SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

[An Autonomous College Affiliated to Periyar University, Salem, Tamil Nadu]
[Accredited by NAAC with 'A' Grade with CGPA of 3.27]
[Recognized 2(f) & 12(B) Status under UGC Act of 1956]
Katteri – 636 902, Uthangarai (Tk), Krishnagiri (Dt)
Tamil Nadu, India
Website: www.svmcugi.com E-mail: principalsvmc@gmail.com

DEGREE OF BACHELOR OF SCIENCE IN PHYSICS

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS AND SYLLABUS FOR

B.Sc. PHYSICS PROGRAMME

(SEMESTER PATTERN)

(For Students Admitted in the College from the Academic Year 2020 - 2021 Onwards)

Programme Outcomes (POs)

PO1	Understand basic principles and experimental basis about different branches of Physics and logical relationships of various fields.
PO2	Based on the gained knowledge, students can acquire technical, analytical, and creative skills.
PO3	Transfer and apply the acquired skills, concept, and principles to study different fields of Physics
PO4	Capable of solving problems using techniques with mathematical skills, conceptual and mathematical models.
PO5	Develop proficiency in the design and construction of portable devices using laboratory components/instruments and to draw valid conclusions from experimental data.

Programme Specific Outcomes (PSOs)

PSO1	Acquire core knowledge in diverse areas of Physics, such as Properties of Matter and Acoustics, Space Physics, Heat and Thermodynamics, Electricity and Magnetism, Optics, Mechanics, Renewable Energy Sources, Digital Electronics, Nuclear Physics, Quantum Mechanics and Relativity, Solid State Physics, Microprocessors, Instrumentation, Communication Electronics, NanoScience, and Nano Technology and Spectroscopy.
PSO2	Expand the proficiency in the usage of a variety of laboratory devices and their demonstration.
PSO3	Gain laboratory skills that allow them to take measurements in a physical laboratory and interpret measurements to draw a logical conclusion.
PSO4	Develop constructive knowledge and communication skills at an international standard.
PSO5	Understand the impact of Physics and Science on society.
PSO6	Create Physics Principles in other fields such as Mathematics, Computer Science, Chemistry, etc.

SRI VIDYA MANDIR ARTS & SCIENCE COLLEGE

(Autonomous)

Bachelor of Science (B.Sc.) in Physics

Programme Pattern and Syllabus (CBCS)

(For Students Admitted in the College from the Academic Year 2020-2021 Onwards)

Sl. No.	Part	Nature of Course	Course Code	Name of the Course	Hours/ Week	Credits	Marks		
							CIA	ESE	Total
SEMESTER I									
1	I	Language	20UTA1F01	Tamil – I	6	3	25	75	100
2	II	Language	20UEN1F01	English – I	6	3	25	75	100
3	III	Core – I	20UPH1C01	Properties of Matter and Sound	6	5	25	75	100
4		Core Practical – I Extended to Semester II	20UPH2P01	Practical – I	3	Credit and Marks are carried to Core Practical – I of Semester II			
5		Allied – I	20UMA1A01	Allied Mathematics - I	6	4	25	75	100
6	IV	Value Education	20UVE101	Manavalakalai - Yoga	3	2	25	75	100
Total					**30**	**17**	**125**	**375**	**500**
SEMESTER II									
7	I	Language	20UTA2F02	Tamil – II	6	3	25	75	100
8	II	Language	20UEN2F02	English – II	6	3	25	75	100
9	III	Core – II	20UPH2C02	Mechanics	5	5	25	75	100
10		Core Practical – I Extended from Semester I	20UPH2P01	Practical – I	3	4	40	60	100
11		Allied – II	20UMA2A02	Allied Mathematics - II	5	4	25	75	100
13	IV	SBEC – I	20UPH2S01	Space Physics	3	2	25	75	100
14		Common Paper	20U2ES01	Environmental Studies	2	2	25	75	100
Total					**30**	**23**	**190**	**510**	**700**

SEMESTER III									
15	I	Language	20UTA3F03	Tamil – III	5	3	25	75	100
16	II	Language	20UEN3F03	English – III	5	3	25	75	100
17	III	Core – III	20UPH3C03	Thermal Physics	5	5	25	75	100
18		Core Practical – II Extended to Semester IV	20UPH4P02	Practical – II	3	Credit and Marks are carried to Core Practical – II of Semester IV			
19		Allied – III	20UCH3A01	Allied Chemistry – I	5	4	25	75	100
20		Allied Practical – II Extended to Semester IV	20UCH4AP02	Allied Chemistry Practical – I	3	Credit and Marks are carried to Allied Practical – II of Semester IV			
21	IV	SBEC – II	20UPH3S02	Bio Medical Instrumentation	2	2	25	75	100
22		NMEC-I		Non-Major Elective – I	2	2	25	75	100
Total					**30**	**19**	**150**	**450**	**600**
SEMESTER IV									
23	I	Language	20UTA4F04	Tamil – IV	5	3	25	75	100
24	II	Language	20UEN4F04	English – IV	5	3	25	75	100
25	III	Core Course – IV	20UPH4C04	Electricity and Magnetism	5	5	25	75	100
26		Core Practical – II Extended from Semester III	20UPH4P02	Practical – II	3	4	40	60	100
27		Allied – IV	20UCH4A02	Allied Chemistry – II	5	4	25	75	100
28		Allied Practical – II Extended from Semester IV	20UCH4AP02	Allied Chemistry Practical – I	3	4	40	60	100
29	IV	SBEC – III	20UPH4S03	Renewable Energy Sources	2	2	25	75	100
30		NMEC-II		Non-Major Elective – II	2	2	25	75	100
Total					**30**	**27**	**230**	**570**	**800**

SEMESTER V									
31	III	Core Course – V	20UPH5C05	Optics	5	5	25	75	100
32		Core Course – VI	20UPH5C06	Basic Electronics	5	5	25	75	100
33		Core Course – VII	20UPH5C07	Solid State Physics	5	5	25	75	100
34		Core Practical – III Extended to Semester VI	20UPH6P03	Practical – III	3	Credit and Marks are carried to Core Practical – III of Semester VI			
35		Core Practical – IV Extended to Semester VI	20UPH6P04	Practical – IV	3	Credit and Marks are carried to Core Practical – IV of Semester VI			
36		Elective – I (Any One)	20UPH5E01	Mathematical and Numerical Methods	5	5	25	75	100
			20UPH5E02	Energy Physics					
37	IV	SBEC – IV	20UPH5S04	Digital Electronics	2	2	25	75	100
38		SBEC – V	20UPH5S05	Nano Science	2	2	25	75	100
Total					**30**	**24**	**150**	**450**	**600**
SEMESTER VI									
39	III	Core Course – VIII	20UPH6C08	Atomic and Molecular Spectroscopy	5	5	25	75	100
40		Core Course – IX	20UPH6C09	Nuclear Physics	6	5	25	75	100
41		Core Course – X	20UPH6C10	Quantum Machanics and Realtivity	5	5	25	75	100
42		Core Practical – III Extended from Semester V	20UPH6P03	Practical – III	3	4	40	60	100
43		Core Practical – IV Extended from Semester V	20UPH6P04	Practical – IV	3	4	40	60	100
44		Elective – II (Any one)	20UPH6E03	Materials Science	5	5	25	75	100
			20UPH6E04	Electronic Communication					
45		SBEC – VI	20UPH6S06	Microprocessor 8085	3	2	25	75	100

	IV								
46	III	Project	20UPH6PR1	Minor Project	2				
					30	**30**	**205**	**495**	**700**
Grand Total					**180**	**140**	**1050**	**2850**	**3900**

Note

CBCS – Choice Based Credit system

CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

Major Elective Courses

For Semester V

1. Mathematical and Numerical Methods – 20UPH5E01
2. Energy Physics – 20UPH5E02

For Semester VI

3. Materials Science – 20UPH6E03
4. Electronic Communication – 20UPH6E04

Non-Major Elective Courses

1. Physics for All
2. Physics of Appliances and Devices

List of Extension Activities

1. National Cade Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

PROGRAMME SYLLABUS

Program: B.Sc. Physics				
Core – I	**Course Code:** 20UPH1C01		**Course Title:** Properties of Matter and Acoustics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I	6	90	5	100

Course Objectives

1. To enlighten the basic concepts of modulus, viscosity, osmosisand acoustics.
2. To understand procedures involved in measuring bending, twisting motions, motion of liquid flow, diffusion process, Acoustics and its applications.
3. To acquire knowledge about properties of matter and acoustics.

UNIT – I: ELASTICITY

Three Types of Elastic Moduli – Poisson's Ratio, Bending of Beams– Expression for Bending Moment – Cantilever–Depression of the Loaded End of a Cantilever, Expression for Young's Modulus - Uniform and Non–Uniform Bending – Pin and Microscope –Koenig's Method, Torsion of a Body – Expression for Couple Per Unit Twist — Determination of Rigidity Modulus by Torsion Pendulum with Mass, Determination of Rigidity Modulus – Static Torsion Method with Scale and Telescope.

UNIT – II: VISCOSITY

Streamlined Motion – Turbulent Motion, Coefficient of Viscosity and its Dimension– Expression for Critical Velocity, Rate of Flow of Liquid in a Capillary Tube – Poiseuilles' Formula, Experiment to Determine the Coefficient of Viscosity of Liquid – Comparison of Viscosities by Oswald's Viscometer Viscosity of a Highly Viscous Liquid –Stoke's Formula, Stoke's Method for the Coefficient of a Highly Viscous Liquid.

UNIT –III: SURFACE TENSION

Definition of Surface Tension with Unit and Dimension, Surface Energy –Formation of Drops– Angle of Contact, Excess of Pressure Inside Curved Surface, Experimental Determination of Surface Tension (Jaegar'sMethod), Drop Weight Method of Determining Surface Tension and Interfacial Surface Tension, Quincke'sMethod

UNIT – IV: OSMOSIS AND DIFFUSION

Definition– Graham's Laws of Diffusion in Liquids–Fick's Laws of Diffusion, Analogy with Heat Conduction– Experimental Determination of Coefficient of Diffusion (Diffusivity Graham's Law of Diffusion of Gases–Effusion–Transpiration.

Osmosis: Definition– Experimental Determination of Osmotic Pressure, Laws of Osmosis– Osmotic Pressure and Vapour Pressure of a Solution.

UNIT – V: ACOUSTICS

Theory of Vibrations: Simple Harmonic Motion, Undamped Vibration, Damped Vibration Forced Vibration, Resonance and Sharpness of Resonance. Determinationof Absorption Coefficient - Ultrasonic– Production (Piezo Electric and Magneto striction Method), Ultrasonic - Detection – Properties – Applications, Acoustics: Acoustics of Buildings – Reverberation Time, Sabine's Formula and its Applications.

Text Books

1. R. Murugeshan, Properties of matter and acoustics, S. Chand & Co, New Delhi (2012). [Units Covered: 1-5; Pages: 1-5, 12 – 27, 32-40, 45-58, 62-67, 70-73, 76-79, 85 – 94, 102 – 105, 171- 181, 188- 201, 205 - 209]
2. Brijlal and N. Subramanyam, Properties of matter, Eurasia Publishing House Limited (2005). [Units Covered : 1-4, Pages: 183- 188, 194-199, 215-220, 226-229, 236-242, 250-259, 273- 275, 289- 291, 298- 305, 310- 318, 324- 326, 328- 329]

Reference Books

1. N. Subramaniam and Brijlal, A Text Book of Sound, Vikas Publication House Pvt Ltd, New Delhi (1999).
2. D.S. Mathur, Elements of properties of matter, S. Chand & Company Ltd., New Delhi (2010).
3. Richard P. Feynman, Lectures on Physics. Vol. I & II, The New Millennium Edition (2012).
4. David Halliday and Robert Resnick, Fundamentals of Physics, Wiley Plus (2013).
5. B.H. Flowers and E. Mendoza, Properties of Matter, Wiley Plus, (1991).
6. H.R. Gulati, Fundamentals of General Properties of Matter, S. Chand & Co. Pvt. Ltd, (2012).

7. Hugh D. Young and Roger A. Freedman, Sears & Zemansky's University Physics with Modern Physics, 14th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of modulus, Surface Tension, Osmosis and Acoustics	K1 & K2
CO2	Gather knowledge about the measurement of modulus for different material, tension of different liquid, diffusion process and production, detection and applications of Ultrasonics	K2, K3 & K4
CO3	Able to gain knowledge in calculating the modulus values of different materials, difference in surface tension of liquids and vibrational motions.	K4 & K5
CO4	Gain knowledge regarding methods of production of Ultrasonic waves, process of diffusion and liquid motions.	K4, K5 & K6

K1– Remember,K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	S
CO2	M	M	S	S	S
CO3	S	S	S	S	M
CO4	S	S	M	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – II	**Course Code:** 20UPH2C02		**Course Title:** Mechanics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	5	75	5	100

Course Objectives

1. To introduce the students to the concepts of vectors, resolution of vectors and vector operators.
2. To provide an understanding of one dimensional and two dimensional motion of objects, impact of bodies and Rigid body dynamics.To understand procedures involved in accounting process and its applications.
3. To impart a knowledge of gravitation and related concepts.

UNIT – I: PROJECTILES AND CIRCULAR MOTION

Projectiles - Time of flight - Maximum height reached - Range of projectile - Path of projectile- Range of projectile up and down an inclined plane.

Circular Motion - Centripetal force - Centrifugal force - Angular velocity - Angular acceleration - Normal acceleration - Relation between linear and angular velocities - Motion of cyclist along a curved path - Banking of curve.

UNIT – II: IMPULSE AND IMPACT

Impulse – Impact – Impulsive force – Laws of impact – Coefficient of restitution – Direct impact of a smooth sphere on a smooth horizontal plane – Direct impact of two smooth elastic spheres – loss of kinetic energy due to direct impact – Oblique impact of a smooth sphere on a smooth horizontal plane - Oblique impact of two smooth elastic spheres – Loss of kinetic energy due to oblique impact.

UNIT – III: DYNAMICS OF RIGID BODIES

Rigid body – Moment of inertia – Radius of gyration – Kinetic energy of rotation – Parallel and perpendicular axes theorems – Theory of compound pendulum – Equivalent simple pendulum – Interchangeability of center of suspension and center of oscillation –

Determination of 'g' and radius of gyration of a bar pendulum – Bifilar pendulum (parallel threads).

UNIT – IV: CENTER OF GRAVITY AND CENTER OF PRESSURE

Center of Gravity: Definition – Centre of gravity of a solid cone, Solid hemisphere, Hollow hemisphere and a tetrahedron.

Center of Pressure: Definition – Center of pressure of a rectangular lamina and triangular lamina.

UNIT – V: GRAVITATION

Newton's law of gravitation – Acceleration due to gravity – Variation of 'g' with altitude, depth and rotation of earth – Inertial mass and gravitational mass – Gravitational field – Gravitational field intensity – Gravitational potential difference – Gravitational potential – Gravitational potential energy – Gravitational potential energy near the surface of earth – Escape velocity – Orbital velocity – Weightlessness.

Text Books

1. R. Murugeshan, Mechanics and Mathematical Physics, S.Chand & Company Ltd., New Delhi, 3rd Revised Edition (2008).
   [Unit Covered: 1 – 5: Pages:1 - 19, 20 - 28, 29 - 43].
2. M. Narayanamurthi and N. Nagarathinam, Dynamics, The National Publishing Company, 8th Edition (2008).
   [Unit Covered: 1 – 3: Pages: 34 - 42, 69 - 76, 181 - 211].
3. P. Duraipandian, Laxmi Duraipandian and Muthamizh Jayapragasam, Mechanics, S. Chand & Company Ltd., New Delhi, 1st Edition (2009).
   [Unit Covered: 1 – 4, Pages:150 - 173, 260 - 284, 285 - 311].

Reference Books

1. D.S. Mathur, Mechanics, S.Chand & Company Ltd., New Delhi, Third Revised Edition (2000).
2. S.G. Venkatachalapathy, Mechanics, Margham Publication, (2012).
3. C. L. Arora, Refresher course in Physics for B.Sc. Classes (Vol-I), S. Chand Publishing, New Delhi, (1981).

4. Halliday, Resnick, Walker, Fundamentals of Physics, 8th Edition, John Wiley & Sons, New Delhi, (2009).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge of analyzing the motion of objects using fundamental laws of Physics.	K1 & K2
CO2	Acquire a knowledge about Dynamics and Rigid bodies	K2
CO3	Understand gravitational potential energy	K2 & K4
CO4	Analyze the variation of acceleration due to gravity 'g'	K4
CO5	Solve simple problems involving the dynamic motions of objects.	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	M
CO4	M	S	S	S	S
CO5	S	S	S	M	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
SBEC – I	**Course Code:** 20UPH2S01		**Course Title:** Space Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II	3	45	2	100

Course Objectives

1. To introduce the students to the Basic Idea of Universe.
2. To provide an understanding of Planets, Stars and Comets.
3. To impart a knowledge of Sun and Steady State Theory.

UNIT – I : UNIVERSE

Planets - Interior Planets - Exterior Planets-Crust, Mantle and Core of the Earth-Different - Region of Earth's Atmosphere-Rotation of the Earth – Magnetosphere-Van Allen Belts – Aurora.

UNIT – II: COMETS, METEORS, ASTEROIDS

Composition and Structure of Comets-Periodic Comets-Salient Features of Asteroids, Meteors and its Use.

UNIT – III: SUN

Structure of Photosphere, Chromosphere-Corona - Sunspots – Solar Flares-Solar Prominences - Solar Piages-Satellites of Planets-Structure, Phases and their Features of Moon.

UNIT – IV: STARS

Constellations - Binary Stars-Origin and Types Star Clusters-Globular Clusters-Types of Variable Stars - Types of Galaxies.

UNIT – V: ORIGIN OF UNIVERSE

Big bang theory-Pulsating theory-Steady state theory-Composition of universe expansion.

Text Books

1. K.D. Abyankar, Astrophysics of the solar system, University press, India (1999).
[Unit Covered:1 – 5: Pages: 1-10, 32 - 79, 142 - 175, 248 – 275, 395 - 420]

BOOKS FOR REFERENCE:

1. Baidyanath Basu, Sudhindra Nath Biswas and Tanuka Chattopadhyay, An Introduction to Astrophysics, Prentice Hall of India, New Delhi (2010).
2. P. Devadas, The fascinating Astronomy, Devadas Telescopies, Chennai (2001).
3. R.P. Singhal, Elements of Space Physics, PHI (2009).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge of Universe.	K1 & K2
CO2	Acquire knowledge about Stars, Comets and Planets.	K2
CO3	Understand the Life Time Period of rotation of the Planets .	K2 & K4
CO4	Understanding the About Galaxies and Clusters	K4
CO5	Acquire Knowledge to Steady State Theory.	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	M	S	S
CO3	S	S	M	M	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core Practical - I	**Course Code:** 20UPH2P01		**Course Title** : Core Practical - I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I & II	3	45	4	100

Course Objectives

1. To expose the technique of handling simple measuring instruments and also measure certain optical, mechanical and thermal properties of matter.
2. To construct and verify various basic electronic circuits.

LIST OF EXPERIMENTS

1. Young's Modulus – Non uniform bending – Scale and Telescope Method.
2. Young's Modulus – Uniform bending – Scale and Telescope Method.
3. Rigidity Modulus–Torsion Pendulum
4. Surface tension and interfacial surface tension – Drop Weight Method.
5. Sonometer – frequency of a tuning fork – Determination of mass of a stone.
6. Sonometer – A.C frequency.
8. Spectrometer – Solid Prism.
9. Spectrometer - Grating – Minimum Deviation Method - Measurement of Wavelength.
10. Current and Voltage sensitivities of a Galvanometer
11. P.O. Box – Temperature Coefficient of Resistance.
12. Joule's calorimeter – Specific heat capacity of a liquid – Barton's Correction
13. Specific heat capacity of a liquid – Method of Mixture.
14. M and B_H- Deflection Magnetometer - TAN A Position.
15. Potentiometer – Internal Resistance of the cell.
16. Potentiometer – Low Range Voltmeter.
17. Junction diode – Characteristics.
18. Zener diode – Characteristics.

19. Study of logic gates (AND, OR, NOT, NAND, NOR & EX-OR).

20. Low range power pack using two diodes.

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Perform experiments on material to identify the strength the given objects	K1
CO2	Deal with liquids based on their Surface tension	K2
CO3	Learn the relation between frequency, length and tension of a stretched string under vibration	K2 & K3
CO4	Acquire knowledge of magnetic dipole moment of a bar magnet using a deflection magnetometer by Tan A position	K4
CO5	Analyse the input and output characteristics of various electronic devices	K5 & K6
CO6	Examine the performance of logic gates using IC's and discrete components and to measure the output	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	M	S	S	S

S – Strong **M – Medium** **L – Low**

ALLIED PHYSICS

(THEORY AND PRACTICALS)

Program: B.Sc. Physics				
Allied - I **B.Sc Maths/ B.Sc Chemistry**		**Course Code:** 20UPH1A01 - Mathematics 20UPH3A01 - Chemistry	**Course Title** : Allied Physics-I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I / III	5	75	4	100

Course Objectives

1. To study the basics of Properties of Matter
2. To study the propagation of sound waves, the production of ultrasonic waves and its applications.
3. To impart a knowledge of heat radiation and sound.
4. To provide an understanding of Gravitation and Electricity.

UNIT – I: PROPERTIES OF MATTER

Elasticity: Stress – strain diagram – Hooke's law – work done in stretching a wire – elastic constants – Bending of beams – Expression for bending moment –Expression for Young's modulus (uniform and non–uniform bending) – Torsion of a body – Expression for couple per unit twist – Determination of rigidity modulus of a wire by torsional pendulum – drop weight method of determining surface tension and interfacial surface tension..

UNIT – II: SOUND AND ULTRASONICS

Sound: Longitudinal waves and transverse waves – Laws of transverse vibrations of strings – Sonometer – Verification of laws of transverse vibrations of Strings – Determination of AC frequency.

Ultrasonics: Introduction to ultrasonics – Piezo electric effect– Production by piezo electric method – Properties – Applications– Acoustics: Acoustics of buildings – Reverberation time – Derivation of Sabine's formula – Determination of absorption coefficient

UNIT – III: HEAT

Vander Waal's equation of state–critical constants–determination of critical constants – Joule– Kelvin effect – Porous plug experiment – Temperature inversion–coefficient of thermal conductivity – Determination of coefficient of thermal conductivity of bad conductor by Lee's disc method.

UNIT – IV: GRAVITATION

Newton's law of gravitation – inertial mass – gravitational mass – Kepler's laws of planetary motion – deduction of Newton's law of gravitation from Kepler's law – determination of G by Boy's experiment – variation of g with altitude – variation of g with depth.

UNIT – V: ELECTRICITY

Electric circuit – open circuit–closed circuit - resistors, capacitors and inductors – series and parallel combinations of capacitors – Carey foster's bridge – theory – measurement of resistance – potentiometer – calibration of low range voltmeter – measurement of high resistance by leakage.

BOOKS FOR STUDY:

1. R. Murugeshan, Properties of matter and acoustics, S. Chand & Co, New Delhi (2012). [Unit covered: 1 and 4: Pages: 1 - 97,113 - 135]
2. N.Subrahmaniyam Brijlal, Sound, S. Chand & Co (2004).

   [Unit covered: 2: Pages:146 - 148,237 - 248,260 - 264]
3. Brijlal & Dr.N.Subramanyam and P.S. Hemne, Heat and Thermodynamics, S. Chand & Co, New Delhi (2004).

   [Unit Covered: 3: Pages: 194 - 199, 203 - 206, 361 - 367]
4. R. Murugeshan, Electricity and magnetism S. Chand & Co, New Delhi (2014).

   [Unit Covered: 5: Pages: 97 - 101]

BOOK FOR REFERENCE:

1. D.S. Mathur, Elements of properties of matter, S.Chand & Company Ltd., New Delhi (2010).
2. R. Murugeshan, Modern Physics S. Chand & Co, New Delhi (2014).
3. Murugeshan, Allied Physics I & II, S. Chand & Co, New Delhi (2006).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of elasticity and its importance in beams	K1
CO2	Analyze the propagation of sound waves, and the production of ultrasonic waves and its applications	K2
CO3	Acquire the knowledge of heat radiation	K2
CO4	Understanding of Gravitation	K3& K4
CO5	Learn the basic ideas of electricity and its applications	K5& K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	M	M	S	S	S
CO3	S	M	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Allied - II **B.Sc Maths/ B.Sc Chemistry**		**Course Code:** 20UPH2A02 - Mathematics 20UPH4A02 - Chemistry	**Course Title** : Allied Physics-II	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
II / IV	5	75	4	100

Course Objectives

1. To study vector atom model and to determine the method of critical potential.
2. To study the basics of nuclear physics
3. To impart a knowledge of solid state physics.
4. To provide an understanding of semiconductor and electronic devices.
5. To impart a knowledge of Laser.

UNIT – I: ATOMIC PHYSICS

The vector atom model – Spatial quantization – Spinning of an electron –Quantum numbers associated with the vector atom model – Coupling schemes –LS and jj coupling – The Pauli's exclusion principle – Stern and Gerlach experiment.

UNIT – II: NUCLEAR PHYSICS

Binding energy – Nuclear fission and nuclear fusion – Nuclear models – Liquid drop model – semi empirical mass formula – Merits and demerits – Shell model – Evidences for shell model – Nuclear radiation detectors – Ionization chamber – G.M counter.

UNIT – III: SOLID STATE PHYSICS

Bonding in crystals – Ionic bond – Covalent bond – Metallic bond – Molecular bond – Hydrogen bond – Their properties – Simple crystal structures – Simple cube – Body centered cube – Face centered cube – Co-ordination number – Atomic radius – Packing factor.

UNIT – IV: SEMICONDUCTOR PHYSICS

Theory of energy bands in crystals – Distinction between conductors, insulators and semiconductors – Intrinsic and extrinsic semiconductors – Zener diode characteristics – Break down voltage – Zener diode as voltage regulator.

Basic Logic Gates – OR, AND, NOT, NAND, NOR, XOR gates – NAND & NOR as universal building block –De Morgan's theorem and its verification – Laws of Boolean algebra – simplification of Boolean expressions.

UNIT – V: LASER

Basic concepts of stimulated emission – Spontaneous emission and induced emission – population inversion and Meta stable state – Helium laser – Ruby laser – Semiconductor laser – application of laser – Uses of laser.

BOOKS FOR STUDY:

1. R. Murugeshan, Allied Physics I & II, S. Chand & Co, New Delhi (2006).
   [Unit covered: 1 and 2: Pages:182 - 197, 198 - 226]
2. R. Murugeshan , Modern Physics, S. Chand & Co, New Delhi (2016).
   [Unit covered: 3and 4:Pages: 563 - 588,741 - 781, 860 - 872]
3. G.Senthilkumar , Engineering Physics -1,VRB Publishers Pvt.Ltd (2009).
   [Unit covered: 5: Pages: 63 - 88]

BOOKS FOR REFERENCE:

1. N. Subramaniyam, Brijlal and M.N. Avadhanulu, A text book of Optics, S. Chand & Co, New Delhi (2012).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge of vector atom model and to determine the method of critical potential	K1 & K2
CO2	Learn the basics of nucleus, radiation detectors and chambers	K2 & K3
CO3	Acquire the knowledge of solid state physics	K3 & K4
CO4	Understanding of semiconductor and electronic devices	K5
CO5	Learn the knowledge of Laser	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Allied Practical - I **B.Sc Maths/ B.Sc Chemistry**		**Course Code:** 20UPHA2P01 – Mathematics 20UPHA4P01 - Chemistry	**Course Title** : Allied Physics Practical -I	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
I & II / III & IV	3	45	2	100

Course Objectives

1. To expose the technique of handling simple measuring instruments and also measure certain optical, mechanical and thermal properties of matter.
2. To construct and verify various basic electronic circuits.

LIST OF EXPERIMENTS

1. Young's Modulus – Non uniform bending – Scale and Telescope.
2. Young's Modulus – uniform bending – Scale and Telescope.
3. Rigidity Modulus –.Torsion pendulum.
4. Rigidity Modulus. – Static Torsion.
5. Surface tension and interfacial surface tension – drop weight method.
6. Sonometer – frequency of fork.
7. Sonometer – A.C frequency.
6. Specific heat capacity of liquid – method of mixtures – half time radiation correction.
7. Lee's disc – coefficient of thermal conductivity of a bad conductor.
8. Potentiometer –calibration of Low range Voltmeter.
9. Potentiometer – Internal resistance of coil.
10. Air Wedge – thickness of wire.
11. Newton's rings – radius of curvature.
12. Spectrometer – Solid Prism.
13. Spectrometer – Grating – Wavelength of spectral lines.
14. LED – Characteristics.

15. Zener diode – characteristics.
16. Demorgan's Theorem.
17. Low range power pack – using two diodes.
18. Basic Logic gates (AND, OR & NOT).
19. Field along the axis of a coil - Deflection Magnetometer – Determination of B_H.
20. Voltage regulated power supply using Zener diode.

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. C. L Arora, Practical Physics, S. Chand & Co (2010).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Perform experiments on material to identify the strength the given objects	K1 & K2
CO2	Deal with liquids based on their Surface tension	K2
CO3	Learn the relation between frequency, length and tension of a stretched string under vibration	K2 & K4
CO4	Analyse the input and output characteristics of various electronic devices	K5 & K6
CO5	Examine the performance of logic gates using IC's and discrete components and to measure the output	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – III	**Course Code:** 20UPH3C03		**Course Title:** Thermal Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	5	75	5	100

Course Objectives

1. To introduce the basic concepts of thermodynamics.
2. To comprehend and learn the concepts of conduction and radiation.
3. To provide an understanding of low temperature Physics.

UNIT – I: CALORIMETRY

Specific heat capacity and thermal capacity –Determination of specific heat capacity of liquid by Newton's law of cooling (Spherical Calorimeter) – Specific heat capacities of a gas – C_p and C_v – Meyer's relation – Determination of C_v by Joly's differential steam calorimeter – Determination of C_p by Regnault's method – Van der Waal's equation of state – Critical constants – Deduction of critical constants.

UNIT – II: LOW TEMPERATURE PHYSICS

Porous plug – Theory and experiment – Joule-Thomson effect – Liquefaction of gases by Linde's process –Liquefaction of Helium by K. Onnes method – Properties of Helium I and Helium II –adiabatic demagnetization – Superconductors – Type-I and II superconductors – Meissner effect - BCS theory – Applications of super conductors.

UNIT – III: CONDUCTION AND RADIATION

Conduction: Thermal Conductivity –Thermal conductivity of a bad conductor: Lee's disc method – Thermal conductivity of a good conductor: Searle's method.

Radiation: Blackbody radiation –Stefan's-Boltzmann law – Distribution of energy in the spectrum of black body – Definition – Wien's Displacement law – Rayleigh Jean's law – Planck's quantum theory of radiation – Solar constant – Temperature of sun.

UNIT – IV: THERMODYNAMICS

Zeroth law of thermodynamics and temperature – First law and internal energy, conversion of heat into work, isothermal, adiabatic, isobaric and isochoric processes – Work done during

isothermal and adiabatic processes, reversible & irreversible processes – Heat engine – Carnot's engine – Carnot's theorem – Otto engine – Working and efficiency.

UNIT – V: THERMODYNAMICAL RELATIONS

Maxwell's thermodynamical relations – Fundamentals of thermodynamic potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions – Maxwell's relations & applications – Clausius-Clapeyron Equation – TdS equations – Second law & Entropy – Entropy changes in reversible & irreversible processes, entropy – Temperature diagrams – Third law of thermodynamics.

BOOKS FOR STUDY:

1. Brijlal, Dr. N. Subramanyam and P.S. Hemne, Heat and Thermodynamics, S. Chand & Co, New Delhi (2004).
   [Unit Covered: 1 – 5:Pages: 72 - 99, 137 - 209, 215 - 321, 360 - 425].
2. R. Murugeshan and Kiruthiga Sivaprasath, Thermal physics, S. Chand & Co, New Delhi, (2008).
   [Unit Covered: 1-5: Pages: 1 - 29, 30 - 67, 68 - 94, 95 - 147].
3. D.S. Mathur, Heat and Thermodynamics, S.Chand & Company Ltd., New Delhi, 3rd Revised Edition (2000).
   [Unit Covered: 2,3 and 5: Pages: 38 - 88, 305 - 357, 427 - 453, 454 - 497, 508 - 570].

BOOKS FOR REFERENCE:

1. Bergman, Lavine, Incropera, Dewitt, Fundamentals of Heat and Mass Transfer, 7th Edition, John Wiley & Sons (2011).
2. Ashok Kumar, S.P. Taneja, Thermal Physics, S. Chand Publications (2014).
3. M. W. Zemasky, R. Dittman, Heat and Thermodynamics, Tata McGraw Hill (1981).
4. Enrico Fermi, Thermodynamics, Courier Dover Publications (1956).
5. A. B. Gupta and H. P. Roy, Thermal Physics, Books & Allied Ltd; 3rd Revised Edition (2010).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge of calorimetry	K1 & K2
CO2	To comprehend and learn the concepts of heat and heat transmission	K2
CO3	Understanding of the low temperature Physics	K2 & K3
CO4	Analyze the concepts of conduction and radiation	K4
CO5	Understanding of the thermodynamics and solving the problems	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	M	S	S	S
CO3	S	S	S	M	S
CO4	S	S	S	S	S
CO5	S	S	M	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – IV	**Course Code:** 20UPH4C04		**Course Title:** Electricity and Magnetism	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	5	75	5	100

Course Objectives

1. To familiarize basic concepts of electricity, magnetism and its features.
2. To understand procedures involved in capacitors, induction, thermoelectricity process and its applications.
3. To acquire knowledge of DC and AC current.

UNIT – I: ELECTROSTATICS

Basic Concepts – Coulomb's Law – Electric Field – Electric Field due to a Point Charge – Electric Dipole – Lines of Force.

Gausss's Law and its Application: Electric Flux – Gauss's Law and its Proof – Application of Gauss's Law – Electric Field due to Uniformly Charged Sphere and Charged Cylinder.

UNIT –II: CAPACITOR

Principle of a Capacitor – Energy Stored in a Capacitor, Energy Density – Change in Energy due to Dielectric Slab, Force of Attraction Between Plates of a Charged Capacitor ,Capacitance of Spherical Capacitors, Capacitance of Cylindrical Capacitor, Types of Capacitors, Electrometer- The Kelvin's Attracted Disc Electrometer– Relativity Permittivity

UNIT – III: THERMOELECTRICITY

Thermoelectricity – Laws of Thermo E.M.F., Intermediate Metals, Intermediate Temperature Carey–Foster Bridge – Theory – Temperature Coefficient of Resistance, Potentiometer – Calibration of Ammeter and High Range Voltmeter , Measurement of Thermo E.M.F. using Potentiometer, Peltier Effect and Peltier Coefficient – Thomson Effect and Thomson Coefficient, Relation Between Π and Σ, Thermoelectric Diagrams and its Uses.

UNIT – IV: MAGNETIC INDUCTION

Magnetic Induction due to a Straight Conductor Carrying Current, Magnetic Induction on the Axis of a Solenoid, Moving Coil Ballistic Galvanometer – Damping Correction - Determination of Absolute Capacity of a Condenser, Self – Inductance by Anderson's Bridge Method, Mutual Inductance - Experimental Determination of Mutual Inductance - Coefficient of Coupling.

UNIT – V: TRANSIENT AND ALTERNATING CURRENT

Transient Current – Growth and Decay of Current in anCircuit Containing Resistance and Inductance - Growth and Decay of Charge in a Circuit Containing Resistance and Capacitance, Growth and Decay of Charge in a LCR Circuit - Frequency of Oscillation. Alternating Current– Peak, Average and RMS Value of Current and Voltage – Form Factor, Choke Coil, Power in an AC Circuit Containing LCR, Wattless Current, Transformer – Construction, Theory and Uses – Energy Loss, Skin Effect.

BOOKS FOR STUDY:

1. R. Murugeshan, Electricity and Magnetism, S. Chand & Co, New Delhi (2016).
   [Units Covered: 1 -5: Pages: 1-10, 12- 18, 56-62, 67- 74, 77- 79, 97- 101, 105- 115, 132- 134, 139- 140, 145- 152, 165- 176, 190- 204, 209- 211, 224-226, 228-236]

BOOKS FOR REFERENCE:

1.Brijlal and Subramaniam, Electricity and Magnetism, S. Chand & Co, New Delhi (2016).

2. K. K. Tewari, Electricity and Magnetism, S. Chand & Co, New Delhi (2016).

3. Hugh D. Young and Roger A. Freedman, Sears & Zemansky's University Physics with Modern Physics,14th Edition (2015).

4. D. N. Vasudeva, Electricity and Magnetism, S. Chand & Co, New Delhi (2016).

5. David J. Griffiths, Introduction to Electrodynamics, Cambridge University Press, Cambridge, United Kingdom, 4th Edition (2017).

6. Oleg D. Jefimenko, Electricity and Magnetism: An Introduction to the Theory of Electric and Magnetic Fields, 2nd Edition (2012).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics of Electricity and Magnetism	K1 & K2
CO2	Gather knowledge about capacitors, induction process and thermoelectricity.	K2, K3& K4
CO3	Able to gain knowledge on the principal of capacitor working, process of thermoelectric current, induced current and working of transformer.	K4& K5
CO4	Gain knowledge regarding potentiometer, B.G and its applications, growth and decay of charge in LCR circuits.	K4,K5& K6
CO5	Learn about electrostatics, thermoelectric current, direct and alternating current, skin effect	K2 &K6

K1– Remember,K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	S	M	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	M	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
SBEC – II	**Course Code:** 20UPH3S02		**Course Title:** Bio-Medical Instrumentation	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	2	30	2	100

Course Objectives

1. To familiarize basic concepts of different biomedical instruments and radiation safety instrumentation
2. To demonstrate the pacemakers and signal conditioning circuits
3. To acquire knowledge of heart functions and blood cells.

UNIT – I: BIO POTENTIAL GENERATION AND ELECTRODES TYPES

Origin of bio potential and its propagation–Types of electrodes – Surface, needle and Micro electrodes and their equivalent circuits–Recording problems – Measurement with two electrodes.

UNIT – II: BIOSIGNAL CHARACTERISTICS AND LECTRODECONFIGURATIONS

Bio-signal characteristics: frequency and amplitude ranges –Electrocardiogram:recording setup, waveform and Einthoven's triangle –Electroencephalogram: recording setup and waveform –Electromyography:Unipolar and bipolar mode.

UNIT – III: PACEMAKERS AND SIGNAL CONDITIONING CIRCUITS

Pacemakers: Introduction–Methods of stimulation– Components of pacemaker –Types of pacemaker:external and internal pacemakers.

Signal Conditioning Circuits: Need for bio-amplifier –Differential bio-amplifier– Impedance matching circuit–isolation amplifiers.

UNIT – IV: MEASUREMENTS AND NONELECTRICAL PARAMETERS

Recording fetal heart movements and blood circulation using Doppler ultrasonicmethod – Laser based Doppler blood flow meter –Blood cell counter: Hemocytometer, counting of RBCs and WBCs– Blood pressure measurement (Indirect method only).

UNIT – V: RADIATION SAFETY INSTRUMENTATION

Radioactivity –Units of radiation(Curie (Ci), Rutherford, Roentgen, rad and rem)–Effects of radiation exposure on human body–Radiation monitoring instruments:pocket dosimeter and pocket typeradiation alarm.

BOOKS FOR STUDY:

1. Dr. M. Arumugam, Bio-Medical Instrumentation, Anuradha Agencies (2002)
   [Units Covered: 1–5; Pages: 8-9, 21-33, 114-156, 164-175, 233-245,274-277, 322-330**]**
2. R.L.Reka, C.Ravikumar, Bio Medical Instrumentation/Medical Electronics, Lakshmi Publications, 5th Edition (2012).
   [Units Covered: 1–5; Pages: 1.6, 1.18– 1.20, 2.1 – 2.45,5.1-5.10,3.1-3.3 &3.41-3.45]

Books for references:

1. P.K. Bajpai, Biological Instrumentation and methodology, S Chand & Co (2010).
2. J. G. Webster, Medical Instrumentation, Application and Design, John Wiley and Sons, New York (2004).
3. L. Cromwell, F. J. Weibell and L. A. Pfeiffer, Biomedical Instrumentation Measurements,Pearson Education, Delhi (1990).
4. R. S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi (2003).
5. J. J. Carr and J. M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education (2004).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the bio potential generation and electrodes types	K1 & K2
CO2	Explain the basic concepts of electrode configurations and its placing	K3
CO3	Understand the pacemakers types	K1 & K2
CO4	Explore the B.P. Measurement	K4
CO5	Study the Radiation monitoring instruments	K1 & K2

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	S	S	S	S	S
CO3	S	S	S	M	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
SBEC – III	**Course Code:** 20UPH4S03		**Course Title:** Renewable Enengy Sources	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	2	30	2	100

Course Objectives

1. To impart basic knowledge about renewable energy sources.
2. To understand technological aspects of diverse renewable energy devices and their application potentials.

UNIT – I: PRINCIPLES OF SOLAR RADIATION

Solar Radiation – Solar constant – Extraterrestrial and terrestrial solar radiation – Solar radiation on titled surface – Instruments for measuring solar radiation and sun shine.

UNIT – II: SOLAR PHOTOVOLTAICS

Basic principle of electrical energy conversion – Components of photovoltaic system – Photovoltaic panels – Series and parallel connections – I-V Characteristics – Photovoltaic parameters – Efficiency.

UNIT – III: SOLAR THERMAL SYSTEMS

Flat plate collector – Concentrating collectors – Classification of concentrating collectors – Material aspects of solar thermal collectors – Solar dryer – Solar pond.

UNIT – IV: WIND ENERGY

Sources and potentials – Wind data and energy estimation – Components of wind energy system – Horizontal and vertical axis wind mills – Performance characteristics.

UNIT – V: OTHER RENEWABLE ENERGY SOURCES

Tidal Energy: Energy from the tides – Barrage and non-barrage tidal power systems – Wave Energy: Energy from waves – Ocean thermal energy conversion.

BOOKS FOR STUDY:

1. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi (2009).
[Unit Covered: 1-5:Pages: 47–72, 178–192, 146–177, 227–310, 495–558]

BOOKS FOR REFERENCE:

1. J.W. Twidell and A. Wier, Renewable Energy Resources, CRC Press (Taylor & Francis), (2011).
1. Tiwari and Ghosal, Renewable Energy Resources, Narosa Publishing House (2007).
2. R. Ramesh and K.U. Kumar, Renewable Energy Technologies, Narosa Publishing House (2004).
3. K.M. Mittal, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd., New Delhi (2003).
4. D.P. Kothari, K.C. Singhal, Renewable Energy Sources and Emerging Technologies, PHI., New Delhi, (2010).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand basic knowledge about different renewable energy sources, principles of solar radiation and its conversion	K1 & K2
CO2	Gain instrument technique skills to measure solar radiation and analyses performance characteristics of different renewable energy technologies	K2 & K3
CO3	Gather research-based knowledge about principal, construction and operation of different energy conversion technologies	K3&K4
CO4	Develop application potentials of various energy sources through appropriate technologies	K5
CO5	Design portable energy conversion devices and their demonstration	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	M	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core Practical - II	**Course Code:** 20UPH4P02		**Course Title** : Core Practical - II	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III & IV	3	45	4	100

Course Objectives

1. To understand the modulus of elasticity of different bodies
2. To gain knowledge about light experiments.
3. To measure the particulal mechanical, thermal and magnetic properties of materials.
4. To explore the basic knowledge in the field of electricity.
5. To construct and verify several electronics and digital circuits

LIST OF EXPERIMENTS

1. Young's Modulus – Uniform Bending – pin and microscope method.
2. Young's Modulus – Non uniform Bending – pin and microscope method.
3. Compound Pendulum
4. Torsion Pendulum – Moment of Inertia and Rigidity modulus – symmetrical masses.
5. Coefficient of Viscosity of a liquid - graduated burette - radius by mercury pellet method.
6. Surface Tension of liquid – Capillary rise method.
7. Sonometer – Relative density of solid and liquid.
8. Specific heat capacity of a liquid by cooling - verification of Newton's law of cooling.
9. Spectrometer – (i-d) curve.
10. Spectrometer – grating – Normal incidence method – Determination of wavelength of spectral lines.
11. Air Wedge - thickness of a wire.
12. Potentiometer - ammeter calibration.
13. Potentiometer – comparison of EMF.
12. M and B_H- Deflection Magnetometer - TAN B position.
13. Field along the axis of a coil - Deflection Magnetometer – Determination of B_H.

14. Carey-Foster's bridge - Specific resistance of a coil.
15. BG - Comparison of Capacities.
16. BG - Comparison of EMF's of two cells.
17. Zener diode – Voltage regulator using four diodes and percentage of regulation.
18. Verification of De Morgan's theorem.
19. Bridge Rectifier.
20. NAND and NOR as a universal building block (AND, OR & NOT).

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Conduct experiments on material and to identify its the strength	K1 & K2
CO2	Analyze various physical parameters related to mechanics	K3 & K4
CO3	Understand theoretical principles of optics in the experimental method through the determination of refractive index of the prism and wavelength of spectral lines using the spectrometer	K4
CO4	Acquire knowledge of magnetic dipole moment of a bar magnet using a deflection magnetometer by Tan A position	K4 & K5
CO5	Acquire knowledge about how a semiconductor diode rectifies an input ac signal and also applications of special diodes	K5
CO6	Design the of universal building block circuits and verify the De Morgan's theorem using IC's	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	S	M	M	S	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
NMEC - I	**Course Code:** 20UPH3N01		**Course Title** : Physics For All	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
III	2	30	2	100

Course Objectives

1. To understand the basic concepts of matter and fundamendal interactions in Physics.
2. To acquire knowledge of the earth and cosmos.

UNIT – I: MATTER

Atomic constituents - Duality - Particles and waves - Uncertainty principle Phases of matter - Internal energy and temperature - Law of Thermodynamics - Conductors, Insulators & Semi-conductors Superconductivity and super fluidity.

Unit – II: FUNDAMENTAL INTERACTIONS

Law of Gravitation (general theory) - Electromagnetism - Maxwell's equations Nuclear force - Radioactivity - Strong and Weak interactions - Elementary particles (Classification) - Unification of forces.

UNIT – III: ENERGY

Conservation of energy - Planck's hypothesis - Mass-energy equivalence - Nuclear energy - Solar energy - Non-conventional sources of energy.

UNIT – IV: THE EARTH

Internal structure of the Earth - Plate Tectonics - Earthquakes - Magnetism of the Earth - Atmosphere - Global climatic changes.

UNIT -V: COSMOS

Visible universe - Galaxies - Milky way - Solar system - Birth and death of stars - Neutron Star, Pulsars, Black holes - Big Bang theory.

BOOKS FOR STUDY:

1. Roger J Blinstoyle, Physics of Particles, Matter and the Universe, Institute of Physics Publishing, Bristol (1997).

2. Robert M. Hazen & James Trefil, Science Matters, Universities Press (India) Ltd. (1991).

BOOKS FOR REFERENCE:

1. John Gribin, Almost Everyone's guide to Science, Universities Press (1998).

3. John J Merill, W Kenneth Hamblin, James M Thorne, Physical Science Fundamentals, - Macmillan, NY (1982).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge of Law of Thermodynamics, Non-conventional sources of energy and Galaxies	K1 & K2
CO2	Deal with Elementary particles and Earthquakes	K3
CO3	Learn the Radioactivity and Magnetism of the Earth	K4
CO4	Analyse the Solar system and Nuclear energy	K5 & K6
CO5	Examine the performance of conservation of energy and Big Bang theory	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	M	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
NMEC - II	**Course Code:** 20UPH4N02		**Course Title** : Physics of Appliances and Devices	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
IV	2	30	2	100

Course Objectives

1. Know the Physics Principles used in many frequently used appliances.
2. Appreciate the Physics principles that are used in media and communication systems.

UNIT - I: HOUSE WIRING

Single phase and three phase electrical power supply– House wiring – Switch board wiring – Fan regulator connection – Eliminator testing – Multimeter – Tester usage – Lighting arrestor.

UNIT - II: HOME APPLIANCES -I

Principle and working of electric lights, the electric fan, air cooler and airconditioning unit.

UNIT - III: HOME APPLIANCES -II

Principle and working of pressure cooker, refrigerator, washing machine, mixie, grinder, rice cooker, microwave oven.

UNIT - IV: COMMUNICATION SYSTEMS -I

Principles of telephone, cell phone, fax, and internet –Working of Xeroxmachine and printers.

UNIT V: COMMUNICATION SYSTEMS -II

Principles involved in the working of the radio, TV, the remote control- Principle and working of the tape recorder,CD player and the DVD player –Uses of microphones, amplifiers and loud speakers.

BOOKS FOR STUDY:

1. Sedov. E, Entertaining Electronics, University Publishers (1986).
2. Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice Hall of India (2011).

BOOKS FOR REFERENCE

1. Ivar Utial, 101 Science Games, Pustak Mahal, Delhi (1989).

2. Brijlal & Subramaniam, Electricity & Magnetism , S. Chand & Co (2002).

3. Theraja, 2002. Electrical technology, S. Chand & Co (2002).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge of electrical power supply and its performance	K1 & K2
CO2	Deal with House wiring	K2
CO3	Learn the Switch board wiring and printers	K2
CO4	Analyse the tape recorder,CD player and the DVD player –Uses of microphones, amplifiers and loud speakers.	K3 & K4
CO5	Examine the performance of pressure cooker, refrigerator, washing machine, mixie, grinder, rice cooker, microwave oven, electric fan, air cooler and airconditioning unit	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – V		**Course Code:** 20UPH5C05		**Course Title:** Optics
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	5	100

Course Objectives

1. To habituate the basic concepts of optics and fiber optics.
2. To interpret about interference, diffraction, polarization and fibers.
3. To acquire knowledge about optics and fiber optics communication system.

UNIT – I: ABERRATIONS

Monochromatic Aberrations – Spherical Aberration – Methods of Minimizing Spherical Aberration – Definition of Coma, Astigmatism, Curvature of Field And Distortion – Chromatic Aberration – Equivalent Focal Length Of Two Thin Lenses – In Contact and out of Contact Method – Eye Pieces: Huygen'sand RamsdenEyepiece – Location of Cardinal Points.

UNIT – II: INTERFERENCE

Interference -Interference in Thin Films due to Reflected Light – Air Wedge –Newton's Rings – Michelson Interferometer –Determination of a Wave Length of Monochromatic Light – Difference in Wave Length Between Two Neighboring Spectral Lines – Febry– Perot Interferometer.

UNIT – III: DIFFRACTION

Fresnel's and Fraunhoffer Diffraction – Fresnel's Half Period Zones – Area of the Half Period Zones – Zone Plate – Comparison of Zone Plate With Convex Lens – FraunhofferDiffraction Pattern with N Slits (Diffraction Grating) – Normal Incidence, Absent and Overlapping Spectra of Diffraction Grating – Resolving Power of a Telescope, Microscope and Grating.

UNIT – IV: POLARIZATION

Polarization – NicolPrism as Polarizer and Analyzer – Dichroic Polarizers – Huygen'sTheory of Double Refraction in Uniaxial Crystals – Double Image Polarizing Prisms – Quarter Wave Plate, Half Wave Plate – Babinet'sCompensator – Plane, Elliptically and Circularly Polarized

Light – Production and Detection – Optical Activity, Analysis of Light by Laurent's Half Shade Polarimeter.

UNIT – V: FIBER OPTICS COMMUNICATION

Introduction – Fiber Optic System – The Fiber Optic Communication Compared to Metallic Cable (Electrical) Communication – Basic Principle–Acceptance Angle and Acceptance Cone – Propagation of Light Waves in an Optical Fiber –Fibers – Classifications – Single Mode and Multimode Fiber – Comparison of Single Mode and Multimode –Fiber Optic Communication System.

BOOKS FOR STUDY:

1. R. Murugeshan and KiruthigaSivaprasath, Optics and Spectroscopy, S. Chand & Co, New Delhi (2010).

[Unit Covered -1,2,3 and 4: Pages 15-29, 38-62,65-101,104-122].

2. N. Subramaniyam, Brijlal and M.N. Avadhanulu, A text book of Optics, S. Chand & Co, New Delhi, (2012).

[Unit Covered -1,2,3,4 and 5: Pages: 172-195, 339-377, 394-461, 480-536, 623-639]

BOOKS FOR REFERENCE:

1. Ashok kumar, D.R. Khanna and H.R. Gulati, Fundamentals of Optics, S. Chand & Co. Pvt. Ltd (2012).

2. Subir Kumar Sarkar, Optic Fibres and Fibre Optic Communication Systems, S. Chand & Co., New Delhi (2003).

3. Eugene Hecht, Optics, Pearson, 4th Edition (2013).

4. Francis Jerkins and Harvey White, Fundamental Optics, McGraw Hill Inc., New Delhi (2011).

5. Ariel Lipson, Stephen G. Lipson & Henry Lipson, Optical Physics, Cambridge University Press, 4th Edition (2010).

6. M.G. Raj, Fundamentals of Optics, Anmol Publications Pvt. Ltd., NewDelhi (2004).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand fundamental principles and concepts of optics and fiber optic communication system.	K1 & K2
CO2	Acquire knowledge about different optical instruments and develop skills towards their operation.	K2 & K3
CO3	Apply the gained knowledge and skills in optical communication.	K3 & K4
CO4	Analyze the output results of different optical communication system.	K5
CO5	Interpretation of analyzed results	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – VI	**Course Code:** 20UPH5C06		**Course Title:** Basic Electronics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	5	100

Course Objectives

1. To acquire basic knowledge about Electronic devices.
2. To understand working principle of basic Electronic devices and their applications.

UNIT – I: DIODES AND ITS APPLICATION

Semiconductor diode – Bridge rectifier – Regulated Power Supply – Zener Diode – Voltage regulation – Light Emitting Diode (LED) and its advantages – Multicolor LEDs and its applications – Photo diode – Characteristics and applications – Tunnel diode and its Characteristics – Tunnel diode as an Oscillator.

UNIT – II: BIPOLAR JUNCTION TRANSISTORS

Transistor – Bipolar Junction Transistor – Transistor connections – CB, CE, CC Configuration – Current Gain – α, β, γ and their relationships – Comparison of transistor connections – Transistor biasing – Base resistor method – Feedback resistor method – Voltage divider bias method – Load line analysis – DC and AC load line analysis.

UNIT – III: UNIPOLAR DEVICES

Junction Field Effect Transistor – Construction and working of JFET –JFET characteristics and its parameters – JFET Common Source Amplifier – MOSFET – Depletion MOSFET– Enhancement MOSFET – Comparison of MOSFET– Construction, working, V–I characteristics – Applications – UJT: Construction, working, V–I characteristics – UJT Relaxation Oscillator.

UNIT – IV: TRANSISTOR AMPLIFIERS AND OSCILLATORS

Definition of gain, frequency response, decibel gain and bandwidth – Operation, frequency response, advantage, disadvantage – RC coupled CE transistor amplifier and transformer coupled amplifier –Principle of feedback in amplifiers – Positive and negative feedback –

Effect of negative feedback – Positive feedback amplifier as an oscillator – Hartley oscillator – Colpitt's oscillator – Phase shift Oscillators –Multivibrators: Astable and monostable using transistor.

UNIT – V: BASIC OPERATIONAL AMPLIFIERS

Operational Amplifier: Symbol and Terminals Op–amplifier – Characteristics – Differential amplifier – CMRR Op – Amp inverting – Non inverting amplifier – Applications: Differentiator – Integrator, Adder and Scale Changer – logarithmic and Antilogarithmic amplifiers –Voltage to current converter and Current to Voltage converter.

BOOKS FOR STUDY:

1. V.K Metha, Principles of Electronics, S. Chand & Co., 11th Edition, New Delhi (2001). [Unit Covered: 1-5: Pages: 125 – 140, 141 – 180, 192 – 239, 506 – 553, 577 – 600, 280 –305, 335 – 363, 364 – 388, 662 – 680].

2. B.L. Theraja, Basic Electronics (Solid state), S. Chand & Co., 5th Edition, New Delhi (2003).

[Unit Covered: 1-4: Pages: 182 – 198, 236 – 247, 274 – 290, 354 – 379, 390 – 399, 400 –416, 417 – 428, 429 – 446, 447 – 459].

BOOKS FOR REFERENCE:

1. M.K. Bagde and S.P. Singh, Elements of Electronics, S. Chand & Co. Pvt. Ltd, (1982).
2. R. S. Sedha, A Text Book of Applied Electronics, S. Chand & Company, Pvt. Ltd, (1990).
3. D. Chattopadhyay and et.al. Foundations of electronics, New Age International Publishers (1999).
4. Thomas L. Floyd, David Buchla, .Electronics: Fundamentals of Analog circuits, Prentice Hall (1999).
5. Gupta & Kumar, Hand book of Electronics, Pragati Prakhasan (2005).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire basic knowledge about Electronic devices	K1 & K2
CO2	Understand basic principles and concepts behind the working of basic Electronic devices	K2 & K3
CO3	Develop skills to identify basic electronic devices based on their output characteristics curves	K3&K4
CO4	Apply the gained knowledge and skills in laboratory practical's and daily life's	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – VII	**Course Code:** 20UPH5C07		**Course Title:** Solid State Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	5	100

Course Objectives

1. To habituate the basic concepts of Crystal, Crystal Structures and Crystal Imperfections.
2. To realize the theories related to X-ray diffraction methods.
3. To acquire knowledge about magnetic and dielectric materials and their properties.
4. To understand the theory, properties and applications of Superconductivity.

UNIT I: CRYSTAL STRUCTURE

Crystal lattice - Primitive and Unit cell – Crystal Systems – Bravais Lattice - Miller indices – Structure of Crystal - Simple Cubic, Body Centered Cubic, Face Centered Cubic and Hexagonal Close Packed structure, Sodium chloride structure, Zinc blende structure and Diamond structure.

UNIT II: CRYSTALLOGRAPHY AND CRYSTAL IMPERFECTIONS

X ray Spectrum - Moseley's law - Diffraction of X-rays by crystals -Bragg's law in one dimension - Experimental method in X-ray diffraction – Laue's method, rotating crystal method – Powder photograph method - Point defects – Line, surface and volume defects - Effects of crystal imperfections.

UNIT III: MAGNETIC PROPERTIES

Different types of magnetic materials (dia , para , ferro, anti- ferro and ferrites) – Langevin's theory of diamagnetism – Quantum theory of diamagnetism - Langevin's theory of paramagnetism - Quantum theory of paramagnetism - Weiss theory of paramagnetism – Heisenberg 's internal field and Quantum theory of ferromagnetism.

UNIT IV: DIELECTRIC PROPERTIES

Fundamental definition in dielectrics - Different types of electric polarization - Frequency and temperature effects on polarization - Dielectric loss - Local field at an atom - Lorentz

formula - Claussius - Mosotti relation - Determination of dielectric constant – Dielectric breakdown - Properties of different types of insulating materials.

UNIT – V: SUPERCONDUCTIVITY

Introduction - General properties of superconductors - Effect of magnetic field - Meissner effect - Effect of current - Thermal properties – Entropy - Specific heat - Energy gap - isotopic effect - London equation - Penetration depth - Josephson effect - Type I and type II superconductors - BCS theory -Application of super conductors

BOOKS FOR STUDY:

1. P.K.Palanisamy, Applied Physics, Scitech Publications (India) Pvt.Ltd, 8th Reprint (2008) [Unit Covered 1,2,3 and 4: Sections: 2.1-2.15 and 2.21-2.23, 2.30-2.36, 7.1-7.9 and 7.15-7.27,6.1-6.14, 9.1-9.20]
2. R.L.Singhal, Solid State Physics, Kedar Nath Ram Nath & Co, Meerut, 7th Revised & Enlarged Edition (2006).
   [Unit Covered 1,2, 3 and 4: Pages: 1-21,25-27, 43-47, 355-361, 280-323, 334-349,408-423]
3. Gupta Kumar, Solid State Physics, K. Nath & Co, Meerut, 9th Edition (2006).
   [Unit Covered 1, 3 and 4: Pages 1-44, 52-71,565-585,437-451, 520-544, 409-430].

BOOKS FOR REFERENCE:

1. Charles Kittel, Introduction to Solid State Physics, John Wiley, 8th Edition (2012).
2. V.Raghavan, Material Science and Engineering: A First Course, PHI Learning, 5th Edition (2004).
3. L.V. Azaroff, Introduction to Solids, Tata Mc.Graw Hill (1993).
4. A. Beiser, Concepts of Modern Physics, Tata Mc.Graw Hill, 5th Edition (1997).
5. A. J.Dekker, Solid State Physics, MacMillan India Ltd, 1st Edition (2000).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concepts of crystal and crystal structure	K1 & K2
CO2	Gather knowledge about importance of crystal defects	K2 & K4
CO3	Develope the practical knowdege in the area of crystallography	K4 & K5
CO4	Analyze the importance of magnetic and insulating materials in different fields	K6
CO5	Learn the theories and applications involved in the superconductors	K4 & K5

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	M
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	M	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – VIII	**Course Code:** 20UPH6C08		**Course Title:** Atomic Physics and Spectroscopy	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	5	100

Course Objectives

1. To habituate the basic concepts of atomic Physics and spectroscopy.
2. To realize the theories related to atomic Physics and spectroscopy.
3. To acquire knowledge about principal and applications of spectroscopy techniques.

UNIT – I: THEORY OF ALPHA PARTICLE SCATTERING

Theory of alpha Particle scattering – Rutherford scattering formula – experimental verification – nature of privileged quantum orbits – Bohr's correspondence principle – effect of motion of nucleus – evidences in favour of Bohr's theory – Determination of critical potential – Davis and Goucher's method –Sommer field's relativistic atom model – application to fine structure of Hα line.

UNIT – II: QUANTUM NUMBERS AND ITS APPLICATIONS

Description of vector atom model – quantum numbers associated with vector atom model – coupling schemes – J.J. coupling – LS. coupling– application of spatial quantisation– Pauli's exclusion principle – the selection rule – intensity rule –Lande's g factor – Bohr magneton– applications of vector atom model – electron configuration – magnetic dipole due to spin – Stern – Gerlach experiment.

UNIT – III: ZEEMAN EFFECT AND ITS APPLICATIONS

Spectral terms and notations – fine structure of Sodium D lines – fine structure of Hα line – Zeeman effect –Larmor's theorem – Quantum mechanical explanation of normal Zeeman effect – anomalous Zeeman effect of D1 and D2 lines of Sodium –Paschen– Bach effect – Stark effect.

UNIT – IV: MOLECULAR SPECTROSCOPY

Diatomic molecules –rotation spectra rigid rotator non - rigid rotator –isotope effect in rotation spectra –vibration spectra –microwave and IR Spectroscopy –linear harmonic oscillator –Raman Effect –Stoke‘s and Anti-stoke‘s lines scattering of light – experimental study of Raman Effect –classical and quantum theories of Raman effect –instrumentation and applications.

UNIT – V: ABSORPTION AND RESONANCE SPECTROSCOPY:

UV, NMR, ESR, Mossbauer spectroscopy–Overview theory of instrumentation and application.

BOOKS FOR STUDY AND REFERENCES:

1. J.B. Rajam, Atomic Physics, S. Chand & Co. (2004)
   [Unit Covered: 1,2 and 3: Pages :553 - 732]
2. Gurdeep R.Chatwal Sham K.Anand, Spectroscopy (Atomic and Molecular), Himalaya Publishing House, Mumbai (2001)
   [Unit Covered: 4 and 5: Sections :2.29 -2.105, 2.185 – 2.23, 2.245 – 2.268, 2.417 – 2.422]

BOOKS FOR REFERENCE:

1. N. Subramanyam and Brijlal, Atomic and Nuclear Physics, S. Chand & Co. (2004).
3. D.N.Sathiyanarayana, Vibrational Spectroscopy, New age international Publisher (2000).
4. Henry Semat, John R. Albright, Introduction to Atomic and Nuclear Physics, Fletcher & Son Ltd, Norwich (1972).
5. T.A. Littlefield, N. Thorley, Atomic and Nuclear Physics, Medtec, New Delhi (2013).
6. B.N. Srivatsava, Basic Nuclear Physics and Cosmic rays, Pragti Prakashan publishers, Meerut (2011).
7. Bernald L. Cohen, Concepts of Nuclear Physics, McGraw–Hill Inc., US (1971).
8. C.N.Banwell, Elaine M.Mc Cash, Fundamental of Molecular Spectroscopy,Mc Graw Hill, New Delhi (2010).
9. G. Aruldhas, Molecular Structure and Spectroscopy, PHI Learning Private Limited, New Delhi (2009).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Gather knowledge about various atom model	K1
CO2	Understand the basic concepts of four types of Quantum Numbers	K1 & K2
CO3	Learn the different theories behind the atom presence within the Magnetic field	K3
CO4	Analyze the importance of rotational and vibrational Spectroscopy	K4 & K5
CO5	Acquire knowledge in absorption and resonance spectroscopy	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	S	S	M
CO2	S	M	S	S	S
CO3	S	S	S	S	M
CO4	S	S	M	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – IX	**Course Code:** 20UPH6C09		**Course Title:** Nuclear Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	5	100

Course Objectives

1. To develop basic knowledge about nucleus and its properties.
2. To impart knowledge about nucleus properties and nuclear models to understand relevant reaction dynamics.

UNIT – I: RADIOACTIVITY

Law of successive disintegration - Transient and secular equilibrium - Range of alpha particles - Experimental measurement - Geiger - Nuttal Law - Alpha ray spectra - Gamow's theory of alpha decay and its experimental verification - Beta ray spectra - Origin of line and continuous spectrum - Fermi's theory of beta decay - K electron capture.

UNIT - II: PARTICLE ACCELERATORS AND DETECTORS

Principle and working - Solid state detector - Proportional counter - Wilson's cloud chamber - Scintillation counter. Accelerators: Synchrotron - Electron synchrotron - Proton synchrotron - Betatron.

UNIT – III: ARTIFICIAL TRANSMUTATION AND NEUTRON:

Artificial Transmutation: Rutherford's experiment - Bohr's theory of Nuclear disintegration – Q value equation for a nuclear reaction - Threshold energy - Types of nuclear reaction - Energy balance and the Q value - Threshold energy of an endoergic reaction. Neutron: Mass, charge, decay, spin and magnetic moment, Neutron diffraction, Absorption of neutron by matter - Neutron sources - Detectors - Neutron collimator.

UNIT - IV NUCLEAR STRUCTURE

General properties of nucleus: Size, mass and charge - Proton-Electron theory - Proton - Neutron theory - Meson theory of nuclear forces - Nuclear models - Liquid drop model - Weizacker's semi empirical formula - Nuclear shell model.

UNIT – V: NUCLEAR FISSION, FUSION AND ELEMENTARY PARTICLES

Nuclear fission - Bohr Wheeler theory - Chain reaction - Nuclear fission reactor – Nuclear fusion - Source of stellar energy - Carbon–Nitrogen cycle - Proton–Proton cycle - Thermo Nuclear reaction – Plasma. Elementary Particles: types of interactions - Classification of elementary particles - Particle quantum numbers – Baryon number - Lepton number - Strangeness number - Hypercharge - Isospin quantum number.

BOOKS FOR STUDY:

1. R. C. Sharma, Nuclear Physics by, K. Nath & Co., 5th Edition, Educational Publishers Meerut, (1992).
   [Unit Covered: 1-5: Pages: 1– 54, 55 – 85, 86 – 127, 128 – 195, 250 – 274, 277 –311, 312 – 352, 413 – 441, 442 – 466, 467 – 516, 517– 540, 541 – 561, 562 – 605].
2. R. Murugesan, Modern Physics, S.Chand & Co., 7 th Edition, New Delhi, (2005).
   [Unit Covered: 1-5: Pages: 385 – 407, 408 – 414, 415 – 431, 432 – 445, 446 – 479, 488 – 509, 510 – 523, 524 – 529, 540 – 551].

BOOKS FOR REFERENCE:

1. S. N. Ghosal, Atomic and Nuclear Physics, S.Chand & Co, New Delhi (2005).
2. G Aruldhas and P Rajagopal, Modern Physics, Prentice Hall India (2005).
3. J.B. Rajam, Atomic Physics, S.Chand & Co. (2005)
4. D. C. Tayal, Nuclear Physics, Himalaya Publishing House Private Ltd. (2008)
5. V.W. Kulkarni, Atomic and Nuclear Physics, Himalaya Publishing House, 1st Edition, New Delhi (2004).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire basic knowledge about Nuclear physics	K1 & K2
CO2	Gain principles and concepts of Radioactivity, nuclear reactors, artificial transmutation, nuclear models and nuclear reactions	K2 & K3
CO3	Exert the knowledge in demonstrating practical experiments	K3&K4
CO4	Analyze the importance of nuclear physics in different fields	K5
CO5	Apply various aspects of nuclear reactions in view of compound nuclear dynamics.	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core – X	**Course Code:** 20UPH6C10		**Course Title:** Quantum Mechanics and Relativity	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	5	100

Course Objectives

1. To understand the basic concept of Quantum Mechanics and Relativity
2. To demonstrate the Uncertainty principle
3. To study the stationary state and eigen spectrum of systems using Schrodinger wave equation.
4. To know the three dimensional Schrodinger's wave equation and how it can be used to understand the separation of variables.

UNIT I: WAVE MECHANICS - I

Inadequacy of classical mechanics – Need of quantum mechanics – Wave packet – Superposition of two waves: phase velocity, group velocity and relation between phase & group velocity–Wave particle duality – de- Broglie wavelength– Experimental confirmation of matter waves:Davisson andGermerexperiment – G.P. Thomson's experiment.

UNIT II:WAVE MECHANICS - II

Heisenberg's Uncertainty Principle– Elementary proof between displacement & momentum and energy & time– Illustration: Diffraction of electrons through a slit, Gamma ray microscope through experiment– Applications: non-existence of free electrons in the nucleus, and size &energy in the ground state of hydrogen atom –Basic postulates of wave mechanics:eigen value and eigen function, operator formalism, linear operators,hermitian operator, parity operator, self- adjoint operators and expectation values – Properties of wave function: normalized and orthogonal wave function and probability current densities in three dimensions

UNIT III: SCHRODINGER'S WAVE EQUATION IN ONEDIMENSION

Schrodinger's wave equation for time dependent and time independent forms –Schrodinger's equation for free particle andphysical significances– Particle in a box: tunneling in one

dimension across a step potential and rectangular potential barrier – Onedimensional harmonic oscillator:Hermitepolynomials and zeropoint energy.

UNIT IV: SCHRODINGER'S WAVE EQUATION IN THREEDIMENSION

Three dimensional schrödinger's wave equation– Hydrogen atom: Wave equation for the motion of a electron, separation of variables, azimuthal wave equation and its solution, radial wave equation and it's solutions, polar wave equation and its solution– Rigid rotator:separation of variables – rotational energy levels and eigen functions– Orbital angular momentum, spin angular momentumand, total angular momentum operators and its commutation relations.

UNIT V: RELATIVITY

Frame of reference –Gallilean transformation – Michelson and Morley experiment – Postulates of special theory of relativity – Lorentz transformation – Length contraction – Time dilation – Relativity of simultaneity: addition of velocities – Variation of mass with velocity: Einstein mass and energy relation – Minkowski's four dimensional space – Elementary ideas of general theory of relativity.

BOOKS FOR STUDY:

1. R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics, S. Chand & Co, New Delhi (2016).
   [Units Covered:1–5; Pages: 3–25, 169–214, 251–255].
2. Satya Prakash, Quantum Mechanics, Pragathi Prakashan Educational Publisher, Special student edition (2006).
   [Units Covered: 1–4; Pages: 1-126, 145-147].
3. G. Aruldhas, Quantum Mechanics, Prentice–Hall of India Pvt. Limited, New Delhi (2006).
   [Units Covered: 1–4; Pages: 22-48, 121-129, 170-180].
4. N.Subrahmanyanand Brij Lal Revised by JivanSeshan, Atomic and Nuclear Physics, S.Chand & Company Ltd. (2005).
   [Units Covered: 1–5; Pages: 1-20, 69-97, 98-115].

BOOKS FOR REFERENCE:

1. V.K. Thangappan, Quantum Mechanics, New Age International (1993).
2. Ajoy Ghatak & S. Loganathan, Quantum Mechanics, Springer (2004).

3. Linus pauling, E. Bright wilson, Introduction to Quantum Mechanics, Dover Publications Inc., United States (1985).
4. Arthur Beiser, Concepts of modern Physics, McGraw Hill Education; 6th Edition (2009).
5. P.M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, Tata McGraw–Hill, New Delhi (1976).
6. Hugh D. Young and Roger A. Freedman, Sears & Zemansky's University Physics with Modern Physics, 14th Edition (2015).
7. Max Born, Atomic physics, Dover Publications Inc, 8th Edition (1990).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand fundamental principles and concepts behind the quantum mechanics and relativity	K1 & K2
CO2	Acquire skills to analyse wave properties, nature of wave functions and commutation relation	K2 & K3
CO3	Understand the formulation of Schrodinger equation and evaluate solutions to eigen value and eigen function	K3 & K4
CO4	Differentiate the nature of particles at different states or environment	K5&K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Elective Courses

Program: B.Sc. Physics				
Elective – I	**Course Code:** 20UPH5E01		**Course Title:** Mathematical Physics and Numerical Methods	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	5	100

Course Objectives

1. To understand the basic concepts of Mathematical Physics and Numerical Methods.
2. To acquire knowledge to solve the problems about matrix, differential equation, curve fitting, numerical interpolation.

UNIT – I: MATRIX

Introduction –Types of Matrices – Transpose of a Matrix– Inverse of a Matrix – Characteristics Equation – Eigen Values and Eigen Vectors – Diagonalization of Matrices – Cramer's rule – Cayley – Hamilton Theorem – Problems.

UNIT – II: BETA, GAMMA FUNCTIONS AND DIFFERENTIAL EQUATIONS

Fundamental Properties of Gamma Functions – Relation Between Beta and Gamma Function – Legendre, Bessel, Hermite and Laguerre differential equations.

UNIT – III: CURVE FITTING

Principle of Least Square – Fitting a Straight Line – Fitting a Parabola – Fitting an Exponential Curve.

UNIT – IV: ITERATIVE METHODS AND SOLUTION OF ORDINARY DIFFERENTIAL EQUATION

Solving Non-Linear Equation – Bisection Method – Runge-Kutta Method (Second and Third orders only) – Euler's Method – Improved and Modified Euler Method – Newton RaphsonMethod – Successive Approximation.

UNIT – V: NUMERICAL INTERPOLATION AND INTEGRATION

Newton's Forward and Backward Formulae – General Formula – Trapezoidal Rule – Simpson's - 1/3 rdRule and 3/8th Rule – Gaussian Quadrature Formula.

BOOKS FOR STUDY:

1. Prof.P.Duraipandian, Dr.S.Udayabaskaran, Allied Mathematics, S.Chand & Company PVT. LTD (2016).
   [Unit Covered: 1: Pages: 192-269]
2. R. Murugeshan, Mechanics and Mathematical Physics, S.Chand& Company Ltd., New Delhi, Third Revised Edition (2008).
   [Unit Covered 2: Pages: 150-16]
3. Dr. A.Singaravelu, Numerical Methods, Meenakshi Agency (2012).
   [Unit Covered 3,4 and 5: Sections : 1.19, 1.93, 4.27 - 4.67, 3.1-3.98]

BOOKS FOR REFERENCE:

1. B. D. Gupta, Mathematical Physics, Vikas Publishing House (2009).
2. S.S. Sastry, Introductory methods of numerical analysis, Prentice Hall of India, New Delhi (2012).
3. M.K.Venkataraman, Numerical method in Science and Engineering, The National Publishing Company (1999).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand fundamental principles and concepts of mathematical physics and numerical methods	K1
CO2	Develop problem solving skills in the field of matrix, differential equation, numerical integration.	K2 & K3
CO3	Apply the gathered skills in diverse areas of Physics	K3 & K4
CO4	Compare the output results of different field of applications.	K5
CO5	Become proficient in the course of mathematical physics and numerical methods	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Elective – I	**Course Code:** 20UPH5E02		**Course Title:** Energy Physics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	5	75	5	100

Course Objectives

1. To gain knowledge pertaining to Physics aspects of diverse energy sources.
2. To understand technological aspects of renewable energy devices and their application potentials.

UNIT I: FOSSIL FUELS AND RENEWABLE ENERGY SOURCES

Fossil fuels and nuclear energy – Comparison – coal, oil and natural gas – Limitations of fossil fuels and nuclear energy – Renewable energy sources and their types.

UNIT II: APPLICATIONS OF SOLAR ENERGY

Solar photovoltaics – Photovoltaic generation basics – Crop dryers – Solar ponds – Water desalination – Merits and demerits of solar energy.

.

UNIT III: HYDRO AND OCEAN ENERGY

Hydropower resources – Hydropower technologies – Ocean thermal energy conversion – Energy from waves and tides – Basic ideas, nature, applications, merits and demerits.

UNIT IV: OTHER RENEWABLE ENERGY SOURCES

Geothermal energy – Geothermal resources and technologies – Hydrogen energy – Hydrogen energy production and storage.

UNIT V: ENERGY FROM BIOMASS

Biomass conversion technologies – Photosynthesis – Classification of biogas plants: Continuous and batch types, Done and drum types – Properties of biogas – Applications of biogas.

BOOKS FOR STUDY

1. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers, New Delhi (2009).
[Unit Covered: 1-5:Pages: 1–44, 146–196, 495–558, 439–491, 609–657,311–435]

BOOKS FOR REFERENCE

1. F. Kreith and J.F. Kreider, Principles of Solar Engineering, Tata McGraw Hill (1978).

2. A.B. Meinel and A.P. Meinel, Applied Solar Energy, Addison Wesley Publishing Co. (1976).

3. M.P. Agarwal, Solar Energy, S. Chand and Co., New Delhi (1983).

4. S.P. Sukhatme, Solar Energy, Tata McGraw Hill (1997).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Gain basic knowledge about origin of diverse energy sources and their types	K1 & K2
CO2	Understand properties of the energy sources and identify their application potentials	K2 & K3
CO3	Gather research-based knowledge about principal, construction and operation of different energy conversion technologies	K3&K4
CO4	Develop skills pertaining to application potential of various energy sources through appropriate technologies	K5
CO5	Design portable energy conversion devices and their demonstration	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Elective – II	**Course Code:** 20UPH6E03		**Course Title:** Materials Science	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	5	100

Course Objectives

1. To enable the student to get knowledge about various crystal structures, the behaviour of magnetic materials and appreciate the applications of ceramics and polymers in various field.

UNIT I: CRYSTALLOGRAPHY

Crystalline and amorphous solids: Crystal lattice – Miller indices – Seven crystal systems and fourteen bravis lattices – X ray crystallography – Laue, rotating crystal and powder methods –Structural determination – Defects in solids – Point, line, surface and volume defects.

UNIT II: BONDING IN SOLIDS AND CRYSTAL GROWTH

Electronic structure of solids – Types of crystal structure – Ionic, covalent, metallic and molecular structures – Binding energy – Crystal structure of compounds – AX, AX2, A2X3, types of compound – Crystal growth techniques: nucleation – Solution growth – Gel growth – PVD – CVD.

UNIT III : ELECTRICAL PROPERTIES OF SOLIDS

Dielectrics and related properties : free electron theory of metals – Wiedemann and Franz law –Schottky effect – Failure of free electron theory – Origin of energy gap – Bands and zones in solids – Classification of solids into insulators, semi conductors and metals – Super conducting materials – Electric dipoles inconstant and alternating fields – Methods dielectric strength –Breakdown of dielectric materials.

UNIT IV – MAGNETIC, CERAMIC AND NANOMATERIALS MAGNETIC MATERIALS

Classification of magnetic materials – Dia, para, ferro, antiferro and ferri magnetic materials –domain theory – Soft and hard magnetic materials – Ferrites and their uses – Ceramics:

classification of ceramic materials and its uses – Structural features – Production techniques – Mechanical properties – Nano materials – Nan clusters and nano tubes.

UNIT V – POLYMERIC MATERIALS

Polymer molecules – Molecular weight of polymers – Osmotic pressure, viscosity and light scattering methods – Thermo plastics and thermosetting materials – Polymerization processes –Polymer classification of structure shapes of polymer molecules – Thermal transition in polymers – Polymer applications.

BOOKS FOR STUDY

1. V. Raghavan, Material Science and Engineering – A First Course, Prentice Hall of India, New Delhi (2004).
2. R.S. Khurmi and R.S Sedha, Material Science, S. Chand and Co. Ltd., New Delhi (2014).
3. M. Arumugam, Material Science, Anuradha Publication, Kumbakonam (1990).

BOOKS FOR REFERENCE

1. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, Hand Book of Chemistry and Physics, The Chemical Rubber Publishing Co., Cleveland (1962).
2. Manaschanda, Science of Engineering Materials, Vol. 1 & 2, LCUE (1981).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Identify the Crystalline and Amorphous nature in Solids and Discuss about the X-ray Crystallography	K1 & K2
CO2	Discuss the various Bonding in solids and Crystal growth using different techniques	K2 & K3
CO3	Acquire knowledge about Electrical knowledge of the solids	K3&K4
CO4	Analyze the behavior of Magnetic materials	K5
CO5	Chose Ceramic and Polymer materials in day to day life	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	S	S	S
CO2	S	S	S	S	M
CO3	M	S	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Elective – II	**Course Code:** 20UPH6E04		**Course Title:** Electronic Communication	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	5	75	5	100

Course Objectives

1. To study fundamentals of about Antennas, Modulation and Receiver.
2. To impart knowledge on Pulse Modulation Techniques.
3. To learn about Radar and Satellite communication.

UNIT – I : ANTENNAS AND WAVE PROPAGATION

Effective Resistance, Effective resistance, Efficiency, Directive gain, Bandwidth, Beam width and polarization - Antenna Arrays and their types - Dipole, Folded dipole, Yagi –Uda, Parabolic, Dish Antennas Ground wave, sky wave and space wave propagation -Skip distance, Maximum usable frequency

UNIT – II : MODULATION TECHNIQUES

Definition - types of modulation AM, FM, PM – expression for amplitude modulated voltage - wave form of amplitude modulated wave – single side band generation -balanced modulator - block diagram and explanation- frequency modulation - expression for frequency modulated voltage -side bands in FM- expression for PM- comparison of AM, FM, PM.

UNIT – III: DEMODULATION TECHNIQUES

Definition - diode detection of AM signals – FM detection - Foster Seely discriminator - radio receivers – straight receivers - TRF receivers – super heterodyne receivers - block diagram- explanation of each stage - FM receivers – block diagram.

UNIT – IV : PULSE MODULATION TECHNIQUES

Sampling theorem - Natural sampling Flat – top sampling- PAM, PWM, PPM, PCM- Quantization of signals, Quantization of noise - Delta Modulation, Adaptive Delta Modulation.

UNIT – V : RADAR AND SATELLITES

Principle of radar – Simple Radar System - Radar equation - Radar antennas - Duplexer - Uses of radar – Introduction to Satellite communication system – Satellite Orbits - Basic components – Telemetry and command system (Block diagram) – Satellite link Model – Satellite link equation.

BOOKS FOR STUDY:

1.A. Amsaveni, Antennas and Wave Propagation, Anuradha Publications, Kumbakonam (2012)

[Unit Covered - 1: Sections, 1.1 – 1.82 and 2.1 – 2.68].

2. Georage Kennedy and Davis, Electronics Communication Systems, Tata McGraw Hill, 4th Edition (2005)

[Unit Covered 1- 4: Pages, 35-39, 56 – 89, 255 – 303 and 484- 499].

3. A. Subramanyam, Applied Electronics, National Publishing Company (2006)

[Unit Covered 2 and 5: Pages, 129 - 154, 241 – 270].

BOOKS FOR REFERENCE:

1.Gupta Kumar, Hand book of Electronics, Pragati Prakhasan, Meerut (2012)

2. Dennis Roddy and John Coolen, Electronics Communications, Pearson Education Publication (1995)

3. Louis E. Frenzel, Principles of Electronic Communication Systems, McGraw-Hill Education (2007)

4. T.G. Palanivelu, Communication Engineering, Anuradha Publicatons (2002).

5. Roddy & Coolen, Communication System -4/e, Pearson Education (2005).

6. Anok Singh, Principles of Communication Engineering, Sathyaprakasam Publications (2004).

7. Wayne Tomasi, Electronic Communication Systems, Pearson Education (2004).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Understand different modulation and demodulation schemes for analog communications.	K1 & K2
CO2	Design analog communication systems to meet desired application requirements .	K1 & K3
CO3	Acquire the knowledge about Digital modulation Techniques	K3 & K4
CO4	Evaluate fundamental communication system parameters, such as Quantization of signals, Quantization of noise etc.	K5
CO5	Elucidate design tradeoffs and performanceof communications systems.	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	M	S
CO3	S	S	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Skill Based Elective Courses

Program: B.Sc. Physics				
SBEC – IV	**Course Code:** 20UPH5S04		**Course Title** Digital Electronics	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	2	30	2	100

Course Objectives

1. To introduce the students to the concepts of Number Systems and the Basic logic Gates.
2. To provide an understanding of Boolean algebra, Karnaugh Map and its Importance in the Electronics.
3. To understand procedures involved in Circuits and its applications.
4. To impart a knowledge of Flip Flop, Counter and Registers.

UNIT I: NUMBER SYSTEMS

Number Systems Used in Digital Electronics-Decimal Number Systems-Binary Number Systems- Octal Number Systems-Hexadecimal Number Systems- Binary Addition-Subtraction-Multiplication and Division, Conversion Algorithms.

UNIT II: BOOLEAN ALGEBRA AND ARITHMETIC CIRCUITS

Boolean Laws and Algebra-Truth Functions- AND Operator- OR Operator- NOT Operator-NAND Operator- Boolean Expressions-Reducing Boolean Expressions and Logic Circuits-NAND and NOR Gates as Universal Building Bloc- Exclusive OR gate- Half Adder and Full Adder- Half Subtractor and Full Subtractor.

UNIT III: MINIMIZATION TECHNIQUES AND CODES

Sum of Product Method-Product of Sum Method- Karnaugh Map-Binary Codes- Weighted and Non-Weighted Codes- Error Detecting Codes-ASCII Code- Gray Code and Excess 3 Code.

UNIT IV: SEQUENTIAL CIRCUITS

Flip Flops- RS Flip Flop-Clocked RS Flip Flop-D Flip Flop-JK Flip Flop-JK Master /Slave Flip Flop- Counters- Asynchronous Counters- Synchronous Counters-MOD 5 Counter and

Wave Forms-Decade Counters and Waveforms-Shift Register- Serial-In- Serial-Out Shift Register (SISO)- Serial-In-Parallel-Out Shift Register (SIPO)-Ring counter.

UNIT V: MEMORY DEVICES

Read Only Memory (ROM), Random Access Memory (RAM)-Programmable Read Only Memory (PROM)-Electrically Programmable Read-Only Memory (EPROM)- Electrically Erasable Programmable Read Only Memory (EEPROM).

BOOKS FOR STUDY:

1. Digital Electronics – An Introduction to Theory and Practice, William H.Gothmann.PHI learning private Limited, New Delhi (1982).

[Unit covered 1-5: Pages: 18 - 37, 88 – 97, 70 - 94,129 – 176, 184 - 213,261 – 270, 333 - 344]

2. Gupta Kumar, Hand Book of Electronics, Pragati Prakashan (2002)

[Unit covered 3: Pages: 640 - 740]

BOOKS FOR REFERENCE:

1. D. A. Godse and A.P. Godse, Digital Electronics, Technical Publlsher, Pune (2008).
2. Morris Mano, Digital Logic and Computer Design, Pearson Education (2004)
3. Don Leach, Albert Malvino, Digital principles and applications, McGraw-Hill Inc., US (1994).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge of analysing about the Number System and Basic Logic Gates.	K1 & K2
CO2	Acquire knowledge aboutKarnaugh Map.	K2
CO3	Understand Sum of Product and Product of Sum.	K2 & K4
CO4	Analyse the Difference of Counter and Register	K4
CO5	Acquire Knowledge of Different Types of Memories.	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	M	S	S
CO3	S	M	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
SBEC – V	**Course Code:** 20UPH5S05		**Course Title** : Nano Science	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V	2	30	2	100

Course Objectives

1. To introduce the basic concepts of Nano Science
2. To learn the concepts of preparation methods
3. To provide an understanding of applications of nanomaterials

UNIT – I: INTRODUCTION TO NANOMATERIALS

Introduction - Historical perspective of nanomaterials - Advantages and disadvantages of nanomaterials - Classification of nanomaterials: Effect of reduced size dimensions on physical properties: Structural – Surface – Optical – Mechanical – Thermal - Magnetic properties - Quantum semiconductors - Quantum confinement - Quantum dots - Quantum wires.

UNIT – II: PREPARATION METHODS

Chemical Method: Synthesis of nanomaterials: Top-down and Bottom-up approaches - Sol gel – Spin coating -Chemical bath deposition - Hydrothermal – Precipitation method – Advantages and disadvantages of chemical method.

Physical method: Introduction- Methods of preparation: Physical Vapour Deposition- Thermal evaporation- Sputtering - DC and RF sputtering - Pulsed Laser deposition - Chemical Vapour Deposition- Pyrolysis – Advantages and disadvantages of Physical method.

UNIT – III: PROPERTIES OF NANOMATERIALS

Properties of nanoparticles; Mechanical properties; Electrical properties; Magnetic properties; Optical properties - Chemical properties - Chemical Vapour Deposition (CVD) – Physical Vapour Deposition (PVD).

UNIT – IV: CHARACTERIZATION TECHNIQUES

Basic principles, instrumentation and application: TGA/DTA – Powder XRD – HRSEM – TEM - UV-Vis spectroscopy – AFM.

UNIT – V: APPLICATIONS OF NANOMATERIALS

Nanomaterials in Photocatalysis – Solar cells - Nanostructured Gas sensors - Bio-Sensors - Drug delivery systems - Diluted magnetic semiconductor (DMS) – Quantum computers – Energy applications.

BOOKS FOR STUDY:

1. K. K. Chattopadhyay, A. N. Banerjee, Introduction to Nanoscience and Technology, New Delhi, PHI Learning Pvt. Ltd. (2009).
2. S. Shanmugam , Nanotechnology, MJP Publishers, Chennai (2010).
3. T. Pradeep, Nano: The Essentials, Tata Mc Graw- Hill Publishers Company Ltd., New Delhi (2007).

BOOKS FOR REFERENCE:

1. A. K. Bandyopadhyay, Nanomaterials, New Age International (P) Ltd., New Delhi (2009).
2. Joseph Goldstein, Scanning Electron Microscopy and X-ray microanalysis, Springer, London (2003).
3. Charles. P. Poole, Frank. J. Owens, Introduction to nanotechnology, New Jerssey, A John Wiley & Sons publications (2003).
4. K. Ravichandran; Introduction to thin films Spectroscopy, Research India Publications, New Delhi (2013).
5. K. Ravichandran, Introduction to the characterization of nanomaterials and thin films, Jazym Publications, Trichy, India (2015).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge about introduction to nanomaterials, their synthesis, properties and applications	K1 & K2
CO2	Understanding of one dimensional and two dimensional nano system	K2 & K3
CO3	Acquire the knowledge in the rapid development of nanoscience and technology	K4
CO4	Learn the different methods of characterizing the Nanomaterials	K5
CO5	Gain knowledge in the development of application of the nanomaterials	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
SBEC – VI	**Course Code:** 20UPH6S06		**Course Title** : Microprocessor 8085	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
VI	2	30	2	100

Course Objectives

1. To introduce the basic concepts of Microprocessor.
2. To provide an understanding of Block Diagram and the Instruction Sets.
3. To impart a knowledge of Writing the Programme and Executing Using Microprocessor.

UNIT I: INTRODUCTION TO 8085 MICROPROCESSOR

Microprocessor- Organization of a Microprocessor Based System-Microprocessor Instruction Set and Computer Language- From Large Computers to Single Chip Micro Controller-Microprocessor-Architecture and its Operations.

UNIT II: ASSEMBLY LANGUAGE PROGRAMMING

8085 Programming Model-Instruction Classification- Instruction and Data Format-Addressing Mode- Overview of 8085-Writing Simple Programs (Addition, Subtraction, Multiplication, Division with 8 bit numbers).

UNIT III: MEMORY INTERFACING

8085 MPU-8085 Microprocessor Pin out and Signals-Microprocessor Communication and Bus Timings- Demultiplexing the Bus AD7-AD0-Generating Control Signals- 8085 Machine Cycles and Bus Timings- Opcode Fetch Machine Cycle- Memory Read Machine Cycle-Memory Structure and its Requirements- Basic Concepts in Memory Interfacing-Address Decoding- Interfacing Circuit.

UNIT IV: INTERFACING OF I/O DEVICES

Basic Interfacing Concepts-Peripheral I/O Instructions- I/O Execution-Device Selection and Data Transfer-Absolute Vs Partial Decoding-Input Interfacing- Interfacing I/Os using Decoders-Interfacing Output Displays-Illustration.

UNIT V: PERIPHERAL DEVICES AND APPLICATIONS OF MICROPROCESSOR

Introduction- Programmable Peripheral Interface (PPI) - Programming the Ports- Modes of Operation- Mode Setting- Setting/Resetting Port- C Plus Bits- Programmable DMA Controller-INTEL 8237A. Applications, Temperature Control System, D.C. Motor Speed Control System.

BOOKS FOR STUDY:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing, 6th Edition (2013).
   [Unit covered:1,3, 4 and 5: Pages: 6 - 10, 20 -21, 31 -32, 49 – 50, 54 – 56, 67 -68, 70 -74, 82 – 85, 106 – 107, 114 -115, 219 -221, 382 – 383, 446 – 477, 497 – 501, 572 – 573]
2. Aditya P. Mathur, Introduction to Microprocessor, Mcgraw Hill (1990).
   [Unit covered:1,2 and 3: Pages: 7 - 10, 65 - 66, 112 -120, 174, 178 -179, 181,186 -187]

BOOKS FOR REFERENCE:

1. V. Vijayendran, Fundamental of Microprocessor 8085: Architecture Programming and Interfacing, Viswanathan, S., Printers & Publishers PVT Ltd (2009).
2. B. Ram, Fundamentals of Microprocessor and Microcontrollers, Dhanpat Rai Publications (2008).
3. Charles M. Gilmore, Microprocessor: Principles and Application, McGraw-Hill (1995).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Acquire knowledge of analysing terms Related to Microprocessor	K1 & K2
CO2	Acquire knowledge of Basic Programs of Addition and Subtraction	K2
CO3	Understand InstructionandMicroprocessor Pin out.	K2 & K4
CO4	Understanding the Basic Interfacing Concepts	K4
CO5	Acquire Knowledge to Programmable Peripheral Interface.	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	M	S	S
CO3	S	S	M	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Core Practical Courses

Program: B.Sc. Physics				
Core Practical - III	**Course Code:** 20UPH6P03		**Course Title** : Core Practical - III	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	3	45	4	100

Course Objectives

1. To understand the concept of cantilever and also determine the thermal conductivity of bad conductor by Lee's disc method
2. To determine the refractive index of the given lens and prism.
3. To construct and verify several electronics and digital circuits
4. To explore the basic knowledge in the field of electricity.
5. To observe the characteristics of LED, FET, UJT and SCR.

LIST OF EXPERIMENTS

1. Young's modulus - Cantilever - mirror and Telescope.
2. Rigidity modulus – Static Torsion.
3. Coefficient of viscosity - ungraduated burette - radius by mercury pellet.
4. Newton's rings - refractive index of a lens.
5. Spectrometer –(i - i')curve.
6. Spectrometer - small angled prism.
7. Lee's disc – Thermal conductivity and emisitivity.
8. Copper voltameter – Determination of B_H
9. Deflection magnetometer - m and B_H- Tan C position.
10. Carey-Foster's bridge – Temperature coefficient of resistance.
11. Potentiometer - Calibration of high range voltmeter.
12. B.G. - Charge Sensitivity.
13. B.G. - Determination of absolute capacity of a condenser.
14. B.G. – Measurement of High resistance by leakage.

15. B.G. – Internal resistance of a cell.
16. Determination of thermo e.m.f – super sensitive galvanometer.
17. LED - Characteristics
18. FET - Characteristics
19. UJT - Characteristics
20. SCR - Characteristics

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Conduct experiments on material and to identify its the strength	K1
CO2	Analyze various physical parameters related to mechanics	K2 & K3
CO3	Understand theoretical principles of optics in the experimental method through the determination of refractive index of the prism and wavelength of spectral lines using the spectrometer	K4
	Acquire knowledge of magnetic dipole moment of a bar magnet using a deflection magnetometer by Tan C position	K4
CO4	Acquire knowledge about how a semiconductor diode rectifies an input ac signal and also applications of special diodes	K5
CO6	Understand the basic concepts of Logic Gates as universal building blocks	K5 & K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	S	S
CO2	M	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**

Program: B.Sc. Physics				
Core Practical - IV	**Course Code:** 20UPH6P04		**Course Title** : Core Practical - IV	
Semester	**Hours/Week**	**Total Hours**	**Credits**	**Total Marks**
V & VI	3	45	4	100

Course Objectives

1. To Determine The Yonng's Modulus Ot The Material By Koenig's Method,
2. To Provide The Undersand Of Wavelength Of Given Light Source And Calculate The Value Of Cauchy's Constant Using Spectrometer.
3. To Construct And Verify Several Electronics And Digital Circuits

LIST OF EXPERIMENTS

1. Young's Modulus - Koenig's method - non - uniform bending.
2. Young's Modulus - Koenig's method - uniform bending.
3. Bifilar pendulum - Parallel threads.
4. Spectrometer - dispersive power of a grating.
5. Spectrometer - Cauchy's constant.
6. Potentiometer - emf of a thermocouple.
7. Field along the axis of a coil - vibration magnetometer.
8. Astablemultivibrator using 555 timer.
9. Monostablemultivibrator using 555 timer.
10. Bistablemultivibrator using 555 timer.
11. IC regulated power supply.
12. Half adder and Full adder.
13. Half subtractor and Full subtractor.
14. RS - flip flops using NAND / NOR gates.
15. BCD to 7 Segment display.
16. Operational amplifier – Inverting and Non-inverting.

17. Operational amplifier – Adder and Subtractor.
18. Operational amplifier – Integrator and Differentiator.
19. Microprocessor *8085* – Addition and Multiplication
20. Microprocessor *8085* – Subtraction and Division.

BOOKS FOR STUDY AND REFERENCE:

1. S. Balasubramanian, R. Ranganathan, M.N. Srinivasan, A Text book of Physics Practical, 2nd Revised Edition, S. Chand & Sons (2017).
2. C. C. Ouseph, U.J. Rao, V. Vijayendiran, Practical Physics, 1st Edition, Viswanathan.S Printers and Publishers Private Ltd. (2015).
3. P. R. Sasi Kumar, Practical Physics, PHI (2014).
4. S. P. Singh, Advanced Practical Physics, Pragathi Prakasam (2017).
5. C. L Arora, Practical Physics, S. Chand & Co (2010).
6. Geeta Sanon, B.Sc Practical Physics, 1st Edition, Chand & Co., New Delhi (2007).
7. K. A. Navas, Electronics Lab Manual, Volume I, PHI, 5th Edition (2015).

Course Outcomes (COs)

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

CO Number	CO Statement	Knowledge Level
CO1	Design the Young's modulus experiments by using Koenig's method and interpret the experimental results	K1 & K2
CO2	Analyze the spectrum of a mercury lamp and record the angle of deviation for the spectral lines	K2 & K3
CO3	Analyze the performance of Half adder,Half Subtractor, Full adder, Full Subtractor and Flip Flop circuits	K4
CO4	Learn the construction and working of Astable, Moonstabe and Bistable multivibrator using IC 555	K5
CO5	Understand the arimatic operations involved in the operational amplifier circuits with IC 741.	K5
CO6	Acquire knomledge about basic program in microprocessor 8085	K6

K1– Remember, K2– Understand, K3– Apply, K4 –Analyze, K5– Evaluate, K6 –Create

Mapping of COs with POs

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	M	M	M	S	S
CO2	M	M	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

S – Strong **M – Medium** **L – Low**