CHOICE BASED CREDIT SYSTEM - LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK

PG & RESEARCH DEPARTMENT OF PHYSICS

(Those who have joined in the Academic year 2023-24)

Preamble

Physics is one of the basic and fundamental sciences. The curriculum for the graduate programme in Physics is revised as per the UGC guidelines on Learning Outcome based Course Framework. The learner-centric courses let the student progressively develop a deeper understanding of various aspects of physics.

The new curriculum offer courses in the core areas of mechanics, acoustics, optics and spectroscopy, electricity and magnetism, atomic and nuclear physics, solid state, electronicsand other fields. The courses will train students with sound theoretical and experimental knowledge that suits the need of academics and industry.In addition to the theoretical course work, the students also learn physics laboratory methods for different branches of physics, specialized measurement techniques, analysis of observational data, including error estimation and etc. The students will have deeper understanding of laws of nature through the subjects like classical mechanics, quantum mechanics, statistical physics etc. The problem solving ability of students will be enhanced. The students can apply principles in physics to real life problems. The courses like integrated electronics and microprocessors will enhance the logical skills as well as employability skills. The numerical methods and mathematical physics provide analytical thinking and provides a better platform for higher level physics for research.

The restructured courses with well-defined objectives and learning outcomes, provide guidance to prospective students in choosing the elective courses to broaden their skills not only in the field of physics but also in interdisciplinary areas.The elective modules of the framework offer students choice to gain knowledge and expertise in specialized domains of physics like astrophysics, medical physics, etc.

Programme	**B.Sc., Physics**
Programme Code	
Duration	**3 years [UG]**
Programme Outcomes: (These are mereguidelines. Faculty can create POs based on their curriculum or adopt from UGC or the University for their Programme)	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate programme of study **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully; read and write analytically and present complex information in a clear and concise manner to different groups. **PO3: Critical thinking:** Capability to apply the analytic thought to a body of knowledge; analyse and evaluate the proofs, arguments, claims, beliefs on the basis of empirical evidences; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach. **PO4: Problem solving:** Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation **PO7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team **PO8: Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective. **PO9: Reflective thinking**: Critical sensibility to lived experiences, with self-awareness and reflexivity of both self and society.

	PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO 12 Multicultural competence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstratingthe ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO 14: Leadership readiness/qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including „learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

Programme Specific Outcomes: **(These are mere guidelines. Faculty can create POs based on their curriculum or adopt from UGC or University for their Programme)**	**PSO1: Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, and beliefs and apply diverse frames of reference to decisions and actions. **PSO 2**: **Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate start-ups and high potential organizations **PSO3**: **Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development. **PSO4**: **Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world. **PSO 5**: **Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

B.Sc PHYSICS
(Those who have joined in the Academic year 2023-24)

Part	Courses	Subject	Code	Cr.	Hrs
SEMESTER I					
I	Lang. – I	nghJj;jkpo; - **I**	230103101	3	6
II	Lang. - II	General English	231003101	3	4
III	CC – 1	Properties of Matter and Sound	232103101	5	5
	CC – 2	Practicals - I	232103102	2	3
	EC – I	Allied Mathematics - I	232003121	4	6
IV	SEC –I (NME	Physics for Everyday Life	234603121	2	2
IV	FC	Introductory Physics	234403121	2	2
	AECC- Soft Skill – 1	Soft skill - I	236003101	2	2
	Total			**23**	**30**
SEMESTER II					
I	Lang. -I	nghJj;jkpo; - **II**	230103201	3	6
II	Lang. -II	General English	231003201	3	4
III	CC – 3	Heat, Thermodynamics and Statistical Physics	232103201	5	5
	CC - 4	Practicals - II	232103202	2	3
	EC – II	Allied Mathematics - II	232003221	4	6
IV	SEC –II (NME)	Astrophysics	234603221	2	2
	SEC - III	Energy Physics	234403221	2	2
	AECC –II Soft Skill -2	Soft Skill - II	236003201	2	2
				23	**30**
SEMESTER III					
I	Lang. -I	nghJj;jkpo; - **III**	230103301	3	6
II	Lang. -II	General English	231003301	3	4
III	CC – 5	General Mechanics and Classical Mechanics	232103301	5	5
	CC - 6	Core Practicals	232103302	2	3
	EC –3	Allied chemistry - I	232203321	3	4
		Chemistry Practical for Physical and Biological Science	232203322	1	2
IV	SEC –IV	Handling of Machines and Tools	234403321	1	1
	SEC – V	Physics of Music	238203321	2	2
	AECC – III	Soft skill – III	236003301	2	2
	EVS	Environmental Studies	234103301	1	1
				23	**30**

Part	Courses		Code	Cr.	Hrs
SEMESTER IV					
I	Lang. – I	nghJj;jkpo; - **IV**	230103401	3	6
II	Lang. - II	General English	231003401	3	4
III	CC – 7	Optics and Spectroscopy	232103401	4	4
	CC - 8	Core Practicals	232103402	3	3
	EC – IV (T)	Allied Chemistry - II	232203421	3	4
	EC – IV (P)	Chemistry Practical for Physical and Biological Chemistry	232203422	1	2
IV	SEC –VI	Photography and Digital Editing	234403421	2	2
IV	SEC –VII	Safety Measures and Management	238203421	2	2
	AECC- Soft Skill – 4	Soft Skill - 4	236003401	2	2
	EVS	Environmental Studies	234103401	1	1
	Total			**24**	**30**
SEMESTER V					
III	CC – 9	Atomic Physics and Lasers	232103501	4	5
	CC - 10	Relativity and Quantum Mechanics	232103502	4	5
	CC - 11	Core Practicals	232103503	4	5
	Core 12	Project /Viva Voce	232103504	4	5
	EC – V	Communication System	234403521	4	5
	EC – VI	Numerical Methods and C Programming	238203521	3	4
IV		Value Education	234303501	1	1
		Internship/Industrial Training(carried out in II year summer vacation)30 hrs		2	
				25	**30**
SEMESTER VI					
III	CC – 13	Nuclear and Particle Physics	232103601	4	5
	CC – 14	Solid State Physics	232103602	3	4
	CC – 15 T	Digital Electronics and Microprocessor 8085	232103603	4	5
	CC – 15 P	Electronics - Practicals	232103604	2	3
	EC –7	Lasers and Fiber Optics	232103605	3	4
	EC - 8	Mathematical Physics	232103606	2	4
IV	Processional competency skill enhancement course	Processional Competency Skill		2	4
		Value Education	234303601	1	1
V		Extension Activity (outside college hrs)		1	
				22	**30**

ALLIED – PHYSICS FOR MATHEMATICS					
Sem	**Title of the Paper**	**SUB CODE**	**Hrs.**	**Cr.**	**Generic/Discipline Specifit**
I	Allied Physics – I	232103121	4	3	EC – 1 Theory
I	Allied Physics Practicals - I	232103122	2	1	EC – I Practical
II	Allied Physics - II	232103221	4	3	EC 2 – Theory
II	Allied Physics Practicals - II	232103222	2	1	EC 2 - Practicals

ALLIED – PHYSICS FOR CHEMISTRY					
Sem	**Title of the Paper**	**SUB CODE**	**Hrs.**	**Cr.**	**Generic/Discipline Specifit**
III	Allied Physics – I	232103321			EC – 3 Theory
III	Allied Physics Practicals - I	232103322			EC – 3 Practical
IV	Allied Physics - II	232103421			EC 4 – Theory
IV	Allied Physics Practicals - II	232103422			EC 4 - Practicals

Title of the Course		PROPERTIES OF MATTER AND SOUND						
PART		III						
Category	Core – 1	Year	I	Credits	5	Course Code	232103101	
		Semester	I					

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
	5	-	--	5	25	75	100

Learning 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	Details	No. of Periods for the 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)	15
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	15
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 *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	15
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. Laws of transverse vibration in strings –sonometer – determination of AC frequency using sonometer –determination of frequency using Melde's string apparatus	15

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. *Ultrasonic waves*: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction effect – application of ultrasonic waves	**15**

Text Books (Latest Editions)
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, AtmaRam & 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.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**
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.

Web Resources
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/

Title of the Course		**Practicals - I**						
Part		**III**						
Category	Core – 2	**Year**	I	**Credits**	2	**Course Code**	**232103102**	
		Semester	I					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		-	-	3	3	25	75	100

Learning Objectives

- ✍ Apply various physics concepts to understand Properties of Matter, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Properties of Matter

1. Determination of rigidity modulus without mass using Torsional pendulum.
2. Determination of rigidity modulus with masses using Torsional pendulum.
3. Determination of moment of inertia of an irregular body.
4. Verification of parallel axes theorem on moment of inertia.
5. Verification of perpendicular axes theorem on moment of inertia.
6. Determination of moment of inertia and g using Bifilar pendulum.
7. Determination of Young's modulus by stretching of wire with known masses.
8. Verification of Hook's law by stretching of wire method.
9. Determination of Young's modulus by uniform bending – load depression graph.
10. Determination of Young's modulus by non-uniform bending – scale & telescope.
11. Determination of Young's modulusby cantilever – load depression graph.
12. Determination of Young's modulus by cantilever – oscillation method
13. Determination of Young's modulus by Koenig's method – (or unknown load)
14. Determination of rigidity modulus by static torsion.
15. Determination of Y, n and K by Searle's double bar method.
16. Determination of surface tension & interfacial surface tension by drop weight method.
17. Determination of co-efficient of viscosity by Stokes' method – terminal velocity.
18. Determination of critical pressure for streamline flow.

19. Determination of Poisson's ratio of rubber tube.
20. Determination of viscosity by Poiseullie's flow method.
21. Determinationradius of capillary tube by mercury pellet method.
22. Determinationof g using compound pendulum.

Title of the Course		PHYSICS FOR EVERYDAY LIFE						
Part		IV						
Category	SEC – 1 NME	Year	I	Credits	2	Course Code	234603121	
		Semester	I					

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
	2	-	--	2	25	75	100

Learning Objectives

- To know where all physics principles have been put to use in daily life and appreciate the concepts with a better understanding also to know about Indian scientists who have made significant contributions to Physics

UNIT	Details	No. of Periods for the Unit
I	**MECHANICAL OBJECTS: s**pring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.	6
II	**OPTICAL INSTRUMENTS AND LASER:**vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser.	6
III	**PHYSICS OF HOME APPLIANCES:** bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners	6
IV	**SOLAR ENERGY:** Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.	6
V	**INDIAN PHYSICIST AND THEIR CONTRIBUTIONS:** C.V.Raman, HomiJehangirBhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, Venkatraman Ramakrishnan, Dr. APJ Abdul Kalam and their contribution to science and technology.	6

Text Books (Latest Editions)

1. The Physics in our Daily Lives, Umme Ammara, Gugucool Publishing, Hyderabad, 2019.
2. For the love of physics, Walter Lawin, Free Press, New York, 2011

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. Halliday, D., Resnick, R. and Walker, J. (2014) Fundamental of Physics. 10th Edition, Wiley and Sons, New York.

Web Resources

https://www.youtube.com/watch?v=QqsieD5BEw8

https://www.youtube.com/watch?v=R8QFOBam5gE

Title of the Course		INTRODUCTORY PHYSICS						
Part		IV						
Category	FC	Year	I	Credits	2	Course Code	234403121	
		Semester	I					

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
	2	-	--	2	25	75	100

Learning 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	Details	No. of Periods for the Unit
I	vectors, scalars –examples for scalars and vectorsfrom physical quantities – addition, subtraction of vectors – resolution and resultant of vectors – units and dimensions– standard physics constants	6
II	different types of forces–gravitational, electrostatic, magnetic, electromagnetic, nuclear –mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces	6
III	different forms of energy– conservation lawsof momentum, energy – typesof collisions –angular momentum– alternate energy sources–real life examples	6
IV	types of motion– linear, projectile, circular, angular, simple harmonic motions – satellite motion – banking of a curved roads – stream line and turbulent motions – wave motion – comparisonof light and sound waves – free, forced, damped oscillations	6
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	6

Course Outcomes

Course Outcomes	On completion of this course, students will;
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.

Text Books (Latest Editions)
1. D.S.Mathur, 2010, Elements of Properties of Matter, S.Chand & Co 2. BrijLal & N. Subrahmanyam, 2003, Properties of Matter, S.Chand & Co.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**
1. H.R. Gulati, 1977, Fundamental of General Properties of Matter, Fifth edition, S.Chand & Co.
Web Resources
1. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://science.nasa.gov/ems/ 2. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/

Title of the Course		**HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS**						
PART		**III**						
Category	Core -3	**Year**	I	**Credits**	5	**Course Code**	**232103201**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		4	1	--	5	25	75	100

Learning Objectives

- The course focuses to understand 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	Details	No. of Periods for the Unit
I	**CALORIMETRY:** specific heat capacity – specific heat capacity of gases C_P& C_V– Meyer's relation – Joly's method for determination of C_V – Regnault's methodfor determination of C_P **LOWTEMPERATUREPHYSICS:** Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect –Boyletemperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.	**15**
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.	**15**
III	**THERMODYNAMICS-II:** second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram –thermodynamicalscale of temperature – Maxwell's thermodynamical relations –Clasius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.	**15**
IV	**HEATTRANSFER:** modes of heat transfer: conduction, convection and radiation.	**15**

	Conduction: thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination ofthermal conductivity of a bad conductor by Lee's disc method. *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.	

V	**STATISTICALMECHANICS:** 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.	**15**

Text Books (Latest Editions)	
1. Brijlal &N. Subramaniam, 2000, Heat and Thermodynamics, S.Chand& Co. 2. Narayanamoorthy&KrishnaRao, 1969,Heat,Triveni Publishers, Chennai. 3. V.R.Khanna&R.S.Bedi, 1998 1st Edition, Text book 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.	
References Books **(Latest editions, and the style as given below must be strictly adhered to)**	
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.	
Web Resources	
1	https://youtu.be/M_5KYncYNyc
2	https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

Title of the Course		Practicals - II						
Part		III						
Category	Core – 4	Year	I	Credits	2	Course Code	232103202	
		Semester	II					

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
	-	-	3	3	25	75	100

Learning Objectives

- ✍ Apply their knowledge gained about the concept of heat and sound waves, resonance, calculate frequency of ac mains set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

HEAT, OSCILLATIONS, WAVES & SOUND(Any Eight of the below list)

1. Determination of specific heat by cooling – graphical method.
2. Determination of thermal conductivity of good conductor by Searle's method.
3. Determination of thermal conductivity of bad conductor by Lee's disc method.
4. Determination of thermal conductivity of bad conductor by Charlaton's method.
5. Determination of specific heat capacity of solid.
6. Determination of specific heat of liquid by Joule's electrical heating method (applying radiation correction by Barton's correction/graphical method),
7. Determination of Latent heat of a vaporization of a liquid.
8. Determination of Stefan's constant for Black body radiation.
9. Verification of Stefan's-Boltzmans law.
10. Determination of thermal conductivity of rubber tube.
11. Helmholtz resonator.
12. Velocity of sound through a wire using Sonometer.
13. Determination of velocity of sound using Kunds tube.
14. Determination of frequency of an electrically maintained tuning fork
15. To verify the laws of transverse vibration using sonometer.
16. To verify the laws of transverse vibration using Melde's apparatus.
17. To compare the mass per unit length of two strings using Melde's apparatus.
18. Frequency of AC by using sonometer.

Title of the Course		ASTRO PHYSICS						
PART		IV						
Category	SEC – II NME	Year	I	Credits	2	Course Code	234603221	
		Semester	II					

Instructional Hours per week	Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
	2	-	--	2	25	75	100

Learning Objectives

- This course intends tointroduce 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 celestialbodies along with the instrumentation and techniques used in astronomical research

UNIT	Details	No. of Periods for the 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.	6
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.	6
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.	6
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.	6
V	**ACTIVITIES IN ASTROPHYSICS:** (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 Any three activities to be done compulsorily.	6

Text Books (Latest Editions)
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,
References Books **(Latest editions, and the style as given below must be strictly adhered to)**
1. Jean Dufay, Introduction to Astrophysics: The Stars, Dover Publications, 2012
Web Resources
1. https://www.youtube.com/watch?v=_yB56tgILUM

Title of the Course		**ENERGY PHYSICS**						
PART		**IV**						
Category	SEC III	**Year**	I	**Credits**	2	**Course Code**	**234403221**	
		Semester	II					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		2	-	--	2	25	75	100

Learning Objectives

- ✍ To get the understanding of the conventional and non-conventional energy sources, their conservation and storage systems.

UNIT	Details	No. of Periods for the Unit
I	**INTRODUCTION TO ENERGY SOURCES:** energy consumption as a measure of prosperity – world energy future – energy sources and their availability – conventional energy sources – non-conventional and renewable energy sources – comparison – merits and demerits.	6
II	**SOLAR ENERGY:**solar energy Introduction – solar constant – solar radiation at the Earth's surface – solar radiation geometry – Solar radiation measurements – solar radiation data –solar energy storage and storage systems – solar pond – solar cooker – solar water heater – solar greenhouse – types of greenhouses – solar cells.	6
III	**WIND ENERGY:**introduction –nature of the wind – basic principle of wind energy conversion – wind energy data and energy estimation – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications – tidal energy	6
IV	**BIOMASS ENERGY:** introduction – classification – biomass conversion technologies –photosynthesis – fermentation - biogas	6

	generation –classification of biogas plants – anaerobic digestion for biogas – wood gasification – advantages & disadvantages.	
V	**ENERGY STORAGE:**importance of energy storage- batteries - lead acid battery -nickel-cadmium battery – fuel cells – types of fuel cells – advantages and disadvantages of fuel cells – applications of fuel cells - hydrogen storage.	**6**

Text Books (Latest Editions)
1. G.D.Rai, Non-Conventional Sources of Energy, Khanna Publishers, 2009, 4th Edn. 2. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGraw Hill, 2008, 3rd Edn. 3. D P Kothari, K P Singal, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2nd Edn.
References Books **(Latest editions, and the style as given below must be strictly adhered to)**
1. John Twidell& Tony Weir, Renewable Energy Resources, Taylor & Francis, 2005, 2nd Edn. 2. S.A. Abbasi and NasemaAbbasi, Renewable Energy sources and their environmental impact, PHI Learning Pvt. Ltd, 2008. 3. M. P. Agarwal, Solar Energy, S. Chand & Co. Ltd., New Delhi,1982 4. H. C. Jain, Non-Conventional Sources of Energy, Sterling Publishers,1986.
Web Resources
1. https://www.youtube.com/watch?v=jhKejoBqiYc

Title of the Course		ALLIED PHYSICS – I (for Mathematics Students – I Year / I Semester ; for Chemistry Students – II Year / III Semester)						
Part		III						
Category	EC – I Theory	Year	I	Credits	3	Course Code	232103121/ 232103321	
		Semester	I					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		3	1	--	4	25	75	100

Learning Objectives

✍ To impart basicprinciplesof Physics that which would be helpful for students who have taken programmes other than Physics.

UNIT	Details	No. of Periods for the Unit
I	**WAVES, OSCILLATIONS AND ULTRASONICS:** simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1) – Lissajous figures – uses – laws of transverse vibrations of strings – determination of AC frequency using sonometer (steel and brass wires) – ultrasound – production – piezoelectric method – application of ultrasonics: medical field – lithotripsy, ultrasonography – ultrasonoimaging- ultrasonics in dentistry – physiotheraphy, opthalmology – advantages of noninvasive surgery – ultrasonics in green chemistry.	**12**
II	**PROPERTIES OF MATTER:** *Elasticity*: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum *Viscosity*: streamline and turbulent motion – critical velocity – coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method, *Surface tension*: definition – molecular theory – droplets formation– shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.	**12**
III	**HEAT AND THERMODYNAMICS:** Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– Linde's process of liquefaction of air– liquid Oxygen for medical purpose– importance of cryocoolers – thermodynamic system – thermodynamic equilibrium – laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.	**12**

IV	**ELECTRICITY AND MAGNETISM:** potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches-fuses and circuit breakers in houses	**12**
V	**DIGITAL ELECTRONICS AND DIGITAL INDIA:** logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem – verification – overview of Government initiatives: software technological parks under MeitY, NIELIT- semiconductor laboratories under Dept. of Space – an introduction to Digital India	**12**

Text Books (Latest Editions)

1. R.Murugesan (2001), AlliedPhysics,S. Chand&Co,NewDelhi.
2. BrijlalandN.Subramanyam (1994), WavesandOscillations,VikasPublishing House,NewDelhi.
3. BrijlalandN.Subramaniam (1994), PropertiesofMatter,S.Chand&Co.,NewDelhi.
4. J.B.Rajam and C.L.Arora (1976). Heat and Thermodynamics (8^{th} edition), S.Chand&Co.,New Delhi.
5. R.Murugesan(2005), OpticsandSpectroscopy,S.Chand&Co,NewDelhi.
6. A.Subramaniyam, AppliedElectronics2^{nd}Edn.,NationalPublishingCo.,Chennai.

References Books
(Latest editions, and the style as given below must be strictly adhered to)

1. ResnickHallidayandWalker(2018).FundamentalsofPhysics(11th edition),JohnWilleyand Sons, Asia Pvt.Ltd., Singapore.
2. V.R.KhannaandR.S.Bedi (1998), TextbookofSound1st Edn. KedharnaathPublish&Co, Meerut.
3. N.S.KhareandS.S.Srivastava (1983), ElectricityandMagnetism10th Edn.,
4. AtmaRam&Sons, New Delhi.
5. D.R.KhannaandH.R. Gulati(1979). Optics,S. Chand &Co.Ltd.,New Delhi.
6. V.K.Metha(2004).Principlesofelectronics6th Edn. S.Chandandcompany.

Web Resources

1. https://youtu.be/M_5KYncYNyc
2. https://youtu.be/ljJLJgIvaHY
3. https://youtu.be/7mGqd9HQ_AU
4. https://youtu.be/h5jOAw57OXM
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
7. https://www.youtube.com/watch?v=gT8Nth9NWPM
8. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
9. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
10. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="8">Allied Physics Practicals – I
(for Mathematics Students – I Year / I Semester ;
for Chemistry Students – II Year / III Semester)</td></tr>
<tr><td colspan="2">Part</td><td colspan="8">III</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">EC – I
Practtical</td><td>Year</td><td>I/II</td><td rowspan="2">Credits</td><td rowspan="2">1</td><td rowspan="2">Course Code</td><td colspan="2" rowspan="2">232103122/
232103322</td></tr>
<tr><td>Semester</td><td>I/III</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td>Lab Practice</td><td>Total</td><td>CIA</td><td>External</td><td>Total</td></tr>
<tr><td>-</td><td>-</td><td>2</td><td>2</td><td>25</td><td>75</td><td>100</td></tr>
<tr><td colspan="10">Learning Objectives</td></tr>
<tr><td colspan="10">✍ Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results</td></tr>
<tr><td colspan="10">ANY Seven only
1. Young’s modulus by non-uniform bending using pin and microscope
2. Young’s modulus by non-uniform bending using optic lever,scale and telescope
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass
2. Surface tension and interfacial Surface tension – drop weight method
3. Comparison of viscosities of two liquids – burette method
4. Specific heat capacity of a liquid – half time correction
5. Verification of laws of transverse vibrations using sonometer
6. Calibration of low range voltmeter using potentiometer
7. Determination of thermo emf using potentiometer
8. Verification of truth tables of basic logic gates using ICs
9. Verification of De Morgan’s theorems using logic gate ICs.
10. Use of NAND as universal building block.
Note : Use of digital balance permitted</td></tr>
</table>

Title of the Course		Allied Physics – II (for Mathematics Students – I Year / II Semester ; for Chemistry Students – II Year / IV Semester)						
Part		III						
Category	EC 2 - Theory	Year	I/II	Credits	3	Course Code	232103221/ 232103421	
		Semester	II/IV					
Instructional Hours per week		Lecture	Tutorial	Lab Practice	Total	CIA	External	Total
		3	1	--	4	25	75	100

Learning Objectives		
	To understand the basic concepts of optics, modern Physics, concepts of relativity and quantum physics, semi conductor physics, and electronics.	
UNIT	**Details**	**No. of Periods for the Unit**
I	**OPTICS: i**nterference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double reflection – Brewster's law – optical activity – application in sugar industries	**12**
II	**ATOMIC PHYSICS:** atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect –Zeeman effect (elementary ideas only) – photo electric effect – Einstein's photoelectric equation – applications of photoelectric effect: solar cells, solar panels, optoelectric devices	**12**
III	**NUCLEAR PHYSICS:** nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.	**12**
IV	**INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES**:frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence –introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences	**12**

V	**SEMICONDUCTOR PHYSICS:** p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) – USB cell phone charger –introduction to e-vehicles and EV charging stations	**12**

References Books (Latest editions, and the style as given below must be strictly adhered to)
1. ResnickHallidayandWalker (2018), FundamentalsofPhysics, 11th Edn., JohnWilleyandSons, Asia Pvt.Ltd.,Singapore. 2. D.R.KhannaandH.R. Gulati (1979).Optics, S.Chand&Co.Ltd.,New Delhi. 3. A.Beiser (1997), ConceptsofModernPhysics,TataMcGrawHillPublication,NewDelhi. 4. Thomas L. Floyd (2017), Digital Fundamentals, 11th Edn., Universal Book Stall, NewDelhi. 5. V.K.Metha(2004), Principlesofelectronics, 6th Edn. ,S.Chandand Company, New Delhi.
Web Resources
1. https://www.berkshire.com/learning-center/delta-p-facemask/ 2. https://www.youtube.com/watch?v=QrhxU47gtj4 3. https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo 4. https://www.youtube.com/watch?v=JrRrp5F-Qu4 5. https://www.validyne.com/blog/leak-test-using-pressure-transducers/ 6. https://www.atoptics.co.uk/atoptics/blsky.htm - 7. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

Title of the Course		**Allied Physics Practicals – II** **(for Mathematics Students – I Year / II Semester ;** **for Chemistry Students – II Year / IV Semester)**						
Part		**III**						
Category	EC – II Practical	**Year**	I/II	**Credits**	1	**Course Code**	**232103222/ 232103422**	
		Semester	II/IV					
Instructional Hours per week		**Lecture**	**Tutorial**	**Lab Practice**	**Total**	**CIA**	**External**	**Total**
		-	-	2	2	25	75	100

Learning Objectives

- ✍ Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results

Any Eight

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistance of a wire using PO box
8. Thermal conductivity of poor conductor using Lee's disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth's magnetic field using field along the axis of a coil
11. Characterisation of Zener diode

12. Construction of Zerner/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block