MADRAS CHRISTIAN COLLEGE Department of Physics (Aided)

B. Sc. (Physics) – Curriculum
(2023-2024**)**

Semester	Part	Course	Hours/cycle	Credits
I	I	Language I	4	3
	II	English I	4	3
	III	Mechanics	4	3
		Properties of Matter & Sound	4	3
		Physics Practicals I	2	--
		Allied: Mathematics I (Offered by Mathematics Department)	6	5
	IV	Basic Tamil/Advanced Tamil/ General Course	4	2
		Value Education I	2	1
II	I	Language II	4	3
	II	English II	4	3
	III	Heat & Thermodynamics	4	3
		Optics	4	3
		Physics Practicals I	2	6
		Allied: Mathematics II (Offered by Mathematics Department)	6	5
	IV	Basic Tamil/Advanced Tamil/ General Course	4	2
		Value Education II	2	1
III	I	Language III	4	3
	II	English III	4	3
	III	Electricity & Electromagnetism	6	5
		Physics of Appliances & Devices	2	--
		Physics Practicals II	2	--
		Allied: Chemistry I (offered by Chemistry Department)	4	3
		Chemistry Practical	2	--
		(or) Computer Science I (offered by Computer Science Department)	6	5
	IV	Inter Disciplinary Course (Elective- offered by all departments)	4	3
		Personality Development	2	-
IV	I	Language IV	4	3
	II	English IV	4	3
	III	Wave Physics & Mathematical Methods	6	5
		Physics of Appliances & Devices	2	2
		Physics Practicals II	2	3
		Allied: Chemistry II (offered by Chemistry Department)	4	3
		Chemistry Practical	2	4
		(or) Computer Science II (offered by Computer Science Department)	6	5
	IV	Environmental Studies	4	2
		Personality Development	2	3
V	III	Electronics I	4	3
		Atomic Physics	4	3
		Optics & Spectroscopy	5	4
		Quantum Mechanics & Relativity	5	4
		Physics Practicals III	6	-
	IV	Computer Training – C Programming	2	2
		General Elective (Elective- offered by all departments)	4	3
VI	III	Electronics II	4	3
		Nuclear Physics	4	3
		Electronic Instrumentation & Measurement Techniques	4	5
		Biophysics	6	5
		Materials Science	6	5
		Physics Practicals III	6	9

BACHELOR OF SCIENCE (PHYSICS)

Core-Course title: **MECHANICS**

Course Code*	231PY1M01			
Credits	**3**			
Hours / Cycle	**4**			
Category	**Part III** **Core/** Theory			
Semester	**I**			
Year of Implementation	**From the academic year 2023-'24 onwards**			
Course Structure	Theory	Tutorial	Practical	Total Hours
	50	10		60
Course Objectives	On completion of the course, the student will be able to • Understand and apply the concepts of Mechanics in static, linear, Circular & Rotational movements. • Apply conservation laws in collision experiments. • Apply pressure-velocity relation in fluid flow in the field of fluid dynamics By the end of this course, students should be able to solve the problems/numericals in mechanics.			

Course Outcome(s)**	PSO Addressed	Bloom's Taxonomy Levels (K1 to K6)
CO1: To recognize and recall the basic physics principles and concepts of Mechanics in static, linear, Circular & Rotational movements.	1,3	K1
CO2: To explain the essential theories, experimental procedures and illustrations in the mechanical systems.	2	K2
CO3: To apply analytical and problem-solving skills to solve problems associated with the principles and phenomena learnt in this course.	2,4	K3
CO4: To analyze the behaviour, causes and outcomes of various forces acting in macroscopic systems.	2,5	K4
CO5: To evaluate the construction and working of devices based on topics learnt in this course.	3,5	K5

* To be allotted by Examinations Office after the Approval of Academic Council

**Minimum 3 Maximum 5.

SYLLABUS: MECHANICS				
UNIT	**CONTENT**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	**Work, Force & Energy:** Newton's Laws of Motion; Conservative and non-conservative forces - Friction-laws of friction-angle of friction-cone of friction- Coriolis force Laws of conservation of energy; Laws of conservation of linear momentum and angular momentum; work energy theorem - work done by gravitational force - work done by spring force - potential energy curve- Problems.	13	1,2,3	K1, K2, K3
II	**Collision & Projectile motion:** Elastic and inelastic collision – Newton's law of impact – coefficient of	12	1,2,3	K1, K2, K3

	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- Problems. Projectile in an Inclined Plane – Range, Time of Flight & Maximum Height- Problems.			
III	**Dynamics of Rigid body** Moment of inertia – Theorems of perpendicular and parallel axes – M.I of a circular ring, disc, solid sphere, hollow sphere, and cylinder about all axes – Flywheel, rotation and translation (rolling & slipping) – Problems. Compound pendulum – theory – equivalent simple pendulum – reversibility of centres of oscillation and suspension – determination of g and k.	12	1,2,3	K1, K2, K3
IV	**Gravitation** Newton's law of gravitation - Determination of G – Cavendish and Boy's Methods - Gravitational Potential and field due to (i) a solid sphere (ii)Hollow sphere (inside & Outside)	10	1,2,4,5	K1, K2, K4, K5
V	**Statics & Hydrodynamics:** Centre of gravity-solid and hollow tetrahedron-solid and hollow hemisphere – Centre of pressure – vertical rectangular lamina – vertical triangular lamina. Hydrodynamics - Equation of continuity– Euler's equation of unidirectional flow – Torricelli's theorem – Bernoulli's theorem and its applications.	13	1,4,5	K1, K4, K5

Prescribed Books/Text Books

1. Mechanics – Part I and II by Narayanamoorthy, National Publishing Company.
2. Mechanics by D.S. Mathur, S. Chand & Co., 2nd Edition (2001).
3. Mechanics by P. Duraipandian, Laxmi Duraipandian, Muthamizh Jayapragasam, S. Chand & Co., New Delhi (1988).
4. Properties of Matter by R. Murugeshan, S. Chand & Co., New Delhi (2001).
5. Statistics, Hydrostatics and Hydrodynamics- M. Narayanamurti and N Nagarathinam,

   National Publishing co. Chennai,(1989).

Reference Books

1. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
2. Fundamentals of Physics by D. Halliday, R.Rensick and J. Walker, 6th edition, Wiley,NY (2001)
3. Advanced Level Physics (7th Edition)- Nelkon & Parker

Suggested Reading

1. F.W.Sears, M.W Zemansky and H.D.Young (1997) University Physics, 12th Edition, Narosa Publishing house, New Delhi.

Web Resources

LEC 2 linear momentum and energy of a particle | CLASSICAL MECHANICS | HC VERMA | GDS K S - YouTube

Mechanics - Course Articulation Matrix			
Course	Programme Outcomes	Programme Specific Outcomes	Cognitive

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	Level
CO 1	1	3	1	1	3	1	1	3	1	1	3	1	1	K1
CO 2	1	3	1	1	3	1	1	3	1	1	3	1	1	K2
CO 3	1	3	1	1	3	1	1	3	1	1	3	1	1	K3
CO 4	1	1	1	1	1	1	1	1	1	1	1	1	1	K4
CO 5	1	2	1	1	2	1	1	2	1	1	2	1	1	K5
Wt. Avg.	1	2	1	1	2	1	1	2	1	1	2	1	1	
Overall Mapping of the Course														

Identify the correlation of POs/PSOs to each CO and make a corresponding mapping table with assigning mark at the corresponding cell.

CORE-Course title: **PROPERTIES OF MATTER AND SOUND**

Course Code*	231PY1M02			
Credits	**3**			
Hours / Cycle	**4 hours/week**			
Category	**Part** **Core/ Theory**			
Semester	**I**			
Year of Implementation	**From the academic year June 2023 onwards**			
Course Structure	Theory	Tutorial	Practical	Total Hours
	54	6	-	60
Course Objectives	On completing this course, the student will be able to 1. Understand the concept of elasticity and derive expression for different modulus of elasticity. 2. Gain basic knowledge on surface tension and viscosity. 3. Understand the concept related to wave motion and study in detail the basic concepts and applications of Acoustics, musical note and Ultrasonics.			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO1: To Understand the basic concept of elasticity and derive expression for Young's modulus and Rigidity modulus. Apply this knowledge in the construction of beams and in torsion pendulum.	PSO3, POS2	K1,K2
CO2: i). To understand the surface tension property of liquid on the basics of cohesive force and molecular theory. ii.To understand how surface tension of liquid changes when surfactants are added.	PSO3, PSO2	K1, K3
CO3: To understand concepts of viscosity of liquid and its definition also to calculate the rate of flow of liquid through a capillary tube (Poiseuille's formula) and its experimental method.	PSO3, PSO4	K1, K3
CO0004: Understand simple harmonic motion, including how to analyse the force, displacement, velocity, and acceleration of an oscillator and the applications of lissajous figures and 'free and forced vibrations.	PSO3, PSO4	K1, K4
CO5: To understand in detail the basic concepts and applications of Acoustics, musical notes and Ultrasonics.	PSO3, PSO2	K1, K3

SYLLABUS: PROPERTIES OF MATTER AND SOUND				
UNIT	**CONTENT**	**Hours**	**COs**	**Bloom's Taxonomy Level**

I	**ELASTICITY** Moduli of elasticity - Hooke's law-Poisson's ratio - Bending of beams: bending moment- Cantilever-Uniform and non-uniform bending - Expression for couple per unit twist -Work done in twisting – Rigidity modulus by dynamic torsion method: Torsional pendulum.	14	CO1	K1, K2, K3
II	**SURFACE TENSION AND VISCOSITY** Surface tension – definition – Molecular Theory of Surface tension-surface energy-- Determination of ST by drop weight and Quincke's method - Variation of ST with temperature – Surfactants Streamlined and turbulent flows -Viscosity - Poiseuille's equation - Determination of coefficient of viscosity by Poiseuilles'method – Reynold's number.	13	CO2	K1, K2, K3
III	**SIMPLE HARMONIC MOTION** Simple Harmonic Motion – Examples of SHM – Mass spring system – Composition of two SHMs in a straight line and at right angles- Lissajous's figures - Free and Damped oscillations – Logarithmic decrement - Forced vibrations and resonance – Sharpness of Resonance**.**	13	CO3	K1, K2, K3
IV	**WAVE MOTION** Longitudinal and transverse waves – Longitudinal waves in gas – Newton's formula – Laplace's correction- Velocity of sound waves – Factors affecting the velocity of sound – Transverse vibrations in a stretched string – Melde's string	10	CO4	K1, K2, K4
V	**ACOUSTICS** Reverberation time – Absorption coefficient – Sabine's reverberation formula – Factors affecting acoustics in Auditorium. Musical sound and noise – Characteristics of musical sound – Musical scale. Ultrasonics - Production using Piezo electric crystal - Applications in NDT, Medical diagnostics (qualitative study).	10	CO5	K1, K2, K3,

Prescribed Books/Text Books

1. Elements of properties of matter – D.S. Mathur – S. Chand & Co., 2004.

2. Properties of matter – R. Murugesan – S. Chand & Co., 2004.

3. Properties of matter – Brijlal and Subramanian S. Chand & Co., 2006.

4. D. R. Khanna and R.S. Bedi, Textbook of Sound, Atmaram and sons (1969)

5. N. Subrahmanyam and Brij Lal, A Text Book of Sound, Vikas Publishing House - Second revised edition (1995)

6. Brijlal and N. Subramaniam, Waves and Oscillations ,2nd revised edition, Vikas publishing house Ltd,(2000),New Delhi.

Reference Books

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

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

Suggested Reading

GENERAL_PROPERTIES_OF_MATTER BY B BROWN
https://www.academia.edu/38872812/GENERAL_PROPERTIES_OF_MATTER

Web Resources

1.https://www.encyclopedia.com/science/news-wires-white-papers-and-books/properties-matter
2. https://spark.iop.org/properties-matter-home-experiments

Properties of Matter & Sound – Course Articulation Matrix

Course Outcomes	Programme Outcomes								Programme Specific Outcomes					Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	3	1	-	1	-	-	-	1	3	3	2	1	K1, K2
CO 2	-	3	1	-	1	-	-	-	1	3	3	2	1	K2, K3
CO 3	-	3	1	-	1	-	-	-	1	3	3	2	1	K2, K3
CO 4	-	3	1	-	1	-	-	-	1	3	2	2	1	K2, K3
CO 5	-	3	1	-	1	-	-	-	1	3	2	2	1	K2, K4
Wt. Avg.	-	3	1	-	1	-	-	-	1	3	3	2	1	
Overall Mapping of the Course														

CORE-Course title: **HEAT & THERMODYNAMICS**

Course Code*	231PY2M01			
Credits	**3**			
Hours / Cycle	**4**			
Category	**Part III Core - Theory**			
Semester	**II**			
Year of Implementation	**From the academic year 2023-2024 onwards**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
	60	**0**	**0**	**60**
Course Objectives	To give a basic understanding of concepts of heat & thermodynamics			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO-1 : Understand the behaviour of real gases and the deviation of their behaviour from ideal gas under various pressure and temperature conditions. They also get an understanding on the significance of critical constants in liquefying gases.	PSO 1, PSO 4	K1, K2, K3, K4
CO-2 : Understand the principle behind liquefaction of gases & various methods adopted in Liquefaction of gases. They also get an understanding of peculiar features of Helium	PSO 1, PSO 4	K1, K2, K3, K4
CO-3: Understand the theory of heat transfer and apply the methods to various thermal systems.	PSO 1, PSO 2, PSO 4	K1, K2, K3, K4
CO-4 : Understand the laws of thermodynamics and apply to heat engines. With Carnot Engine the concept of entropy .	PSO 1, PSO 2, PSO 4	K1, K2, K3, K4, K5
CO-5 : Derive Maxwell's Thermodynamic Relations and apply these equations to derive other thermodynamic relations.	PSO 1, PSO 2, PSO 4	K2, K3, K4

*** To be allotted by Examinations Office after the Approval of Academic Council**

****Minimum 3 Maximum 5.**

SYLLABUS: HEAT & THERMODYNAMICS				
UNIT	**CONTENT**	**Hours**	**COs**	**Bloom's Taxonomy**

				Level
I	UNIT 1: REAL GASES: Equation of state for real Gases - Van der Waals' equation - Andrew's Experiment- Critical constants - Critical coefficient - Boyles temperature in terms of critical constants - Drawbacks of Van der Waals' equation.	**8**	**CO-1**	**K1, K2, K3, K4, K5**
II	UNIT 2: LOW TEMPERATURE PHYSICS Discovery of inter molecular force of attraction - Porous plug Experiment - Results – Joule-Kelvin effect for ideal gas and real gases - Expression for the temperature of inversion - Relation between T_B, T_C and T_i - Liquefaction of gases: Linde's process for air - K Onne's Method for Helium - Helium I and Helium II – Peculiar properties of Superfluid	**12**	**CO-2**	**K1, K2, K3, K4, K5**
III	UNIT 3: TRANSMISSION OF HEAT Thermal conductivity - Conduction along a uniform bar - Determination of thermal conductivity - Forbe's method - Thermal conductivity of a poor conductor - Lee's disc method –Heat convection - Radiative Heat transfer – Black body - Experimental study of energy distribution of black body - Rayleigh-Jean's law – Wein's displacement law - Stefan's law – Derivation of Planck's law - Physical significance of above laws	**15**	**CO-3**	**K1, K2, K3, K4, K5**
IV	UNIT 4: THERMODYNAMICS Thermal equilibrium - Zeroth and First law of thermodynamics - Isothermal and adiabatic processes - Reversible, irreversible and quasi-static processes - Heat engines - Carnot's engine - Otto engine - Diesel engine - Efficiency Second law of thermodynamics - Entropy – Properties of entropy - Change in entropy of a perfect gas in terms of TP, TV and PV. Third law of thermodynamics.	**15**	**CO-4**	**K1, K2, K3, K4, K5**
V	UNIT 5: MAXWELL'S THERMODYNAMICAL RELATIONS Latent heat equation - Effect of pressure on boiling point and melting point - External latent heat - Maxwell's thermodynamic relations - Applications – Clausius Clapeyron's equation – Relationship between C_P and C_V for a perfect gas.	**10**	**CO-5**	**K1, K2, K3, K4, K5**

Prescribed Books/Text Books

1. Brij Lal and N. Subramaniam, Heat and Thermodynamics, S. Chand & Co New Delhi (2003).
2. D.S. Mathur, Heat and Thermodynamics (Revised by M.N. Bapat), S. Chand & Sons (1993).
3. M. Narayanamurti and N Nagarathinam, Heat, 1st edition, National Publishing Co., Chennai (1987).

Reference Books

1. Francis W. Sears and Gerhard L Salinger, Thermodynamics, Kinetic Theory and Statistical thermodynamics,3rd edition Narosa Publishing House, New Delhi (1989).
2. Mark W Zamansky, Heat and Thermodynamics, 6th edition, McGraw Hill Book Co., New York.

Suggested Reading

1. Robert Resnick and David Haliday, Fundamentals of physics, 6th edition –John and Wiley and sons Inc. New Delhi (2005).

Web Resources

https://www.khanacademy.org/science/physics/thermodynamics
http://www.learnthermo.com/tutorials.php

Heat & Thermodynamics - Course Articulation Matrix

Course Outcomes	Programme Outcomes								Programme Specific Outcomes					Cognitive Level
	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO 1	1	3	1	1	3	1	1	-	3	2	-	1	3	**K1, K2, K3, K4, K5**
CO 2	1	3	1	1	3	1	1	-	3	2	-	1	3	**K1, K2, K3, K4, K5**
CO 3	1	3	3	1	3	1	1	-	3	2	-	1	3	**K1, K2, K3, K4, K5**
CO 4	1	3	3	1	3	1	1	-	3	2	-	1	3	**K1, K2, K3, K4, K5**
CO 5	1	3	3	1	3	1	1	-	3	2	-	1	3	**K1, K2, K3, K4, K5**
Wt. Avg.	1	3	3	1	3	1	1	-	3	2	-	1	3	**K1, K2, K3, K4, K5**
Overall Mapping of the Course														

CORE-Course title: OPTICS

Course Code*	231PY2M04			
Credits	**3**			
Hours / Cycle	**4 hours/week**			
Category	**Part III Core - Theory**			
Semester	**II**			
Year of Implementation	**From the academic year June 2023 onwards**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
	55	5	-	60
Course Objectives	By completing this course, the student will be able to 1. Understand properties of light and its propagation through various media, obstacles, and geometries. 2. Design simple optical instruments and estimate the numerical values of optical parameters needed for their optima operation. 3. Understand concepts related to laser light generation in a variety of lasers, and do simple estimates on viability of these lasers.			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO1 : (i) To recognize and recall fundamental concepts of simple optical instruments objects like prisms, lenses, combination of lenses and the aberrations that arise in their manufacturing. (ii) To recognize and recall the basic concepts pertaining to propagation, dispersion and deviation of light.	**PSO1**	**K1**
CO2: (i) To understand and explain the fundamental principles of optical processes such as interference, diffraction and polarization that are produced with slits, gratings and polarizers, respectively. (ii) To understand the concepts of stimulated emission of light that produces laser light.	**PSO2**	**K2**
CO3: To apply their knowledge gained in solving analytical and numerical problems of optical phenomenon under the ambit of diffraction, interference, polarization, as well as to solve problems in generation of laser light and the process of holography.	**PSO1, PSO2**	**K3**
CO4: (i) To analyze the positions and intensity distributions of resultant patterns of light emergent from optical instruments and gadgets such as slits, gratings, and prism. (ii) To examine the criteria for the working of a laser.	**PSO1, PSO2**	**K4**
CO5: To assess the construction of various optical instruments – telescopes, microscopes, polarizers, and lasers.	**PSO1, PSO2**	**K5**

Optics - Course Articulation Matrix

Course Outcomes	**Programme Outcomes**								**Programme Specific Outcomes**					**Cognitive Level**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO 1	-	3	1	1	2	1	2	1	3	3	2	1	1	**K1**
CO 2	-	3	1	1	2	1	2	1	3	3	2	1	1	**K2**
CO 3	-	3	1	1	2	1	2	1	3	3	2	1	1	**K3**
CO 4	-	3	1	1	2	1	2	1	3	3	2	1	1	**K4**
CO 5	-	3	1	1	2	1	2	1	3	3	2	1	1	**K5**

Wt. Avg.	-	3	1	1	2	1	2	1	3	3	2	1	1	
								1.571					2	
												Overall Mapping of the Course	**1.785**	

SYLLABUS: OPTICS

Unit	CONTENT	Hours	COs	Bloom's Taxonomy Level
I	**Geometrical Optics** Propagation of light – reflection and refraction of light from Fermat's principle. Refraction by a prism and minimum deviation. Combination of Prisms: Dispersion without Deviation, Deviation without Dispersion. Thin lenses, combination of thin lenses and Lens maker's formula. Magnification of microscopes, and telescopes. Thick lenses – cardinal points. Lens aberrations - chromatic aberration, and astigmatism.	**14**	**1, 2, 3**	**K1, K2, K3**
II	**Wave Optics – Interference** Interference by division of wave front and division of amplitude. Interference by multiple reflections – Newton's rings, Fabry-Perrot Interferometer, Michelson's interferometer.	**10**	**1, 2, 3**	**K1, K2, K3**
III	**Wave Optics – Diffraction** Fraunhofer diffraction - single slit, double slit and transmission grating. Rayleigh's criterion, chromatic resolving power of prism and transmission grating, resolving power of telescopes and microscopes. Fresnel diffraction – at a circular aperture and opaque circular disc. Fresnel's zone plate for focusing radiation and subatomic particles.	**12**	**2, 3, 4**	**K2, K3, K4**
IV	**Wave Optics – Polarization** Theory of polarization - Linear, circular, and elliptical polarization. Brewster's law and law of Malus. Production and detection of polarized light - Dichroism, and double refraction. Polaroid, Quarter Wave plate and Half wave plate. Optical activity and specific rotatory power.	**12**	**2, 3, 4**	**K2, K3, K4, K5**
V	**Modern Optics** Laser principle - spontaneous emission, stimulated emission and stimulated absorption. Einstein's coefficients, population inversion and threshold gain. Construction and working of He-Ne laser, Ruby laser, and semiconductor laser. Principle of hologram – recording and reconstruction of hologram.	**12**	**2, 3, 4, 5**	**K2, K3, K4, K5**

Prescribed Books/Text Books

1. Jenkins and White, *Fundamentals of Optics*, McGraw Hill Education; 4th edition (1 July 2017)
2. Ajoy Ghatak, *Optics*, McGraw Hill McGraw Hill, 7th edition (2020).
3. N. Subrahmanyam, Brij Lal, M. N. Avadhanulu, *A Textbook of Optics*, S. Chand & Co. (2006)

Reference Books

1. E. Hecht, *Optics,* Pearson; 5th edition (2017)
2. Crawford, *Waves (Berkeley Physics course Vol. 3)*, McGraw Hill Education (2017)

Suggested Reading

1. Feynman, Leighton, and Sands. Feynman's Lectures on Physics, Vol. 1, Addison and Wesley. Free Web Book: https://www.feynmanlectures.caltech.edu/
2. Matveev, Optics, Mir Publishers (1988). Link to Archiv.org: https://archive.org/details/matveev-optics/mode/2up

Web Resources

1. Shaoul Ezekiel, *Video Demonstrations in Physical Optics*, MIT Open Courseware (2008) https://ocw.mit.edu/courses/res-6-006-video-demonstrations-in-lasers-and-optics-spring-2008/pages/demonstrations-in-physical-optics/
2. Shaoul Ezekiel, *Video Demonstrations in Lasers*, MIT Open Courseware (2008) : https://ocw.mit.edu/courses/res-6-006-video-demonstrations-in-lasers-and-optics-spring-2008/pages/demonstrations-in-laser-fundamentals/
3. Arvind Gupta, *Toys from Trash: Fun with Light,* https://www.arvindguptatoys.com/fun-with-light.php
4. S. G. Lipson, *Optics Experiments and Demonstrations for Student Laboratories,* IOP Publishing (20202) Link: https://doi.org/10.1088/978-0-7503-2300-0ch1
5. Application Notes (Edmond Optics) https://www.edmundoptics.in/knowledge-center/application-notes/optics/
6. PhET simulations: Interactive simulations of science and math – *Optics simulations* https://phet.colorado.edu/
7. Wolfram Demonstrations – *Optics simulations* https://demonstrations.wolfram.com/topic.html?limit=20&topic=Optics

ELECTRICITY AND ELECTROMAGNETISM

(For students admitted from June 2008)

Semester: III Couse code: 081PY3M01 Hours/Week: 6 Credits: 5

UNIT 1: THE ELECTRIC FORCE AND ELECTRIC FIELD

Electric charge – Coulomb's law – Electric field strength – Lines of force – Flux of the electric field – Gauss's theorem – Applications of Gauss's theorem – Field due to a point charge – Derivation of Coulomb's law – Field along an infinite cylindrical charge – Field due to a uniform distribution of charge over a hollow spherical surface.

UNIT 2: ELECTRIC POTENTIAL AND ELECTRIC CAPACITANCE

Definition of electric potential – Zero potential – Equipotential surfaces – Potential due to a point charge – A group of point charges, a long charged wire, charged circular ring, a uniformly charged disc, a charged non-conducting sphere – The electron volt.

Capacitance: Units of capacitance – Calculation of capacitance of spherical, cylindrical and parallel plate capacitors – Energy of a charged capacitor – Energy associated with an electric field.

UNIT 3: STEADY CURRENTS

Current and current density – Equation of continuity – Ohm's law – Electrical conductivity - Kirchoff's laws and applications – Current through a galvanometer in Wheatstone's bridge for slight imbalance.

Chemical effects of electric current – Faraday's laws of electrolysis – Calculation and experimental.

Magnetic Effects of Steady Currents:

Magnetic induction and definition of B – Biot-Savart experiments – Laplace's law – Surface and line integrals of magnetic induction – Ampere's circuital theorem – Field at any point in between two infinite wires.

UNIT 4: MAGNETIC FIELD

Magnetic induction vector B – Lines and tubes of induction – Magnetic field due to a dipole – Gauss's theorem – Application to field at a point due to an infinite plane sheet.

MOVING CHARGES IN A MAGNETIC FIELD

Force on a current carrying conductor in a uniform magnetic field – Theory of a moving coil galvanometer – Theory of a ballistic galvanometer – Lorentz Force – Principle of Cyclotron – Cyclotron frequency.

UNIT 5: E.M. INDUCTION

Faraday's laws of E.M. Induction – Lenz's law - Induced current and charge – Eddy currents – Self inductance – Energy associated with an inductor – Experimental determination of L of a solenoid and toroid – Mutual inductance – Coefficient of coupling – Combination of inductances – DC generator and motor.

Transient Phenomena:

Growth and decay of current in an inductive circuit – Charge and discharge of capacitor through a resistance by leakage – LCR circuits – Logarithmic decrement of a circuit.

UNIT 6: ALTERNATING CURRENTS

Definition – AC voltages applied to resistors, inductors and capacitors – Series LCR circuits – Parallel LCR circuits – Resonance – Power in AC circuits – Filter circuits – Transformers – AC generators – Single phase, three phase distributions.

Maxwell equations and EM waves: Introduction – General theory of electromagnetism – Displacement current – EM waves – Maxwell equations – Poynting vector.

Book for Study:

1. M. Nagaratnam and N. Lakshminarayan, *Electricity and Magnetism,* 3rd revised edition The National Pub. Co.(1994).

Books for References:

1. D.C. Tayal, *Electricity and Magnetism*, 2nd revised edition, Himalaya Pub House (1990).
2. Arthur Kip, *Electricity and Magnetism,* 2nd edition, Mc Graw Hill (1969).
3. Seghal, Chopra, Seghal, *Electricity And Magnetism*, 2nd edition, S. Chand and sons, New Delhi,(1977).
4. D. Griffiths, *Electrodynamics*, Prentice Hall of India Pvt. Ltd. – III edition (2003), 4th Indian edition reprint (2004).
5. R.P. Feynman, R.B. Leighton and M. Sands, *The Feynman Lectures on Physics* (1989) Narosa Publishing House Addison, Wesley Publishing Company (1969).
6. Robert Resnick and David Halliday – *Physics Part I and II*, Wiley Eastern Private Limited, New Delhi (1969).
7. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, *Hand Book of Chemistry and Physics* 85th edition (2005), The Chemical Rubber Publishing Co, Cleveland(1960).

PHYSICS OF APPLIANCES AND DEVICES

(For students admitted from June 2008)

Semester: III & IV Couse code: 081PY4M02 Hours/Week:2 Credits: 2

UNIT 1: MECHANICS & HEAT

Heat Engines – types – Comparison of 2 stroke and 4 stroke engines – Principle, Working and Comparison of Diesel and Otto engines – Diesel & Petrol combustion reaction – Engine capacity – Power – HP – BHP – Calculation of BHP of Engines – Multi-cylinder Engines – Centrifuge – Washing machine driers – Variation of boiling point with pressure – Clausius Clapeyron's latent heat equation – Pressure cooker – Joule Kelvin effect – Refrigerants – Air conditioners – Peltier Cooling.

UNIT 2: SOUND & OPTICS

Sound waves – dB – Ultra & Infra Sounds – Supersonics – Applications – Doppler effect – Applications : radar, red shift, spectral broadening, and blood flow – Power of lens – Human eye – Long and short sights – rectifications – Electron microscope – Telescope – Binocular – Digital camera – Pixels – Resolution.

UNIT 3: ELECTRICAL & ELECTRONIC DEVICES

Principle, Working and Parts of Tube light – AC & DC Fans – KWh – Fuse – Heating elements – Applications – Rotational frequency of water molecules – Microwave oven – Photo cell – Xerox machine – CD and its uses – LCD display and LCD projector.

UNIT 4: MEDICAL PHYSICS

Diagnosis : Principles : X rays – Ultrasound scan – CAT scan – PET scan – MRI scan – Endoscopy – Angiogram – ECG – BP monitor & Radiation Therapy.

UNIT 5: COMMUNICATION

Satellite communication – Geostationary satellites – Escape and orbital velocities – Period of satellites – Communication satellites – Indian satellites – Cell phone communication – communication network – Internet.

UNIT 6: ENERGY SOURCES

Nuclear fission energy – energy release calculation in KWh – Nuclear reactor – Indian reactors – Radiation dosimetry – Hazards & Protection – Solar energy – Photovoltaic cell – Solar panel – Calculation of voltage & current – Principles of energy production from winds and tides.

WAVE PHYSICS AND MATHEMATICAL METHODS

(For students admitted from June 2008)

Semester – IV Couse code: 081PY4M01 Hours/Week: 6 Credits: 5

UNIT 1: SIMPLE HARMONIC MOTION

Simple harmonic motion – Equation of motion, general solution, and characteristics – Reference circles – Complex representation – Example of SHM – Mass spring system – Superposition of harmonic oscillations (Collinear and perpendicular) – Lissajou's figures.

Free and Forced Vibrations:

Free damped and Undamped vibrations – Damped oscillator with one degree of freedom – Logarithmic decrement – Example - Moving coil galvanometer – Forced vibrations of one dimensional harmonic oscillator – Resonance – Sharpness of resonance and quality factor.

UNIT 2: WAVE MOTION

Traveling (Progressive) wave – Longitudinal and transverse waves – Classical wave equation – Longitudinal waves in gas – Newton's formula – Laplace's correction- Velocity of sound waves – Factors affecting the velocity of sound.

Vibrations in Strings, Rods and Air Columns:

Stationary waves – Organ pipes – Analytical treatment of stationary waves with respect to position and time – Formation of nodes and anti nodes – Vibration of air column – Resonance column – Longitudinal vibrations of a uniform rod – Kundt's tube experiment.

Transverse vibrations of a stretched string - Longitudinal waves in a uniform rod – Kundt's tube experiment – Transverse of a string - Normal modes – Laws of vibrations in strings – Melde's Experiment.

UNIT 3: PRACTICAL APPICATIONS OF SOUND

Doppler Effect:

Relative motions of source, observer and medium – Applications.

Acoustics:

Reverberation time – Absorption coefficient – Sabine's reverberation formula – Factors affecting acoustics in Auditorium, buildings – Mathematical modeling.

Musical Sound and Noise:

Musical sound and noise – Characteristics of musical sound – Intensity of sound and its measurement – Musical scale.

Ultrasonics:

Production using Piezo electric generator, detection and applications in medicine, industry (NDT), Medical diagnostics (qualitative study).

UNIT 4:

Fourier series:

Dirichlet's conditions – General Fourier series – Fourier cosine and sine – Half range series – Change of length of interval.

Partial Differential Equations (PDE):

PDE for transverse vibrations in elastic strings (one dimensional wave equation)- One dimensional heat flow equation – Solutions to these PDE's by method of separation of variables – Problems based on boundary conditions and initial conditions.

UNIT 5: NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCEDENTAL EQUATIONS

Bisection method – Method of successive approximation (Iterative method) – Newton – Raphson method.

Finite Difference Methods:

Finite differences – Forward (Δ) and backward (∇) difference operators (no central difference) – Shifting (E) and differential (D) operators - Differences of polynomial factorial polynomial – Summation of series.

UNIT 6: NUMERICAL METHODS

Interpolation:

Gregory – Newton forward and backward interpolation formulae – Lagrange's interpolation formula – Equidistant terms with one or more missing values.

Numerical Differentiation:

Derivatives using Newton's forward and backward differences formulas.

Numerical Integration:

Trapezoidal rule – Romberg's method – Simpson's rule.

Books for Study:

1. N.K. Bajaj, *Physics of Waves and Oscillations* (for Units 1, 2 and 3), Tata Mc Graw Hill (1989), New Delhi.
2. Brij Lal and N. Subramaniam, *Waves and Oscillations* (for units 1, 2 and 3)2nd revised edition, Vikas publishing house Ltd,(2000),New Delhi.
3. M. K. Venkataraman, *Engineering Mathematics III- B*, (for unit 4)
4. M. K. Venkataraman, *Numerical Methods in Science and Engineering* (for Units 5&6).
5. S.S. Sastry, *Numerical methods*, Prentice Hall of India (1991) New Delhi.

Books for Reference:

1. V.RajaRaman, *Computer Oriented Numerical Methods* 3rd edition, Prentice, Hall of India Pvt. Ltd (1971),New Delhi.
2. V. Rajaraman, *Analog Computation And Simulation,* Prentice Hall of India Pvt.,Ltd.,(1976).
3. R.P. Feynman, R.B. Leighton and M. Sands, *The Feynman Lectures on Physics* (1989) Narosa Publishing House Addison, Wesley Publishing Company (1969).
4. Robert Resnick and David Halliday – *Physics Part I and II*, Wiley Eastern Private Limited, New Delhi (1969).
5. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, *Hand Book of Chemistry and Physics* 85th edition (2005), The Chemical Rubber Publishing Co, Cleveland(1960).

COMPUTER TRAINING – C PROGRAMMING

(For students admitted from the year June 2008)

Semesters – V Couse code: 081PY5M05 Hours/Week: 2 Credits: 3

UNIT 1: COMPUTER ORGANISATION

Architecture – I/O Concepts – Basic concepts of OS – Basic concepts of JAVA & RDBMS – Review of MS Office.

UNIT 2:

Introduction – Importance of C - Basic structure of C program – Constants, variables and data types – Character set – Declaration of variables – Operators and expression.

Input/ Output operator – Formatted input/output control structure.

UNIT 3:

Decision making with if, if else, go to, break and continue statements, while do while and for students - Arrays – One dimension and two dimension - Functions – Structures and unions – Pointers and functions – Pointers and arrays.

UNIT 4:

Development of algorithms, flow-chart and program.

1. Average of a set of numbers
2. Solving quadratic equations
3. Finding factorial using recursion
4. To add/subtract/ multiply two matrices (3x3)
5. Sorting a set of numbers in ascending/ descending order
6. To arrange the names in the alphabetical order

UNIT 5:

1. Numerical integration be Trapezoidal/Simpson's rule
2. Determination of roots by Newton- Raphson method
3. Solution of differential equation be Runga Kutta II order method and
4. Matrix inversion (n x n)

UNIT 6: COMPUTER PROJECT: 10 Hours

Resources: Any programming language/SW Package – the INTERNET (WWW) - Development manual – Power point projection.

Books for Reference:

1. B.Govindarajulu, *Ibm Pc and Clones* 2nd edition, Tata Mc Graw Hill Pub.co.Ltd., (2002), New Delhi.
2. E. Balagurusamy , *Programming in C* 2nd edition ,Tata McGraw-Hill , New Delhi.
3. S.Bryon and Gottfried, *Schaum's outline of theory and problems of programming with C* 15th reprint , Mc Graw Hill publication (1997).
4. K.R.Venugopal and R.D. Sudeep, *Programming with C*, Tata Mc Graw Hill publication.
5. Herbert Schildt and Osborne, Teach *yourself C*, Mc Graw Hill publication.

6. Sanjay K. Bose, *Hardware and Software of Personal Computers.* , Willey Eastern Ltd. (1992) New Delhi.
7. S.S. Sastry, *Introduction to Numerical analysis*, Prentice Hall Of India (1991) New Delhi.
8. V.RajaRaman, *Computer Oriented Numerical Methods* 3rd edition, Prentice,Hall of India Pvt.Ltd(1971),New Delhi
9. WEBSITE: http://www.library.cornell.edu/nr/bookcpdf.html.

ELECTRONICS I
(SEMICONDUCTOR DEVICES AND ANALOG CIRCUITS)

(For students admitted from June 2010)

Semester – V Couse code: 081PY5M01 Hours/Week: 5 Credits: 3

UNIT 1: TRANSISTOR

BJT – Basic configurations – h-parameters – CE characteristics – Load line – Design of CE amplifier – Biasing – Transistor as switch – Saturation current.

UNIT 2: Semiconductor Devices: FET, MOSFET, UJT, SCR, and Triac

FET – Junction FET, MOSFET – Drain characteristics – Design of Common source amplifier – VMOS – UJT, SCR – Characteristics – Triac.

UNIT 3: Rectification & Regulation

AC to DC convectors: Half wave, Full wave & Bridge rectifier circuits – Ripple factor – Ripple smoothening filter with capacitor – ZENER regulator - Voltage feedback regulation – Current limiting – IC regulators(78,79 Series) – SMPS – SCR & Triac regulation.

UNIT 4: Amplifiers

A.F. amplifiers: Classification – Interstate coupling – Frequency response – dB gain – Power amplifiers – Class A, B push-pull, & C amplifiers – Second harmonic distortion – DC amplifiers and drift.

UNIT 5: Negative Feedback

Feedback in amplifiers: basic concepts – Types of feedback – Effect on amplifier performance – Negative feedback – Emitter follower – DARLINGTON connection – Source follower.

UNIT 6: Positive feedback & Oscillators

Positive feedback & instability – RC Oscillators: Phase shift oscillator – WIEN Bridge oscillator – LC Oscillators – COLPITT's & HARTLEY oscillators – Crystal controlled oscillator: Astable transistor multivibrator – UJT pulse generator.

Books for study:

1. Allen Mottershead, *Electronic Devices and Circuits* Prentice-Hall of India (1989) New Delhi.
2. Jacob Milman & Arwin Grabel, *Micro Electronics* (5th reprint2001), Tata Mc Graw Hill Book Co, (1999) New Delhi.
3. Dennis Le Croissette, *Transistors*, Prentice-Hall of India (1988) New Delhi.
4. D. Chattopadhyay et al., *Foundations of Electronics* 2nd edition , Wiley Eastern Ltd. (1988) New Delhi.

ATOMIC PHYSICS

(For students admitted from June 2008)

Semester – V Couse code: 081PY5M02 Hours/Week: 4 Credits: 3

UNIT 1: MASS SPECTROGRAPH

Positive ray analysis- Thomson's parabola method- Isotopes- Mass spectrograph studies- Aston's Bainbridge and Dempster's mass spectrographs.

UNIT 2: SPECTRA OF ONE ELECTRON ATOMS

Hydrogen spectrum-empirical rules - Bohr's theory of hydrogen atom- Isotope effect- the spectrum of sodium atom - Selection rules - Quantum defects – Excitation potentials.

UNIT 3: X-RAY SPECTRA

Production of soft X- Rays – Production of Hard X-Rays – Applications - X ray spectra – Continuous and characteristics spectra- Mosley's work- interpretation of X ray spectra – Compton effect – Expression for Compton shift – Compton wavelength.

UNIT 4: FINE STRUCTURE AND ELECTRON SPIN

Fine spectra of alkali spectra – Fine structure constant - Vector atom model - Spatial quantization - Electron spin- Quantum associated with vector atom model - Magnetic moments - Stern Gerlach experiment- Coupling schemes.

UNIT 5: PAULI'S EXCLUSION PRINCIPLE

Statement - Electronic structure of elements and periodic table - Empirical rules - Hyperfine structure and nuclear spin angular momentum.

UNIT 6: ZEEMAN EFFECT

Normal Zeeman effect - Explanation in terms of vector atom model – Anomalous Zeeman effect- Lande's splitting factor- Paschen-back effect- Stark effect.

Books for Study:

1. T.A Little Field And Thorley, *Atomic And Nuclear Physics* (3rd Edition),Elbs And Van Nostrand Reinhold Co., Ltd., London
2. F.K. Rithchmyer, E.H. Kennard, John N. Copper, *Introduction To Modern Physics*- Tata Mc Graw Hill Pub Co Ltd., New Delhi.
3. N. Subramanyam and Brijlal, *Atomic and Nuclear Physics*. Revised by Jivan seshan (2005) New Delhi.
4. R.Murugheshan , *Modern Physics* 12th revised edition , S.Chand Co,Ltd,(2002)

Books for Reference:

1. Arthur Beiser, *Concepts of Modern Physics* (6th Ed) –, Mc Graw Hill Book Co (2005).
2. J.B.Rajam, *Atomic Physics*.1st edition , S.Chand and sons , (2002).
3. Samuel Glasstone , *Source Book On Atomic Energy* (3rd Ed), Affiliated East - West Press Ltd., New Delhi.
4. R.P. Feynman, R.B. Leighton and M.Sands, *The Feynman Lectures on Physics* (1989) Narosa Publishing House Addison, Wesley Publishing Company (1969).

5. Robert Resnick and David Halliday – *Physics Part I and II*, Wiley Eastern Private Limited, New Delhi (1969).
6. Charles D.Hodgman, Robert C.Weast and Samuel M.Selby, *Hand Book of Chemistry and Physics* 85th edition (2005), The Chemical Rubber Publishing Co, Cleveland(1960).

OPTICS AND SPECTROSCOPY

(For students admitted from June 2008)

Semester – V Couse code: 081PY5M03 Hours/Week: 5 Credits: 4

UNIT 1: NATURE OF LIGHT

Electromagnetic theory of light - System of units - Polarisation of dielectric medium - Maxwell's equations - EM waves in vacuum space - EM waves in isotropic dielectrics -Energy density of EM field and Poynting theorem.

Resolving Power of Optical Instruments: Lord Rayleigh's criterion for resolution of spectral lines - Resolving power of telescope, prism and grating.

Interferometry: Michelson's interferometer - Fabry-Perot interferometer - Determination of wavelength of light.

UNIT 2: DIFFRACTION

Interference versus diffraction - Fresnel and Fraunhofer diffraction - Fresnel diffraction at a circular aperture and an opaque circular disc - Zone plate - Application of zone plate in OHP - Fraunhofer diffraction at a single slit - Fraunhofer diffraction at a double slit - Theory of plane transmission grating - Determination of wavelength of spectral lines using a plane transmission grating - Fraunhofer diffraction at a circular aperture.

UNIT 3: POLARISATION

Nicol prism - Huygen's explanation of double refraction in uniaxial crystals when (i)Optics axis is in the plane of incidence and inclined to the crystal surface(Positive crystal) (ii)Optic axis is perpendicular to the plane of incidence and parallel to the crystal surface(only oblique incidence in negative crystal).

UNIT 4: ELLIPTICALLY AND CIRCULARLY POLARISED LIGHT

Elliptically and circularly polarised light - Theory - Quarter wave plate - Half wave plate - Production and detection of plane, elliptically and circularly polarised light - Polaroids and their uses - LCD displays - Optical activity - Fresnel's explanation of rotation specific rotation - Laurent's half shade polarimeter - Introduction to Ellipsometry.

UNIT 5: MOLECULAR SPECTRA

Diatomic molecules-rotation spectra - Rigid rotator - Non-rigid rotator - Isotope effect in rotation spectra - Vibration spectra - Linear harmonic oscillator - Raman effect - Scattering of light - Experimental study of Raman effect - Classical theory of Raman effect.

Introduction to UV spectroscopy - Instrumentation and applications.

UNIT 6: LASER AND MASERS:

Laser principle - Spontaneous emission, stimulated emission, Einstein's coefficients- Population inversion - Description and working of Ammonia Maser, Ruby Laser, He-Ne Laser and Semiconductor Laser, chemical laser. Laser application to medicine, Industry and defense. Principle of holography - Recording and reconstruction of hologram.

Book's For Reference:

1. Brijlal and Subrahmanyam, *Optics* -.S. Chand & Company. 1999 Edition
2. B. K. Mathur (Ch19) .*Principles of Optics* – 7th edition. Gopal printing press Kanpur.

3. B. B. Laud, *Lasers and Non-Linear Optics*, Wiley Eastern Limited (1996).
4. COLIN.N.BANWELL and ELAINE M. Mc CASH, *Fundamentals of Molecular Spectroscopy*, 4th edition. Tata McGraw-Hill Publishing Company Ltd

QUANTUM MECHANICS AND RELATIVITY

(For students admitted from June 2008)

Semester: V Couse code: 081PY5M04 Hour/Week: 5 Credits: 4

UNIT 1: PHOTONS AND MATTER WAVES

Difficulties of classical physics and origin of quantum theory: Black body radiation - Planck's law of black body radiation – Einstein's photoelectric equation - Photoelectric effect - Measurement of Planck's constant.

De Broglie's theory of matter waves - Phase velocity and group velocity - Relativistic and non-relativistic cases - Davisson and Germer experiment - G.P. Thomson's experiment - Heisenberg's uncertainty principle – Thought experiments - Illustration of Gamma ray microscope - Applications of uncertainty principle.

UNIT 2: OPERATORS AND SCHROEDINGER EQUATION

Schrödinger equation – Wave function and its interpretation – Postulates of quantum mechanics - Linear operators – Eigenvalue – Hermitian operator – Significance of Hermitian operator and its properties – Observable – Operators for momentum – Commutation relations between position and momentum.

UNIT 3: SIMPLE APPLICATIONS OF SCHROEDINGER EQUATION

One-dimensional problems: (i) Particle in a box (ii) Particle in a ring (iii) Barrier penetration problem (iv) Linear harmonic oscillator.

UNIT 4: QUANTUM THEORY OF ANGULAR MOMENTUM

Angular momentum components - Commutation relations for orbital angular momentum operator – Eigenvalues and Eigenfunctions – Three-dimensional problems -
(i) Rigid rotator (qualitative) (ii) Hydrogen atom (qualitative).

UNIT 5: RELATIVISTIC MECHANICS

Moving frames of reference – Classical relativity – Michelson-Morley experiment – Special theory of relativity – Fundamental postulates – Lorentz transformation equations.

UNIT 6: CONSEQUENCES OF THEORIES OF RELATIVITY

Addition of velocities – Derivations using hyperbolic functions – Relativity of simultaneity – Time dilation – Length contraction – Variation of mass with velocity – Einstein's mass-energy relation – Transformation of mass, momentum and energy – Concept of four vector.

General theory of relativity: Some fundamental ideas of general theory of relativity – Principle of equivalence - Experimental evidences.

Books for Study:

1. F. K. Ritchmeyer, E.H. Kennard and John N. Cooper, *Introduction to Modern Physics*, 6th Edition, Tata Mc Graw Hill Pub. Co. Ltd., New Delhi.
2. Wehr Richards Adair, *Physics of the Atom*, Narosa Publishers.
3. S. P. Singh, M. K. Bagde, *Quantum Mechanics*, S. Chand & Co (2000),New Delhi.
4. Arthur Beiser, *Concepts of Modern Physics* (6th Ed) –, Mc Graw Hill Book Co (2005).
5. V. Devanathan, *Quantum Mechanics*, Narosa Pub. House (2005) Chennai

ELECTRONICS - II

INTEGRATED ELECTRONICS AND MICROPROCESSOR

(For Students admitted from June 2008)

Semester – VI Couse code: 081PY6M01 Hours/week: 4 Credits: 3

UNIT 1: ANALOG INTEGRATED CIRCUITS

Operational Amplifier: Differential amplifier - DC Coupling - Characteristics of an ideal Op-Amp - Inverting and Non Inverting mode operations - Adder - Subtractor-Multiplier - Sign Changer – Scale Changer – Integrator – Differentiator - Instrumentation amplifier Analog Computation - Solving Simultaneous Equations.

UNIT 2: BOOLEAN ALGEBRA AND LOGIC GATES

Number Systems and Codes - Laws of Boolean algebra - DeMorgan's Theorems– Simplification of Boolean expressions.

Logic gates – Universal Gates – Logic Circuits - Translation of Circuits From Boolean expressions – Minimization Techniques - Min terms and Max Terms - K-maps- SOP and POS reductions – Half adder - Full adder – Subtractor - Signed Binary Adder –Decimal Adder – Full Subtractor – 4-bit binary adder / Subtractor.

UNIT 3: COMBINATIONAL LOGIC & SEQUENTIAL LOGIC CIRCUITS

Code Converters - Binary to Gray Decoder - Gray to Binary Decoder - BCD to Decimal decoder – BCD to seven segments Decoder - Parity Generator - Parity Detector Demultiplexers – Multiplexers – Encoders. Flip-Flops - RS latch - Clocked RS latch - D flip flop - JK flip flop - T flip flop - JK M/S flip flop.

UNIT 4:

Counters - Ripple counters - Modulus of a Counter - Up/Down Counters - Synchronous counters - Ring Counter - Johnson counters.

Registers - Serial in - Serial out Registers – Serial in - parallel out Register - Parallel in – serial out - Parallel in parallel out register.

UNIT 5: MICROPROCESSOR- ARCHITECTURE

8085 Architecture - Bus structure - Instruction classification - Instruction format –data format - Overview of instruction set – Memory – I/O devices – Interrupts and types

UNIT 6 – MICROPROCESSOR- INTERFACING AND PROGRAMMING

8085 MPU - Memory interfacing - Memory segment - I/O interfacing - Stack and sub routines – Simple programs (addition, Subtraction, multiplication, division and square wave generation)

Books for Study:

1. D. Roy Choudhury and Shail Jain, *Linear Integrated Circuits*- New Age International (P) Ltd, Publishers
2. A.Subramanyam, *Applied Electronics*, The National Publishing Company.
3. Malvino and Leach, *Digital Principle and Applications*, Mc Graw Hill Book Co.
4. William H Gothmann, *Digital Electronics – An Introduction to theory and Practice*- Prentice Hall of India Private Limited
5. Ramesh. S. Gaonkar, *Microprocessor Architecture, Programming and applications with the 8085*, 11th reprint 1989, Wiley eastern limited
6. Ramakant A.Gayakwad, Op amps and linear integrated circuits 4th edition, Prentice Hall of India

Book for Reference:

1. Jacob Milman & Arwin Grabel, *Micro Electronics* (5th reprint2001), Tata Mc Graw Hill Book Co, (1999) New Delhi.
2. Kennedy Davis, *Electronics Communication Systems*, Mc Graw Hill Book Co.
3. Thomas C Bartee, *Digital Computer Principles and Applications,* Mc Graw Hill Book Co

NUCLEAR PHYSICS

(For students admitted from June 2008)

Semester: VI Couse code: 081PY6M02 Hours/Week: 4 Credits: 3

UNIT 1: STRUCTURE OF THE NUCLEUS:

Nuclear constituents - Isotopes and isobars - Exact atomic masses - mass defects - binding energies of nuclides - Stable and unstable nuclides - Einstein mass energy relation.

PROPERTIES AND USES OF NATURAL RADIOACTIVITY:

The nature of radioactivity - Alpha rays and Geiger-Nuttal rule - Beta rays and the neutrino - The properties of gamma rays - Radioactivity as a measurable quantity - The age of the earth.

UNIT 2: MEASUREMENT AND DETECTION OF CHARGED PARTICLES

Wilson's cloud chamber - Bubble chamber - Ionization chamber - Proportional counter - Geiger Muller counter - Scintillation counter - Semiconductor counter - Spark chamber - Cerenkov counter - Neutron counting - The photographic plate.

UNIT 3: ACCELERATING MACHINES AS USED IN NUCLEAR PHYSICS

Cockroft Walton proton accelerator - Van De Graaf electrostatic generator - Linear accelerator - Lawrence cyclotron - Synchrocyclotron - Proton cyclotron - Accelerating gradient synchrotron - Intersecting beam accelerators - Electron accelerating machines Betatron - Electron synchrotron.

UNIT 4: NUCLEAR MODELS

Neutron cross-section and nuclear radii - Liquid drop model - Weizacker's semi- empirical mass formula - Shell model - Magic numbers (no theory) - Collective model.

ARTIFICIAL RADIOACTIVITY:

Discovery of positron - K-electron capture - Origin of electron and positron inside the nucleus - Nuclear isomerism - Production of radioisotopes - Some uses of radioisotopes.

NEUTRON PHYSICS:

Properties of neutron - Neutron bombardment reactions – Radio carbon dating.

UNIT 5:

NUCLEAR FISSION AND ITS IMPLICATIONS

Theory of fission - Energy of nuclear fission - Distribution of fission products - Characteristics of fission neutrons - Chain reaction - Controlled fission and nuclear reactors.

THERMO NUCLEAR FUSION AND NUCLEAR FUSION

Thermo nuclear reaction – Source of stellar energy - The plasma - Nuclear fusion reactions in plasma.

UNIT 6:

COSMIC RAYS

Discovery of cosmic rays - Nature and origin of cosmic rays - Geomagnetic effects- cosmic rays at sea level - Extension of cosmic ray shower detection of cosmic ray particles -Van Allen belts.

STABLE AND SEMI ATABLE PARTICLES

Particles and anti particles – Positrons, pions, mouns and kaons – Hyperons – Classification of elementary particles – Mesonic atoms- Muonic atoms.

SHORT LIVED RESONANCE STATES:

Forces and fields – 4 interactions -Conservation laws - Baryon and Lepton conservation - Isospin and hypercharge – Quarks - Forces of nature - Charm – Gluons and colour.

Books for Study:

1. T.A Little Field And Thorley, *Atomic and Nuclear Physics* (3rd Edition), Elbs And Van Nostrand Reinhold Co., Ltd., London
2. F.K. Rithchmyer, E.H. Kennard, John N. Copper, *Introduction to Modern Physics*- Tata Mc Graw Hill Pub Co Ltd., New Delhi.
3. N. Subramanyam and Brijlal, Atomic *and Nuclear Physics*.
4. R. Murugheshan, *Modern Physics* 12th revised edition, S. Chand Co, Ltd,(2002)

Books for Reference:

1. Harvey E. White, *Introduction to Atomic and Nuclear Physics,* Affiliated East - West press pvt Ltd., New Delhi.
2. F.K. Rithchmyer, E.H. Kennard, John N. copper , *Introduction To Modern Physics*- Tata Mc Graw hill pub co Ltd., New Delhi.
3. R. D. Evans, *Atomic Physics*-. Mc Graw hill pub co Ltd., London
4. Samuel Glasstone, *Source Book On Atomic Energy* (3rd ed) - Affiliated East- West press Ltd., New Delhi.
5. Arthur Beiser, *Concepts of Modern Physics* (4th ed) –, Mc Graw hill book co.
6. S. P. Patel , *Nuclear Physics An Introduction*- New age international publications ltd (P) 2000
7. R.P. Feynman, R.B. Leighton and M. Sands, *The Feynman Lectures on Physics* (1989) Narosa Publishing House Addison, Wesley Publishing Company (1969).
8. Robert Resnick and David Halliday – *Physics Part I and II*, Wiley Eastern Private Limited, New Delhi (1969).
9. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, *Hand Book of Chemistry and Physics* 85th edition (2005), The Chemical Rubber Publishing Co, Cleveland(1960).

ELECTRONIC INSTRUMENTATION & MEASUREMENT TECHNIQUES

(For Students admitted from June 2008)

Semester: VI Couse code: 081PY6M03 Hour/Week: 4 Credits: 5

UNIT 1: MEASUREMENT & ERROR

Definitions - Accuracy and precision - Significant figures - Types of errors - Statistical analysis - Probability of errors - limiting errors.

UNIT 2: ELECTROMAGNETIC METERS AND DC & AC INSTRUMENTS

PMMC - Galvanometer sensitivity - DC ammeters, voltmeters - Voltmeter sensitivity - resistance measurement by voltmeter - Ammeter method, series type ohmmeter, shunt type ohmmeter - Calibration of DC instruments.

AC measurements - Rectifier type instruments - Electrodynamic instruments – AC Power measurements - Multimeter.

UNIT 3: DC & AC Bridges

Wheatstone's Bridge - Loop tests - Guarded Wheatstone's Bridge.
AC Bridge theory - Maxwell, Hay, Schering & Wien Bridges - Universal Impedance Bridge.

UNIT 4: OSCILLOSCOPES

Basic Oscilloscope – CRT - Deflection systems - Delay line - CRO probes - Oscilloscope controls - Dual trace oscilloscope - Special oscilloscopes overview - CRO techniques.

UNIT 5:ELECTRONIC INSTRUMENTS

Electronic Multimeter - Digital voltmeter - Basic microprocessor - IEEE 488 GPIB - Optoelectronics - Plasma & TFT displays.

UNIT 6: TRANSDUCERS AND INTERFACING

Selecting a transducer - Strain gauges - Transducers for displacement, temperature & magnetic measurements - Photosensitive devices - Digital data acquisition system - D/A & A/D multiplexing.

Books for study:

1. A. D. Helfrick & W D. Cooper , *Modern electronic Instrumentation and Measurement techniques[All UNITS]* , Prentice-Hall of India(1990) New Delhi
2. David A.Bell, *Electronic Instrumentation and Measurements* 2nd edition [UNITS 2 & 4]:. Prentice-Hall of India (1997) New Delhi.
3. A. K. Sawhney , *Electrical and electronics measurement and instrumentation* 4th edition , Dhanpat roy and sons 2001,New Delhi
4. Doeblin , *Measurement systems* revised International students edition, Mc Graw Hill,(1976)

MATERIALS SCIENCE

(For students admitted from June 2008)

Semester: V Couse code: 081PY6M05 Hours/Week: 6 Credits:5

UNIT 1: INTRODUCTION:

Review of atomic structure - Classification of materials and their properties - Structure property relationship. (Ch.1p.1-7)*

UNIT 2: ELEMENTS OF SOLID STATE SCIENCE

Crystalline and amorphous solids - crystal lattice - Seven crystal systems and fourteen Bravais lattices - Miller indices - X ray crystallography (comparison of electron, neutron and X- ray diffraction – broad outline) - Laue, rotating crystal and powder methods - Structure determination - Defects in solids - Point, line, surface and volume defects. (Introductory ideas). (Ch.3 p.21 – 47; ch.6 full).

UNIT 3: ELECTRONIC STRUCTURE OF SOLIDS:

Types of crystal structure - Ionic, Covalent. Metallic and Molecular structures - Binding energy - Crystal of compounds - AX,AX_2 A_2X_3 types of compound (ch.4 full;ch upto p.97).

UNIT 4: DIELECTRICS AND RELATED PROPERTIES:

Free electron theory of metals - Bands and zones in solids - Classification of solids into insulators, semiconductors and metals - Super conducting materials and super ionic conducting materials (qualitative) - Electric dipoles in constant and alternating fields - Methods - Dielectric strength - Breakdown of dielectric materials - Thermal and discharge breakdown - Chemical deterioration - Ceramic and ferroelectric materials (ch.14 & 17 full).

UNIT 5: MAGNETIC MATERIALS:

Fundamentals of magnetism and related equations - classification into Dia, Para, Ferro, Anti-Ferro and Ferromagnetic materials - Classical theories of dia and paramagnetism - ferromagnetism and related phenomena - Domain theory - Soft and hard magnetic materials - Ferrites and their uses (ch.16 full).

UNIT 6: POLYMERS:

Polymer molecules - Molecular length of polymers - Molecular weight of polymers - Osmotic pressure, viscosity and light scattering methods - Types of polymers - Thermoplastic and thermosetting materials - Polymerization process - Polymer classification on basis of structural shapes of polymer molecules - Thermal transitions in polymers - Conducting Polymers - polymer application (ch.5 p.101 - 109).

Book for Study:

1. V.Raghavan, *Materials Science and Engineering First Course* 5th edition, prentice Hall (India) Ltd., (2004).
2. Manas Chanda, *Science of Engineering Materials Vol.1&2*, LCUE edn. (Low cost university Edition1979).
3. R. S .Khurmi, R.S Sedha , *Materials Science* 2nd Edition , S. Chand & Co. ltd.,(1989).

Book for References:

1. R.P. Feynman, R.B. Leighton and M. Sands, *The Feynman Lectures on Physics* (1989) Narosa Publishing House Addison, Wesley Publishing Company (1969).
2. Robert Resnick and David Halliday – *Physics Part I and II*, Wiley Eastern Private Limited, New Delhi (1969).
3. Charles D. Hodgman, Robert C. Weast and Samuel M. Selby, *Hand Book of Chemistry and Physics* 85th edition (2005), The Chemical Rubber Publishing Co, Cleveland(1960).

BIOPHYSICS

(For students admitted from June 2008)

Semester: V Couse code: 081PY6M04 Hours/Week: 6 Credits:5

UNIT 1: PHYSICAL FORCES IN MAN AND NEUROBIOPHYSICS

Introduction - Mechanical forces - Osmotic force - Electric forces - Bioelectrical potentials – Colloids - Intermolecular forces - Electromagnetic force - Generalized force.

NEUROBIOPHYSICS:

Introduction - The nervous system -The nerve cell - Action potential - Membrane potential due to diffusion - Voltage clamp - The eye visual receptor - Rods and cones-Electrical activity and visual generator potentials.

UNIT 2: WAVES IN MATTER, SOUND AND ULTRASOUND

Introduction - Properties of matter waves – Frequency - Amplitude and intensity – Absorption - Principal mechanisms of absorption of matter waves - Frictional resistance and elastic reactance of bulk tissue - Weber-Fechner law - Body's detector of matter waves (ear only) - Hearing mechanism - Physiological effects of intense matter waves - Sonic and ultra sonic therapy - Ultrasonic velocimetry - applications of ultrasound - Dunn-Fry law - Effect of E.M waves on living organisms (Power lines, Cell phones).

UNIT 3: HEAT AND ENERGY-A REVIEW

Heat transfer - Heat lost by the human body to the ambient air - Radiative heat transfer from the human body - Stefan-Boltzman law - Counter current heat exchange - Applications to vasculature of the human arm - Whale flippers - Active transport system. Maximum amount of work turned out by a human adult - Basal Metabolic Rate (BMR). Human body and heat engine - Expression for peak short-term power output - Application to athletic performance.

UNIT 4: FLUIDS

Flow of frictionless fluids: Bernoulli's equation - Fluid flow in a constricted tube - blood flow through a blood vessel with a partial blockage - Rheological behavior of blood. Flow of viscous fluids: Stream line and turbulent flow - Poiseuille's equation - An analogy between fluid and electric current flow - Fluid friction - Problem of scaling in fluid friction -Dynamics of circulation.

UNIT 5: BIOENERGETICS AND BIOMEDICAL INSTRUMENTATION

First and second law of thermodynamics - Entropy and probability - Helmoltz and Gibb's free energy functions – Gibbs-Helmholtz equation - Chemical potential – Gibbs-Duhem equation - Concept of energy in biological systems - Fundamentals of energy cycle - Activation energy - Living body as a thermodynamic system.

BIOMEDICAL INSTRUMENTATION:

Principle of blood pressure measuring Instrument - basic components of ECG machine - Basic principle of CAT scan - Principles used in biotelemetry system

UNIT6: USES OF ISOTOPES AND RADIATION EFFECTS

Labeling with isotopes - Stable and radioactive isotopes - Minimum detectable Weight - Specific activity - Applications of isotopic tracers - Dynamic state of body constituents - Tracer studies of blood - Applications of radio isotopes in medicine - Radio carbon dating. Radiation units - Biological effects of radiation - Internal radiation hazards – Relative Biological Effectiveness (RBE). Genetic effects of radiation - Radiation shielding.

Books for Study:

1. Herold Metcalf - *Topics in classical biophysics*-.J.1981 Edition. Prentice Hall Inc., New Jersey.
2. R.N.Roy, *A text book of biophysics*-.1996 Edition. New central book agency (p) Ltd.
3. E.J.Casey, *Biophysics* –.Student Edition 1969.Van Nostrand Reinhold Co., Affiliated East west press Pvt. Ltd.
4. Leslie Cromwell, Fred J. Weibull and Erich A. Pfeiffer. , *Biomedical Instrumentation and Measurements* 2nd edition, Prentice Hall of India, 1995.
5. Samuel Glasstone, *Source Book of Atomic Energy, Third* edition, D. Van Nostrand company Inc. London (Chapters 17&19-relevant sections only).
6. Vasantha Pattabhi & N. Gautham, *Biophysics* -.2003 Edition. Narosa Publishing House.
7. Puri and Sharma. , *Principles of physical chemistry*- 18th edition, Vishal publications. Jullundur & Delhi. .

Course title – ALLIED PHYSICS FOR MATHEMATICS - I

Course Code*	231PY1A01			
Credits	**4**			
Hours / Cycle	**4**			
Category	**Allied Theory**			
Semester	**I**			
Year of Implementation	**From the academic year 2023 – 2024 onwards**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
	60	**0**	**0**	**60**
Course Objectives	**By completing this course, the student will be able to** **1. Understand the fundamental concepts of gravitation, elasticity, simple harmonic motion, growth and decay of change in a circuit.** **2. Design various logic gates and verification of DeMorgans theorem**			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO1: To recognize and recall fundamental concepts of gravitation, elasticity, simple harmonic motion, growth and decay of charge in a circuit. ii) To recognize and recall the basic concepts pertaining to logic gates and operational amplifier.	**PSO-1**	**K1**
CO2: To understand and explain the fundamental principles of moment of inertia for various objects, different bending moments, wave behaviour in strings, charge and decay of charge in a circuit and logic gates, operational amplifier.	**PSO-2**	**K2**
CO3: To apply their knowledge gained in solving analytical and numerical problems of gravitation and different bending moments, composition of simple harmonic motions, electromagnetism and electronics circuit.	**PSO-1,2**	**K3**
CO4: To analyse the different bending moments and moment of inertia for various objects, wave behaviours in string, growth and decay of charge in circuits, various gates and operation amplifier.	**PSO-1, 2**	**K4**
CO5: To assess the different bending moments and moment of inertia for various objects, wave behaviours in string, growth and decay of charge in circuits, various gates and operation amplifier.	**PSO-1,2**	**K5**

***To be allotted by Examinations Office after the Approval of Academic Council**

****Minimum 3 Maximum 5.**

SYLLABUS: ALLIED PHYSICS FOR MATHEMATICS – I				
UNIT	**CONTENT**	**Hours**	**COs**	**Bloom's Taxonomy Level**
I	**UNIT 1: MOMENT OF INERTIA AND GRAVITATION** Kinetic energy of rigid rotation – Moment of inertia – Radius of gyration – Kinetic energy of a rolling body on an inclined plane – Expression for MI of ring, disc, solid sphere and hollow sphere.	**12**	**CO-1,2,3**	**K1,K2,K3, K4**

	Kepler's laws – Newton's law of gravitation – Boy's method of determining G – Gravitational field and potential – Escape velocity – Orbital velocity – Period and Height of geostationary satellite.			
II	**UNIT 2: ELASTICITY** Definitions of three modulii of elasticity – Poisson's ratio – Relation between the three modulii - Bending of beams – Bending moment – Theory and Experimental determination of Young's modulus by cantilever, uniform and non-uniform bending – Work done in bending – Twisting couple on a rod – Theory and Experimental determination of Rigidity modulus by Torsion pendulum	**12**	**CO-1,2,3**	**K1, K2, K3, K4**
III	**UNIT 3: SIMPLE HARMONIC MOTION** Simple harmonic motion – Composition of two SHMs along a straight line - Composition of two SHMs at right angles – with time period 1:1 and 1:2 – Lissajous figures – Transverse waves in a stretched string – Melde's string apparatus.	**12**	**CO-1,2,3,4**	**K1,K2,K3, K4**
IV	**UNIT 4: ELECTROMAGNETISM** Moving coil galvanometer – theory – Growth and decay of charge in a CR circuit - Growth and decay of current in an LR circuit – Growth and decay of current in an LCR series circuit - Resistance and Specific resistance of coil using Carey Foster's Bridge Maxwell's equations in free space – EM waves	**12**	**CO-1,2,3,4**	**K1,K2,K3, K4**
V	**UNIT 5: INTEGRATED ELECTRONICS** Logic gates – Boolean algebra – Boolean expression and logic circuits – De Morgan's theorems – Statement and proof – RS and JK Flip-flops. Operational amplifier – Characteristics of an ideal OpAmp – Applications of OPAMP (IC 741) – Inverting and Non-inverting modes – Adder – Subtractor – Scale changer - Differentiator – Integrator – D/A converter	**12**	**CO-1,2,3,4,5**	**K1, K2, K3, K4, K5**

Prescribed Books/Text Books

1. Brij Lal and N. Subramaniam, *Properties of Matter*, S. Chand & Co., New Delhi (2003)
2. Brij Lal & N. Subraminam, *Electricity and Magnetism*, S. Chand & Co., New Delhi (2016)
3. D. Chattopadhyay et al., *Foundations of Electronics* 2nd edition, Wiley Eastern Ltd., New Delhi (1988)

Reference Books

1. D. Roy Choudhury and Shail Jain, *Linear Integrated Circuits*, Second Edition, New Age International, New Delhi (2003)
2. M. Nagaratnam and N. Lakshminarayan, *Electricity and Magnetism,* 3rd revised Edition, The National Pub. Co. (1994)
3. Robert Resnick and David Haliday, *Fundamentals of physics*, 6th edition –John Wiley and sons Inc., New Delhi (2005)

Suggested Reading

1. R. Murugeshan S. Chand & Co., (2005), Allied Physics
2. R Murugeshan, S. Chand & Co., (2013), Electricity and Magnetism

Web Resources

1. https://openstax.org/books/university-physics-volume-1/pages/10-4-moment-of-inertia-and-rotational-kinetic-energy
2. https://physics.info/elasticity/
3. https://openstax.org/books/college-physics-2e/pages/16-3-simple-harmonic-motion-a-special-periodic-motion
4. http://www.stpius.ac.in/crm/assets/download/Practical_paper-2_-_Continued.pdf
5. https://openstax.org/books/college-physics-2e/pages/23-2-faradays-law-of-induction-lenzs-law
6.

https://eng.libretexts.org/Bookshelves/Electrical_Engineering/Introductory_Electrical_Engineering/Electrical_Engineering_(Johnson)/03%3A_Analog_Signal_Processing/3.19%3A_Operational_Amplifiers

Allied Physics for Mathematics – I Course Articulation Matrix														
Course Outcomes	**Programme Outcomes**								**Programme Specific Outcomes**					**Cognitive Level**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO 1	1	3	2	1	2	2	2	1	3	3	2	2	1	K1,K2,K3, K4
CO 2	1	3	2	1	2	2	2	1	3	3	2	2	1	K1,K2,K3, K4
CO 3	1	3	2	1	2	2	2	1	3	3	2	2	1	K1,K2,K3, K4
CO 4	1	3	2	1	2	2	2	1	3	3	2	2	1	K1,K2,K3, K4
CO 5	1	3	2	1	2	2	2	1	3	3	2	2	1	K1,K2,K3, K4, K5
Wt. Avg.	1	3	2	1	2	2	2	1	3	3	2	2	1	
Overall Mapping of the Course														

Course title – ALLIED PHYSICS FOR MATHEMATICS – II

Course Code*	231PY2A01			
Credits	**4**			
Hours / Cycle	**4**			
Category	**Allied Theory**			
Semester	**II**			
Year of Implementation	**From the academic year …2023-2024…… onwards**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
	60	**0**	**0**	**60**
Course Objectives	**By completing this course, the student will be able to** **1. Understand properties of wave optics – interference, diffraction, reflection and refraction.** **2. Ability to understand the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles.** **3. Understand different classical and quantum mechanical distribution functions. Can explain the procedures for deriving the relation between thermodynamic parameters such as pressure, temperature, entropy and heat capacity from the distribution functions.** **4. Understand invariant interval, time dilation, length contraction, relativistic mass, a universal speed limit, mass–energy equivalence and the speed of causality and relativity of simultaneity.**			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO1: To recognize and recall fundamental concepts of interference and polarisation, thermodynamics, statistical mechanics and relativity. ii) To recognize and recall the basic concepts pertaining to propagation and dispersion of light, isothermal and adiabatic process, Carnot's engine, black body radiation and relativity.	**PSO1**	**K1**
CO2: i) To understand and explain the fundamental principles of optical processes such as interference, diffraction and polarization that are produced with slits, gratings and polarizers, respectively ability to understand the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles and equilibrium. (iii) To understand mass-energy equivalence, relativity of simultaneity, length contraction, and a universal speed limit and the conventional notion of absolute universal time is replaced by the notion of a time that is dependent on the reference frame and spatial position.	**PSO2**	**K2**
CO3: To apply their knowledge gained in solving analytical and numerical problems of optical phenomenon under the ambit of diffraction, interference, polarization. Ability to apply Law of Thermodynamics and entropy concepts in analysing the thermal efficiencies of heat engine, statistical mechanics and relativity.	**PSO1,2**	**K3**
CO4: To analyse the positions and intensity distributions of resultant patterns of light emergent from optical instruments and gadgets such as slits, grating, laws of thermodynamics, statistical mechanics and relativity	**PSO1,2**	**K4**
CO5: To asses various optical activities, laws of thermodynamics, statistical mechanics and relativity.	**PSO1,2**	**K5**

***To be allotted by Examinations Office after the Approval of Academic Council**

SYLLABUS: ALLIED PHYSICS FOR MATHEMATICS - II				
UNIT	**CONTENT**	**Hours**	**Cos**	**Bloom's Taxonomy Level**
I	**UNIT 1: WAVE OPTICS** Interference due to reflected light in thin films – Air wedge – Thickness of a thin wire by air wedge – Michelson's Interferometer – Theory & Applications. Fresnel and Fraunhoffer diffractions – Half period zone - Fresnel diffraction due to a circular aperture – Fraunhoffer's diffraction due to a single slit, double slit and N slits – Plane transmission grating	**12**	**CO-1,2,3**	**K1, K2, K3**
II	**UNIT 2: POLARIZATION OF LIGHT** Plane of polarization - Polarization by reflection – Brewster's law – Optic axis – Double refraction – Elliptically and circularly polarized light – Quarter wave plate and half wave plate – Production and detection of plane, circularly and elliptically polarized light – Optical activity – Specific rotatory power – Laurent's half shade polarimeter	**12**	**CO-1,2,3**	**K1, K2, K3**
III	**UNIT 3: THERMAL PHYSICS** Zeroth and First laws of thermodynamics – Isothermal and Adiabatic processes – Theory of Carnot Engine – Work done and Efficiency – Entropy of state – Second law of thermodynamics Coefficient of thermal conductivity – Determination of a bad conductor by Lee's disc method – Practical applications of conduction of heat	**12**	**CO-1,2,3**	**K2, K3, K4**
IV	**UNIT 4: STATISTICAL MECHANICS** Postulates of statistical mechanics – Phase space – Relation between entropy and probability – Maxwell - Boltzmann distribution – Application of MB statistics to ideal gas. Black body radiation – Stefan's law – Wien's displacement law – Rayleigh-Jean's law.Planck's quantum hypothesis – Derivation of Planck's formula for black body radiation	**12**	**CO-2,3,4**	**K2,K3,K4, K5**
V	**UNIT 5: SPECIAL THEORY OF RELATIVITY** Postulates of special theory of relativity – Lorentz transformation equations – Length contraction – Time dilation – Addition of velocities – Variation of mass with velocity – Mass-energy equivalence – Derivation of $E = mc^2$	**12**	**CO-2,3,4, 5**	**K2,K3,K4, K5**

Prescribed Books/Text Books

1. A. K. Ghatak, *Optics*, *4th*Edition, Tata-McGraw Hill, New Delhi (2009)
2. Brij Lal and N. Subramaniam, *Heat and Thermodynamics*, S. Chand & Co., New Delhi (2003)
3. Kamal Singh and S. P. Singh, *Elements of Statistical Mechanics*, 3rd Edition - S. Chand & Co.(1999)

Reference Books

1. F. A. Jenkins & H. E. White, *Optics*, McGraw Hill Int., New York (1950)
2. M. W. Zemansky& R. H. Dittman, *Heat & Thermodynamics*, McGraw Hill Int., New York (1997)
3. Robert Resnick and David Haliday, *Fundamentals of physics*, 6th edition –John Wiley and sons Inc, New Delhi (2005)
4. G. Aruldhas, P. Rajagopal, Modern Physics, PHI Learning Pvt Ltd., 2005

Suggested Reading

1. Agrawal Prakash, PragatiPrakashan, 27th edition (2015), Thermodynamics and Statistical Physics.
2. R. Murugeshan S. Chand &Co,. (2005), Allied Physics.

Web Resources

1. https://openstax.org/books/physics/pages/17-1-understanding-diffraction-and-interference
2. https://openstax.org/books/college-physics-2e/pages/27-8-polarization

3. https://openstax.org/books/college-physics-2e/pages/15-introduction-to-thermodynamics
4. https://openstax.org/books/university-physics-volume-2/pages/2-2-pressure-temperature-and-rms-speed
5. https://openstax.org/books/university-physics-volume-3/pages/6-1-blackbody-radiation
6. https://openstax.org/books/college-physics-2e/pages/28-introduction-to-special-relativity

Allied Physics for Mathematics-II									**Course Articulation Matrix**					
Course Outcomes	**Programme Outcomes**								**Programme Specific Outcomes**					**Cognitive Level**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO 1	**1**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	3	3	2	1	**1**	
CO 2	**1**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	3	3	2	1	**1**	
CO 3	**1**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	3	3	2	1	**1**	
CO 4	**1**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	3	3	2	1	**1**	
CO 5	**1**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	3	3	2	1	**1**	
Wt. Avg.	**1**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	3	3	2	1	**1**	
Overall Mapping of the Course														

Allied Course for II B. Sc. (Chemistry)

PHYSICS FOR CHEMISTRY-I

(For students admitted from June 2007)

Semester –III Couse code: 081PY3A01 Hours/week: 4 Credits: 2

Unit1: Thermodynamics and low temperature physics

Zeroth law, First law and Second law of thermodynamics - Latent heat equation-Effect of pressure on B.P. and M.P. - Internal and external latent heats - Otto and Diesel engine - Expressions for efficiency.

Joule Kelvin effect - Temperature of inversion - Liquefaction of air by Linde's process-Liquefaction of Helium by K Onnes method - Helium I and Helium II - Adibatic demagnetization.

Unit 2: Low pressure physics and Elasticity

Low pressure: Production of Low pressure - Exhaust pumps - Characteristics of exchaust pumps - Air pump - Diffusion pump - Waran's pump - Measurement of low pressure - Mcloed gauge - Pirani gauge.

Elasticity: Definition for three modulii of elasticity – Poisson's ratio – Bending of beams – Expression for bending moment – Experimental determination of Young's modulus by cantilever, uniform and non-uniform bending with necessary theory – Twisting couple on a rod – Expression for couple per unit twist - Experimental determination of Rigidity modulus by Torsion pendulum with theory.

Unit 3: Properties of matter

Viscosity: Coefficient of viscosity-Streamline flow and turbulent flow - Reynold's number-Critical velocity - Poiseuille's equation for flow of liquid through a tube-Experimental determination of viscosity (Variable pressure head).

Surface tension: Explanation of surface tension-Surface energy and Surface tension-Excess pressure inside a drop and bubble-Surface tension by Jaegar's method-Drop weight method-Surfactants.

Compressibility – Definition - Production of ultrasound - Piezo-electric effect -Determination of velocity and compressibility of liquid using ultra sound.

Unit 4: Chemical effect of current & Thermoelectricity

Faraday's laws of electrolysis - Primary cell-Secondary cell - Lead acid accumulator, Nicke l-Iron accumulator - Standard cells - Weston cadmium cell - Gibb's-Helmholtz equation for emf of a reversible cell.

Seebeck effect - Measurement of thermo emf of a thermocouple using potentiometer -Peltier effect -Thomson effect - Expression for Peltier and Thomson Coefficients.

Unit 5: Semiconductor devices

Junction diode-Zener diode-Avalanche and Zener breakdown-Voltage regulation using Zener diode & three terminal IC 7805.

Bipolar transistor: The BJT action-Basic configuration-CE characteristics-Common emitter transistor amplifier (Single stage RC coupled amplifier)-Gain-Frequency response-Bandwidth-Input and output impedances.

Oscillators - Principle and Working of a Colpitt's and Hartley oscillator.

Field effect transistor: Structure and behavior of FET- Characteristics of an N-channel FET.

Unit 6: Integrated Electronics

Operational amplifier – Salient features – Description and characteristics – Pin configuration of IC 741 - Applications of OPAMP IC 741 – Inverting and Non-inverting amplifier – Adder – Subtractor – D\A converter.

555 timer IC – Pin configuration –Astable and Monostable multivibrator circuits using 555.

Books for study:

1. Brijlal and N. Subramaniam, *Heat and Thermodynamics*, S. Chand & Co New Delhi (2003).
2. D. S. Mathur, *Heat and Thermodynamics* (Revised By M.N. Bapat), S. Chand & Sons (1993).
3. D. S Mathur, *Elements of Properties of matter*- Shyamlal Charitable Trust, New Delhi (2001).
4. M. Nagaratnam and N. Lakshminarayan, *Electricity and Magnetism*, 3rd revised edition The National Pub. Co. (1994).
5. D. Chattopadhyay et al., *Foundations of Electronics* 2nd edition, Wiley Eastern Ltd. (1988) New Delhi.
6. Ramakant A. Gayakwad, *Op amps and linear integrated circuits* 4th edition, Prentice Hall of India.
7. D. Roy Choudhury and Shail Jain, *Linear Integrated Circuits*- New Age International (P) Ltd, Publishers.
8. Robert Resnick and David Halliday, *Fundamentals of Physics* 6th edition, John Wiley & sons, Inc.
9. H. C. Verma, Concepts of Physics volume 1&2 Bharathi Bhavan Publishers, New Delhi (Reprint 2006).

Allied Course for II B. Sc. (Chemistry)

PHYSICS FOR CHEMISTRY-II

(For students admitted from June 2007)

Semester –IV Couse code: 081PY4A01 Hours/week: 4 Credits: 2

Unit 1: Atomic Physics & X-Rays

Vector atom model – Coupling schemes – Pauli's exclusion principle – Zeeman effect – Paschen back effect (Quantitative treatment) - Bohr correspondence principle.

Lymann series-X- rays – Continuous and characteristics X-ray spectra – Moseley's law – Hard and soft X-rays-Applications.

Unit 2: Quantum Physics

Dual nature of matter waves – De Broglie concept of matter wave-Group velocity and phase velocity –Wave function-Continuity conditions-Schrodinger equation – time dependent equation, time independent equation - Particle in a box.

Unit 3: Spectroscopy

Optical activity- Laurent's half shade polarimeter - Dipole moment - Vibration of diatomic molecules-IR Spectra. Polarizability - Raman effect-Classical theory of Raman effect. Magnetic moment of proton-Principles of NMR-Application-MRI. Rotation of molecules - Principles of microwave spectra-Rotation of H_2O molecule - Application-Microwave Oven.

Unit 4: Maser and Laser

Description and working of the Ammonia Maser – Laser-Spontaneous and stimulated emission-Einstein's coefficients- Population inversion-Methods of pumping– Ruby laser – semiconductor laser-Helium-Neon laser – Applications (Quantitative study only)

Unit 5: Nuclear Physics

Lawrence cyclotron-Betatron.

Structure of Nucleus – Liquid drop model – shell model – Magic numbers - Evidence of shell model.

Mass-energy equivalence-Derivation of $E=mc^2$. Nuclear Fission-Chain reaction-Fission reactor-Energy release per fission-Energy equivalent in KWH-Breeder reactor -Thermonuclear fusion-Stellar energy- Carbon cycle-Proton cycle. C^{14} dating-Radioactive dating.

Unit 6: Transducers and Display Devices

Classification of transducers – Strain gauge- Gauge factor – Displacement Transducer – Capacitive, Potentiometric and Piezo electric transducer – Thermistor - Characteristics of thermistor-Temperature measurement with the thermistor in a bridge circuit – Photosensitive devices-Photodiode, Phototransistor, Photovoltaic cell and LDR – Optoelectonics –Optocoupler, LCD, Plasma & TFT displays.

Books for study:

1. Arthur Beiser, *Concepts of Modern Physics* (6^{th} Ed), Mc Graw Hill Book Co (2005).
2. T.A Little Field And Thorley, *Atomic And Nuclear Physics* (3^{rd} Edition), Elbs and Van Nostrand Reinhold Co., Ltd., London.
3. R. Murugeshan, *Modern Physics*, S. Chand & Co, New Delhi.
4. A. K.Saxena, *Principle of Modern Physics*, Narosa Publishing House Pvt Ltd. New Delhi (2005).
5. S. P. Singh, M. K. Bagde , *Quantum Mechanics*, S. Chand & Co (2000), New Delhi.

6. Colin N. Banwell and Elaine M. Mccash, *Fundamentals of Molecular Spectroscopy*, 4th edition. Tata McGraw-Hill Publishing Company Ltd.
7. A. D. Helfrick & W D. Cooper, *Modern electronic Instrumentation and Measurement techniques*, Prentice-Hall of India (1990) New Delhi.
8. Robert Resnick and David Halliday – *Fundamentals of Physics* 6^{th} edition, John *Wiley* & sons, Inc.

(Elective Course for I year students of other departments)

Course title: General Course – PHYSICS OF EVERYDAY LIFE

Course Code*	231PY1G01			
Credits	**2**			
Hours / Cycle	**4**			
Category	**Part IV General Course - Theory**			
Semester	**I**			
Year of Implementation	**From the academic year 2023 - '24 onwards**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
	55	**5**	**-**	**60**
Course Objectives	By completing this course, the student will be able to **a.** Understand fundamental principles, construction and working of home appliances, automobile engines, energy harvesting instruments. **b.** Understand instruments used in medicine for diagnosing disease and remedy optical defects. **c.** Understand fluid dynamics in sports and spin of a ball in flight. **d.** Understand modern technologies such as satellites, GPS and mobile phones.			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO1 : To recall and revise the basic principles behind appliances and automobile engines, renewable energy sources, medical diagnosis and in space science.		K1
CO2 : To understand the physics of harvesting energy sources from various conventional and nonconventional energy sources, Bernoulli' principle.		K2
CO3 : To apply the principles learnt in this course to study the working of appliances, vehicles, human diagnostic devices, gyroscope and inertial guidance system.		K3
CO4 : To analyse concepts that determine the dynamics of sports articles such as balls in flight, various energy sources both conventional and non-conventional sources and AM, FM transmission and reception.		K4
CO5: To evaluate principles learnt in the course using numerical problems and experimental techniques.		K5

*** To be allotted by Examinations Office after the Approval of Academic Council**

****Minimum 3 Maximum 5.**

SYLLABUS: PHYSICS OF EVERYDAY LIFE				
UNIT	**CONTENT**	**Hours**	**Cos**	**Bloom's Taxonomy Level**
I	**Physics of home appliances and vehicles:** Principle and working of: pressure cooker – Refrigerator, air-conditioner, Microwave oven, LED lamps, washing machine, petrol engine, diesel engine and electric vehicles (hybrid).	13	CO 1-5	K1 to K5
II	**Physics of Energy sources** Overview of conventional and non-conventional energy sources, Nuclear energy – fission and fusion, solar, wind energy, and tidal energy.	10	CO 1-5	K1 to K5

III	**Physics in Human Body and Diagnosis** The eye as an optical instrument, Vision defects and their correction. Microscope, telescope, and camera. Sound waves and hearing, sound intensity, and decibel scale. Ultrasonics, X-rays, CAT scan and MRI scan for medical diagnosis.	13	CO 1-5	K1 to K5
IV	**Physics in Sports** Bicycle dynamics and stability. Continuity and Bernoulli equations - qualitative, turbulence: motion of a spinning balls in flight: cricket, tennis, and football – Magnus effect.	10	CO 1-5	K1 to K5
V	**Physics in Space Science and Communications:** Physics of Gyroscopes and inertial guidance systems, Global positioning systems (GPS), Geostationary orbits. Indian Satellites. Electromagnetic spectrum – radio waves – **Resonance** – Working of radio – AM and FM transmission and reception – Mobile phone technologies: 2G, 3G, 4G and 5G.	14	CO 1-5	K1 to K5

Prescribed Books/Text Books

1. Nelkon and Parker, *Advanced Level Physics*, 7th edition, CBS Publishers.
2. D. Halliday, R. Resnick, and J. Walker, *Fundamentals of Physics*, 10th edition. John Wiley & Sons
3. Handouts by the Course teachers.

Reference Books

1. Jearl Walker, *Flying Circus of Physics*, Wiley; Second edition (2011)

Suggested Reading

1. Randall Munroe, Thing Explainer: Complicated Stuff in Simple Words, John Murray (2016).
2. Yash Pal and Rahul Pal, Random Curiosity – Vols 1 and 2, National Book Trust, India; First edition (2011)
3. Satish Dhawan, How birds fly, , National Book Trust, India; First edition (2000)
4. Hindu Speaks on Scientific facts. Vols 1, 2 and 3.

Web Resources

1. Explainstuff.com
2. Brittanica.com
3. Howstuffworks.com

GC-Physics of Everyday Life Course Articulation Matrix

Course Outcomes	Programme Outcomes								Programme Specific Outcomes					Cognitive Level
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	PSO5	
CO 1	-	-	3	-	2	-	1	1						K1
CO 2	-	-	3	-	2	-	1	1						K2
CO 3	-	-	3	-	2	-	1	1						K3
CO 4	-	-	3	-	2	-	1	1						K4
CO 5	-	-	3	-	2	-	1	1						K5
Wt. Avg.	-	-	3	-	2	-	1	1						

	1.75						
Overall Mapping of the Course						**1.75**	

Course title: General Course – EXPLORING THE UNIVERSE

Course Code*	231PY2G01			
Credits	**2**			
Hours / Cycle	**4**			
Category	**Part IV General Course - Theory**			
Semester	**II**			
Year of Implementation	**From the academic year 2023 - '24 onwards**			
Course Structure	**Theory**	**Tutorial**	**Practical**	**Total Hours**
	60	**0**	**0**	**60**
Course Objectives	To give a basic overview of Astronomy			

Course Outcome(s)**	**PSO Addressed**	**Bloom's Taxonomy Levels (K1 to K6)**
CO-1: Find and name various astronomical objects.		K1
CO-2: Classify astronomical objects based on their properties and relate them.		K2
CO-3: Apply simple laws of Physics to understand astronomical events such as eclipses, birth and death of stars.		K3

*** To be allotted by Examinations Office after the Approval of Academic Council**

****Minimum 3 Maximum 5.**

SYLLABUS: GENERAL COURSE – EXPLORING THE UNIVERSE				
UNIT	**CONTENT**	**Hours**	**Cos**	**Bloom's Taxonomy Level**
I	INTRODUCTION Electromagnetic spectrum and astronomical sources – Units of distances: AU, light year, parsec - Optical telescopes – Reflecting and refracting types – Radio telescope - GMRT – India's space program – Chandrayaan and Mangalyaan.	13	CO 1-5	K1, K2, K3
II	SOLAR SYSTEM Planets – Phases of the moon –Moon's surface – Lunar eclipse – Lunar tides – Origin of the moon. Asteroids – Meteoroids – Meteors – Comets – Orbits of comets – Spectrum of comets – Formation of comet's tail	10	CO 1-5	K1, K2, K3
III	SUN Temperature of sun – Photosphere – Sunspots – Sun's rotation – Chromosphere – Corona - Solar eclipse – Solar flares – Auroras.	13	CO 1-5	K1, K2, K3
IV	STARS Binary and multiple stars –Stellar evolution – Birth and death of a star – Red giant - white dwarf – Neutron star – pulsar – black hole - Interstellar medium – Exoplanets – Possibility of Life outside the earth.	10	CO 1-5	K1 to K5
V	GALAXIES & UNIVERSE Distances of galaxies - Shapes and Structural features of galaxies – Evidence for dark matter – Quasars. Observable universe – Expansion of the universe – CMBR – dark energy – Big bang model.	14	CO 1-5	K1 to K5

Prescribed Books/Text Books

1. Kaufmanns, Universe 3rd edition W. H. Freeman and com

Reference Books

1. Fredrick and Baker, Astronomy 10th edition, D. Van Nostrand Company (1976). 3. Robert Chapman, Discovering Astronomy, W. H. Freeman and company.

Suggested Reading

Handouts by the Course Teacher

Web Resources

1. https://hubblesite.org
2. https://space.com

GC-Physics of Everyday Life Course Articulation Matrix														
Course Outcomes	**Programme Outcomes**								**Programme Specific Outcomes**					**Cognitive Level**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO 1	-	3	3	-	3	-	-	-						K1
CO 2	-	3	3	-	3	-	-	-						K2
CO 3	-	3	3	-	3	-	-	-						K3
CO 4														
CO 5														
Wt. Avg.	-	3	3	-	3	-	-	-						
								3						
Overall Mapping of the Course													**3**	

Elective Course for II year students of all departments
INTERDISCIPLINARY COURSE - ASTROPHYSICS
(For students admitted from June 2008)

Semester – III Couse code: 081PY3I01 Hours/Week: 4 Credits: 3

UNIT 1: OBSERVATIONAL METHODS

Electromagnetic spectrum and astronomical sources – Emission and absorption spectra – Doppler Effect – Units of distances – Parsec - Distance measurements in astronomy – Parallax method of measuring of stellar distances – Apparent, Absolute, Bolometric magnitudes – Luminosity – Solar system-Telescopes for optical astronomy – Reflecting and refracting types - Introduction to UV & X-Ray Astronomy.

UNIT 2: MOON & BETWEEN THE PLANETS

The moon's orbit relative to the earth – Phases of the moon – Sidereal and synodic month – The character of moon's surface – Lunar eclipse – Lunar tides – Origin of the moon

Asteroids – Meteoroids – Meteors – Comets – Orbits of comets – Spectrum of comets – Formation of comet's tail

UNIT 3: THE SUN

Structure of sun – Solar constant – Temperature of sun – Photosphere – Sunspots – Sun's rotation – Chromosphere – Solar eclipse – Solar flares – Associated ionospheric disturbances.

UNIT 4: STARS

Spectral classification of stars – H-R diagram – Binary and multiple stars –Visual, astrometric and eclipsing binaries – Galactic and Globular clusters –Stellar evolution – Birth and death of a star –Red giant - white dwarf – Neutron star – novae - pulsar - Interstellar medium.

UNIT 5: RADIO ASTRONOMY

Introduction – Beginning of radio astronomy – Extent & Range of radio astronomy– Radio emission in our galaxy – Discrete sources – Surface brightness and flux density - brightness and temperature (definitions) – Components of Radio telescopes – Determination of structure of radio source – Interferometry and Aperture synthesis – Radio astronomy in India – GMRT.

UNIT6: GALAXIES AND COSMOLOGY

The Milky Way – Shapes of galaxies - Distances of galaxies - Structural features of galaxies – Evidence for dark matter – Quasars.

Large scale structure of the observable universe – Cosmological principle – Expansion of the universe – CMBR – dark energy – Steady state model – Big bang model.

Books for Study and Reference:

1. Fredrick and Baker, *Astronomy* 10th edition, D. Van Nostrand Company (1976).
2. Robert Chapman, *Discovering Astronomy*, W. H. Freeman and company.
3. K. S. Krishnaswamy, *Astrophysics* 1st edition, New Age International Limited.
4. Kaufmanns, *Universe* 3rd edition W. H. Freeman and company.

Elective Course for III year students of all departments

GENERAL ELECTIVE - ENERGY PHYSICS
(Students admitted from June 2008)

Semester - V Couse code: 081PY5L01 Hours/Week: 4 Credits: 3

UNIT 1: ENERGY FUNDAMENTALS

Energy sources (sun, gravitational, geothermal, nuclear, chemical energies) brief explanation - Energy units and interconversions - Efficiency of devices.
Introduction - Renewable and conventional energy systems - Comparison.

UNIT 2: CONVENTIONAL ENERGY SOURCES

World's reserve of commercial energy sources and their availability - Coal, Oil, Natural gas - Statistical details – Applications - merits and demerits.
Hydro power - Small hydro installations - Measurement of head and flow rate - Various methods - Working of a Pelton wheel impulse turbine.

NON-CONVENTIONAL ENERGY SOURCES:

UNIT 3: SOLAR ENERGY:

Nature of solar radiation - Components - Solar heaters - Crop driers - Space cooling -Solar ponds - Solar cookers - Water desalination - Photovoltaic generation - Solar panel –watt - Hour calculations for solar PV installation – Regulators – Inverters - Solar batteries -merits and demerits of solar energy.

UNIT 4: BIOMASS ENERGY AND GEOTHERMAL ENERGY:

Biomass energy - Biomass conversion process – Gobar gas plants – Photosynthesis-Biofuel classification - Biofuel production process - Advantages and disadvantages of energy farming. Geothermal energy - Wet steam systems - Dry steam systems - Dry rock and hot aquifer analysis.

UNIT5: WIND AND SEA ENERGY SOURCES:

Wind Energy - Turbine types – Solidity - Horizontal axis machines - Vertical axis machines – Concentrators - Energy extraction - Betz model of expanding air stream -interference factor Power coefficient - Thrust on the turbines. Wave energy - Properties of deep water waves - Relationship between frequency and wavelength of deep water surface waves - Period of wave motion and phase velocity - Tidal Wave energy - Lunar induced tide - Period of lunar tides - Solar induced tides. OTEC - Basic principle - Rankine cycle of OTEC system.

UNIT6: NUCLEAR ENERGY AND ENERGY STORAGE:

Nuclear Energy - Fission and Fusion - Energy release calculations - Evolution of Indian reactors - Nuclear power reactors - Construction and principle of working - Nuclear energy in industry, Medicine, and Agriculture.

Types of storage - Chemical storage – Hydrogen - Heat storage - Electrical storage - Lead acid battery - Mechanical storage-Flywheel - Hydrogen as a fuel (basics).

Books for Study and Reference:

1. John. W. Twidell, Anthony. D. Weir, *Renewable Energy Resources* (1987) English language book society/E.& F. N. Spon.
2. S. P. Sukhatme, *Solar Energy*, 1990.Tata McGraw Hill Publishing Co. Ltd.
3. R. Murugeshan, *Modern Physics*. 8th edition, S. Chand and Company (2004).
4. Suresh Garg, Feroz Ahmed, L. S. Kothari, *Physics of Nuclear Reactors* (1996). Tata McGraw Hill publishing company limited. New Delhi.
5. Fonash, *Solar cell devices.*
6. RVER'S guide to solar battery charging: 12V DC-12V AC Inverter –NOEL KIRKBY and BARBARA KIRKBY.
7. G.D. Rao, *Non Conventional energy sources.*