ANNAMALAI UNIVERSITY

(Affiliated Colleges)

203 - B.Sc. Physics
Programme Structure and Scheme of Examination (under CBCS)
(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

Part	Course Code	Study Components &Course Title	Credit	Hours	Maximum Marks		
					CIA	ESE	Total
		SEMESTER – I					
I	23UTAML11/ 23UHINL11/ 23UFREL11	Language-I: பொதுதமிழ்– I/ Hindi-I French-I	3	6	25	75	100
II	23UENGL12	General English – I	3	6	25	75	100
III	23UPHYC13	Core – I: Properties of Matter and Acoustics	5	5	25	75	100
	23UPHYP14	Core –II: Practical –I: Physics Practical –I (Covering 23UPHYC13)	5	4	25	75	100
	23UCHEE15 23UCHEEP1	Elective – I (Generic / Discipline Specific): Chemistry for Physical Sciences–I Chemistry for Physical Sciences Practical –I	2 1	3 2	25 25	75 75	100 100
IV		Skill Enhancement Course – 1 (NME-I):	2	2	25	75	100
	23UPHYF17	Foundation Course: Introductory Physics	2	2	25	75	100
		Total	**23**	**30**			**800**
		SEMESTER – II					
I	23UTAML21/ 23UHINL21/ 23UFREL21	Language-II பொதுதமிழ்– II/ Hindi-II French-II	3	6	25	75	100
II	23UENGL22	General English – II	3	6	25	75	100
III	23UPHYC23	Core – III: Heat, Thermodynamics and Statistical Mechanics	5	5	25	75	100
	23UPHYP24	Core –IV: Practical II: Physics Practical –II(Covering 23UPHYC23)	5	4	25	75	100
	23UCHEE25	Elective - II (Generic / Discipline Specific) Chemistry for Physical Sciences-II	2	3	25	75	100
	23UCHEEP2	Chemistry for Physical Sciences Practical -II	1	2	25	75	100
IV		Skill Enhancement Course – 2 (NME-II):	2	2	25	75	100
	23USECG27	Skill Enhancement Course – 3: Internet and its Applications (Common Paper)	2	2	25	75	100
		Total	**23**	**30**			**800**

Non-major (NME) Electives offered to other Departments

IV	23UPHYN16	Physics for Everyday Life	2	2	25	75	100
	23UPHYN26	Astrophysics	2	2	25	75	100

Semester: I Part: III Core - I	**23UPHYC13** **PROPERTIES OF MATTER AND** **ACOUSTICS**	Credit: 5 Hours: 5

COURSE OBJECTIVES: *Study of the properties of matter leads to information which is of practical value to both the physicist and the engineers. It gives us information about the internal forces which act between the constituent parts of the substance. Students who undergo this course are successfully bound to get a better insight and understanding of the subject.*

UNIT-I   ELASTICITY: Hooke's law – stress-strain diagram – elastic constants –Poisson's ratio – relation between elastic constants and Poisson's ratio – work done in stretching and twisting a wire – twisting couple on a cylinder – rigidity modulus by static torsion– torsional pendulum (with and without masses) [12 Hours]

UNIT-II   BENDING OF BEAMS: cantilever– expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – expression for time period – experiment to find Young's modulus – non-uniform bending– experiment to determine Young's modulus by Koenig's method – uniform bending – expression for elevation – experiment to determine Young's modulus using microscope [12 Hours]

UNIT-III   FLUID DYNAMICS: Surface tension: definition – molecular forces– excess pressure over curved surface – application to spherical and cylindrical drops and bubbles – determination of surface tension by Jaegar's method–variation of surface tension with temperature [7 Hours]

VISCOSITY: Definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille's formula –corrections – terminal velocity and Stoke's formula– variation of viscosity with temperature [7 Hours]

UNIT-IV   WAVES AND OSCILLATIONS: Simple Harmonic Motion (SHM) – differential equation of SHM – graphical representation of SHM – composition of two SHM in a straight line and at right angles – Lissajous's figures- free, damped, forced vibrations –resonance and Sharpness of resonance. [8 Hours]

Laws of transverse vibration in strings –sonometer – determination of AC frequency using sonometer – determination of frequency using Melde's string apparatus [4 Hours]

UNIT-V   ACOUSTICS OF BUILDINGS AND ULTRASONICS:

Intensity of sound – decibel – loudness of sound –reverberation – Sabine's reverberation formula – acoustic intensity – factors affecting the acoustics of buildings. [5 Hours]

Ultrasonic waves: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction effect – application of ultrasonic waves [5 Hours]

TEXT BOOKS:
1. D. S. Mathur, 2010, Elements of Properties of Matter, S. Chand & Co.
2. Brijlal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co
3. D. R. Khanna & R. S. Bedi, 1969, Textbook of Sound, Atma Ram & sons
4. Brijlal and N. Subrahmanyam, 1995, A Text Book of Sound, Second revised edition, Vikas Publishing House.
5. R.Murugesan,2012, Properties of Matter, S. Chand & Co.

REFERENCE BOOKS:
1. C.J. Smith, 1960, General Properties of Matter, Orient Longman Publishers
2. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition,R. Chand & Co.
3. A.P French, 1973, Vibration and Waves, MIT Introductory Physics, Arnold-Heinmann India.

WEBLINKS:
1. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
2. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
3. https://www.youtube.com/watch?v=gT8Nth9NWPM
4. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
5. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
6. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
7. http://www.sound-physics.com/
8. http://nptel.ac.in/courses/112104026/

COURSE OUTCOMES:

After attending the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Relate elastic behavior in terms of three moduli of elasticity and working of torsion pendulum.
	CO2	Able to appreciate concept of bending of beams and analyze the expression, quantify, and understand nature of materials.
	CO3	Explain the surface tension and viscosity of fluid and support the interesting phenomena associated with liquid surface, soap films provide an analogue solution to many engineering problems.
	CO4	Analyze simple harmonic motions mathematically and apply them. Understand the concept of resonance and use it to evaluate the frequency of vibration. Set up experiment to evaluate frequency of ac mains
	CO5	Understand the concept of acoustics, importance of constructing buildings with good acoustics. Able to apply their knowledge of ultrasonics in real life, especially in medical field and assimilate different methods of production of ultrasonic waves

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)**for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM (**M**) and LOW (**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	M	M	S	M	S
CO2	M	S	S	S	M	M	S	M	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	S	M	S	M	M	M
CO5	M	M	S	S	M	S	S	S	S	M

SEMESTER: I PART: III Core – II	23UPHYP14 PRACTICAL - I	Credit:5 Hours: 4

COURSE OBJECTIVES: *Apply various physics concepts to understand Properties of Matter viz., elasticity, surface tension, viscosity, moment of inertia, acceleration due to gravity and sound waves in solids. Set up experimentation to verify theories, quantify and analyze.*

LIST OF EXPERIMENTS (Any Eight Experiments only)

1. Compound Pendulum - Determination of 'g' and 'k'.
2. Determination of moment of inertia of an irregular body.
3. Verification of parallel axes theorem on moment of inertia.
4. Verification of perpendicular axes theorem on moment of inertia.
5. Determination of Young's modulus by stretching of wire with known masses.
6. Verification of Hook's law by stretching of wire method.
7. Young's modulus – Non-uniform bending -Pin and microscope.
8. Young's modulus - Uniform bending –Pin and microscope.
9. Rigidity modulus -Torsional Pendulum -without masses.
10. Rigidity modulus -Static torsion -Mirror, Scale and telescope.
11. Surface tension and Interfacial surface tension - drop weight method.
12. Coefficient of viscosity of liquid - Graduated burette - Radius of capillary tube by using microscope.
13. Determination of critical pressure for streamline flow.
14. Determination of Poisson's ratio of rubber tube.
15. Sonometer – verification of laws of transverse vibrations of stretched strings.
16. Sonometer - Frequency of Tuning fork.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

9. Gupta & Kumar, *Practical Physics,* Pragati prakashan, Meerut

COURSE OUTCOMES:

At the end of the course, the student will be able to:

<table>
<tr><td rowspan="6" style="writing-mode: vertical">COURSE OUTCOMES</td><td>CO1</td><td>Understand and determine accurately the length, radius by using screw gauge and vernier calipers.</td></tr>
<tr><td>CO2</td><td>Grasp and find the Young's modulus, rigidity modulus of solid materials</td></tr>
<tr><td>CO3</td><td>Recognize and estimate the surface tension and interfacial properties two immiscible liquids.</td></tr>
<tr><td>CO4</td><td>Appreciate and measure the internal friction between the layers of the liquid.</td></tr>
<tr><td>CO5</td><td>perform experiments in sonometer and verification of laws of transverse vibrations.</td></tr>
</table>

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

SEMESTER: I Part: III	23UCHEE15 CHEMISTRY FOR PHYSICAL SCIENCE– I	Credit : 2 Hours : 3

Objectives of the course	This course aim state provide knowledge on the • Basic concepts of chemical bonds, hybridization properties. • Concepts of thermodynamics and its applications. • Concepts of nuclear chemistry • Qualitative and analytical methods.
Course Outline	**UNIT-I** **Chemical Bonding and Nuclear Chemistry** Chemical Bonding: Molecular Orbital Theory-bonding, anti – bonding And non-bonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen, discussion of bond orders, magnetic properties. Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and Nuclear reactions-group displacement law. Nuclear binding energy- Mass defect-calculations. Nuclear fission and nuclear fusion- differences and applications. Uses of radioisotopes–carbon dating, rock dating and medicinal applications.

Unit-II

Industrial Chemistry

Fuels: Fuel gases: Natural gas, water gas, semi water gas, carbureted

Water gas, producer gas, CNG, LPG and oil gas (manufacturing

Details not required). Silicones**:** Synthesis, properties and uses of

silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK

fertilizer, superphosphate, triple super phosphate.

UNIT-III

Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap, hybridization and geometry of CH_4,

C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and

consequences on K_a and K_b of organic acids and bases, electromeric,

mesomeric, hyper conjugation and steric-examples.

Reaction mechanisms: Types of reactions–aromaticity (Huckel's rule)

– aromatic electrophilic substitution; nitration, halogenation, Friedel-

Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT-IV

Thermodynamics and Phase Equilibria

Thermodynamics: Types of systems, reversible and irreversible

processes, isothermal and adiabatic processes and spontaneous

processes. Statements of first law and second law of thermodynamics.

Carnot's cycle and efficiency of heat engine. Entropy and its

	significance. Free energy change and its importance (noderivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relation ship between Gibbs free energy and entropy. Phase Equilibria: Phaserule – definition of termsinit. Applicationsof Phase rule to water system. Two component system-Reduced phase Rule and its application to asimple eutectic system (Pb-Ag).

	UNIT-V
	Analytical Chemistry
	
	   Introductiontoqualitativeandquantitativeanalysis.Principlesofvolumetric analysis.Separationandpurificationtechniques–extraction,distillationand crystallization.
	
	   Chromatography: principle and application of column, paper and thin Layer chromatography.

Extended Professional Component(isa Part of internal Component only, Not to be included In the external examination Question paper)	Questions related to the above topics, from various competitive Examinations UPSC/JAM/TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired From this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house,Chennai,firstedition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. S.ArunBahl,B.S.Bahl, Advanced Organic Chemistry; S.Chandand Company, NewDelhi, twentythirdedition,2012. 4. P.L.Soni,H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand&sons,NewDelhi, twentyninth edition,2007.
Reference Books	5. P.L.Soni,Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, NewDelhi, twentieth edition,2007. 6. B.R.Puri,L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co.,NewDelhi, forty seventh edition,2018. 7. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition,2014.
Website and e-learning source	1. https://byjus.com/jee/chemical-bonding/ 2. https://en.wikipedia.org/wiki/Fuel

	3. https://www.brainkart.com/article/Fundamentals-of-Organic-Chemistry_36450/ 4. https://chem.libretexts.org/Courses/ BethuneCookman_University/B-CU%3A_CH-345_Quantitative_Analysis/Book %3A_Analytical_Chemistry_2.1_(Harvey)/ 06%3A_Equilibrium_Chemistry/ 6.02%3A_Thermodynamics_and_Equilibrium_Chemistry 5. https://en.wikipedia.org/wiki/Chromatography

Course Learning Outcomes (for Mapping with Pos and PSOs)
On completion of the course the students should be able to

CO1: Gain in-depth knowledge about the theories of chemical bonding, nuclear
    reactions and its applications.
CO2: Evaluate the efficiencies and uses of various fuels and fertilizers
CO3: Explain the type of hybridization, electronic effect and mechanism involved in
    the organic reactions.
CO4: Apply various thermodynamic principles, systems and phase rule.
CO5:Explain various methods to identify anappropriate method for the separation of
    chemical components

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO/PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SEMESTER: I Part: III	23UCHEEP1 CHEMISTRY FOR PHYSICAL SCIENCE PRACTICALS – I	Credit : 1 Hours : 2

Objectives of the course	This course aims to provide knowledge on the • basics of preparation of solutions. • principles and practical experience of volumetric analysis
Course Outline	**VOLUMETRIC ANALYSIS** 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenyl amine as indicator.
Reference Books	V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.
Website and E-Learning Sources	1)http://www.federica.unina.it/agraria/analytical-chemistry/volumetricanalysis 2)https://chemdictionary.org/titration-indicator/

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to
CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO 2: design, carry out, record and interpret the results of volumetric titration.
CO 3: apply their skill in the analysis of water/hardness.
CO4: analyze the chemical constituents in allied chemical products

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

Note: Scheme for Practical Evaluation.

Volumetric Estimation – 75

Record – 10 marks
Procedure – 15marks
Results
< 2% - 50 marks
2-3% - 40 marks
3-4% - 30 marks
> 4% - 20 marks

Semester: I Part: IV	**23UPHYF17** (Foundation Course) **INTRODUCTORY PHYSICS**	Credit: 2 Hours: 2

COURSE OBJECTIVES: To help students get an overview of Physics before learning their core courses. To serve as a bridge between the school curriculum and the degree programme.

UNIT-I: Vectors, scalars – examples for scalars and vectors from physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants.

UNIT-II: Different types of forces–gravitational, electrostatic, magnetic, electromagnetic, nuclear –mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces

UNIT-III: Different forms of energy– conservation laws of momentum, energy – types of collisions –angular momentum– alternate energy sources–real life examples.

UNIT-IV: Types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – streamline and turbulent motions – wave motion – comparison of light and sound waves – free, forced, damped oscillations.

UNIT-V: Surface tension – shape of liquid drop – angle of contact – viscosity –lubricants – capillary flow – diffusion – real life examples– properties and types of materials in daily use-conductors, insulators – thermal and electric.

TEXTBOOKS:
1. D. S. Mathur, 2010, Elements of Properties of Matter, S. Chand & Co
2. Brijlal & N. Subrahmanyam, 2003, Properties of Matter, S. Chand & Co.

REFERENCEBOOKS:
1. H. R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S. Chand & Co.

COURSEOUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Apply concept of vectors to understand concepts of Physics and solve problems
	CO2	Appreciate different forces present in Nature while learning about phenomena related to these different forces.
	CO3	Quantify energy in different process and relate momentum, velocity, and energy
	CO4	Differentiate different types of motions they would encounter in various courses and understand their basis
	CO5	Relate various properties of matter with their behaviour and connect them with different physical parameters involved.

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

Semester: II Part: III Core - III	**23UPHYC23** **HEAT, THERMODYNAMICS AND** **STATISTICAL MECHANICS**	Credit: 5 Hours: 5

COURSE OBJECTIVES: *The course focuses on understanding a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation.*

UNIT-I   CALORIMETRY: specific heat capacity – specific heat capacity of gases C_P & C_V– Mayer's relation – Joly's method for determination of C_V – Regnault's method for determination of $C_{P.}$ [6 Hours]

LOW TEMPERATURE PHYSICS: Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation. [6 Hours]

UNIT-II   THERMODYNAMICS-I: zeroth law and first law of thermodynamics – P-V diagram – heat engine –efficiency of heat engine – Carnot's engine, construction, working and efficiency of petrol engine and diesel engines – comparison of engines. [12 Hours]

UNIT-III   THERMODYNAMICS-II: second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermodynamical scale of temperature – Maxwell's thermodynamical relations –Clausius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death. [12 Hours]

UNIT-IV   HEAT TRANSFER: modes of heat transfer: conduction, convection, and radiation.
Conduction: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad conductor by Lee's disc method. [6 Hours]

Radiation: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law –Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law. [6 Hours]

UNIT-V   STATISTICAL MECHANICS: Definition of phase-space – micro and macro states – ensembles –different types of ensembles – classical and quantum Statistics – Maxwell-Boltzmann statistics – expression for distribution function – Bose-Einstein statistics – expression for distribution function – Fermi-Dirac statistics –expression for distribution function – comparison of three statistics. [12 Hours]

TEXT BOOKS:
1. Brijlal & N. Subramaniam, 2000, Heat and Thermodynamics, S. Chand & Co.
2. Narayanamoorthy & Krishna Rao, 1969, Heat, Triveni Publishers, Chennai.
3. V. R. Khanna & R. S. Bedi, 1998 1st Edition, Textbook of Sound, Kedharnaath Publish & Co, Meerut
4. Brijlal and N. Subramanyam, 2001, Waves and Oscillations, Vikas Publishing House, New Delhi.

5. Ghosh, 1996, Text Book of Sound, S. Chand & Co.
6. R. Murugeshan & Kiruthiga Sivaprasath, Thermal Physics, S. Chand & Co.

REFERENCE BOOKS:
1. J. B. Rajam & C.L. Arora, 1976, Heat and Thermodynamics, 8th edition, S. Chand & Co. Ltd.
2. D.S. Mathur, Heat and Thermodynamics, Sultan Chand & Sons.
3. Gupta, Kumar, Sharma, 2013, Statistical Mechanics, 26th Edition, S. Chand & Co.
4. Resnick, Halliday&Walker,2010, Fundamentals of Physics, 6th Edition.
5. Sears, Zemansky, Hugh D. Young, Roger A. Freedman, 2021 University Physics with Modern Physics 15th Edition, Pearson.

WEBLINKS:

1. https://youtu.be/M_5KYncYNyc
2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

COURSE OUTCOMES:
At the end of the course, the student will be able to:

COURSEOUTCOMES	**CO1**	Acquires knowledge on how to distinguish between temperature and heat. Introduce him/her to the field of thermometry and explain practical measurements of high temperature as well as low temperature physics. Student identifies the relationship between heat capacity and specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, superfluidity and Condensed Matter Physics
	CO2	Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines
	CO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an insight into thermodynamic properties like enthalpy, entropy
	CO4	Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyse them
	CO5	Interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law. Develop the statistical interpretation of Bose-Einstein and Fermi-Dirac. Apply to quantum particles such as photon and electron

MAPPING WITH PROGRAM OUTCOMES:
Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG(**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M

CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	S	M	S	S	S	M	M	S	M

SEMESTER: II PART: III Core – IV	**23UPHYP24** **PRACTICAL - II**	Credit:5 Hours: 4

COURSE OBJECTIVES: *Apply various physics concepts to understand Properties of Matter viz., elastic properties, thermal properties, acceleration due to gravity and sound waves in solids. Set up experimentation to verify theories, quantify and analyze.*

LIST OF EXPERIMENTS (Any Eight Experiments only)

1. Young's modulus non-uniform bending – Optic lever.
2. Young's modulus uniform bending - Optic lever.
3. Young's modulus-Cantilever – depression – dynamic method-Mirror, Scale and Telescope.
4. Searle's double bar pendulum- Determination of Young's modulus, Rigidity modulus.
5. Determination of Young's modulus by Koenig's method – (or unknown load) and Poisson's ratio.
6. Rigidity modulus and moment of inertia -Torsional Pendulum - with identical masses.
7. Determination of moment of inertia and 'g' using bifilar pendulum.
8. Determination of co-efficient of viscosity by Stokes' method – terminal velocity.
9. Sonometer - Relative density of a solid and liquid.
10. Sonometer - Frequency of AC mains - Steel and Brass wires.
11. Specific heat capacity of liquid - Newton's law of cooling.
12. Determination of thermal conductivity of good conductor by Lee's disc method.
13. Determination of specific heat of liquid by Joule's electrical heating method (applying radiation correction by Barton's correction/graphical method),
14. To verify the laws of transverse vibration using Melde's apparatus.
15. To compare the mass per unit length of two strings using Melde's apparatus.

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

REFERENCE BOOKS:
1. Samir Kumar Ghosh, *A Textbook of Advanced Practical Physics*, NCBA, Kolkatta, 2000
2. D. Chattopadyay, P.C.Rakshit, *An Advanced Course in Practical Physics,* NCBA,

COURSEOUTCOMES:

At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Understand and determine accurately the elevation, depression of a loaded wooden bar using travelling microscope.
	CO2	Grasp and find the Young's modulus, rigidity modulus of some selected solid materials
	CO3	Recognize and estimate the density and frequency of AC supply using sonometer.
	CO4	Appreciate and measure the thermal properties such as specific heat and thermal conductivity of solids.
	CO5	perform experiments in potentiometer, Melde's apparatus, and deflection magnetometer

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

SEMESTER: II Part: III	23UCHEE25 Chemistry for Physical Science– II	Credit: 2 Hours: 3

Objectives of the course	This course aims at providing knowledge on the • Co-ordination Chemistry and Water Technology • Carbohydrates and Amino acids • basics and applications of electrochemistry • basics and applications of kinetics and catalysis • Various photochemical phenomenon
Course Outline	**UNIT I** **Co-ordination Chemistry and Water Technology** Co-ordination Chemistry: Definition of terms-IUPAC Nomenclature - Werner'stheory - EAN rule - Pauling's theory – Postulates - Applications to [Ni(CO)4], [Ni(CN)4]2-,[Co(CN)6]3- Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) – Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques- BOD, COD.
	Unit II **Carbohydrates and Amino acids** Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose interconversion. Properties of starch and cellulose. Amino acids: Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method. RNA and DNA (elementary idea only).

	UNIT III
	Electrochemistry
	Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials -electrochemical series. Strong and weak electrolytes - ionic product of water -pH, pKa, pKb. Conductometric titrations - pH determination by colorimetric method – buffer solutions and its biological applications - electroplating - Nickel and chrome plating – Types of cells -fuel cells-corrosion and its prevention.

	UNIT IV **Kinetics and Catalysis** Order and molecularity. Integrated rate expression for I and II (2A Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction – Half-life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.
	UNIT V **Photochemistry** Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	1. V.Veeraiyan, Textbook of Ancillary Chemistry; High mount publishing house, Chennai, first edition,2009. 2. S.Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur,2006. 3. Arun Bahl, B.S.Bahl, Advanced Organic Chemistry; S.Chand and Company, New Delhi, twenty third edition, 2012. 4. P.L.Soni, H.M.Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, twenty ninth edition, 2007.
Reference Books	1. P.L.Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, twentieth edition, 2007. 2. R.Puri, L.R.Sharma, M.S.Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, forty seventh edition, 2018.

	3. B.K,Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
Website and e-learning source	

Course Learning Outcomes (for Mapping with POs and PSOs) On completion of the course the students should be able to

CO 1: write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology

CO 2: explain the preparation and property of carbohydrate, amino acids and nucleic acids.

CO 3: apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

CO 4: identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.

CO 5: outline the various type of photochemical process.

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PO's and CO's

SEMESTER: II Part: III	23UCHEEP2 Chemistry for Physical Science Practicals – II	Credit: 1 Hours: 2

Objectives of the course	This course aims to provide knowledge on • identification of organic functional groups • different types of organic compounds with respect to their properties. • determination of elements in organic compounds..
	SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows:

	(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose]. (b) Detection of elements (N, S, Halogens). (c) To distinguish between aliphatic and aromatic compounds. (d) To distinguish – Saturated and unsaturated compounds.
Reference Books	V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic Principles ofPractical Chemistry; Sultan Chand & sons, Second edition, 1997.

Course Learning Outcomes (for Mapping with POs and PSOs) On
completion of the course the students should be able to
CO 1: gain an understanding of the use of standard flask and volumetric pipettes, burette. CO
2: design, carry out, record and interpret the results of volumetric titration.
CO 3: apply their skill in the analysis of water/hardness.
CO4: analyze the chemical constituents in allied chemical products

CO /PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to PSOs	3.0	3.0	3.0	3.0	3.0

Level of Correlation between PSO's and CO's

CO /PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted percentage of Course Contribution to POs	3.0	3.0	3.0	3.0	3.0

Level of correlation between CO's and PO's

Scheme of Valuation:
Max.Marks:100
Int.Marks:25
Ext.Marks:75
Record:15 marks
Preliminary Tests:10 marks
Detection Of elements:10 marks
Detection of functional group:10 marks
Identification of compound:10 marks
Confirmatory Tests:5 marks
Report:5 marks
Systamatic Procedure:10 marks

Semester: I Part: IV	**23UPHYN16** Skill Enhancement Course-1 (NME - I) **PHYSICS FOR EVERYDAY LIFE**	CREDIT: 2 Hours: 2

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

UNIT- I: MEASUREMENTS & MECHANICS **6 Hours**
Fundamental quantities - System of Units - CGS - FPS - MKS and SI - Vernier caliper - Screw gauge and their utility-Newton's law of motion- Lever mechanism – Pulleys - Force -Weight - Work - Energy - Power - Horsepower - Circular Motion - Banking of curved tracks.

UNIT-II: THERMO AND HYDRODYNAMICS **6 Hours**
Variation of boiling point with pressure - Pressure cooker - First and Second law of thermodynamics - Refrigerator - Air Conditioner - Principle and construction - Bernoulli Theorem-Applications.

UNIT - III: ELECTRICAL APPLIANCES **6 Hours**
Electric iron Box - Electric Fan - Construction and Working of Ceiling and Table fans - Water Heater -Types - Function - Wet Grinder - Mixer Grinder - Principle and Design.

UNIT- IV: LASER **6 Hours**
Power of a Lens-Human eye - Defects of vision – Laser - Spontaneous emission - Stimulated emission - Meta stable state - Population inversion - Pumping - Laser Characteristics- Ruby Laser - Applications of Laser-Laser cutting - Welding- Drilling - Lasers in Surgery - Lasers in ophthalmology.

UNIT- V: MEDICAL INSTRUMENTS **6 Hours**
Digital thermometer - Digital BP apparatus - One touch Glucometer – thermal scanner - pulse oximeter - pH meter - BMI calculator – Ventilator Principle - description - function and recording of ECG - EMG and EEG - artificial pacemaker.

Course Outcomes:
After completion of the course, the student should be able to understand:
1. *the basics of measurements and mechanics in daily life*
2. *the principle of Pressure cooker, Refrigerator and Air conditioner.*
3. *the construction and working of domestic electrical appliances.*
4. *the fundamentals of laser and its applications.*
5. *the different biomedical instruments used in clinics.*

Text Books:

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

Unit 3
1. Bali, S.P. 2005, *Consumer Electronics*, Pearson Education, New Delhi.
2. TN State Board, *Basic Electrical Engineering, Vocational Theory, Plus One Textbook*, TN Stat Board.

Unit 4
1. Murugeshan, R. 2016, *Optics & Spectroscopy*, S. Chand Co. Ltd, New Delhi.

Unit 5
1. Arumugam M, 2011, *Biomedical Instrumentation*, Anuradha Publications, Kumbakonam.
2. Yuvaraj, V. 2020, *Instrumentation Techniques*, Sri Krishna Publications.

Reference Books

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

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S

SEMESTER: II PART: IV	**23UPHYN26** **Skill Enhancement Course -2 (NME -II)** **ASTROPHYSICS**	Credit: 2 Hours: 2

Course Objective: This course intends to introduce principles of astrophysics describing the science of formation and evolution of stars and interpretation of various heavenly phenomena and provide an understanding of the physical nature of celestial bodies along with the instrumentation and techniques used in astronomical research.

1. *To understand the principle of telescopes and their operation and parameters, types of telescopes, detectors and image processing and advanced space telescopes.*
2. *To grasp the ideas behind Solar system, inter planetary distances, meteors, meteorites, comets, asteroids, belt, cloud, gravitational waves and recent advances in astrophysics.*
3. *To recognize the Physics behind Eclipses and types of eclipses, solar and lunar eclipse, structure of the Sun.*
4. *To appreciate the Stellar Evolution process, birth & death of star, pulsars, black holes, supernovae, Galaxies, dark matter, evolving universe.*
5. *To do any three of the activities mentioned in the Unit V*

UNIT-I   TELESCOPES: Optical telescopes − magnifying power, brightness, resolving power and f/a ratio − types of reflecting and refracting telescopes − detectors and image processing − radio telescopes − Hubble space telescope.

UNIT-II   SOLAR SYSTEM: Bode's law of planetary distances − meteors, meteorites, comets, asteroids − Kuiper belt − Oort cloud − detection of gravitational waves − recent advances in astrophysics.

UNIT-III   ECLIPSES: Types of eclipses − solar eclipse − total and partial solar eclipse − lunar eclipse − total and partial lunar eclipse − transits.

THE SUN: Physical and orbital data − solar atmosphere − photosphere − chromosphere − solar corona − prominences − sunspots − 11year solar cycle − solar flares.

UNIT-IV   STELLAR EVOLUTION: H-R diagram − birth & death of low mass, intermediate mass and massive stars − Chandrasekar limit − white dwarfs − neutron stars − pulsars − black holes − supernovae.
GALAXIES: classification of galaxies − galaxy clusters −interactions of galaxies, dark matter and super clusters − evolving universe.

UNIT-V   ACTIVITIES IN ASTROPHYSICS:
            (Any ***three*** activities to be done compulsorily**)**
   i.   Basic construction of telescope
  ii.   Develop models to demonstrate eclipses/ planetary motion.
 iii.   Night sky observation
  iv.   Conduct case study pertaining to any topic in this paper.
   v.   Visit to any one of the National Observatories

TEXT BOOKS:
1. BaidyanathBasu, (2001). An introduction to Astrophysics, Second printing, Prentice – Hall of India (P) Ltd, New Delhi
2. K.S.Krishnaswamy, (2002), Astrophysics – a modern perspective, New Age

International (P) Ltd, New Delhi.

3. Shylaja, B.S. &Madhusudan, H.R.,(1999), Eclipse: A Celestial Shadow Play, Orient BlackSwan,

REFERENCE BOOKS:
1. Niclolas. A. Pananides and Thomas Arny, (1979), *Introductory Astronomy,* Addison Wesley Publ. Co.
2. Mujiber Rahman, A. *Concepts to Astrophysics,* SciTech Publications, Chennai.
3. Abell, Morrison and Wolf, 1987, *Exploration of the Universe,* 5th ed., Saunders College Publ.
4. Carrol and Ostlie, 2007, *Introduction to Modern Astrophysics,* 2nd ed., Pearson International.
5. William J. Kaufmann, III, 1993, *Universe* Freeman & Company, W. H.
6. Abhyankar, K.D. 2001, *Astrophysics: Stars and Galaxies* Universities Press

COURSEOUTCOMES:
At the end of the course, the student will be able to:

COURSE OUTCOMES	**CO1**	Understand the principle of telescopes and their operation and parameters, types of telescopes, detectors and image processing and advanced space telescopes.
	CO2	Grasp the ideas behind Solar system, inter planetary distances, meteors, meteorites, comets, asteroids, belt, cloud, gravitational waves and recent advances in astrophysics.
	CO3	Recognize the Physics behind Eclipses and types of eclipses, solar and lunar eclipse, structure of the Sun.
	CO4	Appreciate the Stellar Evolution process, birth & death of star, pulsars, black holes, supernovae, Galaxies, dark matter, evolving universe.
	CO5	perform any three of the activities related to the astrophysics.

MAPPING WITH PROGRAM OUTCOMES:

Map course outcomes **(CO)** for each course with program outcomes **(PO)** in the 3-point scale of STRONG (**S**), MEDIUM(**M**) and LOW(**L**).

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	M	S	M
CO2	M	S	S	S	M	S	S	M	M	M
CO3	S	S	S	M	S	S	S	M	S	M
CO4	S	S	S	S	S	S	S	M	M	M
CO5	S	M	S	S	S	S	S	M	M	S