1. Gain knowledge of Nuclei and nuclear models
2. Obtain ideas about radioactivity and α, β, γ rays
3. Know about various types of detectors and accelerators.
4. the concept of nuclear models and reactors.
5. knowledge about the basic interaction of fundamental particles and quark model.

Text books:

1. Murugeshan and KiruthigaSivaprasath,(2008), *Modern Physics* S. Chand &Co.
2. Sathya Prakash,*Nuclear Physics*, Pragati Prakashan, Meerut.
3. Gupta and Roy (2011), *Physics of the nucleus*, Books and Allied (P) Ltd Kolkata.
4. Schlumberger (1991), *Basic Principles of logging*, Schlumberger Wireline & Testing,Texas

Supplementary readings:

1. Pandya,M.L. and Yadav, 2000,*Elements of Nuclear Physics*, Kedarnath& Ramnath.
2. Tayal,D.C.2009,*Nuclear Physics*, Himalaya Publishing House.
3. Ghoshal S. N.2003,*Nuclear Physics* S. Chand & Co.
4. Devanathan.V.2016, *Nuclear Physics*, Narosa Publications, New Delhi,.

Web Resources:

1. https://www.pdfdrive.com/schlumberger - log - interpretation - principles - applicationspdf - e20509665.html

OUTCOME MAPPING

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CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI CORE COURSE: XII Part: III	22UPHYC63 APPLIED ELECTRONICS	CREDIT:4 HOURS: 4/W

COURSE OBJECTIVES

To make the students understand the following:

1. Timer IC and its working modes, fixed voltage regulators, optoelectronic devices
2. Theory of modulation, AM and FM, side bands, detection methods
3. Types of antennae, principle of TV broadcasting
4. The principle behind light wave communication and systems
5. Various types of electronic communication and RADAR

Uni -I : Special ICs and photo Devices: 12Hours

IC 555 Timer block diagram and working – Astable, monostable configurations- Schmitt Trigger – Voltage controlled Oscillator – IC 7805 fixed regulator – Solar Cell – Laser Diode – Liquid Crystal Display (LCD) principle.

Unit II : Modulation and Demodulation 12Hours

Amplitude modulation - Modulation index, Frequency spectrum, Sidebands, Power in AM wave, Amplitude modulation, generation - Frequency modulation - Modulation index - Generation of FM wave - Reactance modulator - Detection of AM wave - Diode detector (qualitative) - Detection of FM waves - Slope detector

Unit III : Antenna and Television 12Hours

Antenna – Half wave dipole – Antenna parameters – Dipole antenna with reflector and director – Yagi - Uda Antenna - Dish antenna - Monochrome TV systems: Monochrome TV transmitter and receiver (Explanation with block diagram) – Scanning - TV bands and standards - Colour TV principle

Unit IV : Optical Fibre Communications 12Hours

Principle of optical fibres – total internal reflection –Types of Fibres – step index, graded index and single mode fibres – Acceptance angle – numerical aperture – losses in fibres – light sources and detectors for OFC – block diagram of OFC – advantages over electronic communication.

Unit V : Forms of Communication 12Hours

Satellite communication – geosynchronous orbit - Transponders - Microwave communication - Cellular mobile communication (Basic ideas only) - Principles of radar - Basic pulsed radar set -Applications of radar.

COURSE OUTCOMES

After completion of the course, the student would have understood the following:

1. Timer IC and its working modes, fixed voltage regulators, optoelectronic devices
2. Theory of modulation, AM and FM, side bands, detection methods
3. Types of antennae, principle of TV broadcasting
4. The principle behind light wave communication and systems
5. Various types of electronic communication and RADAR

Text Books:

1. Dennis Roddy and John Coolen,1999, *Electronic communication*, 4 th edition, PHI private Ltd.
2. G. Kennedy and Davis,1999, *Electronic communication system,*Tata McGraw Hill.
3. Gerd Keiser,2000, *Optical Fiber Communication*, 3 rd Edition, McGraw Hill, Singapore.

Supplementary Readings:

1. Raj Pandya,2003, *Mobile and Personal Communication Services and Systems*, Prentice Hall of India Private Ltd.
2. Sanjeev Gupta,1995, *Electronic Communication Systems*, Khanna Publications.
3. Deshpande, P.K Rangole, 1998, *Communication Electronics*, Tata McGraw Hill Pvt. Ltd.
4. Gulati, R. R. (2005), *Monochrome and colour television.* New Age International.
5. ArumugamM, 2002, *Optical Fiber Communication and Sensors,*Anuradha Agencies.

Web resources:

1. https://www.elprocus.com/light-emitting-diode-led-working-application/
2. https://www.electronicsforu.com/technology-trends/learn-electronics/lcd-liquid-crystal-display-basics
3. https://www.learnelectronicswithme.com/2020/10/liquid-crystal-displaylcd-construction.html

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	3
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CORRELATION LEVELS: 1-LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI CORE COURSE – XIII PART: III	22UPHYE64 MICROPROCESSOR AND ITS APPLICATIONS - INTEL 8085	CREDIT: 4 HOURS: 4/W

COURSE OBJECTIVES

The student will be gotten to know the following topics:

1. to get to know the microprocessor architecture, functions of pins
2. to get to know instruction set of 8085 microprocessor and practice programming skills
3. to get acquainted with the time delay programs and interfacing of memory devices
4. to know the Interfacing of I/O devices and their methods
5. to become familiar with interfacing of Data converters and to study PPI 8255 and its application

Unit 1: Architecture **Hours: 12**

Architecture of 8085 – registers, flags, ALU, address and data bus, demultiplexing address/data bus – control and status signals – control bus – Pin out diagram – Functions of different pins – Interrupts and its types.

UNIT 2: Programming Techniques **Hours: 12**

Instruction set of 8085 – data transfer, arithmetic, logic, branching and machine control group of instructions – addressing modes – register indirect, direct, immediate and implied addressing modes. Assembly language & machine language – programming techniques: addition, subtraction, multiplication, division, ascending, descending order, largest and smallest (single byte)

UNIT 3: Time Delay Routines and Interfacing of memory **Hours: 12**

Instruction cycle, machine cycle and T States - Counters - Time delay using single register and pair of registers - delay calculations – Memory Interfacing: 2K x 8, 4K x 8 ROM and RAM interface – timing diagram for memory read and memory write cycles.

UNIT 3: Interfacing I/O devices: **Hours: 12**

Peripheral I/O instructions – Interfacing I/O using decoders –Interface of LED output display - memory mapped I/O – LED display of binary data – comparison of peripheral I/O and Memory mapped I/O.

UNIT 5: Interfacing Data Converters and Peripheral Devices **Hours: 12**

Interfacing of 8-bit DAC and successive Approximation ADC - Architecture of PPI 8255A - Control word - BSR mode – I/O mode - mode zero only – Program for Flashing LEDs

COURSE OUTCOMES

On the completion of the course, students will be able to do the following:

1. understood the microprocessorarchitecture, functions of pins
2. learned instruction set of 8085 microprocessor and practice programming skills
3. able to write time delay programs and would do interfacing of memory devices
4. perform and analyse the Interfacing of I/O devices and their methods
5. familiar with interfacing of Data converters and to use PPI 8255 IC

Text Books:

1. Gaonkar, R.S(1992),Microprocessor Architecture programming and application with 8085 / 8080A, Wiley Eastern Ltd.
2. VijayendranV(2003), Fundamental of microprocessor 8085, S. Viswanathan Publishers, Chennai.
3. RamB Fundamentals of Microprocessors and microcomputersDhanpat RAI publication.

Supplementary Readings:

1. Aditya Mathur(1987), *Introduction to microprocessor* Tata McGraw Hill Publishing Company Ltd.
2. Douglas V, Hall(1983) *Microprocessor and digital system*, 2nd Edition - McGraw Hill Company.

OUTCOME MAPPING

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CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER:V&VI CORE PRACTICAL – III PART: III	22UPHYP65 GENERAL EXPERIMENTS	CREDIT: 3 HOURS: 4/W

COURSE OBJECTIVES

To promote scientific temper and to learn physical concepts through these experiments

1. To estimate the elastic and optical properties, constants of materials
2. To determine electrical properties of passive components using ballistic galvanometer
3. To determine magnetic properties of coil using magnetometers
4. To estimate the inductance of a coil using an AC bridge
5. Converting galvanometer for Volt and Current measurements

LIST OF EXPERIMENTS

(Pick 15 Experiments from the List)

1. Young's modulus – Koenig's method - uniform bending.
2. Young's modulus – Koenig's method - non uniform bending.
3. Bifilar Pendulum – Parallel Threads – Verification of Two Theorems.
4. Newton's rings – R_1, R_2 and μ of the material of a convex lens.
5. Spectrometer – (**i-i'**) curve.
6. Spectrometer – Grating – Determination of wavelengths of constitutional colours of the mercury spectrum - minimum deviation method
7. Spectrometer - small angled prism – Angle of deviation – Normal incidence and normal emergence methods – refractive index
8. Spectrometer – Determination of Cauchy's constants.
9. Dispersive power of a grating.
10. M and B_H - Absolute determination using deflection and vibration magnetometer
11. Field along the axis of circular coil – deflection magnetometer – M and B_H
12. Ballistic Galvanometer - Figure of merit
13. Ballistic Galvanometer - Absolute Determination of Mutual Inductance.
14. BG – absolute capacitance of a capacitor.
15. BG – comparison of mutual inductances.
16. Anderson's bridge – Self-inductance of a coil.
17. Potentiometer – e.m.f of a thermocouple.
18. Potentiometer – calibration of high range voltmeter.
19. Potentiometer – Conversion of galvanometer into Voltmeter
20. Potentiometer – Conversion of galvanometer into Ammeter

COURSE OUTCOMES

After completing the above experiments, the leaner would be able to:

1. estimate the elastic and optical properties of materials
2. determine electrical properties of passive components using ballistic galvanometer
3. determine magnetic properties of coil using magnetometers
4. estimate the inductance of a coil using an AC bridge
5. convert galvanometer for Volt and Current measurements

Books for Study:

1. Somasundaram, S. (2012), *Practical Physics,* Apsara publications, Tiruchirappalli.
2. Ouseph, C.C. Rao,U.J. Vijayendran,V. (2018)*Practical Physics and Electronics*, S. Viswanathan, Printers & Publishers Private Ltd, Chennai.
3. Department of Physics, (1998) *Practical Physics, (B.Sc. Physics Main)*, St. Joseph's College, Tiruchirappalli.

Books for Reference:

1. Srinivasan,S. (2005) *A Textbook of Practical physics,* S. Sultan Chand publications.
2. Sasikumar, R. (2011) *Practical Physics,* PHI Learning Pvt. Ltd, New Delhi.

OUTCOME MAPPING

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CORRELATION LEVEL: 1-LOW, 2-MODERATE, 3-HIGH

SEMESTER: V&VI CORE PRACTICAL – IV PART:III	22UPHYP66 ELECTRONICS EXPERIMENTS	CREDIT: 3 HOURS: 4/W

COURSE OBJECTIVES

To provide knowledge and skill in Electronics, Digital and Microprocessor programming.

1. To perform experiments to study the behaviour of resonance, regulator, amplifier, oscillator, op amp application circuits
2. To perform experiment to study the characteristics of electronic devices
3. To study the working of some combinational circuits
4. To understand the operation of few sequential circuits
5. To learn the programming of microprocessor – Intel 8085

LIST OF EXPERIMENTS

(Pick Any 15 Experiments)

1. Series & Parallel Resonance circuits.
2. Regulated power supply using Zener diode - Percentage of regulation.
3. Single stage - RC coupled amplifier
4. Emitter Follower amplifier.
5. Hartley oscillator
6. Colpitts's oscillator
7. FET Characteristics.
8. UJT – Characteristics
9. Op – Amp – Voltage follower, adder, subtractor, averager (inverting mode).
10. Op - Amp - Integrator and Differentiator.
11. Astable multi-vibrator using Transistor/op amp
12. Half Adder and Full adder circuits using logic gates.
13. Half Subtractor and Full Subtractor circuits using logic gates.
14. Verification of De Morgan's Theorems.
15. Universality of NAND and NOR gates.
16. RS, Clocked RS, and D Flip Flops
17. Four-bit ripple counter – IC 7473 / 7476.
18. Shift Register – Four bit right – IC 7473 / 7476.
19. Microprocessor – 8-bit addition and Subtraction
20. Microprocessor - 8-bit multiplication and 8-bit division.
21. Microprocessor – Sum of N elements
22. Microprocessor – smallest and largest of given set of numbers
23. Microprocessor – Sorting a given list into ascending / descending order

COURSE OUTCOMES

After finishing the course, the learner would be capable of:

1. performing experiments to study the behaviour of resonance, regulator, amplifier, oscillator, op amp application circuits
2. performing experiment to study the characteristics of electronic devices
3. studying the working of some combinational circuits
4. understanding the operation of few sequential circuits
5. knowing to program the microprocessor – Intel 8085

Books for Study:

1. Somasundaram, S. (2012) *Practical Physics*, Apsara publications, Tiruchirappalli,.
2. Ouseph,C.C. Rao, U.J. Vijayendran, V. (2018)*Practical Physics and Electronics*, S.Viswanathan, Printers & Publishers Private Ltd, Chennai.
3. Department of Physics (1998) *Practical Physics,* (B.Sc. Physics Main), St. Joseph's College, Tiruchirappalli 1998.

Books for Reference:

1. Srinivasan, S. (2005) A *Textbook of Practical physics,* S. Sultan Chand publications.
2. Sasikumar, R. (2011) *Practical Physics,* PHI Learning Pvt. Ltd, New Delhi.

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CORRELATION LEVEL: 1-LOW, 2-MODERATE, 3-HIGH

SEMESTER: VI PART: III	22UPHYE68-1 Internal Elective – IV – (1) NANOPHYSICS	CREDIT: 3 HOURS: 3/W

COURSE OBJECTIVES

1. To create the basic knowledge in nano materials.
2. To understand the scientific perspective of nanomaterials.
3. To identify the techniques suitable for nanomaterial synthesis and study them.
4. To know the significance and applications of nanomaterials.

UNIT I: Nanomaterials **9 hours**

History of Nanotechnology – Nanostructures – Surface to volume ratio – grainboundary volume - surface energy - lattice contraction in nanostructured materials - Quantum confinement – Particle in a 1-D box example - Types of nanostructures (zero, 1, 2 and 3D nanomaterials).

UNIT II: Synthesis of Nanostructured materials **9 hours**

Bottom-up and Top-down methods – Physical methods – Inert gas condensation method - Mechanical Milling - Synthesis of metallic and oxide nanoparticles - Chemical methods – Sol-Gel method –Synthesis of oxide and semiconductor nano particles- Hydrothermal method – Synthesis of materials with different morphologies.

UNIT III: Properties of Nanostructures **9 hours**

Optical properties of Nanoparticles – surface plasmon resonance – Absorption behaviour – size dependence – Magnetic properties - Nanocrystalline soft material- Permanent magnet material- Theoreticalbackground – Superparamagnetism- Coulomb blockade.

UNIT IV Physical method to study nanostructures **9 hours**

X-ray diffraction – Generation of X-rays - Diffraction condition – Experimental method to acquire diffraction pattern – Finding crystal structure of materials – ICDD data base – Scherrer Formula - Particle size calculation for a given pattern – Manual demonstration – Limitations of Scherrer formula.

UNIT V: Application of Nanotechnology **9 hours**

Chemistry and Environment - Energy applications of nanotechnology- Information and Communication- Heavy industry-Consumer goods- Nanomedicine - Medical application of Nanotechnology.

COURSE OUTCOMES

The student after finishing the course would

1. understand the basics of nanostructures and their classifications
2. have learnt the synthesis methods of nanomaterials
3. know the behaviour of nanomaterials
4. know how to analyze the structure of nanomaterials
5. have learnt the applications of nanotechnology in various fields.

Text Book:

1. Moorthy, B. S, Sankar. P, Baldev Raj, Rath. B. B, and James Murday, *Textbook of Nanoscience and Nanotechnology,* University Press (India) e-ISBN 978-3-642-28030-6; DOI 10.1007/978-3-642-28030-6
2. GeradinJayam, Sr. (2010), *Nanophysics,* Holy Cross College, Nagercoil

Supplementary Readings:

3. Ramachandra Rao, M.S, Shubra Singh, (2013), *Nanoscience and Nanotechnology: Fundamentals to Frontiers',* Wiley India Pvt Ltd., New Delhi.
4. Pradeep. T, (2007), *'Nano the Essentials'*, Tata McGraw Hill company Ltd
5. Cullity, B. D, (1978), *Elements of X-Ray diffraction*, Addison-Wesley publishing Company Inc.
6. Rao, C. N. R. Muller. A, Cheetham, A. K, (2004), *'The Chemistry of Nanomaterials: Synthesis, Properties and Applications*', *Volume 1* Germany.

OUTCOME MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	2	3	3	2
CO3	2	3	2	2	3
CO4	3	3	3	3	3
CO5	3	3	2	3	3

CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI PART: III	22UPHYE68-2 Internal Elective - IV – (2) RADIATION SAFETY	CREDIT:3 HOURS:3/W

COURSE OBJECTIVES

1. To Learn the basic concepts of atomic and nuclear physics
2. To know the different types of radiation and interaction of charged particles
3. To understand the basic idea of different units of activity and working principle of radiation detectors
4. To understand the concept of radiation safety management
5. To study the application of nuclear techniques

UNIT -I :Basics of atomic and nuclear physics (9HRS)

Atomic structure - X rays characteristic and production - Bremsstrahlung and Auger electron - The Composition of nucleus and its properties - mass number - isotopes of element – spin - binding energy - stable and unstable isotopes - law of radioactive decay - Mean life and half-life - alpha, beta and gamma decay - cross section and kinematics of nuclear reactions - Types of nuclear reaction - fusion and fission.

UNIT- II : Interaction of radiation with matter (9HRS)

Photoelectric 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.

UNIT- III Radiation detection and monitoring devices (9HRS)

Radiation Units: KERMA, exposure - absorbed dose - equivalent dose - effective dose - collective equivalent dose - Annual Limit of Intake (ALI) and derived Air Concentration (DAC) - working principle of gas detectors (Multi-Wire Proportional Counters (MWPC) and Gieger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors – Thermo-luminescent Dosimeter.

UNIT- IV: Radiation safety management (9HRS)

Biological effects of ionizing radiations - 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.

UNIT- V :Application of nuclear techniques (9HRS)

Application in medical science (e.g. - MRI - PET - Projection Imaging Gamma Camera - radiation therapy) - Archaeology - Art - Crime detection – Oil and natural gas Industrial Uses: Gamma ray log – FDC log – Compensated Neutron log - Tracing - Gauging - Material Modification - Sterilization - Food preservation.

COURSE OUTCOMES

After completion of the course, the student acquire knowledge on

1. the basics of atomic structure and nuclear composition.
2. the properties of alpha, beta and gamma rays and the interaction of charged particles.
3. radiation quantities and units, principle and working of radiation detectors.
4. the radiation safety management.
5. the application of nuclear techniques in medicinal science.

Text Books:

1. Murugeshan. R, KiruthigaSivaprasath, 2006, Modern Physics, S Chand & Co, New Delhi,
2. Cember. H. and Johnson. T. E, 2008, Introduction to Health Physics, 4th Ed., McGraw Hill.
3. Thayalan, K. 2009, Handbook of Radiological Safety, Jaypee Brothers, Medical Publishers.
4. Schlumberger 1991, Basic Principles of logging, Schlumberger Wireline & Testing, Texas.

Supplementary Reading:

1. Thayalan, K, 2003, Basic Radiological Physics, Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi.
2. Mould. R. F, 1985, Radiation Protection in Hospital Adam Hilger Ltd., Bristol.
3. Martin, S. Harbison, K. Beach and P. Cole, 2013, An Introduction to Radiation Protection, 6th Ed. CRC Press.AERB, 2004, Radiation Protection Rules.
4. IAEA Safety Series

E-Materials:

1. https://en.wikipedia.org/wiki/Radioactive_decay
2. https://www.toppr.com/guides/physics/nuclei/radioactivity-law-of-radioactive-decay/
3. https://www.youtube.com/watch?v=9UhmFr2WctU (Tamil video)
4. https://ta.wikipedia.org/wiki/%E0%AE%92%E0%AE%B3%E0%AE%BF%E0%AE%AE%E0%AE%BF%E0%AE%A9%E0%AF%8D_%E0%AE%B5%E0%AE%BF%E0%AE%B3%E0%AF%88%E0%AE%B5%E0%AF%81
5. https://www2.lbl.gov/abc/wallchart/chapters/15/2.html
6. https://www.radiologyinfo.org/en/info.cfm?pg=safety-hiw_09
7. https://www.youtube.com/watch?v=DvSNlmGu55c
8. http://webfiles.ehs.ufl.edu/rssc_stdy_chp_5.pdf
9. https://www.world-nuclear.org/information-library/non-power-nuclear-applications/overview/the-many-uses-of-nuclear-technology.aspx
10. https://www.youtube.com/watch?v=ySnG4JZa7Go
11. https://www.pdfdrive.com/schlumberger_-_log_-_interpretation_-_principles_-_applicationspdf_-_e20509665.html

OUTCOME MAPPING

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CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI PART: III	22UPHYE68-3 Internal Elective - IV-(3) MOLECULAR BIOPHYSICS	CREDIT: 3 HOURS:3/W

COURSE OBJECTIVE

1. To study the Physical phenomena diffusion, osmosis, viscosity, adsorption and hydrogen ion concentration with special reference to biology.
2. To understand the structure of macromolecules.
3. To understand the operation of human nervous system.
4. To know the energetics of cell and whole body.
5. To understand the photochemical reactions in plants

UNIT - I: Biological Membranes: 9 Hours

Cell membranes - diffusion - Fick's law of diffusion passive diffusion - facilitated diffusion - factors affecting diffusion - diffusion across cell membranes - active transport osmosis - osmotic pressure - laws of osmosis - biological significance of osmosis. viscosity - biological significance of viscosity - surface tension - biological significance of surface tension - adsorption - biological significance of adsorption - hydrogen ion concentration (pH) - pH scale - pH meter - factors affecting pH - buffers - importance of buffers in biological systems.

Unit - II: Macromolecules: 9 Hours

Nuclei acids - heterocyclic bases - nucleosides - nucleotides - primary, secondary and tertiary structure of DNA - Ribo nucleic acid (RNA) amino acids - primary structure of proteins - peptide bond - secondary, tertiary and quaternary structure of proteins - structure of virus - protein - protein interactions - protein - ligand interactions - carbohydrates - monosaccharides - disaccharides - polysaccharides - glycoproteins - lipids - Phospholipids - lipoproteins - antigens - antibodies.

UNIT - III: Neuro Bio Physics: 9 Hours

Nervous system - synapse - physics of membrane potentials and nerve impulse conduction - Eye - visual receptor - electrical activity and visual generator potentials - optical defects of the eye - neural aspects of vision - bio luminescence - Ear - Phono receptors - auditory function - sensitivity of a detector and the Weber - Fechner law - Hearing aids - basic components of hearing aids - types of hearing aids.

UNIT - IV: Bioenergetics: 9 Hours

Cellular bioenergetics - whole body bioenergetics - scheme of bioenergetics - laws of thermodynamics - endergonic and exergonic reactions - oxidation/reduction reactions catabolism and anabolism - enzymes - allosteric interactions - competitive inhibition - noncompetitive inhibition.

Unit - V: Photobiology: 9 Hours

Absorption - primary photochemical reactions - basic laws of photochemical reactions - quantum efficiency - photosynthesis - Calvin cycle - chlorophyll and accessory pigments - photosynthetic energy transformation - chloroplast structure and organization - stages of photosynthesis - light reaction - dark reaction - polarization - limiting factors in photosynthesis.

COURSE OUTCOMES

On completion of the course the student will be able to grasp the following:

1. Physical phenomena viz., diffusion, osmosis, viscosity, adsorption and hydrogen ion concentration with special reference to biology.
2. the structure of macromolecules such as carbohydrates, DNA, RNA, Proteins, Saccharides and lipids
3. the electrical activity of human nervous system.
4. the energetics of cell and whole body, catabolism and anabolism
5. the photochemical reactions in plants, its quantum efficiency etc.

Text Books:

1. VasanthaPattabhi and N. Gautham (2005), *Bio Physics,*Narosa publishing house,New Delhi,
2. Agarwal, S. K. (2005), *Advanced biophysics,* APH Publishing Corporation, NewDelhi,
3. Subramanian. M.A, *Bio physics principles and techniques,* MJP publishers,
   Chennai,
4. Daniel, M, (2003), *Basic biophysics for biologists,*Agrobios (India), Jodhpur.
5. Narayanan. P, (2005),*Essential of biophysics,* New age International (P) limited,New Delhi.

Supplementary Readings:

1. Hoppe. W, Lohman. W, Mark. H, and Zeigler. H, (1989). *Biophysics*,Springer Verlag, New York.
2. Rodney Cotterill (2002) *Biophysics an Introduction* John Wiley and sons Ltd,England.

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CORRELATION LEVELS: 1- LOW, 2- MODERATE, 3- HIGH

SEMESTER: VI PART: IV	22UPHYS69 Skill Based Subject - IV INSTRUMENTATION TECHNIQUES	CREDITS: 2 HOURS: 3/W

COURSE OBJECTIVES

This course enables the students:

1. To impart knowledge about basic instruments.
2. To understand the concept and working of CRO.
3. To have a better understanding of signal generators.
4. To learn about Q - meters.
5. To acquire ideas of digital instruments.

UNIT – I : Basic Instrumentation **Hours: 6**

Basics of Instrumentation – Accuracy- precision- sensitivity- resolution range- Errors in measurement and loading effects – Multimeter - Principles of measurement DC voltage, DC current, AC current and Resistance. Specification and their significance - Electronic Voltmeter – Principles of Voltmeter and significance (Block Diagram only).

UNIT – II: Transducers **Hours: 6**

Classification of instrument transducers – Input and output characteristics – Static and dynamic response – Linearity and hysteresis. (i) Resistive, (ii) inductive, (iii) capacitive (iv) thermoelectric (v) photo-electric, (vi) piezo-electric, (vii) ionization and (viii) Hall-effect based transducers – Displacement measurement - Fluid flow measurement – Temperature measurement – Measurement of light.

UNIT - III : Cathode Ray Oscilloscope: **Hours: 6**

Block Diagram of CRO – Construction of CRT, Electron gun – Electrostatic focussing and acceleration – (Explanation only) Time-Base operation – synchronization – Front panel controls – Use of CRO for measuring Voltage, Time period and Frequency-Lissajous figure method.

UNIT – IV: Signal Generators **Hours: 6**

Block diagram, explanation and specifications of low frequency signal generators. Pulse generator, and Function generator. Brief idea for testing, specifications.

Block diagram & working principles of a Q- Meter.

UNIT -V Digital Instruments **Hours: 6**

Principle and working of digital meters. Comparison of analog and digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter -Digital Multimeter: Block diagram and working of a digital multimeter.

COURSE OUTCOMES

On completion of the course, the students:

1. Develop the skill to understand the concepts of basic instruments.
2. Obtain knowledge of analog instruments.
3. Understand the working of CRO.
4. Learn the Key factors of Signal generators.
5. Acquire knowledge of digital instruments.

Text books:

1. Theraja, B. L. (2008)*A Textbook of Electrical Technology*S Chand & Co Ltd.
2. Theraja A K, (2004), A *Textbook of Electrical Technology,* S Chand & Co Ltd
3. Subrata Ghoshal, 2012*Digital Electronics,* Cengage Learning.
4. SalivahananS & KumarN. S (2012), *Electronic Devices and Circuits* 3rd Ed., Tata Mc-Graw Hill

Supplementary Reading:

1. Say M G, Performance and Design of AC machines, ELBS Edn.
2. Venugopal, 2011, Digital Circuits and Systems, Tata McGraw Hill.
3. Shimon P. Vingron, 2012, Logic Circuit Design,Springer.

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