MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL

DEPARTMENT OF PHYSICS

B.Sc. PHYSICS

SYLLABUS TO BE IMPLEMENTED FROM THE ACADEMIC YEAR
2021-2022

(CHOICE BASED CREDIT SYSTEM)

Mother Teresa Women's University, Kodaikanal
Department of Physics
Choice Based Credit System (CBCS)
(2021-2022 onwards)
B.Sc Physics

1. About the Programme

B.Sc.Physics is a three- year undergraduate program comprising of theory and experimental courses mainly from Physics and few interdisciplinary courses from Mathematics, Chemistry and Computer Science. The program emphasises on the fundamentals of Physics while introducing modern concepts such as Quantum Mechanics and Relativity proceeding over to Classical Mechanics, Electrodynamics taking forward the courses like Electricity and Magnetism, Optics and Waves similarly Statistical Mechanics and Thermodynamics.

The undergraduate degree programme paves a solid ground for students to further acquire mastery in Physics concentration areas. The programme trains graduate to establish entry-level careers in the government and private sectors.

2. Programme Educational Outcomes (PEO)

The Programme has been designed to enable the learners to

PSEO1	pursue their Higher Studies in Leading Institutes
PSEO2	attain significant position in Academics with proficiency
PSEO3	cultivate their research acumen for resolving challenging research issues, and secure a position in Research Organization.
PSEO4	create inclusive society with gender equality.
PSEO5	work in Defence Organization with shrewdness, courage, and confidence.
PSEO6	imbibe communicative skills and value system and work ethically in a multidisciplinary environment.

3. Eligibility

A strong foundation in Physics with Mathematics subject at the HSC level passed students

4. General Guidelines for UG Programme

i. **Duration:** The programme shall extend through a period of 6 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.

ii. **Medium of Instruction:** English

iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment and External Examination.

- **Evaluation Pattern**

Evaluation Pattern	Theory		Practical	
	Min	Max	Min	Max
Internal	10	25	10	25
External	30	75	30	75

- **Internal (Theory): Test (15) + Assignment (5) + Seminar/Quiz(5) = 25**
- **External Theory: 75**

- **Question Paper Pattern for External examination for all course papers.**

  Max. Marks: 75   **Time: 3 Hrs.**

S.No.	Part	Type	Marks
1	A	**10*1 Marks=10** Multiple Choice Questions(MCQs): 2 questions from each Unit	10
2	B	**5*4=20** Two questions from each Unit with Internal Choice (either / or)	20
3	C	**3*15=45** Open Choice: Any three questions out of 5 : one question from each unit	45
		Total Marks	75

  * Minimum credits required to pass: 156

- **Project Report**
  A student should select a topic for the Project Work at the end of the third semester itself and submit the Project Report at the end of the fourth semester. The Project Report shall not exceed 75 typed pages in Times New Roman font with 1.5 line space.

- **Project Evaluation**
  There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination. The Project Work carries 100 marks (Internal: 25 Marks; External (Viva): 75 Marks).

5. Conversion of Marks to Grade Points and Letter Grade
   (Performance in a Course/ Paper)

Range of Marks	Grade Points	Letter Grade	Description
90 – 100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	Very Good
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
40-49	4.0 – 4.9	C	Satisfactory
00-39	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

6. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the Prescribed Form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the Prescribed Form with the prescribed fee along with the Medical Certificate. Students with attendance lesser than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

7. Maternity Leave

The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and the Registrar.

8. Any Other Information

In addition to the above mentioned regulations, any other common regulations pertaining to the UG Programmes are also applicable for this Programme.

9. Programme Outcomes (POs):

PO1	To get a thorough understanding of the nature, principles, methods, approaches, and goals of the core subjects
PO2	Solve the problem and get to a logical conclusion by thinking carefully and independently.
PO3	To improve students' problem-solving skills so that they can compete in national level competitive examination.
PO4	To comprehend the connections between physics and other disciplines, as well as societal challenges
PO5	Students will be taught how to improve their employability and entrepreneurship abilities.
PO6	To instills a scientific mindset among students and others outside of the scientific community.

10. Program Specific Outcomes:

PSO1	Demonstrate, solve, and comprehend major topics in all physics fields.
PSO2	Students will show mastery of mathematics and the mathematical principles required for a thorough grasp of physics.
PSO3	Design, carry out, record, and analyse the outcomes of Physics experiments using critical thinking and scientific knowledge.
PSO4	Provide essential foundations, as well as a thorough understanding of underlying principles and contemporary advances.
PSO5	Ability to plan and carry out their own creative ideas in the form of projects, product development, and design.

B.Sc. PHYSICS

S. No.	Course Code	Course Title	Credits	Hours L	Hours P	CIA	ESE	Total
Semester I								
1	U21LTA11	Part I– Tamil–I	3	6	-	25	75	100
2	U21LEN11	Part II– English –I	3	6	-	25	75	100
3	U21PHT11	Core I-Properties of Matter and Sound	4	5	-	25	75	100
4	U21PHP11	Core II- Practical I	4	-	6	25	75	100
5	U21MAA11	Allied Mathematics I (Theory)	4	5	-	25	75	100
6	U21EVS11	Environment Studies	2	2	-	25	75	100
7	U21PEPS11	Professional English I	4	6	-	25	75	100
		Total	**24**	**36**				**700**
Semester II								
8	U21LTA22	Part I– Tamil–II	3	6	-	25	75	100
9	U21LEN22	Part II– English –II	3	6	-	25	75	100
10	U21PHT21	Core III- Mechanics	4	5	-	25	75	100
11	U21PHT22	Core IV- Heat and Thermodynamics	4	5	-	25	75	100
12	U21MAA22	Allied Mathematics II (Theory)	4	5	-	25	75	100
13	U21VAE21	Value Education	3	3	-	25	75	100
14	U21PEPS22	Professional English II	4	6	-	25	75	100
		Total	**25**	**36**				**700**
Semester III								
15	U21LTA33	Part I– Tamil–III	3	6	-	25	75	100
16	U21LEN33	Part II– English –III	3	6	-	25	75	100
17	U21PHT31	Core V- Optics and Spectroscopy	4	5	-	25	75	100
18	U21CHA33	Allied Chemistry	4	5	-	25	75	100
19	U21PHE311/ U21PHE312	Elective I-Energy Physics/ Waves and Oscillations	3	4	-	25	75	100
20	U21MSS31	SBE I-Managerial Skills	2	2	-	25	75	100
21	U21PHN311/ U21PHN312	NME-I	2	2	-	25	75	100
		Total	**21**	**30**				**700**
Semester IV								
22	U21LTA44	Part I– Tamil–IV	3	6	-	25	75	100
23	U21LEN44	Part II–English–IV	3	6	-	25	75	100
24	U21PHT41	Core VI - Electricity and Electromagnetism	4	4	-	25	75	100
25	U21PHP42	Core VII-Practical II	4	-	4	25	75	100
26	U21CHA44	Allied Chemistry Practical	4	-	4	25	75	100
27	U21PHE431/ U21PHE432	Elective II- Medical Physics / Materials Science	3	3	-	25	75	100
28	U21CSS42	SBE II-Computer Skills for Office Management	2	-	2	25	75	100

29	U21PHN421/ U21PHN422	NME-II	2	2	-	25	75	100
		Total	**25**	**31**				**800**
		Semester V						
30	U21PHT51	Core VIII-Atomic and Nuclear Physics	4	5	-	25	75	100
31	U21PHT52	Core IX- Classical and Statistical Mechanics	4	5	-	25	75	100
32	U21PHT53	Core X - Basics of Data Communication and Programming in C	4	5	-	25	75	100
33	U21PHT54	Core XI-Basic Electronics and Communication	4	5	-	25	75	100
34	U21PHP53	Core XII- Practical III	4	-	5	25	75	100
35	U21PHE531/ U21PHE532	Elective III- Numerical methods/ Basic Instrumentation	3	3	-	25	75	100
36	U21PHS531/ U21PHS532	SBE III-Microprocessor Fundamentals / Television Transmission and Receiver	2	2	-	25	75	100
		Total	**25**	**30**				**700**
		Semester VI						
37	U21PHT61	Core XIII – Relativity and Quantum Mechanics	4	5	-	25	75	100
38	U21PHT62	Core XIV-Solid State Physics	4	5	-	25	75	100
39	U21PHT63	Core XV- Mathematical Physics	4	5	-	25	75	100
40	U21PHT64	Core XVI-Nanophysics	4	5	-	25	75	100
41	U21PHP64	Core XVII-Practical IV	4	-	5	25	75	100
42	U21PHE641/ U21PHE642	Elective IV-Astrophysics / Atmospheric Physics	3	3	-	25	75	100
43	U21PHS641/ U21PHS642	SBEIV- Problems Solving Skills in Physics / Weather Forecasting	2	2	-	25	75	100
44	U21EAS61	Extension Activities (NSS/NCC/RRC/YRC/Physical Education)	3	-	-	100	-	100
		Total	**28**	**30**				**800**
		Grand Total	**148**	**193**				**4400**

Non Major Elective

The candidates, who have joined the UG Programme, can also undergo Non Major Elective offered by other Departments.

Non Major Elective offered by Department of Physics

U21PHN311	NME-I House Hold Appliance
U21PHN312	NME-I How Things Work
U21PHN421	NME-II Digital Photography
U21PHN422	NME-II Physics in Musical Instrument

Additional Credit Courses (Two Credit courses)
1. **U21PHO31 Online course 3rd Semester**
2. **U21PHI41   Internship 4th Semester**
3. **U21PHV51 Value added course 5th Semester (Solar Energy Technology)**

SEMESTER-I

COURSE CODE	U21PHT11	PROPERTIES OF MATTER AND SOUND	L	T	P	C
CORE -I			5	-	-	4

Objective:
    To expose students to the fundamental properties of matter and sound.

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

Unit II: Surface Tension
Surface tension – definition – Molecular forces – Explanation of surface tension on kinetictheory – Surface energy – work done in increasing the area of as surface – Excess pressure inside a curved liquid surface – Excess pressure inside a spherical and cylindrical drops and bubbles-drop weight method-variation of surface tension with temperature-experimental determination- Jaegar's method.

Unit III: Viscosity
Viscosity–Coefficient of viscosity–Stream lined and turbulent motion–critical velocity–Rate of flow of liquid in a capillary tube – Poiseuille's formula–viscosity of highly viscous liquid-terminal velocity - Stoke's method- Ostwald Viscometer – viscosity of gas -Mayer's formula- Rankine 's method

Unit IV: Sound
Simple Harmonic Motion –Composition of two S.H.M in a straight line - at right angles - Lissajous's figures - Free, Damped, Forced Vibrations-Resonance-Fourier theorem-application.

Unit V: Ultrasonics and Acoustics
Ultrasonics –Production– Piezo electric crystal method–Magnet ostriction method–Properties and Applications. Acoustics of building – Reverberation- Sabine's Reverberation formula (No derivation) - Factors affecting acoustics of building-Sound distribution in an auditorium-Requisitesfor goodacoustics.

Text Books:
1.   D.S.Mathur, Elements of Properties of Matter, S.Chand & Co., 2010.
2.   R.Murugesan, Properties of Matter, S.Chand & Co., 2004.
3.   Brijlal and Subramanian, Properties of Matter, S.Chand & Co., 2006.
4.   D.R.Khanna and R.S.Bedi, Textbook of Sound, Atmaram and Sons, 1971.
5.   N.Subrahmanyam and Brijlal, A Text Book of Sound, Vikas
      Publishing House - Second Edition, 2018.

Books for Reference:

1. H.R.Gulati, Fundamentals of General Properties of Matter, S.Chand & Co., 1982.

2. D.Halliday, Resnick and J Walker, Fundamental of Physics, 6th Edition,Wiley,2001.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Evaluate modulus of different materials	K3
CO2	Acquire knowledge on properties of liquids	K2
CO3	Understand the physics of sound and its applications	K2
CO4	Learn about different methods of producing Ultrasonic waves and its applications	K1
CO5	Apply the theories in building acoustics	K3

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	2
CO3	3	3	3	3	2	2	3	3	3	3	2
CO4	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	3	3	3	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHP11	PRACTICAL-I	L	T	P	C
CORE -II			-	-	6	4

Objective:

It is aimed at exposing the undergraduate students of the physics department to the techniques of handling equipment's, making error free measurements and error analysis.

ANYFOURTEEN

1. Estimation of Errors
2. Young's modulus- Uniform bending pin and Microscope Method.
3. Young's modulus- Non uniform bending pin and Microscope Method.
4. Young's modulus-Uniform bending opticall ever Method.
5. Young's modulus-Non uniform bending opticall ever Method.
6. Compound Pendulum-gandk.
7. Spectrometer–Angle of prism.
8. Potentiometer–Low range Voltmeter Calibration.
9. Potentiometer–Low range Ammeter Calibration.
10. Sonometer –Law's verification.
11. Melde's -Frequency of the Vibrator.
12. Determination of coefficient of Viscosity– Stoke's Method.
13. Potentiometer–Ammeter Calibration.
14. Torsional oscillation sn, I
15. Thermal conductivity of a bad conductor -Lee's disk Method.
16. Newton's law of cooling.
17. Focal Length of a Convex lens.
18. Focal Length of Concave lens.
19. Comparison of Viscosities by Capillary Flow Method.
20. Comparison of Radii by Capillary Flow Method.
21. Specific heat capacity by Joule's Calorimeter.

TEXT BOOKS:

1. C.C.Ouseph, G.Rangarajan, A Text Book of Practical Physics, S.Viswanathan Publisher – Part I, 1990.
2. C.COuseph, G.Rangarajan, R.Balakrishnan, A Text Book of Practical Physics, S.Viswanathan Publisher-PartII, 1996.
3. S.L.Gupta and V.Kumar, Practical Physics, Pragati Prakashan,25th Edition, 2002.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Able to Estimate Errors	K3
CO2	Calculate the change in dimension of bar	K4
CO3	Determine focal length of different lenses	K4
CO4	Determine co-efficient of viscosity of liquids	K3
CO5	Compare and measure the potential difference of EMF	K4

K1-Remember   K2- Understand   K3-Apply K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating (S)	3
Moderately correlating (M)	2
Weekly correlating (W)	1
No correlation (N)	0

SEMESTER-II

COURSE CODE	U21PHT21	MECHANICS	L	T	P	C
CORE -III			5	-	-	4

Objective:

To give the students fundamental ideas on conservation laws, rotational and vibrational motion of rigid bodies, gravitational fields and some idea about fluid mechanics

Unit I: Laws of Motion

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

Unit II: Dynamics of Rigid body

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

Unit III: Gravitation

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

Unit IV: Central Force Motion

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

Unit V: Statics and Hydro dynamics

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

Text Books:

1. Narayana Moorthy, Mechanics – Part I and II, National Publishing Company,1990.
2. D.S.Mathur, Mechanics, S.Chand & Co.,2nd Edition, 2001.
3. P.Duraipandian, Laxmi Duraipandi, Jayapragasam, Mechanics, S.Chand & Co., NewDelhi, 1988.
4. R.Murugesan, Properties of Matter, S.Chand & Co., New Delhi, 2001.

Books for Reference:

1. Halliday, Resnick and J.Walker, Fundamentals of Physics 6th edition, Wiley,NY,2001.
2. David Kleppner, Robert Kolenkow, Introduction to Mechanics, McGraw Hill Education; 1stedition (2017)

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Learn about laws involved in mechanics	K1
CO2	Understand the forces imposed on a dynamic rigid body	K2
CO3	Determine gravitational field and potential value	K3
CO4	Apply conservation laws in collision experiments.	K3
CO5	Understand the concepts of static and hydrodynamics	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	2
CO3	3	3	3	3	2	2	3	3	3	3	2
CO4	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	3	3	3	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT22	HEAT AND THERMO DYNAMICS	L	T	P	C
CORE -IV			5	-	-	4

Objective:

To understand the phenomena connected with various units of measurement of temperature, knowing the concept of specific heat capacities of matter, transmission of heat, concept of flowering the temperature, liquefying gases and process of making heat to do mechanical work.

Unit I: Thermometry and Calorimetry

Specific heat capacity of solids–Regnault's method of mixtures (solid)–specific heat capacity of liquids–Callendar and Barnes method –Specific heat capacity of gases – C_p and C_v – Meyer's relation – C_v by Joly's differential steam calorimeter method – C_p by Regnault's method.

Unit II: Kinetic Theory of Gases

Kinetic Theory of gases - assumptions – Molecular collisions –mean free path–expression forme an free path – Transport phenomenon – Brownian motion and its features-expression for viscosity, Diffusion and thermal conductivity of gas. Experimental verification-Vander Walls equation of state–Determination of Vander Walls constant- Relation between Vander Wall's constant and critical constants.

Unit III: Low Temperature Physics

Joule-Kelvin Effect- Lique faction of Air- Linde's Process – liquefaction of hydrogen - liquefaction of helium-Kamerlingh - Onne's method -Helium I and II-Lambda point-production of low temperatures-adiabatic demagnetization -practical applications of low temperature - refrigerators and air-conditioning machines-super fluidity-application of super fluidity.

Unit IV: Transmission of Heat

Conduction–coefficient of thermal conductivity–Rectilinear flow of heat along a bar – convection – lapse rate – Stability of the atmosphere –Newton's law of cooling – determination of specific heat capacity of liquid - Radiation -blackbody – Kirchhoff's law – Stefan – Boltzmann law - energy distribution in black body spectrum - Wien's law – Rayleigh Jean's law–Planck's law –solar constant–water flow pyrheliometer.

Unit V: Thermodynamics

Zeroth and first law of thermodynamics – reversible and irreversible processes –isothermal process-a diabatic process-gas equation during adiabatic process –work done Entropy–change of entropy in reversible an irreversible processes–temperature – entropy diagrams – physical significance of entropy - change of entropy when ice converted into steam-third law of thermodynamics –Extensive and Intensive thermodynamic variables–distinction between them–Maxwell thermo dynamical relations–derivation and application -Clausius–Clapeyron equation and specific heat relation.

Text Books:
1. Brijlal and Subramanyam, Heat and Thermodynamics,S.Chand& Co,16th Edition, NewDelhi, 2005.

2. D.S.Mathur, Heat and Thermodynamics, S.Chand &Sons, 5th Edition, New Delhi, 2014.

3. R. Murugesan and Kiruthiga Sivaprasath, Thermal Physics, S.Chand& Co, II Edition, New Delhi, 2008

Books for Reference:
1. J.B.Rajan, Heat & Thermo dynamics, SC Publisher, New Delhi,1985.
2. H.C.Varma, Concepts of Physics–Volume I and II, Bharati Bhawan Publishers, New Delhi, 2015
3. M.Narayana Moorthy and N.Nagarathinam, Heat, National publishing Co, Chennai, Eight Edition, 1987.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Understand the basics of thermodynamics and their applications	K2
CO2	Learn the basics of low temperature and how to construct a successful experiment using low temperature.	K2
CO3	Learn experimental Methods To Determine The transmission of heat.	K2
CO4	Understand the kinetic theory of gas	K2
CO5	Analyze the laws of thermodynamics and maxwell's Thermo dynamical relations	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

SEMESTER-III

COURSE CODE	U21PHT31	OPTICS AND SPECTROSCOPY	L	T	P	C
CORE -V			5	-	-	4

Objective:

To understand the basics of Spectroscopy, interference, Michelson's Interferometer and phenomenon like interference, diffraction, polarization through wave nature of light and its applications and to gain knowledge in spectroscopy.

Unit I: Geometrical Optics

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

Unit II: Interference

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

Unit III: Diffraction

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

Unit IV: Polarization

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

Unit V: Spectroscopy

Infrared spectroscopy–sources and detector–uses–ultraviolet spectroscopy–sources–quartz spectrograph-applications-Raman Spectroscopy–Quantum theory of Raman effect– applications–Nuclear magnetic resonance – Nuclear quadrupole resonance–Electron spin resonance spectroscopies-(Qualitative study)

Text Books:

1. Subramanyam and Brijlal, A text book of Optics, S.Chand and co., 25th Edition, New Delhi 2004.

2. R.Murugeshan, Optics and Spectroscopy, S.Chand and Co.,6 th Edition, New Delhi, 2008.
3. S.L.Gupta,V.Kumar and R.C.Sharma, Elements of Spectroscopy, Pragati Prakashan, 13th Edition, Meerut,1997.
4. G.Aruldhass, Molecular Structure and Spectroscopy, PHI Pvt Ltd, II Edition, New Delhi, 2007.

Books for Reference:
1. Sathyaprakash, Ratan Prakashan Mandhir, Optics, VII Edition, NewDelhi, 1990.
2. C.N.Banewell, Introduction to Molecular Spectroscopy, TMH publishing co.IV Edition, New Delhi, 2006.
3. Ajoy Ghatak, Optics, (TMH), New Delhi, Fourth edition, 2009.
4. Singh & Agarwal, Optics and Atomic Physics, Pragati Prakashan Meerut, Nineth edition, 2002.
5. Halliday, R.Resnick and J.Walker, Fundamentals of Physics, Wiley, 6thEdition, NewYork, 2001.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Learn about various lens and its aberrations	K1
CO2	Acquire knowledge about interference and interferometers	K2
CO3	Understand about the diffraction phenomenon and resolving power in optical instruments	K3
CO4	Study about polarization	K2
CO5	Apply different spectroscopic technique to obtain information about the molecule	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	3	3	3	3	3	3
CO2	3	3	3	3	2	3	3	3	3	3	3
CO3	3	3	3	3	2	3	3	3	3	3	3
CO4	3	3	3	3	2	3	3	3	3	3	3
CO5	3	3	3	3	2	3	3	3	3	3	3

Correlating	Marks
Strongly correlating (S)	3
Moderately correlating (M)	2
Weekly correlating (W)	1
No correlation (N)	0

COURSE CODE	U21PHE311	CHOICE I	L	T	P	C
ELECTIVE-I		ENERGYPHYSICS	4	-	-	3

Objective:
   To provide an understanding of the present energy crisis and various available energy sources.

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

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

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

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

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

Text Books:
   1. Kothari D.P., K.C. Singal and Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India, 2008.
   2. S.P.Sukhame, Solar Energy, Principles of thermal collection and storage TATA, McGraw, Hill publishing company ltd. 1984

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

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Know about conventional and non-conventional sources of energy	K1
CO2	Understand about solar energy and its appliances	K3
CO3	Know about Photovoltaic Systems and Point out the types of solar cells and its applications	K2
CO4	Understand about Biomass	K2
CO5	Examine the different wind energy sources	K3

K1-Remember K2-Understand K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3	3	3	2	3	3	3
CO2	3	2	2	3	3	3	3	2	3	3	3
CO3	3	2	2	3	3	3	3	2	3	3	3
CO4	3	2	2	3	3	3	3	2	3	3	3
CO5	3	2	2	3	3	3	3	2	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE312	CHOICE II	L	T	P	C
ELECTIVE-I		WAVES AND OSCILLATIONS	4	-	-	3

Objectives:

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

UNIT I: **Simple Harmonic Motion**
Characteristics of S.H.M., Differential equation of S.H.M.,K.E.,P.E.and Total Energy of a vibrating particle, Energy of Vibration, Oscillations with one degree of freedom, Linearity and super position principle, Simple pendulum, Compound pendulum, Bar pendulum, Composition of two SHM(s) of frequencyratio2:1,

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

UNIT III: Wave motion
Characteristics of wave motion, Transverse wave, motion ,Longitudinal wave motion, Differential equation of wave motion, Particle velocity, Wave velocity, Principle of superposition, Interference of Sound waves, Beats, Decibel, Doppler effect, Applications.

UNIT IV: Reflection of Sound
Reflection of a plane wave at plane surface, Experimental determination of reflection of sound, Echo, Refraction of plane wave front at plane surface, Diffraction of sound, Fresnel's Assumptions, Intensity of sound at a point due to plane wave front, Doppler effect, Applications.

UNIT V: Ultrasonics
Production of Ultrasonics by magnet ostriction and piezo electric methods, detection of Ultrasonic waves, Acoustic grating, Applications of Ultrasonic waves.

Text Book:
1. Brijlal & Subramanyam "Waves & Oscillations", S.Chand &Co., 1974,Unit1-V

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

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Understand the concept of SHM	K2
CO2	Analyze the different types of vibration	K4
CO3	Acquire the knowledge of wave motion	K3
CO4	Know the properties of sound	K3
CO5	Apply the knowledge to ultrasonic waves	K3

K1-Remember   K2-Understand K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	1	3	3	3	2	2
CO2	3	3	3	3	1	1	3	3	3	2	2
CO3	3	3	3	3	1	1	3	3	3	2	2
CO4	3	3	3	3	1	1	3	3	3	2	2
CO5	3	3	3	3	1	1	3	3	3	2	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weakly correlating(W)	1
No correlating (N)	0

SEMESTER- IV

COURSE CODE	U21PHT41	ELECTRICITY AND ELECTRO MAGNETISM	L	T	P	C
CORE - VI			4	-	-	4

Objectives:

- To provide comprehensive knowledge and understanding of the basics of Electricity and Magnetism.
- To expose the students to the applications of Electricity and Magnetism.

UNIT I : **Magnetic Effect of Electric current**

Magnetic flux and magnetic induction- Biot Savart law-magnetic induction at a point due to a straight conductor carrying current - magnetic induction at a point on the axis of a circular coil carrying current- amperes circuital law-magnetic field inside a long solenoid –toroid-Lorentz force on a moving charge-direction of force-torque on a current loop in a uniform magnetic field–Moving coil Ballistic galvanometer-theory-experiment to find charge sensitivity and absolute capacity of a capacitor-De-Sauty's bridge

UNIT II: **Capacitance**

Capacitance-Principle of capacitor-Expressions for the capacitance of i) spherical capacitor ii) Cylindrical capacitor and iii) parallel plate capacitor with and without partly filled dielectrics- Energy of a capacitor- Loss of energy when two charged conductors share the charges- Types of capacitors- fixed capacitor, variable capacitor, electrolytic capacitor and sliding capacitor.

UNIT III: **Electromagnetic Induction**

Faraday's laws of electromagnetic induction -self-induction –self-inductance of a longsolenoid –toroidal solenoid-determination of L by Anderson's and Rayleigh's methods-Owen's bridge – mutual induction – mutual inductance between two co-axial solenoids-experimental determination of mutual inductance –co-efficient of coupling- energy stored in a coil-eddy currents-uses.

UNIT IV: **AC and DC Circuits**

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

Alternating Current-j operator method–use of operator in the study of AC circuits-Resistance in an AC circuit-Inductance in an AC circuit-Capacitance in an AC circuit-AC through an inductance and resistance in series-capacitance and resistance in series – LC R series resonance circuit-sharpness of resonance-parallel resonance circuit-power in an AC circuit-power factor.

UNIT V: **Maxwell's Equation & Electro magnetic Waves**

Introduction-Maxwell's equations––Displacement current-Poynting Vector-Electromagnetic waves in free space-Hertz experiment for production and detection of EM waves- Wave equations for Electric field and Magnetic field-monochromatic plane waves-EM waves in a

Matter - Reflection and Transmission at normal incidence and oblique incidence–Polarization by reflection.

Text Books:

1. R.Murugesan, Electricity and Magnetism, S Chand & Co, 2008.
2. Brij Lal& Subramanyam, Electricity and Magnetism, Ratan Prakashan Mandir Publishers, 2005.
3. M.Narayanamurthy & N.Nagarathnam, Electricity & Magnetism, NPC pub., Revised edition, 1992.

Books for Reference:

1. D.N.Vasudeva, Electricity and Magnetism, S.Chand & Co, 2011
2. K.K.Tewari, Electricity and Magnetism, S.Chand & Co,2002.
3. E.M.Pourcel, Electricity and Magnetism- Berkley Physics Course,Vol.2 McGrawHill Education; 2nd edition 2017.
4. D.C. Tayal, Electricity and Magnetism, Himalaya Publishing Co., Fourth Edition2019.
5. D. Halliday, R.Resnick and J.Walker, Fundamentals of Physics–Electricity andMagnetism(2011), Wiley India,PvtLtd
6. David Griffith, Introduction to Electrodynamics, Pearson Education India Learning Private Limited; 4th edition 2012.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Study about magnetic field produced in electric circuits	K1
CO2	Learn about capacitor and its type	K1
CO3	Acquire knowledge about electromagnetic induction	K2
CO4	Analyses and solves electrical circuits with dc and ac source	K4
CO5	Gain knowledge about Maxwell Equation	K2

K1-Remember   K2-Understand K3-Apply K4-Analyze K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHP42	PRACTICAL-II	L	T	P	C
CORE - VII			-	-	4	4

Objective:

It is aimed at exposing the under graduate students to the technique of handling simple measuring instruments and also make them measure certain mechanical and optical properties of matter.

ANY FOURTEEN
1. Spectrometer–Grating Minimum Deviation
2. Spectrometer-Dispersive Power, Resolving of Prism Grating.
3. Spectrometer–Diffraction Grating-Normal Incidence
4. Newton's Ring.
5. Air wedge.
6. LCR –Resonance parallel and Series.
7. LCR.
8. Potentiometer–E.M.F.
9. Meter bridge.
10. De Morgan's theorem using Integrated Chips.
11. Verify Basic gates using IC's.
12. Characteristics of a Junction Diode.
13. Characteristics of a Zener Diode.
14. NAND as a universal gate.
15. NOR as a universal gate.
16. Basic gates using discrete Components.
17. RS, D, JK, flip flop.
18. Figure of merit-galvanometer

TEXT BOOKS:
1. C.COuseph, G.Rangarajan–A Text Book of Practical Physics-S.Viswanathan publisher – part I, 1990.
2. C.COuseph, G.Rangarajan, R.Balakrishnan– A Text Book of Practical Physics-S.Viswanathan publisher-partII 1996.
3. S.L.Gupta and V.Kumar–Practical Physics–Pragati Prakashan–25th, Edition, 2002.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Able to characterize diodes	K3
CO2	Determine dispersive and resolving power of prism	K4
CO3	Determine wave length of Sodium vapor light	K4
CO4	Analyze working of different flip flop	K3
CO5	Verify bridges and LCR connections	K4

K1-RememberK2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE431	CHOICE -I	L	T	P	C
ELECTIVE-II		**MEDICAL PHYSICS**	3	-	-	3

Objective:
        To understand the basics about the biological systems in our body, their behavior and the diagnostic devices.

Unit 1: Basic Anatomical Terminology
 Standard anatomical position, Planes, Familiarity with terms like – Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal, Distal. Forces on and in the Body – Physics of the Skeleton – Heat and Cold in Medicine- Energy work and Power of the Body.

Unit 2: Pressure system of the body
 Physics of Cardiovascular system- Electricity within the Body – Applications of Electricity and Magnetism in Medicine. Sound in medicine-Physics of the Ear and Hearing- Light in medicine- Physics of eyes and vision.

Unit 3: Transducers
 performance of characteristics of transducer- static and dynamic active transducers-(a) magnetic induction type (b) piezo electric type (c) photo voltaic type (d) thermo electric type. Passive transducer - (a) resistive type- effect and sensitivity of the bridge (b) capacitive transducer (c) linear variable differential transducer (LVDT).

Unit 4: X-rays
 Production of X-rays- X-ray spectra- continues spectra and characteristic spectra-Coolidge tube-Electro Cardio Graph(ECG)- Block diagram-ECG Leads-Unipolar and bipolar-ECG recording set up.

Unit 5: Electro Encephalography (EEG)
 Origin- Block diagram- Electromyography (EMG) – Block diagram- EMG recorder-Computer Tomography (CT) principle Block diagramof CT scanner.

Text Books:
1. John R.Cameron and James G.Skofronick, Medical Physics, John Willy& Sons,1978,
2. DrM. Arumugam, Biomedical instrumentation, EDII,AnuradhaAgencies1997.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Understands Basic Anatomical Terminology	K2
CO2	Applies medical physics to know the different aspects of the body	K3
CO3	Analyze the performance of transducer	K4
CO4	Learn about Electro Cardio Graph(ECG)and its application	K3
CO5	Study about EEG and EMG and its application	K3

  K1-Remember K2- Understand   K3-Apply   K4- Analyze K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3	3	3	3	3	3	3
CO2	3	2	2	3	3	3	3	3	3	3	3
CO3	3	2	2	3	3	3	3	3	3	3	3
CO4	3	2	2	3	3	3	3	3	3	3	3
CO5	3	2	2	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE432	CHOICE -II	L	T	P	C
ELECTIVE-II		MATERIALS SCIENCE	3	-	-	3

Objective: The objective of this course is to predict and control material properties through an understanding of atomic, molecular, crystalline, and microscopic structures of materials

UNIT–I: Materials Science
Classification of materials – Properties of Engineering materials – Materials Structure – Types of Bonds – Bonds Formation–Ionic Bond –Covalent Bond – Metallic Bond – Comparison of Bonds – Secondary Bonds.

UNIT – II: Phase diagram and transformation
Basic terms – Solid Solution – Hume –Rothery's rule – Intermediate Phase – Phase Diagrams – Gibb's Phase Rule – Time –Temperature cooling curves –Construction of Phase Diagrams–The Lever Rule – Equilibrium Binary System – Eutectic System – Mechanism of Phase Transformation.

UNIT – III: Vacuum and oxidation
History of vacuum technology – units of Vacuum –Kinetic aspects of Gases–Application of Vacuum– Gas flow in vacuum systems – production of vacuum – Measurement of vacuum – Thermal conductivity gauges – Penning Gauge– Oxidation – Oxidation Resistant Materials.

UNIT–IV: Non-destructive testing
(NDT) NDT and its advantages–Defects in materials – Selection of the NDT Method – Liquid Penetration Testing – Physical Principle –Magnetic Particle Testing (MPT) – Principle of MPT – Sensitivity – Limitation – Eddy Current Testing (ECT)–Principle– Instrument for ECT–Applications –Limitations.

UNIT – V: Electrical and magnetic properties of materials
Dielectrics – Polarization –Temperature and frequency effects–Electric Break down–Ferro electric materials– Electrostriction– Piezo electricity–Uses of Dielectrics–Magnetic Properties–Classification– Magnetostriction – Soft and Hard Magnetic Materials.

Text Books:
1. G.K.Narula, K.S.Narula, V.K.Gupta, Materials Science, Tata McGraw Hill Publishing, 1994.
2. V.Raghavan, Materials Science and Engineering Prentice Hall of India, 2004.

Books for reference:
1. Baldevraj,T. Jayakumar, M. Thanvasimuthu, Practical Non-Destructive Testing, Narosa Publishing House, Chennai, 2002.
2. A.V.K. Suryanarayana, Testing of Metallic Materials, B.S. Publications, Giriraj lane, Sultan Bazar, Hyderabad– 95, 2003.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Classify the materials based on their bonding	K2
CO2	Learn phase diagram to understand material phase transformation	K2
CO3	Understand the conducting, semiconducting, superconducting, dielectric, ferro-electric and piezo electric behavior of material	K2
CO4	Gain knowledge on vacuum technology for application in material synthesis	K3
CO5	Characterize materials using nondestructive testing	K4

K1-Remember   K2-Understand K3-Apply K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weakly correlating(W)	1
No correlating (N)	0

SEMESTER-V

COURSE CODE	U21PHT51	ATOMIC AND NUCLEAR PHYSICS	L	T	P	C
CORE - VIII			5	-	-	4

Objective:
- To provide an introductory account about the atomic structure
- To acquire knowledge on static properties of nuclei and its stability.
- To know about different modes of decay and interaction of nuclear radiations with matter

UNIT I: Positive Rays:
Discovery-properties- analysis – Thomson's parabola method – Aston's mass spectrograph –Bainbridge's mass spectrograph – Dempster's mass spectrograph – Dunning ton's method of determining e/m.

UNIT II: Atomic Structure
Early atomic spectra-Thomson model-Alpha particle scattering-Rutherford 's nuclear model-drawbacks-Bohr atom model –Bohr's interpretation of the Hydrogen spectrum-correction for nuclear motion-evidences in favor of Bohr's theory- Ritz combination principle -correspondence principle-Sommer field's relativistic atom model-drawbacks- the vector atom model – Quantum numbers associated with the vector atom model — the Pauli's exclusion principle–periodic classification of elements

UNIT III: Fine Structure of Spectral Lines
Coupling schemes-L-S Coupling-j-j Coupling- Hund rules- magnetic dipole moment due to orbital motion of the electron- due to spin of the electron -Stern and Gerlach experiment-spin-orbit coupling-optical spectra-spectral terms-spectral notation- selection rules- intensity rules- interval rule- fine structure of sodium D line- hyperfine structure- Normal Zeeman effect- theory and experiment-quantum mechanical explanation- Larmor's theorem-Anomalous Zeeman effect- Paschen –Bach effect-Stark effect.

UNITIV: Properties and Structure of Nuclei
General properties of nucleus- binding energy–BE/A curve - significance-proton electron theory-proton neutron theory-Nuclear forces–characteristics–Meson theory of nuclear forces– Yukava Potential- Nuclear models –Liquid drop model-Shell model.

UNIT V: Radio Activity & Nuclear Reactions
Fundamental laws of radio activity –theory of α ,β and ϒ decay- properties of alpha, beta and gamma rays - Kinematics of nuclear reaction-Nuclear fission–Nuclear fusion–Nuclear reactor-uses - atom bomb - hydrogen bomb-fusion reactor –plasma confinement –artificial transmutation-Q value of nuclear reaction-types of nuclear reaction

Text Books:
1. Modern Physics, R.Murugeshan, Kiruthiga Sivaprasath, S.Chand & Co., New Delhi(2008).

2. Modern Physics, D.L.Sehgal, K.L.Chopraand N.K.Sehgal.Sultan Chand & Sons Publication, 7th Edition, New Delhi (1991).
3. Atomic Physics, J.B. Rajam,S. Chand & Co., 20th Edition,New Delhi (2004).
4. Atomic and Nuclear Physics, N.Subrahmanyam and BrijLal, S.Chand & Co.5th Edition, New Delhi (2000).
5. Nuclear Physics, Tayal D.C., Himalaya Publishing House, Mumbai (2006).
6. Nuclear Physics, R.C.Sharma, K.Nath & Co.,Meerut (2000)
7. Nuclear Physics, Irving Kaplan, Narosa Publishing house, New Delhi.

Books for Reference:
1. Modern Physics, J.H.Hamilton and Yang, McGraw-Hill Publication (1996).
2. Concepts of Modern Physics, A. Beiser,Tata McGraw-Hill, New Delhi (1997).
3. Fundamentals of Physics, D.Halliday, R.Resnick and J. Walker, Wiley, 6th Edition, New York (2001).
4. Modern Physics, Kenneth S.Krane, John Willey & sons, Canada (1998).
5. Nuclear Physics, R.R.Roy and B.P.Nigam, New Age International (P) Ltd., New Delhi(1997).

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Acquire knowledge on the fundamental principles governing the structure of the atom	K1
CO2	Gain knowledge in atomic physics to follow courses at the Advanced level.	K2
CO3	Obtain knowledge about fine structure of spectral lines	K2
CO4	Understanding on the basics of nuclear physics that treats atomic nuclei as self-bound many-body quantum systems	K2
CO5	Learn about nuclear reaction and radio activity	K1

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT52	CLASSICAL AND STATISTICAL MECHANICS	L	T	P	C
CORE - IX			5	-	-	4

Objective:
- To understand the mechanics of systems of particles and their equations of motion
- To study the concept of statistics of molecules.

UNITI: Mechanics of a System of Particles
External and internal forces, centre of mass-Conservation of linear momentum-Conservation of angular momentum-Conservation of energy-work-energy theorem-Conservative forces-examples-Constraints-Types of constraints - Examples-Degree of freedom – Generalized coordinates (transformation equations) – Generalized velocities-Generalized Momentum.

UNIT II: Lagrangian Formulations
Principle of virtual work, D'Alembert's principle, Lagrange's equation of motion for conservative and non-conservative systems - Simple applications-simple pendulum-Atwood's machine-compound pendulum- Hamilton's Principle-Deduction of Lagrange's equation of motion from Hamilton's Principle-Deduction of Hamilton's principle from D'Alembert's principle.

UNIT III: Hamiltonian Formulations
Phase space-The Hamiltonian function H -Hamilton's Canonical equation of motion-Physical significance of H-Deduction of Canonical equation from a variational principle-Applications-Harmonic Oscillator- Planetary Motion- Compound pendulum

UNIT IV: Classical Statistics
Micro and macrostates - Themu-space and gamma space –fundamental postulates of statistical mechanics – Ensembles – different types – Thermo dynamical probability – entropy and probability - Boltzmann's theorem – Maxwell – Boltzmann statistics – Maxwell – Boltzmann energy distributive law – Maxwell - Boltzmann velocity distributive law.

UNIT V: Quantum Statistics
Development of Quantum statistics- Bose - Einstein and Fermi –Dirac statistics – Derivation of Planck's radiation formula from Bose – Einstein statistics - Free electrons in metal- Fermi gas – Difference between classical and quantum statistics.

Text books:
1. J.C.Upadhyaya, Classical Mechanics, Published by Himalya Publishing House, Mumbai (2005).
2. Brijlal & Subramaniam, Heat & Thermodynamics, S.Chand & Company Ltd (1998).
3. Agarwal, 'Statistical Physics' S.Chand & Co New Delhi (1996).

BooksforReference:
1. Gupta B.D., Satyaprakash, Classical Mechanics, 9th ed., Kadernath Ramnath Publ., Meerut (1991)
2. Gupta, Kumar, Sharma, Classical Mechanics, Pragati Prakashan Publ., Meerut (2005).

3. Murray R.Spiegal, Theoretical Mechanics, Schaum's outline series, Mc Graw Hill Publ. Co., New Delhi (1981).

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Knowledge about mechanics of the particles	K1
CO2	Differentiate Lagrangian equation of systems for conservative and non-conservative systems	K3
CO3	Apply Hamiltonian function for various application	K3
CO4	Understand about classical and quantum statistics	K1
CO5	Acquire knowledge to apply the principles of statistical mechanics to selected problems.	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	1	1	3	3	2	2	2
CO2	3	3	3	3	1	1	3	3	2	2	2
CO3	3	3	3	3	1	1	3	3	2	2	2
CO4	3	3	3	3	1	1	3	3	2	2	2
CO5	3	3	3	3	1	1	3	3	2	2	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT53	BASICS OF DATA COMMUNICATION AND PROGRAMMING IN C	L	T	P	C
CORE - X			5	-	-	4

Objective:
To introduce to data communication and Programming in C

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

Unit II: Multiplexing
Parallel and serial transmission – Interface standards – modems – guided media-types of error -multiplexing - Types of multiplexing-multiplexing application - Telephone system–Ethernet.

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

Unit IV: Introduction to Programming in C
Basic structure of C Program – character set – identifiers and key words –constants and variables - data types – operators and expressions – Relational, Logical and Assignment operators – increment and decrement operators – Arithmetic expressions –Mathematical functions.

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

Text book:
1. Balagurusamy. E, Programming in ANSIC, Second Edition, Tata McGraw Hill, 2008.
2. Brijendra Singh, Data Communications and Computer Networks, 4th Edition, 2014

Books for References:
1. Kamthane Ashok. N, "Programming in C",2nd Edition, Pearson Education.2013.
2. Yashvant P.Kanetkar, "LetusC", 8[th]Edition, Infinity Science Press-2008.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Gains knowledge about network and transmission mode	K1
CO2	Understand about series and parallel transmission	K2
CO3	Differentiate analog and digital network	K4
CO4	Study about basic structure of C Programming	K2
CO5	Understand about statement and commands used in C programming	K2

K1-Remember K2-Understand K3-Apply K4-Analyze K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3	2	3	2	3	3	3
CO2	3	3	2	2	3	2	3	2	3	3	3
CO3	3	3	2	2	3	2	3	2	3	3	3
CO4	3	3	2	2	3	2	3	2	3	3	3
CO5	3	3	2	2	3	2	3	2	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT54	BASIC ELECTRONICS AND COMMUNICATION	L	T	P	C
CORE - XI			5	-	-	4

Objectives:
1. To enable the students to understand the aspects of analog electronics in a lucid and comprehensive manner.
2. To understand the fundamental concepts of logic gates, counters , registers, fibre Optics etc.
3. To develop skill to build and trouble shoot combinational digital circuits.

Unit I: Linear circuit analysis and semi conductor diodes
Constant voltage source – constant current source – The venin's theorem-procedure for finding The venin Equivalent circuit - PN junction theory - V-I characteristics of a PN junction diode – Half-wave rectifier - Bridge rectifier - Efficiency - filters - Shunt capacitor filter–pi filter- Zener diode-equivalent circuit-voltage regulator-LED-V-I characteristics–advantages - applications -photodiode- characteristics-applications.

Unit III: Transistor Amplifier
Transistor - Different modes of operations-CB mode &CE mode – Two port representation of a transistor-h parameter-AC equivalent circuit using h parameters- analysis of amplifiers using h parameters (CE only) - RC coupled amplifier - transformer coupled amplifier-power amplifier.

Unit III: Digital Fundamentals
Number Systems and Conversions – Binary, Decimal, Octal, Hexa-BCD Code-Gray code
- 1's and 2's complements, 9's complements, 10's complements – Basic logic gates - NAND, NOR and EX- OR gates -NAND and NOR as Universal Building blocks-Laws and theorems of Boolean algebra–NAND-NAND circuits- Karnaugh's map-SOP and POS-applications

Unit IV: Sequential Logic
RS flip flop, Clocked RS flip flop, D flip flop, J-K flip flop and J-K Master-Slave Flip-flop - Shift registers and Counters-Multiplexers and Demultiplexers – Decoders and Encoders-Memory Circuits-D/A and A/Dconverters-IC555 monostable and a stable multi-vibrators.

Unit V: Modulation and Demodulation
Amplitude modulation-Frequency modulation, Phase Modulation and Pulse Width Modulation - Detectors of AM, FM, PM and PWM, PLL-Noise in Communication Systems - ASK, FSK, PSK Modulation and Demodulation, Advantages and disadvantages of digital communication

Text Books:
1. Gupta and Kumar, Hand Book of Electronics – Pragati Prakashan–Meerut, 2002.
2. V.K. Mehta, Principles of Electronics, Rohit Mehta S.Chand & Co., 2006.
3. M. Arul Thalapathi, Electronics, Comptek Publishers (2005).
4. M.K. Bagde and Singh S.P., Elements of Electronics, S.Chand & Co.,New Delhi,1990.

5. A. Subramanyam – Applied Electronics, National Publishing Co. 1997.
6. Ramakant A.Gayakwad, OP-AMPs and Linear Integrated Circuits, Prentice Hall of India,1994.
7. Malvino Leach, Digital Principles and Application, Tata McGraw Hill, 4TH Edition 1992.
8. Thomas L. Floyd, Digital Fundamentals, Universal Book Stall, New Delhi (1998).
9. V.Vijayendran, S.Viswanathan, Introduction to Integrated Electronics (Printers and Publishers) Pvt.Ltd., Chennai, 2005.

Books for Reference:
1. Mittal.G.K., Electronic Devices by G.K.Publishers Pvt.Ltd.,1993.
2. B.L.Theraja, Basic Electronics S.Chand & Co., 2008.
3. Ambrose and Vincent Devaraj, Solid State Electronics, Meera Publication.
4. R.S.Sedha, Applied Electronics, S.Chand & Co.1990.
5. Thomas L. Floyd, Digital Electronics Practice Using Integrated Circuits- R.P.Jain– Tata McGraw Hill, 1996.
6. D.Roy Choudhury and Shail Jain, Linear Integrated Circuits –New AgeInternational(P)Ltd. 2003.
7. I.J.Nagrath - Electronics-Analog and Digital, Prentice-Hall of India, NewDelhi1999.
8. J.Millman and C.Halkias, Integrated Electronics, Tata McGraw Hill, New Delhi 2001.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Acquire knowledge on transistor and its applications	K2
CO2	Study about linear circuit theorems and diode	K1
CO3	Study about different number systems and basics of logic gates	K1
CO4	Understand the operation of sequential logic circuits	K2
CO5	Design communication system with different modulation	K3

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHP53	PRACTICAL-III	L	T	P	C
CORE - XII			-	-	5	4

Objective:

It is aimed at exposing the under graduate students to the technique of handling simple measuring instruments and also make them measure certain mechanical, electrical and optical properties of matter.

ANYFOURTEEN

1. Spectrometer-i-d curve–i-I' curve.
2. Galvanometer Comparison of capacitances
3. L- Owen's bridge.
4. L-Anderson's Bridge.
5. L.Maxwell's Bridge.
6. L.Rayleigh's Bridge.
7. Spectrometer–Cauchy's Constant.
8. Field along the axis of the Coil.
9. Small angle Prism.
10. Cary Foster's bridge.
11. Mutual Inductance.
12. Absolute Capacity of condenser.
13. Hallow prism.
14. Ballistic Galvanometer
15. Solar Spectrum-Light wavelength.
16. Spot Galvanometer– Comparisons of Voltmeter
17. Spot Galvanometer –Charge sensitivity
18. Potentiometer Comparisons of EMF.

Text Books:

1. C.C.Ouseph, G.Rangarajan–A Text Book of Practical Physics-S.Viswanathan publisher - partI, 1990.
2. C.C.Ouseph, G.Rangarajan, R.Balakrishnan – A Text Book of Practical Physics-S.Viswanathan publisher - partII. 1996..
3. S.L.Gupta andV.Kumar–Practical Physics–Pragati Prakashan–25th, Edition 2002.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Able to fabricate bridges and measure inductance	K3
CO2	Compare EMF value using potentiometer	K4
CO3	Determine wave lengths of visible light	K4
CO4	Compare voltmeter and charge sensitivity using spot galvanometer	K3
CO5	Determine Cauchy's constant	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE531	CHOICE -I	L	T	P	C
ELECTIVE-III		NUMERICALMETHODS	3	-	-	3

Objectives:

To understand various approximation methods to find solution to problems which don't have exact solutions.

UNITI: Errors and Root of Equations

What is Numerical analysis-numbers and their accuracy – errors-measurement of errors-round off error-truncation error-absolute error-relative error-percentage error-inherent error-accumulated error-general error formulae-convergence Roots of equations-Iteration method-Maclaurin's series method-Newton-Raphson method-Von- Moises Formula-Bisection method.

UNIT II: Matrix and Linear Equations

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

UNITIII: Interpolation and Approximation

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

UNIT IV: Numerical Differentiation and Integration

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

UNIT V: Differential Equations

Introduction-Euler's method (Adams Bashforth first order method)-backward Euler method-Taylor's series method-Runge-Kutta method-predict or corrector methods

Learning Outcomes:

☐ On completion of the course the students will have the ability to solve equation using an appropriate numerical method.

Books for Reference:

1. S.S.Sastry, Introductory methods of numerical analysis –Prentice Hall of India, New Delhi, 2000.
2. A.Singaravelu, Numerical methods – Meenakshi Agency, Chennai, 2001.
3. M.K.Venkataraman, Numerical Method in Science and Engineering –PHI New Delhi 1997.
4. R.Murugesan, Mechanics and Mathematical Methods, S.Chand & Co, New Delhi 1999.
5. P.Kandasamy, K.Thilagavathy and K. Gunavathy, Numerical Methods, S.Chand & Co. (2002).

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Understand basics of Errors and Root of Equations	K2
CO2	Solve problem using Matrix and Linear Equations	K3
CO3	Interprets Numerical Differentiation and Integration	K3
CO4	Able to apply Differential Equations for different problems	K4
CO5	Enhance problem solving skill using Interpolation and Approximation	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	3	2	2	1
CO2	3	3	3	3	2	2	3	3	2	2	1
CO3	3	3	3	3	2	2	3	3	2	2	1
CO4	3	3	3	3	2	2	3	3	2	2	1
CO5	3	3	3	3	2	2	3	3	2	2	1

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE532	CHOICE -II	L	T	P	C
ELECTIVE-III		**BASIC INSTRUMENTATION**	3	-	-	3

Objective

 To make students skilled in using basic laboratory instruments to carry out their practical and project in efficient manner.

UNIT-I Basic of Measurement

Instrument's accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects.

UNIT II Multi meter

Principles of measurement of dc voltage and dc current, ac volt- age, ac current and resistance. Specifications of a multimeter and their significance. Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagramonly). Specifications of an electronic Voltmeter / multimeter and their significance. AC millivoltmeter:Type ofAC millivoltmeters: Amplifier-rectifier,andrectifieramplifier.

UNIT-III Cathode Ray Oscilloscope

Block diagram of basic CRO. Construction of CRT,Electron gun, electrostatic focusing and acceleration (Explanation only no mathematicaltreatment), Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Digital storage Oscilloscope: Block diagram and principle of working.

UNIT-IV Signal Generators and Analysis Instruments

 Block diagram, explanation and specifications of low frequency signal generators, pulse generator, and function generator, Brief idea for testing, specifications, Distortion factor meter, wave analysis.

UNIT-V Digital Instruments

Principle and working of digital meters, Comparison of analog and digital instruments, Characteristics of a digital meter, Working principles of digital voltmeter. Digital Multimeter: Block diagram and working of a digital multimeter, working principle of time interval, frequency and period measurement using universal counter / frequency counter, time-base stability, accuracy and resolution.

Text Books:
 1. B.L.Theraja,ATextBooksbookofElectricalTechnology-(S.ChandPublishing),Volume 1, 1959.
 2. Venugopal, Digital circuits and Systems, Tata McGraw Hill Education Private Limited,2011.

Reference Books:
 1. Subrata Ghoshal, Digital Electronics- Blue King fisher publishing, 24July2012
 2. S. Salivahanan and N. S.Kumar, Electronic Devices and Circuits - (Tata Mc-Graw Hill),2011.
 3. Thomas L.Floyd, Electronic Devices-(Pearson Education),2013.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Understand CRO as a versatile measuring device	K2
CO2	Learn to trace circuits of electronic equipment's	K2
CO3	Use Digital multimeter / VTVM to measure voltages	K3
CO4	Apply knowledge to troubleshoot the circuit	K3
CO5	Skilled in winding a coil /transformer	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3	3	3	3	3	3	3
CO2	3	3	2	2	3	3	3	3	3	3	3
CO3	3	3	2	2	3	3	3	3	3	3	3
CO4	3	3	2	2	3	3	3	3	3	3	3
CO5	3	3	2	2	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weakly correlating(W)	1
No correlating (N)	0

COURSE CODE	U21PHS531	CHOICE -I	L	T	P	C
SKILLBASED ELECTIVE-III		MICRO PROCESSOR FUNDAMENTALS	2	-	-	2

Objective:

This course deals with the basic concepts of microprocessor, programming instructions and interfacing concepts.

Unit 1: Architecture

Architecture of 8085–registers, flags, ALU, address and databus, demultiplexing address/data bus – control and status signals – control bus, Programmer's model of 8085 – Pinout diagram– Functions of different pins.

Unit 2: Programming Techniques

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

UNIT 3: Interfacingmemoryto8085

Memory interfacing – Interfacing 2kx8 ROM and RAM, Timing diagram of 8085 (MOVRd,Rs – MVIRd, data.

Unit4: Interfacing I/O Ports to 8085

Interfacing input port and output port to 8085– Programmable peripheral interface 8255– flashing LEDs.

Unit5: Interrupts

Interrupts in 8085- hardware and software interrupts–RIM, SIM instructions–priorities– simple polled and interrupt-controlled data transfer.

Text Books:
1. R.S.Gaonkar, Microprocessor Architecture programming and application with 8085 / 8080A., Wiley Eastern Ltd. 1992.
2. V.Vijayendran, Fundamental of Microprocessor 8085, S.Viswanathan Publishers, Chennai, 2003.
3. B.Ram, Fundamentals of Microprocessors and Microcomputers - Dhanpat Raipublication2012.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Know the basic ideas on microprocessor ,memory and I/O devices	K2
CO2	Familiar with the basic concepts of microprocessor architecture and interfacing	K2
CO3	Acquire skills in the programming instruction sets of microprocessors	K4
CO4	Acquire skills in interrupts	K2
CO5	Apply the programming instructions to perform simple programs using microprocessor	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	3	3	3	3	3
CO2	3	3	2	3	2	1	3	3	3	3	3
CO3	3	3	2	3	2	1	3	3	3	3	3
CO4	3	3	2	3	2	1	3	3	3	3	3
CO5	3	3	2	3	2	1	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHS532	CHOICE -II	L	T	P	C
SKILLBASED ELECTIVE-III		TELEVISION TRANSMISSION & RECEIVER	2	-	-	2

Objective

   The course deals with theoretical and practical knowledge on TV functioning and its servicing skill are incorporated.

UNIT–I: Elements of a Television System:

Picture transmission – sound transmission – picture reception – sound reception – picture synchronization–Basic monochrome transmitter and receiver–gross structure, image continuity, number of scanning lines, flicker, fine structure, total gradation – composite video signal – horizontall synchronization details–vertical synchronization details–function of vertical pulse train.

UNIT– II: Signal Transmission:

AM: Channel band – vestigial side band transmission – transmission efficiency – complete channel band width – reception of vestigial side band signals - demerits of vestigial side band transmission– FM:FMChannelbandwidth–channelbandwidthforcolourtransmission–Televisionsignalstands–monochrome picture tube–beam deflection screen phosphor faceplate-picture tube characteristics – picture tube circuit controls.

UNIT–III: Camera:

Camera principle–photo electric effect–image storage principle–electron scanning beam
– video signal electron multiplier – image orthicon – vidicon – plumbicon – CCD. TV receiver Block diagram-antenna-RF section – IF section – vestigial side band correction – choice of IF – sound separation – sound section – sync processing – vertical deflection – EHT supply.

UNIT – IV: Colour Television:

Compatibility – natural light – colour perception – three colour theory – luminance, Hue and saturation–colour TV camera–luminance signal–production of colour difference voltage
– compatibility considerations – Delta gun picture tube – purity and convergence PIL colour picture tube pin cushion correction- Auto Degaussing circuit– greyscale tracking.

UNIT –V: Television applications:

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

TEXTBOOK:

   1. R.R.Gulati, Monochrome and Colour Television, WileyEastern22nd Reprint (1983).

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Learn about components present in TV system	K1
CO2	Differentiate AM and FM Channel band	K3
CO3	Gain knowledge about different types of Camera	K2
CO4	Acquire knowledge about colour television	K3
CO5	Analyze the transmission of TV using different media	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3	3	3	3	3	3	3
CO2	3	3	2	3	3	3	3	3	3	3	3
CO3	3	3	2	3	3	3	3	3	3	3	3
CO4	3	3	2	3	3	3	3	3	3	3	3
CO5	3	3	2	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

SEMESTER-VI

COURSE CODE	U21PHT61	RELATIVITY AND QUANTUM MECHANICS	L	T	P	C
CORE - XIII			5	-	-	4

Objectives:

The aim of this course is to acquire sufficient knowledge in the concept of Relativity, dual nature of matter waves, Evolution of Quantum mechanics, Schrodinger equation and its applications and Operator formalism

Unit I: Relativity
Frames of reference-Galilean transformation-Michelson-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– Mass energy relation –Elementary ideas of general relativity.

Unit II: Wave Nature of Matter
Phase and group velocity - wave packet - expression of De Brogile's wave length-Davisson and Germer's experiment - G.P.Thomson's experiment - Heisenberg's uncertainty principle and its consequences.

Unit III: Schrodinger Equation
Inadequacy of classical mechanics - Basic postulates of quantum mechanics –Schrodinger equation - Properties of wave function - Probability interpretation of wave function – linea operators - self adjoint operators- expectation value –eigen values and eigen functions – commutativity and compatibility.

Unit IV: Angular Momentum in Quantum Mechanics
Orbital angular momentum operators and their commutation relations -separation of three dimensional Schrodinger equation into radial and angular parts - Elementary ideas of spin angular momentum of an electron –Paulimatrices.

Unit V: Solutions of Schrodinger Equation
Free particle solution - Particle in a box - Potential well of finite depth (one dimension) – linear harmonic oscillator – rigid rotator and hydrogen atom.

Text Books:
1. A Text book of Quantum mechanics by P.M.Mathews and S.Venkatesan, Tata McGraw-Hill, New Delhi(2005).
2. Quantum Mechanics by V.K.Thankappan, New Age International (P) Ltd.Publishers, New Delhi (2003).
3. Quantum mechanics by K.K.Chopra and G.C.Agrawal, Krishna Prakasam Media (P)Ltd., Meerut First Edition (1998).
4. Modern Physics by R.Murugeshan and Kiruthiga Sivaprasath, S.Chand & Co.,(2008).

Books for Reference:
1. Mechanics and Relativity by Brijlal Subramanyam, S.Chand & Co.,New Delhi,(1990).

2. Concepts of modern physics by A.Beiser. Tata McGraw - Hill,5[th]edition,NewDelhi(1997).
3. Introductiontoquantum mechanicsbyPauling andWilson, McGraw–Hill(1935).
4. QuantummechanicsbyA.GhatakandLoganathan,MacmillanIndiaPvt.Ltd(2012).

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Gain knowledge in the concepts of special and theory of relativity	K1
CO2	Evolve ideas about dual nature of matter	K2
CO3	Understand about Schrodinger equation	K2
CO4	Learn about different operator mechanism	K2
CO5	Apply of Schrödinger's equation to micro system	K3

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	2
CO3	3	3	3	3	2	2	3	3	3	3	2
CO4	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	3	3	3	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT62	SOLID STATE PHYSICS	L	T	P	C
CORE - XIV			5	-	-	4

Objective:
- ☐ To understand the different types of bonding in solids
- ☐ To understand the magnetic and dielectric properties of crystalline structures.
- ☐ To acquire knowledge on the basics of magnetic phenomena on materials and various types of magnetizations.
- ☐ To know the properties of super conducting materials.

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

UNIT II: Crystal Diffraction and Defects
Crystal Diffraction – Bragg's Law-Experimental methods-Laue method, powder method and rotating crystal method-Reciprocal lattice- Point defects - Frenkel and Schottky defects - Equilibrium concentrations - Line defects – Edge dislocation and screw dislocation - Surface defects - Grain boundary - Effects of Crystal imperfections

UNIT III : Bonding in Solids
Types of bonds in crystals-Ionic, covalent, Metallic, Vanderwaal's and Hydrogen Bonding - Bond energy of sodium chloride molecule –variation of inter atomic force with inter atomic spacing -cohesive energy - cohesive energy of ionic solids-application to sodium chloride crystal.

UNITIV: Magnetic Properties
Spontaneous Magnetization–WeissTheory–Temperature dependence of Magnetization- classical Theory of Diamagnetism–Weiss theory of Paramagnetism–Ferro magnetic domains–Blochwall–Basic ideas of anti-ferro magnetism–Ferrimagnetism.

UNIT V: Dielectric Properties
Dielectrics, polarization, polar and non-polar dielectrics–dielectric constant, Polarizability Clausius Mossottirelation–Different types of Polarization – electronic, ionic, orientational, space charge –Dependence of polarization on frequency and temperature; Dielectric loss sources; Dielectric strength and break-down–contributing

Text Books:
1. M.Arumugam, Materials Science, Anuradha Agencies,Publishers.,2002.
2. RLSinghal, Solid State Physics, Kedarnath Ram Nath & Co.,Meerut 2003.
3. Kittel, Introductionto Solid State Physics, Willey Eastern Ltd.2003.
4. V.Raghavan, Materials Science and Engineering, Prentice Hall of India Private Limited, New Delhi, 2004.

Books for Reference:
1. S.O.Pillai, Solid State Physics, New Age International (P) Ltd.,2002.
2. A.J.Dekker, Solid State Physics, Macmillan India,1985.
3. HCGupta, Solid State Physics, Vikas Publishing House Pvt. Ltd., NewDelhi,2001.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Understand about different crystal structure	K1
CO2	Analyze structure of different crystalline material and defects	K4
CO3	Able to know about the inter atomic forces and bonds between solids	K2
CO4	Analyze the various kinds of magnetic materials	K4
CO5	Understand the dielectric properties of crystalline structures.	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	3	3	3	3
CO2	3	3	3	3	2	2	3	3	3	3	3
CO3	3	3	3	3	2	2	3	3	3	3	3
CO4	3	3	3	3	2	2	3	3	3	3	3
CO5	3	3	3	3	2	2	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT63	MATHEMATICAL PHYSICS	L	T	P	C
CORE - XV			5	-	-	4

Objective:
> To understand the various mathematical methods used in Physics.

UNIT1: Vectors
Vectors and scalars-Vector algebra-The scalar product-The vector (cross or outer) product- The triple scalar product-The triple vector product-The linear vector space Vn- Vector differentiation -Space curves - Motion in a plane - A vector treatment of classical orbit theory - Vector differential of a scalar field and the gradient- Conservative vector field -The vector differential operator - Vector differentiation of a vector field - The divergence of a vector- Theoperator∇^2, the Laplacian- The curl of a vector.

UNIT 2: Differential Equation
First-order differential equations - Separable variables -Exact equations Integrating factors - Bernoulli's equation- Second-order equations with constant coefficients - Nature of the solution of linear equations - General solutions of the second-order equations - Finding the complementary function - Finding the particular integral - Rules for D operators - The Euler linear equation - Solutions in power series.

UNIT 3: Matrix
Definition of a matrix - Four basic algebra operations for matrices - Equality of matrices - Addition of matrices - Multiplication of a matrix by a number - Matrix multiplication - Thecommutator-Powersofamatrix-Functionsofmatrices-transposeofamatrix-Symmetric   and skew-symmetric matrices - The matrix representation of a vector product -The inverse of a matrix - A method for finding A-1 - Systems of linear equations and theinverseofamatrix- Complexconjugateofamatrix-Hermitianconjugation-Hermitian/anti-Hermitianmatrix- Orthogonal matrix(real)- Unitary matrix- Rotation matrices- Trace of a matrix.

UNIT 4: Laplace Transformation
Definition of the Laplace transform - Existence of Laplace transforms - Laplace transforms of some elementary functions-Shifting (ortranslation) theorems-The first shifting theorem - The second shifting theorem - The unit step function - Laplace transform of a periodic function - Laplace transforms of derivatives - Laplace transforms of functions defined by integrals – A note on integral transformations.

UNIT 5 : Partial Differential Equations
Linear second-order partial differential equations-Solutions of Laplace's equation: separation of variables- Solutions of the wave equation: separation of variables- Solution of Poisson's equation. Green's functions - Laplace transform solutions of boundary-value problems

Text Books:
1.   Mathematical Methods for Physicists: A concise introduction,-TAIL.CHOW– Cambridge University Press 1995.

Books for Reference:
1. Piyoosh KumarTyagi, Mathematical Physics- RBSA Publishers 2018
2. Satya Prakash-Mathematical Physics-Sultan Chand &Co: 2021
3. R.Murugesan-Mechanics and Mathematical Physics - Sultan Chand & Co: 2014
4. Gupta-Mathematical Physics-Sultan Chand & Co: 2014

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Able to apply vector and scalar operator in different applications	K3
CO2	Understand different orders of differential equation	K2
CO3	Able to apply Matrix and functions of matrices in different problems.	K4
CO4	Enhance problem solving skill using Laplace transform	K3
CO5	Solve different problems using Partial Differential equations	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	3	3	3	2
CO2	3	3	3	3	2	2	3	3	3	3	2
CO3	3	3	3	3	2	2	3	3	3	3	2
CO4	3	3	3	3	2	2	3	3	3	3	2
CO5	3	3	3	3	2	2	3	3	3	3	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHT64	NANO PHYSICS	L	T	P	C
CORE - XVI			5	-	-	4

Objectives:
- To create the basic knowledge in nano materials.
- To understand the scientific perspective of nano materials.
- To identify the techniques suitable for nanomaterial synthesis.
- To know the significance of nano materials.

UNIT I: Nano Materials
History of Nano technology- Nanostructures- synthesis of oxide nanoparticles-Synthesis of semi conductor nano particles-Synthesis of metallic nanoparticles

UNITII: Quantum Hetero Structure
Super lattice -preparation of Quantum nanostructure- Quantum well laser-Quantum cascade laser-Quantum wire- Quantum dot-Application of Quantum dots.

UNIT III : Carbon Nano tubes
Discovery of Nano tubes- Carbon Allotropes- Types of carbon Nanotubes -Graphenesheet to a single walled nanotube -Electronic structure of Carbon Nanotubes -Synthesis of Carbon Nanotube.

UNIT IV: Application of Nanotechnology I
Nanocrystalline soft material- Permanent magnet material-Theoretical background-Super paramagnetism-Coulomb blockade-Quantum cellular Automata.

UNITV: Application of Nanotechnology II
Chemistry and Environment–Energy applications of nanotechnology-Information and Communication – Heavy Industry – Consumer goods- Nano medicine- Medical application of Nanotechnology

Text Books:
1. Textbook of Nanoscience and Nanotechnology– B. S. Moorthy, P. Sankar, Baldev Raj, B.B. Rathand James Murdy University Press –IIM(2013).
2. Nanophysics, Sr.Geradin Jayam, Holy Cross College, Nagercoil (2010).

Books for Reference:
1. 'Nano science and Nanotechnology: Fundamentals to Frontiers', M.S. Ramachandra Rao, Shubra Singh, Wiley Indiapvt. Ltd., New Delhi(2013).
2. 'Nano the Essentials'- T. Pradeep, TataMc. Graw Hill company Ltd(2007)
3. 'The Chemistry of Nano materials : Synthesis, Properties and Applications',Volume1 C. N. R. Rao,A. Mu¨ller, A.K. Cheetham, ,Germany(2004).

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Identify the Nano particles and apply physics concepts to the nano – scale and nano continuum domain.	K4
CO2	Identify the Quantum hetero structure and acquire the knowledge in application of Quantum dots	K4
CO3	Understands about Nano tubes, Allotropes and its structure and synthesis	K2
CO4	Acquires knowledge about the Nano crystalline soft materials, Super-paramagnetism, Quantum cellular automata	K2
CO5	Apply Nano technology in different fields	K3

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	3	3	3	2	3	3	3
CO2	3	2	2	3	3	3	3	2	3	3	3
CO3	3	2	2	3	3	3	3	2	3	3	3
CO4	3	2	2	3	3	3	3	2	3	3	3
CO5	3	2	2	3	3	3	3	2	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHP64	PRACTICAL-IV	L	T	P	C
CORE-XVII			-	-	5	4

Objective:

Provide opportunity for students to learn about basic concepts of electronics through practical settings e.g.test conductors, insulators and semiconductors for their various properties and characteristics.

ANYFOURTEEN

1. Zener diode Characteristics.
2. Transistor Characteristics – CE mode.
3. Single stage amplifier.
4. Two stage amplifier –without feedback.
5. LC–II filters.
6. Clippers and clampers using diode and CRO.
7. Construct Colpitts's Oscillator and measure its frequency.
8. Construct Hartley oscillator and measure its frequency.
9. UJT relaxation oscillator.
10. Voltage doubler.
11. Construct Dual power supply using–IC 7812 and IC 7912.
12. A stable multi vibrator using transistors.
13. Mono stable multi vibrator using transistors.
14. Bi stable multi vibrator – RS flip flop (transistors).
15. Op-ampIC741–characteristics.
16. Op-ampIC741–differentiatorandintegrator.
17. Op-ampIC741–adderandsubtractor.
18. Construct Logic Gates–using discrete components.
19. XOR and XNOR gates–using IC's and verify their truth table.
20. Verification of Demorgan's theorem
21. Design of Half adder and Full adder.
22. Design of Half subtractor and Full subtractor.

TEXT BOOKS:

1. Adrian C.Melissions, Jim Napolitano, Experiments in Modern Physics, 2003.
2. Paul B.Zbar andAlbertB.Malvino, Basic Electronics (AText–Lab Manual),Tata McGrawHill, Edition,5.Publisher,1983.
3. A.P.Malvino, Electronics ,Cybergear,2010.
4. JohnMorris, Analog Electronics, Import,1999.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Design Half and Full subtractor	K3
CO2	Study the characteristics of diode and transistor	K4
CO3	Analyze arithmetical operation using OP-Amp	K4
CO4	Construct oscillator and multivibrator and determine its frequency.	K3
CO5	Verify Demorgan's theorem	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE641	CHOICE -I	L	T	P	C
ELECTIVE-IV		ASTROPHYSICS	3	-	-	3

Objective:
   To understand the basics about the universal bodies and other object in the universe.

Unit 1: **Birth of Modern Astronomy**
Geocentric and Heliocentric theories – Kepler'slaws of planetary motion – Newtonian gravitation – Celestial sphere – Planets – Terrestrial and Jovian planets (Planets individual description is not required in detail) - Asteroids-Meteorites –Comets.

Unit 2: Telescopes
  Elements of telescope – Properties of images – Types of Optical telescopes–Refracting and Reflecting telescopes-Radio telescope–Spectrograph–Limitations – Photographic photometry – Photoelectric photometry – Spectro photometry –Detectors and image processing.

Unit 3: Sun–Physical properties Composition–Core–NuclearReactions–Photosphere–Chromospheres–Corona–Sunspots– Sunspotcycle–SolarWind–Auroras – space weather effects – History of the Earth – Temperature of a planet – The atmosphere–Pressure and Temperature distribution– Magnetosphere–Eclipses–Solar and Lunar Eclipses.

Unit 4 : Classification of Stars
The Harvard Classification system–Luminosity of a Star Hertzsprung -Russel Diagram – Stellar evolution using the HR diagram – Theoretical evolution of stars – White Dwarfs – Neutron Stars-Black holes – Event horizon – Basic physics of Black Holes.

Unit 5: Galaxy nomenclature
Types of Galaxies–Spiral–Elliptical–irregular galaxies Milky Way Galaxy and its structure – Rotation and Mass Distribution – Rotation curve and Doppler shift – Star clusters – Galactic clusters – Pulsars – Cosmological Models – Big bang theory– Steady state theory–Hubble's law –Olber's paradox.

Text Books:
   1. Niclolas. A. Pananides and Thomas Arny, Introductory Astronomy, Addison WesleyPubl.Co., 1979.
   2. A.Mujiber Rahman,Concepts to Astrophysics,, Scitech Publications, Chennai, 2018.

Books for References:
   1. Abell, Morrison and Wolf, Exploration of the Universe, 5th ed., Saunders College Publ.1987,
   2. Carrol and Ostlie, Introduction to Modern Astrophysics, 2nd ed., Pearson International.2007

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Assess the design of physical nature of celestial bodies through co-ordinates of space and time	K2
CO2	Apply various optical instruments and explore the observable universe	K3
CO3	Understand about Structure and properties of Sun and Earth.	K2
CO4	Relate to the stellar observations, the properties, their environment and even the presence of planets with appropriate theories.	K3
CO5	Evaluate the structure of milky way galaxy and all its contents with cosmology for the study of the character and evolution of the universe.	K3

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping:

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	3	3	3	3	3	3
CO2	3	3	1	3	2	3	3	3	3	3	3
CO3	3	3	1	3	2	3	3	3	3	3	3
CO4	3	3	1	3	2	3	3	3	3	3	3
CO5	3	3	1	3	2	3	3	3	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHE642	CHOICE -II	L	T	P	C
ELECTIVE-IV		ATMOSPHERIC PHYSICS	3	-	-	3

Objective:
This paper aims to describe the characteristics of earth's atmosphere and also its dynamics. Atmospheric waves along with the basic concepts of atmospheric Radar and Lidar are discussed in detail.

Unit I: General features of Earth's atmosphere
Thermal structure of the Earth's Atmosphere, Composition of atmosphere, Potential temperature, Atmospheric Thermodynamics, Greenhouse effect, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze.

Unit II: Atmospheric Dynamics
Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, annual and semi-annual oscillations.

Unit III: Atmospheric Waves
Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a non-homogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration

Unit IV: Atmospheric Radar and Lidar
Radar equation and return signal, Signal processing and detection,Various type of atmospheric radars, Applications of radars to study atmospheric phenomena, Lidar and its applications,

Unit V: Atmospheric Aerosols
Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation, Rayleigh scattering and Mie scattering.

Text Book
1. Fundamental of Atmospheric Physics, M.L Salby; Academic Press,Vol 61,1996
   Unit I-V

Book for Reference
1. The Physics of Atmosphere – John T. Houghton; Cambridge University press; 3rd edn.2002.
2. An Introduction to dynamic meteorology– James RHolton; AcademicPress,2004
3. Radar for meteorological and atmospheric observations – S Fukao and K Hamazu, Springer Japan, 2014

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Understand the characteristic of earth's atmosphere	K2
CO2	Study about the fundamental forces and conservation laws governing the earth	K2
CO3	Acquire knowledge about atmospheric waves	K2
CO4	Use the radar theory in data analysis and tool techniques	K4
CO5	Evaluate the application of aerosols	K5

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	2	3	3	2	3	3	2
CO2	3	2	2	3	2	3	3	2	3	3	2
CO3	3	2	2	3	2	3	3	2	3	3	2
CO4	3	2	2	3	2	3	3	2	3	3	2
CO5	3	2	2	3	2	3	3	2	3	3	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weakly correlating(W)	1
No correlating (N)	0

COURSE CODE	U21PHS641	CHOICE -I	L	T	P	C
SKILLBASED ELECTIVE-IV		PROBLEMS SOLVING SKILLS IN PHYSICS	2	-	-	2

Objective:

Main objective of this course is to make the student to solve problems in core physics. Minimum of 20 problems based on various principles of Physics are required in each unit.

Unit 1: Problems in Mechanics
Newton laws of motion for various systems (1,2and3dimension), Conservation laws and collisions, Rotational mechanics, central force, Harmonic oscillator, special relativity

Unit II: Problems in Thermal Physics
Kinetic theory – MB distribution-Laws of thermodynamics – Ideal Gas law-Various Thermo dynamic process - Entropy calculation for various process-Heat engine-TS and PV diagram-Free energies various relations

Unit III: Problems in Electricity & Magnetism
Electrostatics- calculation of Electrostatic quantities for various configurations- Conductors, Magnetostatics-Calculation of Magnetic quantities for various configuration, Electro magnetic induction, Poynting vector, Electromagnetic waves.

Unit IV: Problems in Quantum mechanics
Origin of Quantum mechanics- Fundamental Principles of Quantum mechanics- potential wells and harmonic oscillator-Hydrogen atom.

Unit V: Problems in General Physics& Mathematics
Plotting the graphs for various elementary and composite functions-Elasticity- Viscosity and surface tension-fluids-Buoyancy-pressure-Bernoulli's theorem applications-waves and oscillations, Errors and propagation of errors.

Text books

1. Charles Kittel, Walter D knight, Mechanics (in SI units) (Berkeley Physics course-volume1), Tata McGraw Hill Publication, Second Edition (2007).
2. S.C.Garg, RM Bansal &CK Ghosh, Thermal Physics, Tata McGraw Hill Publications, 1stEdition (2013).
3. E.M. Purcell, Electricity & Magnetism (in SI units), Tata Mc Graw Hill Publication, 2nd Edition (2016).
4. N.Zettili, Quantum Mechanics, Wiley Publishers, Second Edition (2009).
5. David. J.Griffith, Introduction to Quantum Mechanics, Pearson Publications, Second edition (2015).
6. Halliday & Resnick, Fundamentals of Physics, Wiley Publications, 8thEdition (2007).

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Develop problem solving skill in mechanics	K3
CO2	Apply thermodynamics principle to solve entropy related problem	K3
CO3	Determine electrostatic quantities using theorem	K4
CO4	Develop problem solving in Quantum Mechanics	K3
CO5	To appear for research oriented competitive examinations	K3

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2	2	3	2	3	3	2
CO2	3	3	3	3	2	2	3	2	3	3	2
CO3	3	3	3	3	2	2	3	2	3	3	2
CO4	3	3	3	3	2	2	3	2	3	3	2
CO5	3	3	3	3	2	2	3	2	3	3	2

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

COURSE CODE	U21PHS642	CHOICE -II	L	T	P	C
SKILLBASED ELECTIVE-IV		WEATHER FORECASTING	2	-	-	2

Objective:
The aim of this course is to impart theoretical knowledge and develop an awareness and understanding regarding the causes and effects of different weather phenomenon and basic forecasting techniques

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

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

Unit III: Weather systems
Global wind systems; air masses and fronts: classifications; jet streams; local thunder storms; tropical cyclones: classification; tornadoes; hurricanes.

Unit IV: Climate and Climate Change
Climate: its classification; causes of climate change; global warming and its outcomes; airpollution;aerosols,ozonedepletion, acidrain, environmental issues relatedto climate.

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

Text Book:
1. Aviation Meteorology, I.C. Joshi, Himalayan Books,3rd edition 2014.
2. The Weather Observers Hand book, Stephen Burt, Cambridge University Press, 2012.

Reference books:
1. Meteorology, S.R.Ghadekar, Agromet Publishers, Nagpur, 2001.
2. Text Book of Agrometeorology, S.R. Ghadekar, Agromet Publishers, Nagpur, 2005.
3. Atmosphere and Ocean, JohnG. Harvey, The Artemis Press, 1995.

Course Outcomes (CO):

CO	Learning outcome	Remarks
CO1	Learn elementary ideas about atmosphere i.e., temperature, cyclone etc.	K1
CO2	Understand about weather measurement	K2
CO3	Gain Knowledge about climatic change	K2
CO4	Acquire ideas about weather system	K2
CO5	Analysis on weather forecasting	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

Outcome Mapping

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	3	2	3	3	2	3	3	3
CO2	3	3	1	3	2	3	3	2	3	3	3
CO3	3	3	1	3	2	3	3	2	3	3	3
CO4	3	3	1	3	2	3	3	2	3	3	3
CO5	3	3	1	3	2	3	3	2	3	3	3

Correlating	Marks
Strongly correlating(S)	3
Moderately correlating(M)	2
Weekly correlating(W)	1
No correlation(N)	0

NON-MAJOR ELECTIVE(NME)

OURSE CODE	U21PHN311	CHOICE -I	L	T	P	C
SEMESTER III		**HOUSE HOLD APPLIANCES**	**2**	**-**	**-**	**2**

OBJECTIVE

To understand the working principles of different household domestic appliances and to repair the electrical appliances for the general troubleshoots and wiring faults.

UNIT-I

Voltage, Current, Resistance, Capacitance, Inductance, Electrical conductors and Insulators,Ohm'slaw,Seriesandparallelcombinationsofresistors,Galvanometer,Ammeter,Volt meter,Multimeter,Transformers,Electricalenergy,Power,Kilowatthour(kWh),consumptionof electrical power

UNIT-II

Direct current and alternating current, RMS and peak values, Power factor, Single phase and three phase connections, Basics of House wiring, Electric shock, First aid for electric shock, Overloading, Earthing and its necessity, Short circuiting, Fuses, MCB, ELCB, Insulation, Inverter, UPS

UNIT-III

Principles of working, parts and servicing of Electric fan, Electric Iron box, Water heater; Induction heater, Microwave oven; Refrigerator, Concept of illumination, Electric bulbs, CFL, LED lights, Energy efficiency in electrical appliances, IS codes& IE codes.

UNIT IV

1. Studying the electrical performance and power consumption of a given number of bulbs connected in series and parallel circuits.
2. Measuring parameters in combinational DC circuits by applying Ohm's Law for different resistor values and voltage sources
3. Awareness of electrical safety tools and rescue of person in contact with live wire.
4. Checking the specific gravity of lead acid batteries in home UPS and topping-up with distilled water.
5. Identifying Phase, Neutral and Earth on power sockets.

UNIT V

1 Identifying primary and secondary windings and measuring primary and secondary voltages in various types of transformers.
2. Observing the working of transformer under no-load and full load conditions.
3. Observing the response of inductor and capacitor with DC and AC sources.
4. Observing the connections of elements and identify current flow and voltage drops.
5. Studying electrical circuit protection using MCBs, ELCBs

Text Books:

1. B.L.Theraja, A.K. Theraja, A Text book on Electrical Technology, S.Chand & Co.,Reprint (2018)
2. M.G.Say,The Performance and Design of Alternating Current Machines**,**2002

COURSE CODE	U21PHN311	CHOICE -II	L	T	P	C
SEMESTER III		HOW THINGS WORK	2	-	-	2

OBJECTIVES

The Course aims to give the basic function of domestic Appliance, Music Instruments , Aircraft & Camera.

UNIT I: DOMESTIC APPLIANCES

Electric bell - Door locks - Fans, Blowers and Centrifugal compressors - Refrigerator – Air conditioning - Vacuum cleaner - Sewing machine - Flat iron- Tape recorder – Washing machine–Fuse

UNIT II: LIGHT AND MUSIC

Compact Fluorescent lamp - Incandescent lamp - Colour television - Pianoforte - Piano tone and tuning-Accordion -Electric organ- Electronic music.

UNIT III: METALLURGY

Powder metallurgy - Forging - Cutting and machining of metals - Pressure welding – Fusion welding-Soldering –Metal spraying.

UNIT IV: AIRCRAFT

Present day method of aircraft construction - Airfoils and airflow - Wind tunnel – Hydraulic power system – Vertical takeoff and landing aircraft (VTOC).

UNIT V: CAMERA

Cameras: General Introduction - Focal length and size of image - Interchangeable lenses - Diaphragm shutters - Depth of field - Range finder - Video camera - Projectors – Color photography.

TEXT BOOK

1. The Universal Encyclopedia of Machines – How Things Work 1 & 2 –Harper Collins Publishers India- Volume I, 1992.

COURSE CODE	U21PHN421	CHOICE -I	L	T	P	C
SEMESTER IV		**DIGITAL PHOTOGRAPHY**	2	-	-	2

Objective:
   To understand the function and basic concept of digital camera, Photography and editing.

Unit I: Introduction to Digital Photography
Understanding film and paper photography – Learning about the digital revolution-Advantages and disadvantages of digital photography over film photography - Computers as photographic tools

Unit II Digital Basics
Digital image method of storing and processing digital image: Raster and Vector method - Representation of digital image: Resolution – Pixel Depth – Pixel Aspect Ratio – Dynamic Colour Range–FileSize–ColourModels–ImageCompression–FileFormats–Calculating image resolution for outputs

Unit III Digital Capture
Digital Image formation–Image Sensors–Different Capturing Method: Digital camera–Scanner–Frame Grabber- DIGITAL CAMERA: Understanding how digital cameras work – Digital camera types: Floppy Disc type, Flash Card type, Hard Disc type –Overview of current digital cameras

Unit IV: Image Editing
Image editing through image editing softwares like Adobe Photoshop – Adjustment of Brightness, Contrast, Tonal and Colour Values–Experimenting with Level and Curve.

Unit V: Digital Retouching & Image Enhancement
Image size – Resolution – Selection tools and techniques – History – Retouching tools – Layers–Photo mounting techniques–Incorporation of text into picture - Digital Manipulation: Applying selective effects to images and filters with masks and different digital darkroom effects.

Text Books
1. Phillip K rejcarek, Digital Photography-A handson Introduction, Delmer Publishers 1996
2. Jon Torrant, Understanding Digital Cameras, Focal Press,2002

COURSE CODE	U21PHN422	CHOICE -II	L	T	P	C
SEMESTER IV		PHYSICS IN MUSICAL INSTRUMENT	2	-	-	2

Objectives:

The course aims to relate applications of Physics concepts on various musical phenomena.

UNIT – I: Basic Ideas of Sound

Wave motion – types of waves-simple Harmonic motion – Properties of sound waves – reflection, refraction, diffraction and interference of sound velocity of sound standing waves-Beats-Resonance.

UNIT – II: Basic Idea of Music

The ear-pitch loudness and quality of musical notes-just noticeable difference in pitch-barrel hearing-aural or combination tones-subjective tones - subjective music-vibrato and tremolo-pitch range of musical instruments.

UNIT–III: Musical Instruments

String instruments-frequency of stretched strings-longitudinal vibration in strings-plucked, bowed and struck stringed instruments-one example for each from carnatic Hindustani and western. Wind Instruments modes of oscillation in open and closed pipes-Different types of wind instruments-examples from carnatic and western. Vibrations in Stretched Membranes and Plates. Drums, cymbals etc.

UNIT– IV: Electronics of music

Microphones (carbon & crystal) – pickup – Loud speaker, Amplifiers. Addition of sound - santoors.

UNIT –V: Electronic systems

Tape recording and play back equalizers, Recording and reproduction of sound in cine films. Acoustic of Buildings: Acoustics-Reverberation and Reverberation time – Acoustic measurements: A coustic intensity level– Acoustic pressure level-Factors affecting the acoustics of buildings–sound distribution in an Auditorium– Requisites for good acoustics.

TEXT BOOKS:
1. A skill. J,Physics of Musical Sounds, Van Nostrand Rein hold Inc.,U.S. (1979).
2. Johnson.K,Physics for you,OUP Oxford;5th edition(2016)
3. Berkely,Waves, McGraw Hill Education (2017)
4. Krishnasami.S,Musical Instruments of India, Publications Division (30August2017)

VALUE ADDED PROGRAMME

COURSE CODE	U21PHV51	SOLAR ENERGY TECHNOLOGY	L	T	P	C
SEMESTER - V				30		2

OBJECTIVES

Give knowledge about Renewable Energy.

UNIT 1: Need for Solar Energy

The need for alternate energy sources – The Sun – Basic parameters of the Sun– Energy source of the Sun– Estimate of energy emitted by Sun and energy that reaches the Earth – Solar radiation – Solar constant – Solar Radiation calculation - Geographical location of India.

UNIT 2: Physics of Solar Energy

Interaction of sunlight with Earth– Absorptivity–Reflectivity–Transmittivity–Emissivity – Interaction of sunlight with atmosphere–Beam and diffuse solar radiation–Pyranometer – Energy storage–Salt hydrates– Solar energy and electric vehicles.

UNIT 3: Solar Thermal Devices

Heat transfer and losses – Conduction – Convection – Radiation – Collectors – Flat plate collectors–Tracking collectors– Concentrating collectors–Tilted collectors–Constructionof different types of solar heating devices- Solar Air Heaters.

UNIT 4 : Basics of Solar Photo voltaics

Solar Cells – Applications and advantages of photovoltaic(PV) devices.

UNIT 5: National Solar Energy Programmes

Short notes on National Solar Mission – Notes on: Green Energy corridors – Solar Parks and Ultra Mega Solar Power Projects – Surya mitra Programme - other schemes: Canal bank & Canal Top–NISE–National Institute of Solar Energy : About Training Programmes-ISA–International Solar Alliance- objective- vision: One World, One Sun, One Grid.

Books for Study:

1. Zekai Sen. Solar Energy Fundamentals and Modeling Techniques, Springer-Verlog,London2008
2. Chen CJ.Physics of Solar Energy, Wiley2011.

COURSE CODE	U21MAA11	SEMESTER-I	L	T	P	C
B.Sc.Physics /Chemistry		ANCILLARY MATHEMATICS I	5	-	-	4

Objectives:
- ☐ The learner will become proficient in expansion and summation of function
- ☐ The learner will acquire knowledge of solving problems in matrices
- ☐ The learner will capable of solving the interpolation problems.
- ☐ The learner will gain knowledge of trigonometric functions and related problems
- ☐ The learner will become proficient in various types of hyperbolic functions

Unit-I: Partial Fractions

Introduction of Partial Fractions- Binomial Theorem: The General Term – Expansion of Rational Fractions – Summation of Series. Exponential Theorem: Summation of Series, The Logarithmic Series- Problems.

Unit-II: Theory of Equations

IntroductionofthegeneralEquations-FundamentalTheoremofAlgebra–SymmetricFunction of Roots – Relation between Roots and Coefficient of Equation – Formation of Equation – Diminish the Roots of the Equation – Reciprocal Equation. Newton – Raphson Method problems.

Unit-III: Matrices

Fundamental Concepts of Special Types of Matrices –Addition and Subtraction of Matrices – Matrix Multiplication – Associated Matrices. Rank of a Matrix: Elementary Operations or Transformation. Linear Equations: Homogeneous linear Equation – Non-Homogeneous Equation Characteristic Roots and Vectors: Eigen Value and Eigen Vectors – Properties of the Eigen Vectors– Cayley -Hamilton theorem.

Unit-IV: Interpolations:

Introduction about Interpolations : Newton's Forward Method-Newton's Backward Method-Lagrange's Interpolation Formula: Different form of Lagrange's Interpolation Formula-problems.

Unit-V: Trigonometry:

Basic ideas in Trigonometry: Expansions: $\cos^n\theta$, $\sin^n\theta$ – $\cos n\theta$ and $\sin n\theta$ –Expansion of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in powers of θ. Hyperbolic Function: Relation between Hyperbolic Functions and Circular Functions – Periods of Hyperbolic Functions – Inverse Hyperbolic Functions. Logarithm of Complex Quantities

Text Book:
1. **P.Kandasamy, K.Thilagavathy**,"Allied Mathematics Paper I", 1st Semester, S. Chand Publishing. A Division of S. Chand & Company Pvt.Ltd, Edition 2013

ReferenceBooks:
1. **G.C.Sharma and Madhu Jain**, Algebra and Trigonometry, 1st Edition, GalgotiaPublicationsPvt.Ltd.2003
2. **Dr.S.Arumugam, A.Thangapandi Isaac and A.Somasundaram**, Numerical

Methods, 2nd reprint, Scitech Publication India Pvt, Ltd., 2004.

Course Outcome:

On the successful course completion, students will be able to:		Cognitive Level
CO1	Remember numbers, sequences, series,basic summaries from partial fraction, equations, matrices	K1
CO2	Understand trigonometric values and Interpolations	K2
CO3	Solve problems by using theorems.	K3
CO4	Analyze homogeneous and non-homogeneous linear equations.	K4
CO5	Analyze and Evaluate inverse functions.	K4,K5

K1-Remember;K2-Understand; K3-Apply;K4- Analyse; K5-Evaluate;K6-Create

COURSE CODE	U21MAA22	SEMESTER-II	L	T	P	C
B.Sc.Physics /Chemistry		**ANCILLARY MATHEMATICS II**	5	-	-	4

Objectives:

☐ To learn methods of integration and properties and its solving related problems.
☐ Understand the basic concepts of first order differential equation and its applications.
☐ Find solutions by applying Laplace transform methods.
☐ Vectors and its product and its integrations.

Unit-I: Vector Calculus:

Introduction about Vector Calculus–Gradient, Divergence and curl(problems only).Integration of vectors: Integration of vector functions, Line integrals – Surface integrals –Green's theorem in the plane (statement only) – Gauss Divergence theorem (statement only) –Problems– Stoke's theorem(statement only) – Problems

Unit-II : Partial differential equation

Introduction of Partial differential equation from differential equations - Formation of Partial differential equations by eliminating arbitrary constants and arbitrary functions* – Solutions of standard types of first order equations- $f(p, q) = 0$, $f(x, p, q)=0$, $f(y, p, q)=0$, $f(z, p, q)=0$, $f_1(x,p)= f_2(y, q)$, $z = px+qy+f(p, q)$, Clairaut's form– Lagrange method of solving linear partial differential equations $P p + Qq = R$. (problems only)

Unit-III: Total differential equations

Introduction of total differential equations - Bessel's equations : Bessel's equations – Solutions of Bessel's general differential equations (derivations not included) – General solution of Bessel's equations - Recurrence formulae (derivations not included) – Simple problems using Recurrence relation.

Unit-IV: Laplace Transforms

Introduction of Laplace Transforms- Definition – Laplace Transform of e^{at}, cos at, sin at, coshat, sinhat,t^n, n, a positive integer–$e^{at}f(t)$, $t^n f(t)$, $f'(t)$, $f''(t)$ – Inverse Laplace Transform of standard functions–Solving differential equations of Second order with constant coefficients using Laplace Transform.

Unit-V: Fourier Series

Introduction of Fourier Series: Definition-Dirchlet's conditions- Fourier series of periodicity 2π and $2l$ - Odd and even functions –Root mean square value of a function Halfrange series: Introduction- Half range series –Cosin series- sin series – Parseval's theorem –Harmonic analysis

Text Book:

1. **P.Kandasamy and K.Thilagavathy**. "Mathematics for B. Sc., Br. -I, Volume-II and Volume-III", S.Chand & Company Ltd, First edition, 2004.(UNIT I and III)
2. **S.Narayanan and T.K. Manickavasagam Pillai**," Calculus Vol. III ", S.Viswanathan (Printers and Publishers, (P)Ltd, Chennai,2010.(UNIT II and V)
3. **S. Narayanan and T. K. Manickavasagam Pillai**, "Calculus Vol. III " S.Viswanathan (Printers and Publishers, (P)Ltd, Chennai, 1997.(UNITIV)

ReferencesBook
1. **P. Kandasamy and K.Thilagavathy**, "Mathematics, Vol Iv", S.Chand And CompanyLtd.,-2004
2. **Shanti Narayan**, "Differential Calculus", Shyamlal Charitable Trust, New Delhi, 2004.
3. 3.**P.N.Chatterji**,"VectorCalculus",1stEdition,RajhansPrakahanPublishers,Chennai,199

Course Outcome:

On the successful course completion, students will be able to:		Cognitive Level
CO1	Understand the I and II integrals	K2
CO2	Understand properties of integrals, Laplace transform.	K2
CO3	Understand first order differential equations.	K2
CO4	Analysis Theorems and proves.	K3,K4
CO5	Evaluate the importance of shifting properties.	K3,K4

K1-Remember: K2- Understand:K3-Apply, K4- Analyse,K5-Evaluate;K6-create

COURSE CODE	U21PHA33	SEMESTER III	L	T	P	C
ALLIED-3		ALLIED CHEMISTRY THEORY PHYSICAL SCIENCES	5	-	-	4

Objectives
1. To understand the handling of chemicals and errors in chemical analysis
2. To get knowledge in chemical bonding and hybridization
3. To acquire knowledge in volumetric analysis
4. To understand the basic concept of chemistry of Thermodynamics and Kinetics

Unit-I Handling of Chemicals and Data Analysis
a) Storage and handling of chemicals: Handling of acids, ethers, toxic chemicals. Antidotes, threshold vapour concentration and first aid procedure.
b) Errors in chemical analysis: Accuracy, precision. Types of error-absolute and relative errors. Methods of eliminating and minimizing errors.
c) Separation techniques –Solvent extraction. Principle of adsorption and partition chromatography, column chromatography, thin layer chromatography (TLC), paper chromatography and their applications.

Unit-II ChemicalBonding
a) Ionic Bond: Nature of Ionic bond. Structure of NaCl, KCl and CsCl. Factors influencing the formation of ionic bond.
b) Covalent Bond: Nature of covalentbond. Structure of CH_4,NH_3,H_2O based on hybridization.
c) Coordinate Bond: Nature of coordinate bond. Coordination complexes. Werner's theory. Geometrical and optical isomerism in square planar and octahedral complexes. Mention of structure and functions of chlorophyll and hemoglobin
d) Hydrogen Bond: Theory and importance of hydrogen bonding.Types of hydrogen bonding. Hydrogen bonding in carboxylicacids, alcohol, amides, polyamides, DNA and RNA.

Unit- III Volumetric Analysis
a) Methods of expressing concentration: normality, molarity, molality, ppm.
b) Primary and secondary standards: preparation of standard solutions c) Principle of volumetric analysis : end point and equivalence points.
c) Strong and weak acids and bases-Ionic product of water, pH, pKa, pKb. Buffer solutions -pH of buffer solutions. Mention of Henderson equation & its significance.

Unit-IV Kinetics
a) Chemical Kinetics: Rate, rate law, order and molecularity. Derivation of rate expressions for I and II order reactions.
b) Catalysis-Homogeneous and heterogeneous catalysis. Enzyme catalysis, enzymes in biological system and in industry.

Unit- V Thermodynamics
a) Introduction: Scope and importance of thermodynamics – system and surrounding-isolated, closed and open systems-state of the system-intensive andextensive variables. Thermodynamic process- reversible and irreversible, isothermal and adiabatic process
b) First law of thermodynamics-statement-definition of internal energy(E), enthalpy(H),

applications of first law of thermodynamics.

The second law of thermodynamics: Limitations of first law and the need for the second law, different ways of stating II law and its significance, Spontaneous or irreversible process.

The concept of entropy–definition and physical significance of entropy.

Text Books:
1. A.Bahl and B.S. Bahl, Advanced Organic Chemistry, I Multicolor Edition, S.Chand & Company, New Delhi,2010.
2. Satya Prakash, Advanced Inorganic Chemistry, R.D.Madan, VolI, 5th Edition, S.Chand and Sons, New Delhi, 2012.
3. B.R. Puri, L.R.Sharma and M.S.Pathania, Principles of Physical Chemistry, 46thEdision,Vishal Publishing Company, New Delhi, 2013.

Reference Book:
1. R.Gopalan, S. Sundaram,*Allied Chemistry*, Sultan Chand and Sons, 1995.

CO	Course outcomes	Remarks
CO1	Students can gain the knowledge on the handling of chemicals and errors in chemical analysis.	K2, K3
CO2	Learn Chemical Bonding and Hybridization	K2
CO3	Learn the calculations of preparing standard solutions	K2, K3
CO4	Understand and appreciate the advanced concepts and rate equations in chemical kinetics.	K2
CO5	Calculate change in thermodynamic properties, equilibrium constants, partial molar quantities, chemical potential	K2

K1-Remember　　　**K2**-Understand　　**K3**- Apply　　**K4**-Analyze **K5**-Evaluate

COURSE CODE	U21PHA44	SEMESTER IV	L	T	P	C
ALLIED-4		ALLIED CHEMISTRY PRACTICAL-PHYSICAL SCIENCES	4	-	-	4

Objectives
1. To enable the students to acquire knowledge in Organic Estimation
2. To understand basics and gain knowledge inorganic analysis
3. At the end of the course, the students should be able to plan experimental projects and execute them.

Acidimetry and alkalimetry: Titration acids used: hydrochloric acid, sulphuric Standard solutions prepared: sodium carbonate, sodium bicarbonate, oxalic acid.
Oxidation and reduction titration: Oxidising agents: Potassium permanganate (permanganimetry) Reducing agents: Ferrous sulphate, ferrous ammonium Sulphate, oxalic acid
Standard solutions prepared: Ferrous Sulphate, ferrous ammonium Sulphate and oxalic acid.
Iodometry titrations: titrations of liberate diodine against sodium thiosulphate using acidified potassium permanganate, potassium dichromate and copper Sulphate solutions.
Standard solutions: potassium dichromate, copper sulphate.

Text Books
1. Sundaram, Krishnan, Raghavan, Practical Chemistry (PartII), S.Viswanathan Co. Pvt., 1996.
2. B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.

Reference Books
1. Practical Chemistry by A.O. Thomas, Scientific Book Centre, Cannanore, 2003.
2. Basic Principles of Practical Chemistry, V.Venkateswaran, R.Veeraswamy, A.R.Kulandaivelu, Sultan Chand & Sons, New Delhi,2nd Edn., 2004.

CO	Course outcomes	Remarks
CO1	Learn the concept of Titration methods and various Titrations	K2
CO2	Understand the Acidimetry and alkalimetry titrations	K2
CO3	The preparation of standard solutions and methods of analyze the various salts	K2, K4
CO4	Understand the calculations of molarity, molality and Normality of the solutions	K2
CO5	Understand the concept of Iodometry titrations	K2

K1-Remember   **K2**-Understand **K3**- Apply **K4**-Analyze **K5**-Evaluate

ALLIED PHYSICS (for B.Sc Mathematics / B.ScChemistry)
Objective:

To impart preliminary knowledge on basic concepts of physics to chemistry and mathematic students to make them understand the fundamentals of core physics.

UNITI: Mechanics
Centre of Gravity – Centre of Gravity of a solid hemisphere – Hollow hemisphere – Centre of Gravity of a solid cone – Centre of Gravity of a solid tetrahedron. States of Equilibrium: Equilibrium of a rigid body – Stable, unstable and neutral equilibrium – Example. Stability of Floating bodies – Meta center– Determination of Metacentric height of a ship.

UNIT II: Properties of Matter
Stress – Strain – Young's modulus – Behavior of wire under progressive tension –Bending of beams – Expression for the bending moment – Measurement of Young's modulus by bending of a beam – Non uniform bending and Uniform bending. Viscosity: Stream line flow and Turbulent flow–critical velocity -Poiseuille's formula–Determination of coefficient of viscosity of a liquid (Variable pressure head). Surface Tension: Drop weight method of determining the surface tension of a Liquid – Experiment to determine the interfacial tension.

UNIT III: Electronics
Intrinsic and extrinsic semiconductor – PN Junction diode – Biasing of PN junction – V-I characteristics of junction diode–Rectifiers–Half wave–Full wave and bridge rectifiers
– Zener diode – Characteristics of Zener diode–Voltage regulator–Transistor–Characteristics of transistor–CB,CEmode–Transistors as an amplifier.
Digital: Decimal– Binary – Octal and Hexa Decimal number systems and their Mutual Conversions – 1'sand 2's complement of a Binary number and Binary arithmetic (Addition, Subtraction, Multiplication and Division) – Binary Subtraction by 1's and 2's complement method –Basic logic gates – AND, OR, NOT, NAND, NOR and EXOR gates – NAND and NOR as universal building gates – Boolean Algebra – Laws of Boolean Algebra – De Morgan's Theorems– Their verifications using truth tables.

UNITIV: Optics
Geometrical Optics: Spherical aberration of a thin lens – Methods of reducing spherical aberration – Coma – A planatic surface – Astigmatism – Curvature of the field – Distortion. Interference: Introduction – Air wedge – Newton's rings – Colors of thin films. Diffraction: Plane diffraction Grating – Theory of plane transmission Grating

UNIT V: Modern Physics
Atomic Physics Atom Models: Sommerfield's and Vector atom Models–Pauli's exclusion Principle–Various quantum numbers and quantization of orbits. X-rays: Continuous and Characteristic X-rays – Mosley's Law and importance – Bragg's law –Miller indices.
Nuclear Physics Introduction–Nucleus–Classification of Nuclei–Nuclear Size–Charge – Mass and Spin -Nuclear Radiations and their properties, Laws of Radioactivity-Decay Constant-Half life and mean life- age of the earth-carbon Dating.

Text Books:

1. R.Murugeshan, Properties of Matter, S.Chand&Co.Pvt.Ltd.,Revised edition,2012.
2. Narayanamoorthy and N.Nagarathinam, Mechanics– Part II, The National Publishing Company, Chennai, 2005.
3. N.Subramaniyam, Brijlal and M.N.Avathanulu, Optics, S.Chand & Co.Pvt.Ltd.25 th revised edition, New Delhi,2012.
4. V.Vijayendran,S.Viswanathan, Digital Fundamentals, Printers & Publishers Private Ltd, Chennai, 2004.
5. MehtaV.K.,Principles of Electronics, S.Chand and company Ltd,2014.
6. Albert Paul Malvino, Digital Principles and Applications, Mc Graw-Hill International Editions, New York, 2002.
7. Puri V.K.,Digital Electronics Circuits and Systems, TATA McGraw Hill Publications, New Delhi, 2011.
8. R. Murugeshan, Kiruthiga Sivaprasath, Modern Physics, S. Chand & Co, New Delhi, First edition, 1984.
9. R.S.Sedha, A Text Book of Digital Electronics, S.Chand & Co, New Delhi, First edition,2004

Books for Reference:

1. D.S Mathur. Revised by: Dr.P.S.Hemne, Mechanics–S.Chand and Co.   New Delhi. First edition 1981, Reprint2015.
2. BrijLal and Subramanyam, Properties of Matter–Eurasia publishing house (Pvt.) LTD. New Delhi. Sixth Edition 1991
3. B.L.Theraja, Basic Electronics(Solid State),S.Chand and Co.NewDelhi2006
4. R.Murugesan, Optics and Spectroscopy-S.Chand Publishing,1997.
5. J.B.Rajam, Atomic Physics.,S. Chand & Company Limited, New Delhi, First edition, 1990.
6. B.N. Srivastava, Basic Nuclear Physic, Pragati Prakashan, Meerut, 2005.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Analyze center of gravity	K4
CO2	Learn about modulus, viscosity and surface tension of materials	K2
CO3	Study the characteristics of diode and transistor	K1
CO4	Understand about aberration and different properties of lenses	K2
CO5	Gain knowledge about atomic model and basic nuclear properties	K2

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

ALLIED PRACTICALS

Objective:

    It is aimed at exposing the non-physics under graduate students to the technique of handling simple measuring instruments and also make them measure certain mechanical, electrical and optical properties of matter

Any Twelve experiments

1. Estimation of Error
2. Compound Pendulum–g and unknown mass determination
3. Young's Modulus – Uniform bending–pin and microscope method
4. Young's Modulus–Cantilever–Pin & Microscope
5. Young's Modulus –Uniform bending–Opticlever method
6. Young's Modulus – Non-Uniform bending–pin and microscope method
7. Viscosity–Stoke's Method
8. Viscosity– Poiseuille's method
9. Sonometer–frequency of a lining fork
10. Calibration of Voltmeter – potentiometer
11. Comparison of capacitances– B.G
12. Dispersive power of prism– Spectrometer
13. Logic Gates–AND, OR, NOT using discrete components
14. Logic Gates–NAND,NOR–using IC's
15. Diode Characteristics
16. Zener diode Characteristics
17. Newton's rings of a liquid
18. Spectrometer–Prism-i-d curve to find µ
19. NAND as Universal gate: IC
20. NOR as Universal gate: IC
21. Surface Tension–Capillary Rise
22. Newton's Law of cooling

TEXT BOOKS

1. C.COuseph, G.Rangarajan-ATextBookofPracticalPhysics,-S.ViswanathanPublisher-PartI(1990).
2. C.COuseph, Rangarajan, R.Balakrishnan,A Text Book of Practical Physics, S.Viswanathan Publisher- Part II (1996).
3. S.LGupta and V.Kumar –Practical Physics, Pragati Prakashan –25th, Edition(2002).
4. A.P.Malvino, Electronics, Cybergear, 2010.
5. John Morris, Analog Electronics, Import,1999.
6. S.K. Bhattacharya, Electrical Machines (TTTI Chandigarh) - TMH1998.

Course Outcomes(CO):

CO	Learning outcome	Remarks
CO1	Able to Estimate Errors	K3
CO2	Analyze dimensional change of bar	K4
CO3	Determine viscosity of liquid	K4
CO4	Study the characteristics of diode and ICs	K3
CO5	Determine surface tension of liquid	K4

K1-Remember   K2-Understand   K3-Apply   K4-Analyze   K5-Evaluate

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