SRI SARADA COLLEGE FOR WOMEN

(AUTONOMOUS),

Reaccredited with 'A' Grade by N321AAC

Affiliated to Periyar University

Fairlands, SALEM- 636 016

DEPARTMENT OF PHYSICS

B.Sc. Physics Syllabus

(2020 – 2021)

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM –16
DEPARTMENT OF PHYSICS
B.Sc. PHYSICS COURSE STRUCTURE UNDER CBCS
(*Applicable to the candidates for the academic year 2020-2021)*

I SEMESTER					
Part	**Course**	**Course Title**	**Code**	**Hrs/ week**	**Credit**
I	Tamil/ Hindi/ Sanskrit	Tamil/ Hindi/ Sanskrit Paper – I	20ULTC1/ 20ULHC1/ 20ULSC1	6	3
II	English	English Paper – I	20ULEC1	6	3
III	Core Course – I	Properties of Matter and Sound	20UPHC1	4	4
III	Core Course – II	Mechanics	20UPHC2	4	3
III	Core Course (Practical)	Core Practical – I		2	*
III	Allied Course – I	Allied Chemistry– I	20UPHAC1	3	3
III	Allied Course – I (Practical)	Allied Chemistry Practical		2	*
IV	Skill Based – I	Electrical Circuits and Network Skills	20UPHSC1	2	2
V	Extension Activity	Project based on Extension Activity	20UEXAC	1	1
V	• *Articulation and Idea Fixation skills – 6 Hours per semester (out of college hours)* • *Life Skills Promotion – 2 Hours per semester (out of college hours) – 1 credit extra* • *Physical Fitness Practice – 35 Hours per semester (out of college hours) – 1 credit extra*				
			Total	**30**	**19 +2#**
II SEMESTER					
I	Tamil/ Hindi/ Sanskrit	Tamil/ Hindi/ Sanskrit Paper – II	20ULTC2/ 20ULHC2/ 20ULSC2	6	3
II	English	English Paper – II	20ULEC2	6	3
III	Core Course – III	Thermal Physics	20UPHC3	4	4
III	Core Course – IV	Atomic Physics	20UPHC4	3	3
III	Core Course (Practical)	Core Practical – I	20UPHQC1	2	2
III	Allied Course – I	Allied Chemistry – II	20UPHAC2	3	3
III	Allied Course – I (Practical)	Allied Chemistry Practical	20UPHAQC	2	2
IV	Skill Based – II	Basic Instrumentation Skills	20UPHSC2	2	2
IV	EVS	Project based on Environmental Studies	20UEVSC/ 20UEVSPC	2	2
V	• *Articulation and Idea Fixation skills – 6 Hours per semester (out of college hours) – 1 credit extra* • *Life Skills Promotion – 2 Hours per semester (out of college hours) – 1 credit extra* • *Physical Fitness Practice – 35 Hours per semester (out of college hours) – 1 credit extra* • *Certificate Course – 30 Hours per semester (out of college hours) – 1 credit extra*				
	Total			**30**	**24 +4#**

III SEMESTER					
I	Tamil/ Hindi/ Sanskrit	Tamil/ Hindi/ Sanskrit Paper – III	19ULTC3/ 19ULHC3/ 19ULSC3	6	3
II	English	English Paper – III	19ULEC3	6	3
III	Core Course – V	Optics	19UPHC5	3	3
III	Core Course – VI	Medical Physics	19UPHC6	3	3
III	Core Course (Practical)	Core Practical – II		3	*
III	Allied Course – II	Allied Mathematics – I	19PHAC3	5	5
IV	Skill Based – III	Physics Workshop Skills	19UPHSC3	2	2
IV	Non Major Elective – I		19UPHNEC1	2	2
V	• *Articulation and Idea Fixation skills – 6 Hours per semester (out of college hours)* • *Life Skills Promotion – 2 Hours per semester (out of college hours) – 1 credit extra* • *Physical Fitness Practice – 35 Hours per semester (out of college hours) – 1 credit extra*				
	Total			**30**	**21 + 2#**
IV SEMESTER					
I	Tamil/ Hindi/ Sanskrit	Tamil/ Hindi/ Sanskrit Paper – IV	19ULTC4/ 19ULHC4/ 19ULSC4	6	3
II	English	English Paper – IV	19ULEC4	6	3
III	Core Course – VII	Spectroscopy and Laser Physics	19UPHC7	3	3
III	Elective – I	Physics of Nanomaterials	19UPHEC1	3	3
III	Core Course (Practical)	Core Practical – II	19UPHQC2	3	3
III	Allied Course – II	Allied Mathematics – II	19PHAC4	5	5
IV	Skill Based – IV	Renewable Energy Resources	19UPHSC4	2	2
IV	Non Major Elective – II	Astrophysics	19UPHNEC2	2	2
V	• *Articulation and Idea Fixation skills – 6 Hours per semester (out of college hours) – 1 credit extra* • *Life Skills Promotion – 2 Hours per semester (out of college hours) – 1 credit extra* • *Physical Fitness Practice – 35 Hours per semester (out of college hours) – 1 credit extra*				
	Total			**30**	**24 + 3#**

V SEMESTER					
III	Core Course – VIII	Electricity and Magnetism	18UPHC7	6	5
III	Core Course – IX	Electronics	18UPHC8	5	5
III	Core Course – X	Numerical Methods	18UPHC9	5	5
III	Elective – II		18UPHEC2	5	5
III	Core Course (Practical)	Core Practical – III		3	*
III	Core Course (Practical)	Core Practical – IV		3	*
IV	Non Major Skill based – I		18UPHNSC1	2	2
IV	Value Education	Value Education		1	-
V	• *Life Skills Promotion – 2 Hours per semester (out of college hours)* • *Physical Fitness Practice – 35 Hours per semester (out of college hours) – 1 credit extra* • *Certificate Course – 30 Hours per Semester (out of college hours) – 1 credit extra*				
	Total			**30**	**22 + 2#**
VI SEMESTER					
III	Core Course – XI	Solid State Physics	18UPHC10	6	5
III	Core Course – XII	Wave Mechanics and Nuclear Physics	18UPHC11	5	5
III	Core Course – XIII	Mathematical Physics	18UPHC12	5	5
III	Elective – III		18UPHEC3	5	5
III	Core Course (Practical)	Core Practical – III	18UPHQC3	3	3
III	Core Course (Practical)	Core Practical – IV	18UPHQC4	3	3
IV	Non Major Skill based – II		18UPHNSC2	2	2
IV	Value Education	Value Education	18UVENC	1	2
V	• *Life Skills Promotion – 2 Hours per semester (out of college hours) – 1 credit extra* • *Physical Fitness Practice – 35 Hours per semester (out of college hours) – 1 credit extra*				
	Total			**30**	**30 + 2#**
	Grand Total				**140 + 15#**

* ***Examination at the end of the year***

\# ***Extra Credits***

- ***Free and Open Source Software (FOSS)-2 hours per semester (out of college hours)***

ELECTIVE PAPERS FOR B.Sc. PHYSICS

Semester –IV

Elective – I

1. Physics of Nanomaterials * – 19UPHEC1
2. Geo Physics – 19UPHSEC1

Semester – V

Elective – II

1. C Programming and C++* – 18UPHEC2
2. Fundamentals of Microprocessor – 18UPHSEC2

Semester – VI

Elective – III

1. Digital Electronics and communication* – 18UPHEC3
2. Environmental Physics – 18UPHSEC3

NON MAJOR ELECTIVE / NON MAJORSKILL BASED PAPERS
(For students other than B.Sc. Physics)

1. Non Major Elective:

Semester – III: Non- Major elective I: Energy Resources – 19UPHNEC1

Semester – IV: Non- Major elective II: Astrophysics – 19UPHNEC2

2. Non Major Skill Based:

Semester – V: Non- Major Skill based I: Introductory Bio Physics – 18UPHNSC1

Semester–VI: Non-Major Skill based II: Physics in Everyday Life– 18UPHNSC2

ALLIED PAPERS OFFERED
(For I B.Sc. Mathematics/Chemistry/II B.Sc. Home Science)

Semester – I: Allied Physics – I – 20UMAAC1/ 20UCHAC1/19UHSAC1

Semester – II: Allied Physics – II – 20UMAAC2/ 20UCHAC2/19UHSAC2

Allied Physics Practical – 20UMAAQC/ 20UCHAQC/ 19UHSAQC

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM-16
PROGRAMME: B.Sc. PHYSICS
PROGRAM EDUCATIONAL OBJECTIVES

At the end of the program, the students will be able to

PEO1	Pursue higher career paths in teaching /industry.
PEO2	Demonstrate deep conceptual understanding of their chosen discipline.
PEO3	Approach challenges with curiosity, critical thinking and creativity.
PEO4	Understand and value different cultures and perspectives.
PEO5	Display a strong sense of personal and professional identity.
PEO6	Commit to professional ethics and responsibilities.

PROGRAMME OUTCOMES

At the end of the program, the students will be able

PO1	To understand the basic concepts and analyse them for prediction of physical systems.
PO2	To derive several conclusions for the science problems related to public health, safety and environmental issues using the knowledge of physics.
PO3	To apply critical and reasoning skills with ethical principles to solve physics related problems with precision and accuracy.
PO4	To equip the students to communicate effectively on interdisciplinary concepts and describe the natural phenomena individually and in teams.
PO5	To prepare the students to create and apply appropriate techniques and modern tools.

PROGRAMME SPECIFIC OUTCOMES

At the end of the program, the students will be able to

PSO1	Acquire knowledge on the concepts of fundamental physics in their respective fields.
PSO2	Identify, formulate and solve problems in Physics.
PSO3	Perform procedures as per the laboratory standards in the relevant areas of light, heat, electronics, electricity and properties of matter.
PSO4	Able to apply theoretical/experimental knowledge, including the use of numerical/ mathematical methods effectively.

Programme: B.Sc.Physics				
Semester: I	**Code: 20UPHC1**	**Core Course - I PROPERTIES OF MATTER AND SOUND**	**Credit: 4**	**Hours: 4/Week**

Course Objective:

This paper helps the students to understand the basic properties of solids, liquids and gases and also the concepts of sound.

SYLLABUS

Unit	Content	Hrs
I	**ELASTICITY** Definition of three moduli of elasticity and Poisson's ratio – relations connecting them – Theoretical limits to the value of σ - Torsional couple per unit twist in a wire – Work done in stretching and twisting a wire – Period of Torsional Oscillations – Rigidity modulus and moment of inertia by torsional oscillation with and without masses – Internal bending moment – Expression for the depression at the loaded end of a cantilever – Uniform and non-uniform bending (pin and microscope method with theory) – q by Koenig's method – non-uniform bending – I form girders.	**12**
II	**SURFACE TENSION** Surface tension and surface energy - The effect of gravity and surface tension on the formation of drops – Excess of pressure inside a curved surface – application to cylindrical and spherical drops and bubbles – Variation of Surface Tension with Temperature by Jaeger's Method - Theory of capillarity – Determination of surface tension by capillary rise method with theory – Definition of angle of contact – Surface tension and angle of contact by Quincke's method -Interfacial tension and surface tension by drop weight.	**12**
III	**VISCOSITY** Coefficient of Viscosity – Stream lined and turbulent motion – Critical velocity – Derivation of Poisseulle's formula – correction for pressure head and length of the tube – Comparison of viscosities by Ostwald's Viscometer – Searle's viscometer – Meyer's formula for the viscosity of gases – Rankine's method of determination of viscosity of a gas.	**12**
IV	**SOUND** **Theory of Vibration** Theory of free, damped and forced vibration – Principle of resonance – Sharpness of resonance – Differential equation for a progressive wave – Expression for velocity of longitudinal wave in a fluid – Newton's – Laplace formula – effect of pressure, temperature and humidity on velocity of sound. Velocity of transverse wave in a stretched string – Laws of transverse vibrations in strings – Measurement of frequency by Melde's string - (Longitudinal and Transverse mode).	**12**

V	**ACOUSTICS** Acoustics of buildings – Reverberation – Sabine's formula – derivation – Determination of absorption coefficient – Sound distribution in an auditorium. **ULTRASONICS** Production (Magnetostriction and Electrostriction generator) – Detection – Acoustic grating – Properties of Ultrasonics – Application of Ultrasonics (In Communication, Industry, Scientific and Medical).	**12**

Books for Study:

1. Properties of matter by R. Murugeshan, S.Chand&Co (2012).
2. Sound by R. Murugeshan, S.Chand&Co (2005).

Books for References:

1. Properties of matter by Brijlal and N.Subrahmanyam, S.Chand&Co(2005).
2. Sound by Brijlal and N.Subrahmanyam, S.Chand& Co.(2005).
3. Elements of properties of matter by D.S.Mathur, S.Chand& Co.(2005).
4. David Halliday and Robert Resnick, Fundamentals of physics,Wiley Plus,(2013).
5. H.R.Gulati, Fundamentals of General Properties of Matter, S.Chand&Co.Pvt.Ltd,(2012).
6. Hugh D.Young and Roger A.Freedman,Sears&Zemansky's University Physics with Modern Physics, 14th Edition (2015).

Web Resources

1. www.cpalms.org>public>preview
2. http://www.teacher created.com>lessons
3. www.discoveryeducation.com>teachers

Course Outcomes: At the end of the course the student will be able:

CO Number	CO Statement	Knowledge Level
CO1	To understand the physical properties of different states of matter and to understand the elastic properties of solids.	K_2
CO2	To study the concepts of surface tension and the various methods to determine the parameters experimentally.	K_5
CO3	To study the basic concepts of viscosity and the various methods to determine the parameters experimentally.	K_5
CO4	To analyse the characteristics of sound and requisites of good acoustics.	K_4
CO5	To understand and apply the ultrasonics to find the depth of the sea.	K_2, K_3

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	M	M	S	S	S	M	M	S
CO 2	S	S	S	S	S	S	S	M	S
CO 3	S	S	S	S	S	S	M	S	S
CO 4	S	S	M	S	S	S	M	M	S
CO 5	S	S	M	S	S	M	M	M	S

Programme : B.Sc. Physics				
Semester I	**Code: 20UPHC2**	**Core Course - II MECHANICS**	**Credit: 3**	**Hours: 4/Week**

Course Objective:

The aim of the course is to describe the basic laws concerning the motion of bodies under forces and to apply these laws to a range of problems including collisions, Dynamics of rigid body, Centre of Pressure, hydrostatics and hydrodynamics.

SYLLABUS

Unit	Content	Hrs
I	**LAWS OF MOTION** Newton's laws of motion – Force- Impulse of a force - law of conservation of linear momentum –Collision – Elastic and inelastic collision – (Fundamental laws of impact) – Newton's law of impact – coefficient of restitution 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.	**12**
II	**CENTRAL FORCE MOTION** Angular velocity, angular momentum and K.E of rotation – Torque and angular acceleration – Relation between them – Expression for a acceleration of a body rolling down an inclined body without slipping -center of mass –velocity and acceleration of centre of mass – determination of motion of individual particle– system of variable mass-Rocket motion.	**12**
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 – Compound pendulum – theory – equivalent simple pendulum – reversibility of centers of oscillation and suspension – determination of g and k.	**12**
IV	**GRAVITATION** Newton's law of gravitation – Kepler's law of gravitation – G by Boy's method – Mass and density of earth – Acceleration due to gravity – Variation of g with altitude, depth and rotation of earth - Value of g at poles and equator- Escape velocity Gravitational field – Gravitational potential – Gravitational potential due to spherical shell – Gravitational potential due to a solid sphere (inside and outside).	**12**
V	**HYDROSTATICS AND HYDRODYNAMICS** Thrust on plane surface - center of pressure- rectangle- Triangular lamina with its vertex on the surface and with one side on the surface – Floating bodies – Laws of floatation – Metacentre – stability of floating bodies – Metacentric height of a ship – Variation of atmospheric pressure with altitude - application of Bernoulli's theorem: Toricelli's theorem –Pitot tube.	**12**

Books for Study

1. Mechanics by D.C.Tayal, Himalaya Publishing House, First Edition,(2013)
2. Properties of Matter by R.Murugeshan and S.Chand, (2014)
3. Dynamics by M.Narayanamurti and N. Nagarathnam, NatioanlPublishing company (2008).
4. Mechanics by D.S.Mathur, S.Chand& Co. (2001)

Books for Reference

1. Mechanics and Relativity by BrijlalSubramaniam, S.Chand Publications (2010).
2. Fundamentals of Physics by Halliday,Resnic and Walker,Wiley India Pvt Ltd (2008).
3. Mechanics and Mathematical Physics by R.MurugesanS.Chand& Co. (2008).

Web Resources

1. https://bookboon.com/en/physics-ebooks
2. https://houseofphy.blogspot.in/ B.Sc. Physics Mechanis Notes(HRK) By Muhammad Ali Malik

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Apply Newton's laws to direct and oblique impacts and to provide an ability to solve any problem on this topic.	K_3,K_4
CO2	Impart knowledge on circular and rotational motion and apply them to study the motion individual particle and rocket motion.	K_4
CO3	Explore the fundamental concepts of moment of inertia and use it to calculate moment of inertia of simple objects of different shapes.	K_2,K_4
CO4	Impart the knowledge about universal force (Newton's law of gravitation) acting between all matters and use it to calculate gravitational potential and field.	K_3
CO5	Gain knowledge in the field of hydrostatics and hydrodynamics and its application in day to day life.	K_5,k_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	S	M	S
CO 2	S	S	S	S	S	S	S	M	S
CO 3	S	S	S	M	S	S	S	L	S
CO 4	S	S	S	S	S	S	M	S	S
CO 5	S	S	S	S	S	S	S	S	S

Programme: B.Sc Physics				
Semester I & II	**Code: 20UPHQC1**	**CORE PRACTICAL –I**	**Credit:2**	**Hours: 2/Week**

Course Objective:

The aim of the course is to gain practical knowledge by applying the experimental methods to correlate with the Physics theory and to learn the usage of electrical and optical systems for various measurements and enable the students to explore the concepts involved in the thermodynamics, sound, properties of matter, heat and to understand the fundamentals of instruments involved.

SYLLABUS

Students are expected to perform at least 15 experiments out of following list.

S.No.	Content	Hrs
1.	Young's modulus – Non uniform Bending – Optic lever and Telescope.	60
2.	Compound Pendulum-Determination of G	
3.	Static Torsion - Determination of Rigidity modulus using Scale and Telescope.	
4.	Coefficient of viscosity of a liquid Capillary flow - Radius by mercury pellet –graduated burette method.	
5.	Surface tension and interfacial surface tension - Drop weight method.	
6.	Specific heat capacity of solid by the method of mixtures – Half time correction.	
7.	Thermal conductivity of a bad conductor - Lee's disc	
8.	Sonometer - Frequency of Tuning fork	
9.	Sonometer - AC frequency (Steel and Brass wire)	
10.	Potentiometer – Calibration of Voltmeter (low range)	
11.	Potentiometer – Calibration of ammeter .	
12.	Focal length of long focus convex lens –U-V method, Conjugate foci method and combination method.	
13.	Spectrometer – Refractive index - Solid prism.	
14.	Mirror Galvanometer – Current and Voltage sensitiveness.	
15.	Basic Logic gates – AND and OR using diodes and NOT using transistor.	
16.	Study of AND, OR and NOT gates using IC.	
17.	Characteristics of Zener diode.	

Books for Study:

1. Practical Physics and Electronics - C.C.Ouseph, U.J.Rao, V.Vijeyendran, SV Printers and Publishers Pvt. Ltd., 2007.
2. Practical Physics, Prof.A.Ponnusamy and B.Amalanathan, Bright Publishers, 1996.

Books for Reference:

1. A text book of Practical Physics – M.N.Srinivasan and others, Sultan Chand and Sons, 2014.
2. Practical Physics, Physics Department, St. Joseph's College, 1981.

Web Resource:

1. http://www.git.edu

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Develop the ability to design and connect simple electronic circuits and to collect and analyse the data using these circuits. To develop skills in using electronic instruments like multimeter and oscilloscopes.	K_3
CO2	Analyse the data to determine the desired physical quantity design and conduct experiments and interpret the experimental results and identify, formulate and solve physical problems.	K_2,K_4
CO3	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.	K_3
CO4	Analyze the physical principle involved in the various instruments; also relate the principle to new application**.**	K_2,K_3
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of science.	K_5,K_2

K_6-*Create*; k_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	M	S
CO 3	S	M	S	S	S	S	S	S	S
CO 4	S	S	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S

Programme : B.Sc. Maths / Chemistry / II B.Sc.,Home Science				
Semester I/III	**Code: 20UMAAC1/20UCHAC1/19UHSAC1**	**ALLIED PHYSICS – I**	**Credit: 3**	**Hours: 3/Week**

Course Objective:

To acquire knowledge about properties of matter, mechanics, electricity and magnetism and heat.

SYLLABUS

Unit	Content
I	**ELASTICITY** Young's modulus- Rigidity modulus – Bulk Modulus – Poisson's ratio (definition alone) – Bending of beams – Expression for bending moment – Determination of Young's modulus – Uniform and Non-uniform bending – Torsional oscillations of a body – Rigidity modulus of a wire.
II	**VISCOSITY AND SURFACE TENSION** Viscosity – Viscous force – Co-efficient of viscosity – units and dimension – Poiseuilles formula for co-efficient of viscosity of liquid – determination of co-efficient of viscosity using burette and Oswald's viscometer. **Surface Tension:** Definition - Units and dimension – Molecular theory- Surface tension of a liquid by drop weight method.
III	**CONDUCTION, CONVECTION AND RADIATION** Specific heat capacity of solids and liquids – Newton's law of cooling Specific heat capacity of liquid by cooling – Thermal conduction – Co- efficient of thermal conductivity of a bad conductor by Lee's dics method. Lapse rate – Greenhouse effect – Blackbody radiation – Planck's radiation law – Rayleigh Jean's law, Wien's displacement law – Stefan's law of radiation (No derivations).
IV	**OPTICS** Interference – conditions for interference maxima and minima – Air wedge – thickness of thin wire – Newton's rings – determination of wavelength using Newton's Rings. Diffraction – Difference between diffraction and interference – theory of transmission grating - Normal incidence.
V	**SOUND** Laws of stretched strings – Sonometer - Determination of frequency of a tuning fork – Determination of frequency of alternating current – Ultrasonics– Properties -Piezo-electric effect –Production of ultrasonics wave - Piezo-electric oscillator - applications.

Books for Study

1. Ancillary Physics, A. Ponnusamy and others, Einstein publications, (1998).
2. A text book of optics N. Subrahmanyambrijlal, S.Chand.
3. Allied Physics, R.Murughesan, S.Chand& Co., (2005).
4. A Textbook of Allied Physics, Dr.Sabesan and et al, (2002).

Books for Reference

1. Engineering Physics, Palanisamy P. K. SCITECH Publications (2011).
2. Sound, M. Narayanamurti, N. Gosakan and T. Rajagopalan, The National PublishingCo, Madras, First Edition, (1978).
3. Ancillary Physics, Kamalakannan and others, S. Viswanathan, (2000).
4. A.S.Vasudeva, Modern Engineering Physics, S. Chand and Company Ltd., (1988).
5. Allied Physics, G. Ravichandran, Padmapriya Publications, (2007).
6. A textbook of Practical Physics, M.N.Srinivasan et.al, Sultan Chand & sons, (2006).
7. General Physics and Properties of Matter, S. Krishnaswamy. The National Publishing & Co (1981).

Web Resources

1. https://physics.info/elasticity/
2. https://en.wikipedia.org/wiki/Thermal_conductivity
3. https://sciencedemonstrations.fas.harvard.edu/presentations/sonometer

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	To understand the Young's modulus, Rigidity modulus and Bulk Modulus. Distinguish rigid materials by measuring moduli of elasticity.	K_2,K_4
CO2	To learn the units and dimension of Viscosity and Surface tension of a liquid. Determine the co-efficient of viscosity using burette and Oswald's viscometer	K_4, K_5
CO3	To Understand specific heat capacity of solids and liquids, and the different laws on radiation.	K_2, K_4, K_5
CO4	To analyze the wavelength using Newton's Rings, and difference between diffraction and interference and to understand the properties and applications of light like reflection, refraction, diffraction and interference.	K_2,K_4
CO5	To learn the fundamentals of Sonometer and Piezo-electric oscillator and to determine the frequency of a tuning fork and to Analyse production, detection of Ultrasonic waves and applications.	K_2, K_4

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Programme : B.Sc. Physics				
Semester I & II	**Code: 20UMAAQC/ 20UCHAQC/ 19UHSAQC**	**ALLIED PHYSICS PRACTICAL**	**Credit:2**	**Hours: 2/Week**

Course Objective:

The aim of the course is to develop practical skills in mechanical, electrical, heat and optics experiments.

SYLLABUS
Any Fourteen Experiments

S.No.	Content	Hrs
1.	Young's modulus – Non-Uniform Bending – Scale and Telescope.	**60**
2.	Surface tension and interfacial surface tension - Drop weight method.	
3.	Rigidity modulus of a wire - Torsion Pendulum.	
4.	Sonometer – Frequency of tuning fork.	
5.	Potentiometer – Low range voltmeter (0-3V).	
6.	Study of logic gates - AND, OR, NOT using IC.	
7.	Zener diode characteristics.	
8.	Thermal conductivity of a bad conductor by Lee's disc method.	
9.	Specific heat capacity of liquid – method of mixtures – half time correction.	
10.	Air Wedge – Thickness of wire.	
11.	Potentiometer – Ammeter calibration.	
12.	Sonometer – Determination of AC frequency.	
13.	Figure of merit of a periodic galvanometer.	
14.	Spectrometer – Refractive index of Solid Prism (A , D and μ).	
15.	Newton's Rings – Radius of curvature of a convex lens.	
16.	Rigidity modulus of a rod – Static Torsion.	
17	Focal length of convex lens.	
18.	Field along the axis of a coil – Determination of H and B_H .	
19.	Junction diode characteristics.	

Books for Study

1. Practical Physics and Electronics - C.C.Ouseph, U.J.Rao, V.Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007).
2. Practical Physics, Prof.A.Ponnusamy and B.Amalanathan, Bright Publishers, (1996).

Books for Reference

1. A text book of Practical Physics – M.N.Srinivasan and others, Sultan Chand and Sons, (2014).

Web Resources

1. *www.practicalphysics.org/*

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Develop skills in using instruments like travelling microscope, vernier caliper, screw gauge and multimeters.	K_3, K_5
CO2	Apply the theory of heat, light, electricity and sound to laboratory experiments to arrive solutions to physical problems.	K_2
CO3	Understand and apply the theory of semiconductors to design and analyze electronic circuits.	K_3, K_5
CO4	Understand the working principle of potentiometer, spectrometer and sonometer instruments.	K_3, K_4
CO5	Acquire enhanced practical skills in digital measurements.	K_2

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Programme : B.Sc. Physics				
Semester I	**Code: 20UPHSC1**	**Skill Based Course – I ELECTRICAL CIRCUITS AND NETWORK SKILLS**	**Credit: 2**	**Hours: 2/ Week**

Course Objective:

The aim of the course is to enable the students to design and trouble shoots the electrical circuits for practical applications.

SYLLABUS

Unit	Content	Hrs
I	**BASIC ELECTRICITY PRINCIPLES** Fundamentals of Electricity - Current, Volt, Resistance - Ohm's Law - Power - Kilowatt Hour -Capacitance -Inductance -Electrical Charge - Electrical Energy-Electric Potential-Familiarizing Ammeter, Voltmeter and Multimeter- Grouping of Capacitors: Capacitor in Series –Capacitor in Parallel- Capacitor in Series Parallel Combinations.	6
II	**D.C CIRCUITS** Resistance: Series Circuit, Parallel Circuit and Series-Parallel Circuits- Colour Codes- Kirchoff's Law - Application of Wheatstone's Network.	6
III	**AC CIRCUITS** AC Fundamentals- Generation of Alternate emf- Important Terminology- AC Circuit Containing: Resistance, Inductance and Capacitance-Generation of Three Phase Voltage: Star Connection- Delta Connection.	6
IV	**NETWORK THEOREMS** Introduction-Linear And Non-Linear Networks- Network Theorems- Superposition Theorem- Reciprocity Theorem -Thevenin's Theorem- Norton's Theorem.	6
V	**DOMESTIC WIRING** Introduction -Wiring Materials And Accessories -Earthing And Its Necessity-Over Loading –Short Circuiting –Fuses- Circuit Breaker.	6

Books for Study

1. Electric Circuit Analysis- Prof.T.NageswaraRao, A.R.PUBLICATIONS, (2006)
2. Basic Electrical, Electronics and Communication Engineering – S.ChenthurPandian (2000)
3. Electricity And Magnetism – R. Murugeshan,S.chand& company ltd.(2001)
4. Basic Electrical and Electronics Engineering, Dr.N.Premkumar, Anuradha Publications Chennai (2012).

Books for Reference

1. Electricity & Magnetism –Brijlal&Subramaniyam,RatanPrakashanMandir, Educational & University Publishers, New Delhi, (1987).

Web Resources

1. https://swayam.gov.in/nd1_noc19_ee36/preview

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Recall the basic concepts of electricity.	K_1, K_2,K_3
CO2	Apply the concepts of electricity to solve problems.	K_3
CO3	Understand and apply the basic concepts of a.c circuits.	K_1, K_2
CO4	Acquire knowledge about network analysis and network theorems.	K_2
CO5	Apply the principles of domestic wiring and earthing.	K_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	M	S	S	S	S	M
CO 2	S	S	S	S	S	S	S	S	L
CO 3	S	S	M	S	S	S	M	S	S
CO 4	S	M	S	S	M	S	M	M	L
CO 5	S	S	M	S	S	S	M	S	S

Programme : B.Sc. Physics				
Semester II	**Code: 20UPHC3**	**Core Course - III THERMAL PHYSICS**	**Credit: 4**	**Hours: 4/Week**

Course Objective:

The aim of the course is to study the basics of thermodynamics, statistical mechanics, and kinetic theory and to provide a general introduction to each of the core heat-related subjects.

SYLLABUS

Unit	Content	Hrs
I	**THERMOMETRY AND CALORIMETRY** Variation of resistance with temperature – Measurement of temperature by Platinum resistance thermometer with theory advantages – Thermistor. Newton's law of cooling – Determination of specific heat of a liquid by cooling – cooling correction – Half time correction – Barton's correction – Definition and determination of C_p and C_v - Regnault's method and Joly's differential steam calorimeter.	**12**
II	**LOW TEMPERATURE PHYSICS** Latent heat of fusion of ice and steam – effect of pressure on melting point– Regelation – Super heating and super cooling – Ice line, steam line and Hoarfrost line – Triple point of water. Porous plug experiment - Joule Kelvin effect – theory and experiment – J.K.effect below, at and above Boyle temperature – Temperature of inversion in terms of Vander Waal's constants – Liquefaction of air – Linde's process.	**12**
III	**CONDUCTION AND RADIATION** Thermal conductivity – definition –conductivity of a good conductor by Forbe's method - conductivity of bad conductor by Lee's disc method. Stefan's law – Experimental verification of Stefan's law – Experimental determination of Stefan's constant – Deduction of Newton's law from Stefan's law – Distribution of energy in the spectrum of a black body - Wien's displacement law - Rayleigh – Jean's law and Planck's law – Planck's radiation law derivation – Average energy of Planck's Oscillator.	**12**
IV	**THERMODYNAMICS** Entropy – concept of entropy – Entropy of a perfect gas - change in entropy during reversible and irreversible process – T.S. diagram for Carnot engine- Carnot theorem – Calculation of entropy change in different phases – Law of increase of entropy - Maxwell's thermodynamic relations.	**12**
V	**STATISTICAL MECHANICS** Phase space – micro and macro states - Definition of probability – Classical statistics – Maxwell's Boltzmann statistics – Difficulty of classical statistics – Quantum statistics – Bose - Einstein statistics – Expression for energy distribution – Fermi – Dirac statistics – Expression for energy distribution (Qualitative study only).	**12**

Books for Study

1. Heat and Thermodynamics and Statistical Physics by Brijlal and Subramaniam S.Chand & Co., 2018.
2. Heat by M. Narayanmurthy and M.Nagarathinam, National Publishing Co.,Chennai (1987).

Books for Reference

1. Heat by D.S. Mathur, S.Chand& Co. (1978)
2. Text Book of Heat and Thermodynamics by J.B. Rajam and C.L. Arora, S.Chand& Co (2003)
3. Text Book of Heat and Thermodynamics by, Singhal, S.Chand& Co (2003)

Web Resources

1. www.physbot.co.uk/thermal-physics.html

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Recognize the difference between Heat and Temperature.	K_1, K_4
CO2	Understand the principles of thermodynamics and heat transfer.	K_2,
CO3	Acquire knowledge on low temperature Physics.	K_3
CO4	Understand the concept of entropy and calorimetry	K_2
CO5	Realize the conceptual understanding of the facts through implications of quantum statistics	K_4,k_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	S	M	L	S	S
CO 2	S	S	S	S	M	S	M	L	S
CO 3	M	M	S	S	L	S	M	S	S
CO 4	S	M	S	L	S	S	S	M	M
CO 5	S	S	M	M	M	S	S	S	S

Programme : B.Sc. Physics				
Semester II	**Code: 20UPHC4**	**Core Course – IV ATOMIC PHYSICS**	**Credit:3**	**Hours: 3/Week**

Course Objective:

The aim of the course is to provide the basic ideas about the structure of atoms, historical development of atomic theories, evolution of atomic spectra and origin of X-rays.

SYLLABUS

Unit	Content	Hrs
I	**POSITIVE RAY ANALYSIS** Positive ray analysis – Properties - e/m of positive rays - Thomson‟s parabola method –Dempster‟s mass spectrographs – Uses of mass spectrograph - Mass defect Packing fraction – Polarization of X- rays - Excitation and ionization potentials - Determination of critical potential – Franck and Hertz‟s experiment.	9
II	**PHOTOELECTRIC EFFECT** Photoelectric effect – Lenard‟s method to determine e/m for photo electrons - Richardson and Compton experiment – Relation between photoelectric current and retarding potential – Relation between velocity of photo electronics and frequency of light – Failure of electromagnetic theory –Photo electric cells - Photo emission cell – Photo voltaic cell – Photo conductive cell – Applications**.**	9
III	**X-RAY CRYSTALLOGRAPHY** X-Rays – Coolidge tubes – Properties- X-ray spectra – Continuous and Characteristics – X-ray Spectrum – Mosley‟s law (Statement , Explanation and Importance) – Compton effect – Expression for change of wavelength – X-ray Diffraction – Quantum Theory – The distribution of energy in the Spectrum of a Black Body – It‟s results – Planck‟s hypothesis – Derivation of Planck‟s law of radiation.	9
IV	**VECTOR ATOM MODEL** Vector atom model – Various quantum numbers - LS and JJ couplings - Pauli‟s exclusion principle – Magnetic dipole moment of an electron due to orbital and spin motion – Bohr magnetron - Stern- Gerlach experiment – Optical spectra - Spectral terms and notations - Selection rule – Intensity rule – Interval rule - Fine structure of sodium D lines – Hyperfine structure.	9
V	**INFLUENCE OF ELECTRIC AND MAGNETIC FIELDS** Zeeman effect – Experiment- Lamour’s theorem – Debye‟s Quantum mechanical explanation of normal Zeeman effect – Anamolous Zeeman effect – Theoretical explanation - Lande‟s g factor and explanation of splitting up of D_1 and D_2 lines of sodium – Paschen Back effect – Stark effect – Experimental study.	9

Books for Study

1. Modern Physics – R.Murugesan, S.Chand and Co, (2005).

Books for Reference

1. Atomic Physics – J.B. Rajam., S.Chand and Co, (2005).
2. Advance Atomic Physics - P.K. Das, Campus books international, (2009).

Web Resources

1. https://www.britannica.com/science/atomic-physics
2. https://www2.physics.ox.ac.uk/.../atomic_physics_lecture_notes_c_port_pdf_20824.p...

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Discuss the location and role of each of the subatomic particles: the proton, neutron and electron.	K_2
CO2	Impart knowledge about photoelectric effect and its application in day to day life.	K_2,K_3
CO3	Understand and distinguish between continuous and characteristics X-ray spectra and its applications.	K_2, K_4
CO4	Recognize the periodic table from the viewpoint of the electronic structure and understand the quantum numbers and their physical significance.	K_4, K_2
CO5	Describe the origin of fine, hyperfine structure in atomic spectra and analyse atomic effect such as space quantization and Zeeman Effect.	K_2,K_4

K_6-Create; k_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	M	M	S	S	S	M	M	S
CO 2	S	S	M	S	S	S	M	S	S
CO 3	S	S	S	S	S	S	M	S	S
CO 4	S	M	S	S	S	S	M	M	S
CO 5	S	M	S	S	S	S	M	M	S

Programme : B.Sc. Maths / Chemistry / Home Science				
Semester II/IV	**Code:20UMAAC2 / 20UCHAC2/ 19UHSAC2**	**ALLIED PHYSICS – II**	**Credit: 3**	**Hours: 3/Week**

Objective:
To provide knowledge on optics, nuclear physics, electronics, fibre optics and lasers.

SYLLABUS

Unit	Content	Hrs
I	**ELECTRICITY** Electricity - Ohms law – Law of resistance in series and parallel – Specific resistance –Capacitors - capacitors in series and parallel – Carey -Faster's bridge – measurement of specific resistance - Potentiometer – Principle – Calibration of voltmeter.	**9**
II	**ATOMIC AND NUCLEAR PHYSICS** **Atomic Physics:** Vector Atom model – Spatial Quantization – Spinning Electron - Quantum numbers associated with Vector atom model - Pauli's exclusion principle – X-rays – production properties. **Nuclear Physics**: Nucleus – Nuclear Properties – Mass defect – Binding energy – Radio isotopes – Uses of Radio isotopes – Nuclear fusion and Fission**.**	**9**
III	**ANALOG ELECTRONICS** Semiconductor – PN Junction diode – Zener diode – Regulator power supply – Transistor – working of transistor – CE Configuration – current gain relationship between α and β – Transistor characteristics.	**9**
IV	**DIGITAL ELECTRONICS** Number system – Decimal – Binary – Octal and Hexadecimal System – Binary addition, Subtraction and multiplication – Conversion of one number system to another number system. Basic logic gates – OR, AND, NOT, NOR and NAND gates- Symbols, Logic equations and truth tables – De Morgan's theorems and its verification.	**9**
V	**LASER PHYSICS** Einstein's co-efficient - Spontaneous and stimulated emission - Population inversion - Optical pumping - Condition for Laser action – He-Ne Laser – Ruby Laser - Applications of lasers.	**9**

Books for Study

1. Basic Electrical, Electronics and Communication Engineering by S.ChenthurPandian 2000.
2. Allied physics by R.Murugesan, S.Chand& Company 2008.
3. Modern physics by R.MurugesanS.Chand& Company 2007.
4. Allied Physics paper II, Dr. K. Thangaraj, Dr. D. Jayaraman ,(2004).
5. Allied Physics, Part 2, Kamalakannan and others, S. Viswanathan, (2000).
6. Applied Physics, R. Murughesan, Anuradha Pub., (2008).

Books for Reference

1. Allied Physics, R.Murughesan, S.Chand& Co., 2005.
2. A Textbook of Allied Physics, Dr.Sabesan and et al, - VoI - I and Vol - II, 1998.
3. Ancillary Physics, Kamalakannan and others, S. Viswanathan, 2000.
4. Engineering Physics, M. Arumugam, Anuradha Agencies, Publishers, 2010.
5. A.S.Vasudeva, Modern Engineering Physics, S.Chand and Company Ltd., 1988.
6. Allied Physics, G.Ravichandran, Padmapriya Publications, 2007.
7. Ancillary Physics, A. Ponnusamy and others, Einstein publications, 1998.
8. Engineering Physics, Palanisamy P.K. SCITECH Publications, 2011.
9. V.K. Mehta, Principles of Electronics, S.Chand and Company Ltd., 2009.

Web Resources

1.https://www.schand publishing.com/books/.../physics/allied-physics.

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge of fundamental concept of electrical quantities, working principle of potentiometer and its calibration.	K_3, K_1
CO2	Express the basic concepts about the electronic and nuclear structure of atoms and apply it to solve problems related it. Gain knowledge on radio isotopes, nuclear fission and fusion and its uses in modern scientific development.	K_2, K_1 K_2
CO3	Acquire basic knowledge and working of semiconductors devices	K_3
CO4	Gain knowledge about types of number systems, and their conversions. understand the symbols, Truth tables of logic gates and Boolean equations.	, K_6, K_4
CO5	Having a scientific background about the nature of Laser light and different types of laser Sources and its applications	K_2, K_3, K_6

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	PO						PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	M	S	S	S	S
CO 2	S	S	S	M	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	S	M	S	S	S	S	S	S
CO 5	S	S	S	S	M	M	S	S	M	S

Programme : B.Sc. Physics				
Semester II	**Code: 20UPHSC2**	**Skill Based – II BASIC INSTRUMENTATION SKILLS**	**Credit:2**	**Hours: 2/Week**

Course Objective:
The aim of the course is to get exposure with various aspects of instruments and their usage through hands-on mode.

SYLLABUS

Unit	Content	Hrs
I	**BASICS OF MEASUREMENT** Instruments accuracy- precision-sensitivity- resolution range- Errors in measurements- loading effects- Multimeter-Principles of measurement of dc voltage -dc current-ac voltage-ac current –resistance-multimeter-specifications-significance.	6
II	**ELECTRONIC VOLTMETER** Advantage over conventional multimeter – voltage Measurement–sensitivity-Principles of voltage measurement (block diagram only)-Specifications of an electronic Voltmeter/Multimeter –significance- AC millivoltmeter-Block diagram-specifications.	6
III	**CATHODE RAY OSCILLOSCOPE** Block diagram of basic CRO-Construction of CRT-Electron gun-electrostatic focusing- acceleration (no mathematical treatment), brief discussion on screen phosphor-chemical composition-Time base operation-synchronization-Specifications of a CRO - significance.	6
IV	**SIGNAL GENERATORS** Block diagram-explanation- specifications of low frequency signal generators-pulse generator- function generator- Brief idea for testing-specifications - wave analysis.	6
V	**DIGITAL INSTRUMENTS** Digital meters-Principle-working- Characteristics - digital voltmeter-digital multimeter-Block diagram - Working principle.	6

Books for Study

1. A text book in Electrical Technology - B L Theraja (2005) - S Chand and Co.
2. Electronic Instrumentation-HS Kalsi,(2012)-Tata McGraw Hill
3. Electrical and electronic measurements and instrumentationengineering-Dr.NilkandaDatta (2009)-Books and allied (P) LTD.

Books for Reference

1. Electronics measurements and Instrumentation, S.Ramachandran, Khanna publishers (2002).
2. Digital instrumentation, A.J. Bowens, TMH (1977).
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.

4. Electrical and electronics measurement and instrumentation, A.K.Sawhney, Dhanpat& sons (2000).
5. Logic circuit design, Shimon P. Vingron, 2012, Springer.
6. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
7. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012,

Web Resources

1. web.mst.edu/~cottrell/ME240/Resources/basic_inst/Basic_Instrumentation.pdf.
2. http://www.kelm.ftn.uns.ac.rs/literatura/si/pdf.
3. https://www.accessengineeringlibrary.com/browse/electronic-instrument-handbook-third-edition.
4. *web.iitd.ac.in/~janas/courses/ell301.html.*

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand and apply the basic of measurements to electronic instruments.	K_3
CO2	Acquire knowledge on the specifications and working principle of electronic voltmeter.	K_2
CO3	Understand and apply the principle of operation of cathode ray oscilloscope for measuring frequency and time.	K_3
CO4	Develop skills in using signal generators to analyze different waveforms.	K_4
CO5	Acquire enhanced practical skills in digital measurements.	K_3

K_6–*Create*; K_5–*Evaluate*; K_4–*Analyse*; K_3–*Apply*; K_2–*Understand*; K_1–*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	M	M	S	M	S	M
CO 2	S	S	M	M	M	S	M	S	M
CO 3	S	S	S	S	S	S	S	S	M
CO 4	S	S	S	M	S	S	S	S	S
CO 5	S	S	S	M	S	S	M	S	S

Programme : B.Sc. Physics				
Semester II	**Code: 19UEVSC/19UEVSPC**	**ENVIRONMENTAL STUDIES**	**Credit:2**	**Hours: 2/Week**

Course Objective:

- To educate the students regarding the environmental issues and problems.
- To give an exposure towards the scientific and socio – economic dimensions of the environment.
- To impart and enhance the basic knowledge about environment and develop concern towards it.
- To develop the ability to evaluate the measures for the improvement and protection of environment.
- To sensitize the students on the various environmental issues.
- To integrate different disciplines and fields that intersect with environmental concerns
- To make the younger generations aware of the values of natural resources.

Course Outcomes

- Demonstrate critical thinking skills in relation to environmental issues.
- Develop an integrative approach to environmental issues with a focus on sustainability.
- Bring an awareness, knowledge and appreciation of intrinsic values of ecological processes and communities.
- Reflect critically about their roles and identities as citizens, consumers and an environmentalist in the complex, interconnected world.
- Apply systems, concepts and methodologies to analyse and understand interactions between social and environmental processes.
- Understand the transactional character of environmental problems and ways of addressing them, including interactions across local to global scales.

SYLLABUS

Unit	Content	Hrs
I	**FUNDAMENTALS** Environmental -Definition, scopes, structure and Function of Ecosystems- Producers,Consumers and Decomposers- Energy Flow in the Ecosystem- Ecological Succession-Food Chain, Food Webs and Ecological Pyramids- Concepts of Sustainable Development.	
II	**NATURAL RESOURCES** Renewable Resources – Air ,Water, Soil, Land and Wildlife resources;Non-Renewable Resources- Minerals, Coal, Oil and Natural Gas; Environmental problems related to the Extraction and use of Natural Resources.	
III	**BIODIVERSITY** Biodiversity – Definition – Values – Consumption use, Productive social, Ethical, Aesthetic and Option Values Threats to Biodiversity- Hotspots of Biodiversity – Conservation of Biodiversity : *in – situ, Ex-situ.* Bio- Wealth National and Global Level.	

IV	**ENVIRONMENTAL POLLUTION** Definition- Cauuses, Effects and Mitigation Measures- Air , Waste and Soil Pollution, Noise Pollution , thermal Pollutiohn, Nuclear Hazards, Solid Wastes, Acid Rain, Climate Change and Global Warning, Environmental Laws and Regulations in India- Earth Summit.	
V	**POLLUTION AND ENVIRONMENT** Population Explosion- Environment and Human Health – HIV/AIDS – Women and Child Welfare – Resettlement and rehabilitation of people, Role of Information Technology in Environmental Health- Envirnmental Awareness. Envirnmental Disaster Management- Fire Safety and Prevention. **FIELD WORK** • Visit to an area to document environmental assets: river / forest / flora/ fauna, ect. • Visit to a local polluted site- Urban/Rural/Industrial / Agricultural • Study of common plants, insects, birds and basic principles of identification. • Study of simple ecosystems- ponds, river, Delhi Ridge, etc. (Equal to 5 lectures)	

BOOKS FOR REFERENCES

1. Carson , R.2002. Silent Spring , Houghton Mifflin Harcourt.
2. Gadgil,M., & Guha, R. 1993.This Fissured Land : An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.)1999. Global Ethics and Envirnment, London, Routledge.
4. Gleick, P.H.1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security Stockolm Env. Institute , Oxford Univ. Press.
5. Groom , Martha J., Gary K.Meffe, and carl Ronald Carroll. Principles of Conservation Biology. Sunderland : Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P. 1996. Rivers no more: the einvironmental effects on dams (pp. 29-64). Zed Books.
8. McNeill,John R.2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum. H.T. & Andrews, J.1971. Fundamendals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba,C.P. & Brusseau, M.L.2011.Environmental and pollution science. Academic Press.

11. Rao, M.N. & Datta, A.K. 1987. Waste Water Treatment. Oxford and IBH Publishing Co.Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R 2012. Environment. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in india.Tripathi 1992.
14. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology : Voices from the Tropics John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A National History of the Indian Suncontinent.
18. Warrren, C. E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Willson, E. O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on Environment and Development. 1987. Our Common Future. Oxford Univertstiy Press.

Programme : B.Sc. Physics				
Semester III	**Code: 19UPHC5**	**Core Course - V OPTICS**	**Credit: 3**	**Hours: 3/Week**

Course Objective:
The aim of the course is to give the basic ideas and principles of optics, geometrical and physical optics, learn the mathematical techniques employed in physical optics and use these principles and techniques to solve problems in optics.

SYLLABUS

Unit	Content	Hrs
I	**GEOMETRICAL OPTICS** Lens– Power of thin lens – Spherical aberration in lenses – Methods of minimizing spherical aberration - Coma – Astigmatism – chromatic aberration in lenses – condition for achromatism of two thin lenses (in contact) Velocity of light – Houston Piezo electric grating method-importance of measuring velocity of light.	**18**
II	**DISPERSION AND DEVIATION** Dispersion – Deviation produced by a thin lens – Dispersive power – Dispersion without deviation and deviation without dispersion – Direct vision spectroscope – Constant deviation spectroscope-comparative study of Huygens's and Ramsden's eyepieces.	**18**
III	**INTERFERENCE** Conditions for interference –coherence- Fresnel Biprism- Theory of interference fringes – determination thickness of thin transparent sheet- interference due to reflected light (thin films) - colours of thin films –determination of diameter of a thin wire by Air wedge – test for optical flatness –Michelson's Interferometer – theory and its Application (Measurement of wavelength) – Jamin's interferometers – determination of refractive index of gases.	**18**
IV	**DIFFRACTION** Fresnel's diffraction –Rectilinear propagation of light – zone plate –action of zone plate - Plane diffraction grating – theory of plane transmission grating - experiment to determine wavelength(Normal incidence method) –Resolving power– Rayleigh's criterion for resolution – resolving power of a prism - resolving power of grating.	**18**
V	**POLARISATION** Double refraction –Nicol Prism – Nicol Prism as polarizer and analyzer – Huygens's explanation of double refraction in uniaxial crystals– Plane, elliptically and circularly polarized light– Quarter wave plates and Half wave plates – Production and detection of plane, circularly and elliptically polarized light- Optical activity– Specific rotatory power –Laurent's half shade polarimeter.	**18**

Books for Study

1. A Text Book of Optics - N.Subrahmanyam&Brijlal, S.Chand& Company Ltd, Reprint (2002).

Books for Reference

1. Optics - R. Murugesan, S.Chand&Company Ltd, (2010).
2. Optics: Principles and Applications - Kailash K. Sharma, AcadamicPress , (2006).
3. Optics and Spectroscopy - R. Murugeshan, KiruthigaSivaprasath, (2005).
4. A text book of Optics - Brijlal, N. Subrahmanyam, S.Chand& Company, Ramnagar, New Delhi, (2005).
5. Fundamentals of Optics - Ashok Kumar, Dr. Khanna, Dr.Gulati R. Chand and Co., (2011).
6. Applied Optics - Devaraj Singh, Laxmi Publications Pct Ltd., (2010).

Web Resources

1. www.ais.ku.edu.tr
2. www.adelaide.edu.au

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the fundamental properties of light and inspire interest for the knowledge of concepts in physical & geometrical physics.	K_4, K_2
CO2	Implement the knowledge of minimizing aberrations various optical instruments and its application in real life.	K_2, K_4, K_5
CO3	Understand and apply the various concepts of interference by theoretical/experimental level and apply it in to solve any problems	K_3, K_5, K_6
CO4	Distinguish between Fresnel and Fraunhoffer diffraction, gain knowledge on diffraction, and understand the theory of plane transmission grating and its resolving power.	K_2, K_3
CO5	Gain knowledge on production and detection of circularly and elliptically polarized light, construction of half wave plate. Analyze the intensity variation of light due to polarization, interference and diffraction. Apply the principle of polarized light.	K_5, K_2, K_3

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	M	S	M	M	S
CO 2	S	M	M	S	S	S	S	M	M
CO 3	S	S	S	S	M	S	S	M	S
CO 4	S	M	S	S	S	M	M	S	S
CO 5	S	S	M	S	S	S	M	M	S

Programme : B.Sc. Physics				
Semester III	**Code: 19UPHC6**	**Core Course – VI MEDICAL PHYSICS**	**Credit: 3**	**Hours: 3/Week**

Course Objective:

The aim of the course is to enable the students to understand the physics of the body and to familiarize various medical equipments, measurements involved and their technical aspects and safety.

SYLLABUS

Unit	Content	Hrs
I	**HUMAN PHYSIOLOGICAL SYSTEMS** Cell and their structure – Transport of ions through cell membrane- Resting and action potential: Characteristics of resting potential –Bio-electric potential –Nerve tissues and organs- Different systems of human body –Skeletal , Circulatory, Respiratory ,Digestive ,Excretory and Regulatory systems.	**9**
II	**TRANSDUCERS** Transducers- characteristics of transducer- static and dynamic active transducers – magnetic induction type - piezoelectric type - photovoltaic type- thermoelectric type- Passive transducer- resistive type - capacitive transducer	**9**
III	**MEDICAL IMAGING PHYSICS** X-rays- electromagnetic spectrum- Production of X-rays- X-ray spectra- continuous spectra and characteristic spectra- Coolidge tube- Computer Tomography **(**CT**)** principle- Block diagram of CT scanner**.**	**9**
IV	**BIO-POTENTIAL RECORDER** Introduction-characteristics of recording system-Electrocardiography(ECG)-cardiac cycle-ECG wave form-analysis of ECG signals-Block diagram of ECG-ECG leads –unipolar-bipolar-ECG recording setup- Electromyography **(**EMG**)** – Block diagram-EMG recording setup.	**9**
V	**RADIATION PHYSICS** Radiation units exposure-absorbed dose-units: rad-Curie-Roentgen, relative biological effectiveness-interaction of radiation with matter-photoelectric effect-Compton effect (qualitative treatment)-radiation monitoring instruments-pocket dosimeter-pocket type radiation alarm -area monitoring instrument: Ionization chamber-GM counter.	**9**

Books for Study

1. Bio-medical Instrumentation – Dr.M.Arumugam – Anuradha Agencies, Kumbakonam , Sixth Reprint (2016).
2. Modern Physics, R.Murughesan, Kiruthiga Sivaprasath, S.Chand & Co., (2016).

Books for Reference

1. Biological Instrumentation and methodology P.K.Bajpai, S.Chand& Co, New Delhi, First Edition (2006).

2. Biological Instrumentation - C.Bhuvaneswari, Anuradha Publications, Chennai, First Edition (2007).

3. Bioanalytical Techniques, M.L.Srivastava, Narosa publishing house (2008).

4. Handbook of Biomedical Instrumentation, R.S.Khandpur, Tata McGraw-Hill publishing company (2009).

Web Resources

1. http://www.freebookcentre.net/Physics/Medical-Physics-Books.html
2. Physics in Medicine
   University of Notre Dame
   Online | NA Pages | English
3. https://www.slideshare.net/PrincyRandhawa/biomedical-instrumentation-60215990
4. https://www.accessengineeringlibrary.com/.../handbook-of-biomedical-instrumentation.

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the functions of physiological systems and acquire the knowledge about the origin of bioelectric potentials	K_2
CO2	Acquire knowledge on working principle of transducers and its applications in biomedical instruments.	K_4
CO3	Understand the properties, production of X-rays and gain knowledge on the role X-rays in imaging techniques	K_2
CO4	Impart knowledge on bio potential recorder and to analyze heart signals and its application in electrocardiography.	K_3
CO5	Understand the units of radiation exposure and gain knowledge of the working of radiation monitoring instrument and safety.	K_4

K_6-*Create*; k_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recal*

Mapping of CO with PO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	M	S	M	M	M
CO 2	S	S	M	S	M	S	M	S	S
CO 3	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	M	S	M	S	S
CO 5	S	S	S	S	M	S	M	S	S

Programme: B.Sc Physics				
Semester III & IV	**Code: 19UPHQC2**	**CORE PRACTICAL –II**	**Credit:3**	**Hours: 3/Week**

Course Objective:

The aim of the course is to gain practical knowledge by applying the experimental methods to correlate with the Physics theory and to learn the usage of electrical and optical systems for various measurements and enable the students to explore the concepts involved in the thermodynamics, sound, properties of matter, heat and to understand the fundamentals of instruments involved.

SYLLABUS

Any Fifteen Experiments

S.No.	Content	Hrs
1.	Young's modulus – Uniform Bending – Pin and Microscope.	90
2.	Compound pendulum.	
3.	Torsion pendulum with and without masses – Rigidity Modulus and Moment of Inertia.	
4.	Surface Tension by Capillary rise method.	
5.	Latent heat of fusion of ice and determination of specific heat of liquid – Half time correction.	
6.	Focal length of concave lens – Lenses in contact and out of contact.	
7.	Spectrometer – Refractive index – Hollow prism.	
8.	Spectrometer – i-d curve.	
9.	Spectrometer – Grating – Minimum deviation – Wavelength determination.	
10.	Air wedge – Thickness of a wire.	
11.	B.G – Comparison of E.M.F. of two cells.	
12.	BG comparison of Capacitance – Desauty's bridge.	
13.	Potentiometer – Specific resistance of a wire.	
14.	Transistor Characteristics – Common Emitter configuration.	
15.	Regulated power supply using IC (5 Volts).	
16.	Bifilar Pendulum – Moment of Inertia and verification of Perpendicular axes theorem.	
17.	Searle's Double bar pendulum – Determination of q, n & σ.	
18.	Liquid lens – Refractive index of a liquid.	
19.	Meter Bridge – Specific resistance of the given wire.	

Books for Study

1. B.Sc. Practical Physics - C.L.Arora, S.Chand, (1995).
2. Practical Physics and Electronics - C.C.Ouseph, U.J.Rao, V.Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007).
3. A text book of Practical Physics – M.N.Srinivasan and others, Sultan Chand and Sons, (2014).

Books for Reference

1. B.Sc Practical Physics - N.N.Ghosh. Bharat Bawan, (2001).
2.B.Sc Practical Physics - GeetaSanon, R.Chand& Co., (2007).
3. A Text Book of Practical Physics- S. N. Ganguly, K. P. Basu Publishing, (1960).

Web Resources

1. http://www.git.edu

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Develop the ability to design and connect simple electronic circuits and to collect and analyse the data using these circuits. To develop skills in using electronic instruments like multimeters and oscilloscopes.	K_1 K5
CO2	Analyse the data to determine the desired physical quantity and conduct experiments and interpret the experimental results and identify, formulate and solve physical problems.	K_2,K_4 K6
CO3	Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results Developed problem solving skills of a practical nature.	K_3 K3 K5
CO4	Analyze the physical principle involved in the various instruments; also relate the principle to new application. Developed an awareness of the importance of accurate experimentation, particularly observation, record keeping.	K_2,K_3
CO5	The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of science.	K_5,K_2

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	S	S	S	S	S
CO 2	S	S	S	S	M	L	S	S	M
CO 3	S	S	L	S	S	S	M	S	S
CO 4	M	S	S	M	S	S	M	S	S
CO 5	S	S	M	S	S	S	L	S	M

Programme : B.Sc. Physics				
Semester III	**Code: 19UPHSC3**	**Skill Based – III PHYSICS WORKSHOP SKILLS**	**Credit:2**	**Hours: 2/Week**

Course Objective:
The aim of the course is to enable the students to acquire laboratory skills, electrical skill, and mechanical skill measurements and basics concepts involved.

SYLLABUS

Unit	Content	Hrs
I	**MEASURING UNITS** Conversion to SI and CGS - Familiarization with meter scale – Vernier Calliper- Screw gauge Measure the dimension of a solid Volume of cylindrical block beaker and glass -Measure the dimension of a solid - Diameter of a thin wire-Thickness of metal sheet- Use of Sextant to measure height of buildings, mountains.	6
II	**MECHANICAL SKILL** Casting– Rolling- Machining - Forming and Welding - Types of Welding joints– Welding defects- Steel copper, iron, metal sheets - Machine tools like lathe– Shaper – Drilling – Milling - Cutting tools- Cutting of a metal sheet using blade - Smoothening of cutting edge of sheet using file - Drilling of holes of different diameter in metal sheet and wooden block.	6
III	**ELECTRICAL SKILL** Soldering of electrical circuits– Series RLC circuit analysis – AC generator - Making regulated power supply - Timer circuit - Electronic switch using transistor – Operation of oscilloscope.	6
IV	**ELECTRONIC SKILL** Electronic Instruments, Multimeter – Vacuum tube voltmeter – Solid state multimeter – Cathode ray oscillograph – Television – Radar – Electron microscope - Masers Problems.	6
V	**INTRODUCTION TO PRIME MOVERS** Mechanism of gear system and wheel - Fixing of gears with motor axel - Lever mechanism - Lifting of heavy weight using lever - braking systems - Working principle of power generation systems.	6

Books for Study

1. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.
2. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newnes [ISBN: 0750660732]
3. Basic-Gear-Mechanisms.

Books for Reference

1. A text book in Electrical Technology - B L Theraja – S. Chand and Company.

2. Performance and design of AC machines – M.G. Say, ELBS Edition.

3. Mechanical workshop practice, K.C. John, 2010, PHI Learning Pvt. Ltd.

4. Workshop Processes, Practices and Materials, Bruce J Black 2005, 3rd Edn., Editor Newness [ISBN: 0750660732].

Web Resources

1. *https://web.uri.edu/newstudent/files/StudyTipsPhysics.pdf*

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the basics of physics and its conversion to SI and CGS - Familiarization with meter scale – Vernier Calliper- Screw gauge Measurement.	K_2
CO2	To apply the application of Shaper, Drilling, Milling, Cutting tools and physical application involved in the various instruments.	K_3
CO3	To design a system of the soldering, electronic switch and transistor circuits, be able to demonstrate a knowledge of experimental issues.	K_6
CO4	Recognize the multimeter, television and electron microscope from the viewpoint of the electronic structure and understand their physical significance	K_4, K_2
CO5	To execute the result of a Fixing of gears with motor mechanism and Lifting the weight using lever and safety, manufacturability and sustainability.	K_5, K_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	M	S	M	M	M
CO 2	S	S	M	S	M	S	M	S	S
CO 3	S	S	S	S	S	S	M	S	S
CO 4	S	S	S	S	M	S	M	S	S
CO5	S	S	S	M	S	S	S	S	S

Programme : II B.A / B.Sc / B.Com				
Semester III	**Code: 19UPHNEC1**	**Non Major Elective - I ENERGY RESOURCES**	**Credit: 2**	**Hours: 2/Week**

Course Objective:

The aim of the course is to cover the wide spectrum of solar radiation and various forms of energy derived from the solar radiation and also explain the various environmental impacts of energy utilization and study various types of conventional and non-conventional energy resources including solid, liquid and gaseous fuels.

SYLLABUS

Unit	Content	Hrs
I	Introduction to energy sources – Primary, secondary and supplementary sources – Energy consumption as a measure of prosperity – Energy sources and their availability – Minor and major sources of energy – Qualitative ideas of coal, oil, gas, organic waste and nuclear power and water power.	**6**
II	Solar energy – Solar constant – Units of solar constant – Solar radiation at the earth surface – Beam & diffuse radiation – Sun at zenith – Air mass – Attenuation of beam radiation – Absorption & scattering – Application of solar energy – Hot water supply system.	**6**
III	Bio mass energy – Geothermal energy – Wind energy – Ocean thermal energy conversion – Energy from waves and tides (Basic ideas of energies).	**6**
IV	Environmental legislation & laws – Water (Prevention and Control of Pollution) Act – Air (Prevention and Control of Pollution) Act – Forest (Conservation) Act – Wildlife (Protection) Act – Environment (Protection) Act – Issues Involved in Enforcement of Environmental legislation – Major issues related to this legislation.	**6**
V	**ENERGY USE AND ENVIRONMENTAL IMPACTS** Energy used and environmental impacts – Global issues – Global climatic change – Green house effect – Stratospheric ozone depletion – Biodiversity and habitat loss – Regional issues – Acid rain – Local issues – Urban pollution – Solid and hazardous waste.	**6**

Books for Study

1. Non – Conventional energy source – G.D. Rai, Khauna Publications, (2005).
2. Environmental & Science Engineering – A. Ravikrishnan- Sri Krishna publications, (2007).
3. Renewable energy – B.K. Bala, Agrotech Publisher, (2009).

Books for Reference

1. "Renewable energy sources and emerging Technologies" by D.P. Kothari , K.C. Singal and RakeshRanjan , Prentice Hall of India pvt. Ltd., New Delhi.
2. Solar energy - S.P. Sughatme, Tata McGraw Hill, (1998).

3. Fundamentals of energy renewable sources - D.Mukherjee and S. Chakrabarthi. New Age International Pvt. Ltd., (2007).

Web Resources

1. http://advanced.jhu.edu
2. http://www.thapar.edu

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Acquire basic knowledge on renewable and non-renewable energy sources and measure the prosperity of country.	K4, K_3
CO2	Understand the fundamental concept of solar energy resources and its applications in everyday life.	K_2, K_4
CO3	Recall the effective use of different types of energy sources based on the requirements and describe the primary renewable energy resources and technologies.	K1, K_3
CO4	Analyze environmental legislation, laws, prevention and control of pollution. Aware of important acts and laws in respect of environment and apply critical reasoning skills to solve environmental problems.	K5, K_2, K_3
CO5	Understand the environmental impacts and give the awareness among the public.	K_5, K_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*, K_2-*Understand*; K_1-*Recall*

Programme : B.Sc. Physics				
Semester IV	**Code: 19UPHC7**	**Core Course –VII SPECTROSCOPY AND LASER PHYSICS**	**Credit:3**	**Hours: 3/Week**

Course Objective:
The aim of the course is to make the learners to understand the basics of spectroscopy and the phenomenon of laser action.

SYLLABUS

Unit	Content	Hrs
I	**TYPES OF SPECTRA** Various spectral range of electromagnetic radiation- Types of spectra – emission and absorption spectra – Continuous, band and line spectra – Solar spectrum – Fraunhofer's lines – Ultraviolet spectra – Sources - Simple experimental set up – Characteristic features and applications – Infrared spectra – Sources – Simple experimental set up – Characteristic features and applications.	9
II	**ROTATIONALSPECTRA** Molecular spectra-origin of molecular spectra, nature of molecular spectra –Different modes of molecular excitation Factors affecting line width, intensity of spectra. Classification of Molecules – Linear, Symmetric top, Asymmetric top and spherical top molecules – Theory of rotational spectra of diatomic molecules and its energy levels (rigid & non-rigid).	9
III	**VIBRATIONAL SPECTRA** Theory of vibrational spectra of diatomic molecules and its energy levels(harmonic &anharmonic oscillator) –Theory of vibratinon rotational spectrum of a molecule-spectral range of IR radiation-types of vibration, Raman effect – Experimental set up – Characteristic features of Raman lines – Molecular structure.	9
IV	**LASERS AND TYPES OF LASERS** Basic principles of laser – Einstein Coefficients – Condition for light amplification - Population inversion - Threshold condition – Optical resonators (Qualitative only) Types of Lasers – Construction and Working – Ruby Laser – He- Ne Laser , Nd YAG Laser.	9
V	**APPLICATIONS OF LASER** Applications of Lasers in industry – Cutting – Welding – Drilling – Surface hardening – Medical applications – Laser as diagnostic and therapeutic tool – Holography – Theory of recording and reconstruction – Applications of holography – Holographic interferometry in non destructive testing – Acoustic holography and– Laser Hazards.	9

Books for Study

1. Optics and Spectroscopy - R.Murugeshan, S.Chand (2005)
2. A Text book of Spectroscopy - M.S.Yadav, Anmol Publications, (2003)
3. A Text book of Optics N.Subrahmanyam, Brijlal, Avadhanulu M.N.S Chand (2013)
4. Modern Physics-R.Murugeshan (2018)
5. An Introduction to Laser and Spectroscopy David -L.Andrews&Andrey. A. Demidov-

Books for Reference

1. An Introduction to Laser and Spectroscopy David -L.Andrews&Andrey. A. Demidov Springer Publications, (2002)

2. Lasers and Non Linear optics - G.D.Baruah, PragathiPrakashan Publications, (2009)
3.An introduction to Lasers, Theory and Applications - Avadhanulu M.N. -, S Chand & Co., New Delhi, (2001)
4. Physics for Engineering - P.K.Palanisamy, Scitech Publications private Ltd., (1999)
5. Optics - Gosakan, S.Chand& Co, (2001)

Web Resources

1. http//www.Spectroscopy links at Curlie
2. http//www."Laser Fundamentals" an online course by Prof. F. Balembois and Dr. S. Forget. Instrumentation for Optics.

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Recall about fundamental properties of light, electromagnetic waves, emission and absorption spectra	K_1, K_2
CO2	Gain knowledge about rotational spectra and vibrational spectra.	K_2, K_3
CO3	Understand the principles behind laser action and get a depth of knowledge about uses of Laser and spectroscopy.	K_2, K_3, K_4, K_5
CO4	Analyze the working of different types of lasers.	K_4, K_5
CO5	Apply the theory of lasers in various applications.	K_3, K_4, K_5, K_6

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	M	M	S	S	M	M	M	S
CO 2	M	S	M	S	M	S	M	M	S
CO 3	M	S	S	M	M	S	S	M	S
CO 4	S	S	S	M	S	S	S	S	S
CO 5	S	S	S	S	S	S	M	M	M

Programme : B.Sc. Physics				
Semester IV	**Code: 19UPHEC1**	**Elective – I PHYSICS OF NANOMATERIALS**	**Credit: 3**	**Hours: 3/Week**

Course Objective:
The aim of the course is to make the students to understand the basics of nanomaterials which have wide applications in various fields.

SYLLABUS

Unit	Content	Hrs
I	**BASIC AND SCALE OF NANOTECHNOLOGY** Introduction-Nano Materials-Importance of nanotechnology-Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods)-Dimensionality and size dependent phenomena-Particle size determination.	6
II	**SYNTHESIS OF NANOSTRUCTURE AND MATERIALS** Top down and Bottom up approach-Photolithography- Particle confinement - Chemical vapor deposition (CVD)- Classification based on dimensionality-Quantum dots-wells& wires.	6
III	**CHARACTERIZATION** X-Ray Diffraction - Optical Microscopy-Scanning Electron Microscopy- Transmission Electron Microscopy.	6
IV	**PROPERTIES OF NANOMATERIALS** Structural- Optical -Vibrational -Electrical- Mechanical Properties (Basic ideas only).	6
V	**APPLICATIONS OF NANOMATERIALS** Nanomaterials in medicine – energy sector – Computer Technology – Communication – Industry.	6

Books for Study

1. 1. C.P. Poole, Jr. Frank J. Owens, Introduction to Nanotechnology (Wiley India Pvt. Ltd.).
2. M.A. Shah Tokeer Ahmad, Principles of Nanoscience and Nanotechnology, Narosa Pub (2013).

Books for Reference

1. S.K. Kulkarni, Nanotechnology: Principles & Particles (Captial Publishing Comapny).
2. K.K. Chattopadhyay and A.N. Banerjee, Introduction to Nanoscience and Technology (PHI Learning Private Limited).
3. Richard Booker, Earl Boysen, Nanotechnology (John Wiley and Sons).

Web Resources

1. www.ucd.ie/nanobio/physics_nanomaterials.html

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the basic physics behind size and effect of nano materials.	K_2
CO2	Gain knowledge in synthesizing.	K_2, K_3, K_4,
CO3	Impart the knowledge on characterization techniques	K_3, K_4
CO4	Analyze the magnetic, electrical, thermal and mechanical properties.	K_4
CO5	Develop new optic and electronic components and new materials for use in communications technology, sensor technology, catalysis, energy sector, and environmental safety.	K_3, K_5, K_6

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**						**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	M	S	S	**S**
CO 2	M	S	S	M	S	M	S	S	S	M
CO 3	M	S	S	S	S	S	S	S	M	M
CO 4	S	S	M	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	M	S	S	S	S

Programme : B.Sc. Physics				
Semester: IV	**Code: 19UPHSEC1**	**Elective – GEO PHYSICS**	**Credit: 5**	**Hours: 5/Week**

Course Objective:
The aim of the course is to enable the students to acquire the basic and fundamental knowledge in Earth Science in accordance with the Geo physical prospecting.

SYLLABUS

Unit	Content	Hrs
I	**GRAVITY METHOD** Introduction - Gravitational field of the Earth - 'G 'and 'g' - gravity formula - Gravitational Field of the Earth – Densities of Rocks and Minerals – Instruments – The gravimeters and its Classification – Applications.	9
II	**MAGNETIC METHODS** Introduction – Earth magnetism - Magnetic Susceptibilities of some Minerals -Magnetic Susceptibility values of some Indiacn Rocks – instruments – Magnetometers and its classification - Densities of some Minerals - Densities of some Rock formations of India. – Applications.	9
III	**ELECTRICAL METHODS, EARTH RESISTIVITY METHOD AND SELF POTENTIAL** Electrical methods - Introduction – Self-potential (S.P.) method – Resistivity methods and principles – Potential drop ratio method - Electromagnetic (E.M.) Methods - Principles – Instruments Resistivity of Rocks and Minerals - Electrical conductivities of ores - methods of measurement-Self Potential - Definition – groundwater exploration (Qualitative study).	9
IV	**SEISMIC METHODS** Seismic methods - General Principles – Elastic Properties of Rocks – Refraction and Reflection of Seismic Waves – General Scheme of Seismic Operations – Refraction methods - General Principles – Instruments and Equipment - Application – Reflection methods (Qualitative study). - General Principles –Instruments and Equipment – Application.	9
V	**WELL LOGGING METHODS** Introduction - Electrical Logging methods – Resistivity Logging- Induction logging – Radioactivity logging method – Sonic logging – Miscellaneous Logging – Logging data interpretation - Applications of well logging method in Oil fields.	9

Books for Study

1. Fundamentals of Geophysics – William Lowrie –Cambridge University Press 2nd Edition (1997).
2. Outlines of Geophysical Prospecting – A manual for Geologists, M.B. Ramachandra Rao – EBD Educational Pvt., Ltd. (1975).

Books for Reference

1. Prasnis, Applied Geophysics – Chaparang Hall (1972).
2. Stanislane, M., Introduction to Applied Geophysics, Reidel Publishers (1984).

Web Resources

- https://pangea.stanford.edu/geophysics
- https://en.wikipedia.org/wiki/Geophysics

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Identify and classify basic geological materials, including minerals, rocks, fossils, structures and landforms and know their basic material and biological properties.	K_2, K_3
CO2	Apply magnetic method to analyze densities, magnetic susceptibility of some minerals and Indian rocks and its applications.	K_3, K_4
CO3	Gain knowledge in electrical methods, earth resistivity method and self potential method and its application in groundwater exploration.	K_2, K_3
CO4	Describe seismic method to analyze elastic properties of rocks and its application.	K_2, K_4
CO5	Explain well logging methods and its application in oil fields.	K_2, K_3

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	**PO**						**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	S	S	S	M
CO 2	S	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S	S
CO 4	S	S	S	M	S	S	S	S	S	S
CO 5	S	M	S	S	S	S	S	S	S	S

Programme : B.Sc. Physics				
Semester IV	**Code: 19UPHSC4**	**Skill Based – IV RENEWABLE ENERGY RESOURCES**	**Credit:2**	**Hours: 2/ Week**

Course Objective:

To understand the various forms of conventional energy resources. To know about the present day energy scenario and the need for energy conservation. To explain the concept of various forms of renewable energy and analyse the environmental aspects of renewable energy resource.

SYLLABUS

Unit	Content	Hrs
I	**SOURCES OF ENERGY** Energy definition-Renewable energy sources –Solar energy-Wind energy-Ocean energy-Tidal energy –Thermal energy- Geothermal energy –Biomass energy (Introduction only). Non-Renewable energy resources-Coal-Petroleum-LPG-Nuclear energy-Uses of alternate energy source - Comparison between coal power and nuclear power.	6
II	**SOLAR ENERGY AND ITS APPLICATIONS** Introduction of Solar energy- -Storage of solar energy (flow chart only) –solar pond-non convective solar pond-applications of solar pond-solar water heater –solar crop drying –solar distillation- -solar cooker-Photovoltaic systems –solar cell.	6
III	**WIND ENERGY AND GEOTHERMAL ENERGY** Wind energy –Introduction –Fundamentals Principles –Power coefficient (definition and basic idea only) Basic component of wind energy conversion. Classification of Wind energy conversion –advantages and disadvantages. Geothermal energy-Introduction-Nature of geothermal fields-Geothermal sources –hydrothermal convective resource- advantages and disadvantages.	6
IV	**BIOMASS ENERGY AND OCEAN THERMAL ENERGY** Introduction- Biomass–Biomass conversion technologies –thermal chemical conversion–Fermentation-Wet process- Dry process-Photosynthesis-Photosynthetic efficiency Introduction-methods of ocean thermal electrical power generation-open cycle OTEC system-close OTEC system –advantages and disadvantages of tidal power generation.	6
V	**ENERGY USE AND ENVIRONMENTAL IMPACTS** Energy used and environmental impacts –global issues –Global climate change –Greenhouse effect-stratospheric ozone depletion biodiversity and habit loss regional issues –Acid rain –Local issues – Urban pollution-Solid and hazardous waste.	6

Tutorial

1. Demonstration of solar energy utilization
2. Demonstration of Bio-mass energy utilization

Books for Study

1. Environmental science and engineering –A.Ravikrishnan-Sri Krishna Hi tech Publishing Company.
2. Nonconventional energy sources G.D Rai, KhannaPublishers,New Delhi.
3. Solar energy Fundamentals design Modelling and applications-G.N.TiwariNaraosa Publishing House.
4. Solar Energy Principles of thermal collection and storage S.P.Sukhatme& J.K Nayank Third Edition McGraw Hill and companies.
5. Renewable energy - B.K. Bala, Agrotech Publisher, (2009).
6. Solar energy fundamentals and its applications. BrajeshPriyadarshi.Ishwarbooks(Delhi).

Books for Reference

1. Solar Cell-Charles Cohen Argotech Press New Delhi.

Web Resources

1. NPTEL Course in Non-Conventional energy resources

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Acquire the knowledge on fundamental concepts of Renewable energy resources and Non Renewable energy	K_2
CO2	Understand and analyse the need for solar energy its resources, historical and latest developments.	K_2 K_4
CO3	Gain knowledge on the fundamental principles in wind and geothermal energy	K_1
CO4	Evaluate the basic and advanced techniques in the field of biomass energy and ocean thermal energy.	K_5
CO5	Figure out the use of energy and its environmental impacts	K_4

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	M	M	S	S	S	M	M	S
CO 2	S	M	S	S	S	S	S	S	S
CO 3	S	M	L	S	S	S	M	S	S
CO 4	S	M	S	S	S	S	S	M	S
CO 5	S	S	S	S	S	S	M	S	S

Programme : II B.A / B.Sc / B.Com				
Semester IV	**Code: 19UPHNEC2**	**Non Major Elective –II ASTROPHYSICS**	**Credit: 2**	**Hours: 2/week**

Course Objective:
The aim of the course is to enhance the student's ability to identify and understand the outer space.

SYLLABUS

Unit	Content	Hrs
I	**EARTH, MOON, SUN AND SATELLITES** Earth in space- Days and years- Calendars - Tracking the cycle of the year – Phases and Eclipses – Motions of the moon – Phases of the moon – Solar eclipses –Total solar eclipses and Partial solar eclipses - Lunar eclipses - Total lunar eclipses and Partial lunar eclipses – Rockets and Satellites – Working of rockets – Multi stage rockets – Artificial satellites.	6
II	**THE SOLAR SYSTEM** Observing the solar system – Earth at the centre – Sun at the centre – Inertia and gravity – The sun – The Sun's interior – The Sun's atmosphere - Photosphere, Chromosphere and Corona - Features on the sun – Sunspots – Prominences – Solar Flares.	6
III	**PLANETS, COMETS ASTEROIDS AND METEORS** The Inner planets – Earth – Mercury – Venus – Mars – The outer planets – Jupiter – Saturn – Uranus – Neptune –Comets, Asteroids and Meteors.	6
IV	**STARS AND TOOLS OF MODERN ASTRONOMY** Characteristics of stars – Classification, Size, Colour, Temperature and Brightness of stars – Lives, Lifetimes and Deaths of stars – Black holes - Tools of modern astronomy – Electromagnetic radiation – Telescopes – Reflective , Refractive and Radio telescopes – Spectrographs.	6
V	**GALAXIES AND THE UNIVERSE** Galaxies – Milky Way Galaxy, Spiral, Elliptical, Irregular and Moving Galaxies – The Big Bang Theory, Pulsating theory and Steady State Theory– The future of the universe-Dark Matter and Energy.	6

Books for Study

1. Explorer – P.Michale J. Padilla, Prentice Hall (2002).

Books for Reference

1. Astrophysics for Physicists- Arnab Raj Choudhuri, Cambridge University, (1998).
2. In Quest of the Universe – Karl F. Kuhn, Jones & Bartlett (1994).
3. Physics of the University - A. Hewish., CSIR Publication, New Delhi (1995).
4. Asteroseismology -ConnyAerts, Springer (2007).
5. An introduction to modern astrophysics - Bradley W. Carroll, Addison Wesley (1995).

Web Resources

1. http://research.lib.buffalo.edu>astronomy
2. https://www.loc.gov.scitech>astronmy
3. https://www.nature.com>natastron

Course Outcomes: At the end of the course the student will be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the basic concepts of the phases of the moon and the solar, lunar eclipses.	K_2
CO2	Get the fundamental ideas about the features on the sun.	K_6
CO3	Know the basic features of the inner and outer planets, comets and asteroids	K_1
CO4	Get the fundamental ideas of the characters of stars and the tools of modern astronomy.	K_2
CO5	Recollect the origin of the universe, different types of galaxies, theories, dark matter and energy.	K_1

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Programme : B.Sc. Physics				
Semester V	**Code: 18UPHC7**	**Core Course – VII ELECTRICITY AND MAGNETISM**	**Credit:5**	**Hours: 6/ Week**

Course Objective:
To make the students to understand the basics of electricity and magnetism which have wide application in various field.To identify, formulate and solve real world problems related to Electricity and Magnetism.

SYLLABUS

Unit	Content	Hrs
I	**ELECTROSTATICS** Normal electric induction – Gauss theorem in electrostatics – Application of Gauss theorem – An insulated conductor – Electric field due to a uniformly charged sphere – Isolated uniformly charged conducting sphere (i.e) charged spherical shell – Field due to infinite plane sheet of charge – Coulomb's theorem - Mechanical force experienced by unit area of a charged conductor – Energy stored per unit volume – Deduction of Coulomb's inverse square law from Gauss law. Potential difference – Electric potential – Electric potential as line integral at electric field – Potential at a point due to a point charge – Relation between potential and intensity $E = -\Delta V$ – Potential at a point due to a uniformly charged non- conducting solid sphere – Potential and field due to an electric dipole.	**18**
II	**ELECTRICITY** Carey Foster's bridge – Determination of temperature co-efficient of resistance – Potentiometer - calibration of ammeter – High and low range voltmeter - Measurement of thermo emf - Laws of thermo emf – Seebeck, Peltier and Thomson effects (only definitions) - Thermo dynamics of thermo couple –Thermo electric diagrams - uses of thermo electric diagrams – Gibb's Helmholtz equation – calculation of emf of a Daniel cell.	**18**
III	**MAGNETIC EFFECT OF ELECTRIC CURRENT** Ampere's swimming rule – Maxwell's Cork Screw rule – Right hand clasp rule – Magnetic field – Magnetic inductions – Fleming's left hand rule – Biot – Savart rule (only definitions) – Magnetic Induction in a straight conductor - Magnetic induction at a point on the axis of a circular coil carrying current at any point on the axis of a solenoid carryingcurrent – Effect of iron core in a solenoid – Torque on a current loop in a uniform magnetic field – Moving coil ballistic galvanometer – theory - Damping correction – uses of B.G. – measurement of charge sensitiveness - Absolute capacitance of a capacitor – Mutual inductance.	**18**

IV	**TRANSIENT CURRENT** Growth and Decay of current in a circuit containing inductance L and resistance R with steady emf - Growth and decay of charge in a CR circuit – Determination of high resistance by leakage - Growth and decay of charge in a LCR Circuit – Condition for the discharge to be oscillatory – Frequency of oscillation. **ALTERNATING CURRENT** Emf induced in a coil rotating in a magnetic field – average and rms values of A.C. voltage and current – AC circuit containing resistance, inductance and capacitance in series and parallel resonant circuit - Power in an ac circuit containing L,C and R – Wattless current.	**18**
V	**MAGNETISM** Magnetic induction – Magnetization – Susceptibility-permeability and relation between them ($B=\mu_0(M+H)$) – IH and BH loops - Magnetometer method of drawing I-H curve – energy loss due to hysteresis – uses of hysteresis curves – magnetic alloys – magnetic circuits – determination of susceptibility – Curie Balance method – Guoy's method. Derivation of Maxwell's electromagnetic equation – Displacement current and its magnitude – Electromagnetic waves in free space – Velocity of light – Transverse nature of electromagnetic waves.	**18**

Books for Study

1. Electricity and Magnetism - R. Murugeshan, S.Chand& Co, New Delhi, (2008)

Books for Reference

1. Electricity and Magnetism - Brijlal and Subramaniam, Prem Chand Jain, (1984)
2. Electricity and Magnetism - Narayanamurthi and Nagarathinam, National Publishing & Co, (1994)
3. Electricity and magnetism - Seghal,Chopra,Sultan Chand & Co, (2005)

Web Resources

www.Electicity and magnetism- *Hyper Physics. Georgia State University*. *http://faculty.wcas.northwestern.edu/~infocom/Ideas/electric.html*

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Acquire the knowledge on fundamental concepts of electric field, potential and electromagnetic induction.	K_2
CO2	Apply the knowledge of electricity and magnetism in formulating and solving practical problems.	K_3
CO3	Recall the basic rules on ampere's swimming rule – maxwell's cork screw rule – right hand clasp rule – magnetic field – magnetic inductions – fleming's left hand rule.	K_1
CO4	Evaluate the basic and advanced problems in the field of transient current and alternating current.	K_5
CO5	Figure out the applications of magnetism	K_3

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	M	M	S	S	S	M	M	S
CO 2	S	M	S	S	S	S	S	S	S
CO 3	S	M	L	S	S	S	M	S	S
CO 4	S	M	S	S	S	S	S	M	S
CO 5	S	S	S	S	S	S	M	S	S

Programme : B.Sc. Physics				
Semester V	**Code: 18UPHC8**	**Core Course - VIII ELECTRONICS**	**Credit: 5**	**Hours: 5 /Week**

Course Objective:
The aim of the course is to enable the students to acquire the basic and fundamental knowledge in both theory and practical.

SYLLABUS

Unit	Content	Hrs
I	**SEMICONDUCTOR DIODES** Biased P-N Junction – Forward and Reverse biased –Current and voltage Characteristics of P-N Junction – Zener breakdown –regulated power supply using Zener diode - Break down mechanisms of Semiconductor Diodes – Avalanche break down- LED, photo diode and Solar cell (Basic idea).	9
II	**RECTIFIERS, FILTERS AND CLIPPING AND CLAMPING CIRCUITS** Rectification - Dynamic characteristics of a diode – Rectifier operation - Half wave rectifier – full wave rectifier – bridge rectifier – comparison between a full wave and bridge rectifier - factors determining rectifier performance. Filters circuits – full wave rectifier with filters - capacitor filter – inductor filter – π type LC filter Clipping Circuit- Positive and Negative clipper – Biased clipper-biased Positive and biased negative clippers, biased combination clipper-base clipper -clamping circuits- positive and negative clamping circuits using diodes (qualitative study).	9
III	**SEMICONDUCTOR DEVICES** Field Effect Transistor (FET) Construction-Symbol- Bias- Working - static and transfer characteristics of a FET ,Parameters – Difference between FET and BJT – Enhancement and depletion MOSFET Construction, working, Drain and transfer characteristics – Difference between JFET and MOSFET- Uni Junction transistor (UJT) – construction and working – equivalent circuit of UJT - characteristics – UJT as relaxation oscillator – silicon controlled rectifier (SCR) – construction and working – Two transistor equivalent circuit of SCR – V-I characteristics – SCR applications- switch and rectifier.	9
IV	**JUNCTION TRANSISTOR AND H - PARAMETERS** The Junction transistor – PNP and NPN transistors Transistor manufacturing techniques – Mechanism of transistor action - A transistor amplifier-Current components in a transistor- Modes of transistor operation-CB, CE and CC configurations –Static characteristics of a transistor – Experimental arrangement for studying transistor characteristics-Expressions for currents- relation between α and β –Transistor as a switch. Two port device and its hybrid model- Determination of h- parameters from transistor characteristics - Conversion formula – Analysis of a CE transistor amplifier using h-parameter – approximate expression for current gain , voltage gain , input impedance , output impedance, power gain in decibels. – High frequency effects in a transistor (Qualitative study).	9

V	**AMPLIFIERS, OSCILLATORS AND OPERATIONAL AMPLIFIERS** Classification of amplifiers –Voltage and power amplifiers, audio, video and radiofrequency amplifiers- Class A, B, AB and C amplifiers - RC coupled amplifier – Class B push pull amplifiers - Feedback in amplifiers- Transfer gain of a feedback amplifier –Effects of negative feedback . Feedback oscillator concepts - Barkhausen criterion for oscillation – Hartley, Colpitts, Phase shift and Wien bridge oscillator – determination of frequency and condition for stability – crystal oscillator (qualitative study). Salient features Operational amplifier- inverting amplifier – summer – differentiator – integrator – Comparator (qualitative study).	**9**

Books for Study

1. Electronics Fundamental and applications - D.Chattopadhya, New Age International(P) Ltd, 5th Edition, 2007.
2. Applied Electronics – A. Subramaniyam, National Publishing Company, 2nd Edition, 2003.
3.

Books for Reference

1. Electronic principles and applications - A.B. Bhattacharya, New Central book Agency (P) Ltd, 3rd Edition, (2009)
2. Principles of Electronics -V. K. Mehta, S.Chand & Co, 5th Edition,(1994)
3. Basic Electronics – B. L. Theraja, S. Chand & Co, 5th Edition,(2005)
4. Hand Book of Electronics – Gupta and Kumar, Khanna Publishers, 37th Reprint,(2009)
5. Electronic principles and applications – Charles A.Schuler, Glencoe, (1994)
6. Introduction of electronics – Yatindra Nath Singh, Joseph John, NPTEL, (2007)
7. Introduction to Physical Electronics – Bill Wilson, Connexions, (2010)
8. Microwave filters, impedance, matching network, and coupling structures – G. Matthaei, L. Young, E.M.T. Jones, SRI, (1963)
9.

Web Resources

1. https://en.wikipedia.org/wiki/Semiconductor_device
2. https://en.wikipedia.org/wiki/Bipolar_junction_transistor

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand and apply the zener break down mechanism and zener breakdown voltage to construct and analyse the regulated power supply using zener diode.	K_2, K_3, K_4
CO2	Understand evaluate and analysis of a CE transistor amplifier using h-parameter and its approximate expression for current gain, voltage gain, input impedance, output impedance, power gain in decibels.	K_2,K_4,K_5
CO3	Apply the knowledge about uni Junction transistor (UJT), its application relaxation oscillator and to apply SCR as a switch.	K_3,K_4
CO4	Evaluate and create the amplifier circuits and to apply in the voltage amplifiers construction, for the precision and accurate output.	K_3, K_5,K_6
CO5	Evaluate and create the operational amplifier circuits and to apply for the mathematical operations.	K_5, K_6

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	M	S	M	S	S	M	S	S
CO 2	S	S	M	S	S	S	S	M	S
CO 3	M	S	S	S	S	M	S	S	S
CO 4	S	S	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	S	S	S

Programme : B.Sc. Physics				
Semester V	**Code: 18UPHC9**	**Core Course – IX NUMERICAL METHODS**	**Credit:5**	**Hours: 5/Week**

Course Objective:
The aim of the course is to solve mathematical problems arising in engineering and science that cannot be solved by exact methods.

Unit	Content	Hrs
I	**CURVE FITTING** Principle of least squares - Fitting a straight line, parabola, exponential curve of the form $y = ax^b$ and $y = ab^x$.	15
II	**SOLUTION OF NON-LINEAR EQUATIONS** Bisection method - Successive approximation - Newton-Raphson method – Euler's method - modified Euler's method – RegulaFalsi method - Runge-Kutta method – IV order only.	15
III	**SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS** Gauss elimination method – Method of triangularisation - Iterative method – Gauss - Seidal method.	15
IV	**METHODS OF INTERPOLATION** Newton's definite interpolation - Equal and unequal intervals-Newton's forward interpolation formula - Newton's backward interpolation formula - Lagrange's interpolation method - Numerical differentiation.	15
V	**NUMERICAL INTEGRATION** Trapezoidal rule - Simpson's 1/3 and 3/8 rules - Weddle's rule - Gaussian quadrature formulae.	15

Books for Study

1. Numerical methods – P.Kandasamy, K.Gunavathy, K.Thilagavathy,S.Chand& Co., Second edition, 2003.

Books for Reference

1. Numerical methods in Science and Engineering – Venkatraman M.K., National Publishing Co.,(2005).
2. Numerical methods - A.Singaravelu, Meenakashi Agency, Chennai, (2004).
3. Numerical methods in Engineering and Science -Grewal, B.S. et al., Khanna Publications, (2012).
4. Introductory methods of numerical analysis - S.S. Sastry , Prentice Hall of India,New Delhi., (2006).

Web Resources

1. www.damtp.cam.ac.uk/lab/people/sd/lectures/nummeth98/contents.html

Course Outcomes: At the end of the course the student should be able to:

CO Number	CO Statement	Knowledge Level
CO1	Apply numerical methods to fit the data for getting best fit curve which can be used an aid for data visualization and to summarize the relationships among two or more variables.	K_3
CO2	Analyse and evaluate the numerical tools for solving non – linear equations.	K_4,K_5
CO3	Create the knowledge about numerical methods to obtain approximate solutions for linear equations.	K_6
CO4	Derive numerical methods for various mathematical operations and tasks such as interpolation and differentiation.	K_5, K_2
CO5	Perform numerical integration for a definite integral.	K_3

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	M	S	S	S	L	S
CO 2	S	M	M	L	M	S	S	L	M
CO 3	S	M	S	L	M	S	M	L	M
CO 4	S	S	S	M	M	S	M	L	S
CO 5	S	M	S	M	M	S	S	L	S

Programme : B.Sc. Physics				
Semester: V	**Code: 18UPHEC2**	**Elective - II C PROGRAMMING AND C++**	**Credit:5**	**Hours: 5/Week**

Course Objective:
The aim of the course is to develop the skill to gain knowledge in programming in C and C++ and to understand the basic functioning of C language and its applications.

SYLLABUS

Unit	Content	Hrs
I	C Programming – Constants – Variables – Data Type – Declaration of Variables – Defining Symbolic constants, operators and Expressions – Precedence of operators and associativity – Reading a Character – Writing a Character – Formatted input and output statements.	**15**
II	Control Statements – Simple if, if – else, else -if ladder – switch statements – go to statement – Break and continue statement – looping while , do and for statements.	**15**
III	Arrays- User defined functions –Strings and string functions – strcat, strcpy, strlen, strcmp –Elementary idea.	**15**
IV	Development of algorithm, flowchart and program for the following 1. Average of a set of numbers 2. Finding the smallest and largest element in a set of numbers. 3. Sorting a set of numbers in ascending and descending order. 4. Summing the series of numbers 5. Solving the quadratic equation. 6. Finding factorial using recursion. 7. Calculating mean and variance 8. Addition, subtraction and multiplication of matrices. 9. Numerical integration by Trapezoidal rule and Simpson's 1/3 rule. 10. Solution of differential equation by Runge-Kutta method – IV order.	
V	Object oriented programming: Principles –Benefits of OOP – What is C++ and Application of OOP-Tokens, Expression and control structures: Tokens - keywords-identifiers and Constants-Data types-Constants – Variables-Operators-Manipulators-Expressions-Control structure.	**15**

Books for Study

1. Programming in ansi C - E.Balagurusamy – Tata McGraw Hill (2008).
2, Object Oriented Programming with C++ - E.Balagurusamy, 5th edition, Tata McGraw Hill Pub. Ltd., New Delhi (2008).

Books for Reference

1. Numerical Methods and C programming –C.Xavier (2009).
2. Programming with C – Byron Gottfrid – Schaum Series (2008).

Web Resources

- https://www.tutorialspoint.com › C programming › C – Home

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Remember the basic concepts of C programming.	K_1
CO2	Understand the role of control statements in C.	K_2
CO3	Apply the concept of functions in C.	K_3
CO4	Review the need for Object Oriented Programming.	K4
CO5	Develop algorithm, flowchart and programs in C.	K_5,K_6

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	M	S	M
CO 3	S	S	S	S	S	S	S	M	S
CO 4	S	S	M	S	S	S	S	S	S
CO 5	S	M	S	S	S	S	S	S	S

Programme : B.Sc. Physics				
Semester: V	**Code:** 18UPHESC2	**Elective - II FUNDAMENTALS OF MICROPROCESSOR**	**Credit: 5**	**Hours: 5 / Week**

Course Objective:
The aim of the course is to enable the students to acquire the basic knowledge about microprocessor.

SYLLABUS

Unit	Content	Hrs
I	Architecture of 8085 microprocessor, registers, flags, ALU – Address bus and data bus –Demultiplexing address/data bus – control and status signals – control bus – Programmer's model of 8085 – Pin-out signal function diagram – Functions of different pins.	**15**
II	Instruction set of 8085 – Data transfer, arithmetic, logic, branching and machine control group of instruction – Addressing modes –Register, register indirect, direct, immediate and implied addressing modes. Assembly language and machine language – Programming exercises – addition, subtraction, multiplication and division (all 8-bit binary), ascending order/ descending order.	**15**
III	Memory interface – Interfacing 2Kx8 ROM and RAM interface –Timing diagram of 8085 instructions (MOV Rd, Rs –MVI data 8)	**15**
IV	Interfacing input port and output port to 8085 – Programmable peripheral interface 8255 – Flashing LEDs.	**15**
V	Interrupts in 8085 – Hardware and software interrupts –RIM, SIM instructions – Priorities Simple – Polled and interrupt controlled data transfer.	**15**

Books for St udy

1. Microprocessor Architecture Programming and Application with 8085/8080 by Ramesh Gaonkar, Willey Eastern.
2. Fundamentals of Microprocessor 8085 by – V. Vijayendran, S.Viswanathan Publishers, Chennai.

Books for Reference

1. Introduction to Microprocessor by Aditya Mathur.
2. Introduction to microprocessor by Lance A. Leventhal.

Web Resources

- https://www.tutorialspoint.com/microprocessor/microprocessor_8085_architecture.htm

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the architecture of 8085 microprocessor, registers, flags, ALU and address bus and data bus apply the knowledge in the demultiplexing address/data bus.	K_3, K_4
CO2	Understand the addressing modes of 8085 register, register indirect, direct, immediate and implied addressing modes.	K_2, K_4
CO3	Apply the knowledge about the memory interface, interfacing 2Kx8 ROM and RAM interface and the timing diagram of 8085 instructions.	K_3
CO4	Understand and apply the knowledge in the field of interfacing input port and output port to 8085, Programmable peripheral interface 8255 and Flashing LEDs.	K_2, K_3
CO5	Describe and apply the interrupts in 8085, hardware and software interrupts, RIM, SIM instructions, Priorities Simple and Polled and interrupt controlled data transfer.	K_3, K_5

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	M	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	M
CO 4	S	S	S	S	S	S	S	S	S
CO 5	S	S	S	S	S	S	M	S	S

Programme : B.Sc. Physics				
Semester V	**Code: 18UPHNSC1**	**Non Major Skill Based –I INTRODUCTORY BIO PHYSICS**	**Credit: 2**	**Hours: 2 / Week**

Course Objective:

To introduce the basic idea and the principles of bio physics.

SYLLABUS

Unit	Content	Hrs
I	**PHYSICO - CHEMICAL TECHNIQUES** Atoms-Hydrogen, Helium, Carbon, Nitrogen, Oxygen and Chlorine atoms- stable atoms-chemical bonds-ionic bonds- covalent bonds – Hydrogen Bonds- Hydrophobic interactions-Colloidal interactions - Hydration of macromolecules- Diffusion and osmosis - Understanding friction (qualitative study).	6
II	**BIOENERGETICS AND BIOMOLECULES** First and Second Laws of thermodynamics- concept of free energy-Living systems and equilibrium state- Chloroplast Bioenergetics Amino acids - Primary structures of protein- the peptides and Secondary structures of protein, Tertiary structures-super secondary and domain structure.	6
III	**NEURO BIOPHYSICS** The nervous system - Physics of membrane potentials - Physical aspects of hearing - Signal transduction (qualitative study). Membrane potential due to diffusion – The Physiology of sight - Electrical activity and visual generator potentials –optical defects of eye- Physical aspect of hearing – the ear.	6
IV	**MECHANICS OF TISSUE, BONES AND MUSCLES** Starling pressure and edema prevention–Interstitial Fluid transport-Lymphatic morphology-mechanics of Lymphatic valve - The surface of the bone – Bone fracture –Joint stability and mobility-Body muscles-Physiological approach- categories of muscle contraction –Group action of muscle- The muscle twitch(Qualitative study) -Blood pressure – Electrical activity during the heart beat through EGC (Basic idea).	6
V	**FLUORESCENCE, PHOSPHORESCENCE AND BIOLUMINESCENCE** Fluorescenceand its use- Phosphorescence and its characteristics - Types of Bioluminescence - Mechanism of Bioluminescence - Bioenergetics of Bioluminescence - Bioluminescence in fire fly - physical characteristics of Bioluminescence (Basic idea).	6

Books for Study

1. Biophysics – VasanthaPattabi and N.GauthamNarosa , Springer, 1st edu (2007)
2. Molecular and cellular Biophysics by Yougesh Kumar and Rajeev TyagiMangalam Publishers and Distributers, Delhi, (2013).
3. Bio Physics – Dr. S. Thiravia Raj, Saras Publication, (1993).
4. Bio Physics and Bio Instrumentation – Dr. N. Arumugam , Prof. V. Saras Pub,(2012).

Books for Reference

1. Principles of Bio Physics – Dr. S. Palanychamy, Dr. M. Shunmugavelu, Palani Paramount Publications, first edition 1992, second revised enlarged edition (1996) Reprint (2002).
2. Elementary Bio Physics – P.K. Srivastava, Narosa Publishing House, second edition.
3. Bio Physics – Mohan P. Arora, Himalaya Publishing house, First Edition (2004).
4. Biophysics: Principles and Technique - M .A. Subramanian, MJP Publishers,
5. Essentials of Biophysics - P. Narayanan, AnshanLtd., 2nd Revised Edition.
6. Introduction to Bio Physics - Pranab Kumar Banerjee , S Chand , (2010).
7. Essentials of Biophysics - P.Narayanan, New Age International Publishers, (2000).

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand and apply the knowledge of atoms of living system-hydrogen, helium, carbon, nitrogen, oxygen and chlorine atoms, stable atoms, chemical bonds, ionic bonds, covalent bonds.	K_2,K_3
CO2	Understand and apply the knowledge of first and second Laws of thermodynamics**,** concept of free energy, living systems and equilibrium state and tertiary structures-super secondary and domain structure.	K_2, K_3
CO3	Understand the knowledge about physics of membrane potentials, physical aspects of hearing and signal transduction.	K_3
CO4	Apply and gain knowledge in the field of the lymphatic morphology, mechanics of Lymphatic valve and the structure of the bone, bone fracture, joint stability and mobility.	K_2,K_3
CO5:	Acquire knowledge about the fluorescence, phosphorescence and analyse the bioluminescence.	K_3, K_4

K_6-*Create*; k_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Programme : B.Sc. Physics				
Semester VI	**Code: 18UPHC10**	**Core Course - X SOLID STATE PHYSICS**	**Credit: 6**	**Hours:5/ Week**

Preamble/Course Objective:

The course aims to

- Study the basic idea of crystal structure, atomic bonding and imperfections.
- Make the students aware of the fact that the new materials are rapidly being developed and it is possible to change the properties of materials.

SYLLABUS

Unit	Content	Hrs
I	**Crystal Structure and Chemical Bonding** Crystal lattice-Primitive and unit cell- Seven classes of crystals - Bravais lattice - Miller indices - Miller indices of cubic crystal planes - Structure of crystals -simple cubic, face centered cubic structure, body centered cubic structure and hexagonal close packed structure - Sodium chloride structure, Zinc blende structure, Diamond structure. Types of bonds in crystals - Ionic, Valence, Metallic and hydrogen bonding.	**18**
II	**Crystallography and Crystal Imperfections** Diffraction of X-rays by crystals -Bragg's law in one dimension. Experimental method to determine the crystal structure - Laue method, Rotating crystal method -Powder Photograph method Point defect - Line defect -Burger's circuit -Surface defect - volume defect -Effects of crystal imperfection.	**18**
III	**Magnetic and Superconducting Materials** Magnetism - Different types of magnetic materials - Classical theory of diamagnetism - Langevin theory of paramagnetism - Qualitative explanation of Heisenberg interpretation on internal field and quantum theory of ferromagnetism - Weiss theory of ferromagnetism. Superconductors: Properties - Critical temperature - Isotopic effect - Meissner effect - Type I and Type II superconductors- Applications of Superconductors.	**18**
IV	**Dielectrics** Fundamental definitions in dielectrics -Different types of electric polarization -Frequency and temperature effects on polarization - Dielectric loss - Local field - internal field – ClausiusMosotti relation - Determination of dielectric constant - Dielectric breakdown - Properties of different types of insulating materials	**18**
V	**Semiconducting Materials** Introduction - Energy band in crystals - Metal, insulator and semiconductor - Intrinsic and extrinsic semiconductors - Carrier concentration and Fermi level in intrinsic and extrinsic semiconductors - Current flow in semiconductors - electrical conductivity and carrier mobility - Hall effect - Experimental determination of Hall coefficient - uses of Hall effect.	**18**

Books for Study

1. Material Science-M.Arumugam, Anuradha Agencies Publishers, 2004.
2. Applied Physics - M.Arumugam, Anuradha Agencies Publishers, 2008.

Books for Reference

1. Solid State Physics - Dr.S.L. Gupta & V. Kumar, Kedarnath& Co Educational Publishers, Meerut, 2009.
2. Statistical & Solid State Physics -B.Basavaraj, P.Sadashiva&S.Siddappa, Omkar Publications, Bangalore.

Web Resources

1. https://byjus.com/chemistry/imperfections-in-solids-point-defects/
2. http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf

Course Outcomes: At the end of the course the student should be able to:

CO Number	CO Statement	Knowledge Level
CO1	State the fundamental concepts of crystal structure and to solve problems related to it.	K1, K2, K3
CO2	Understand the diffraction principle, use of X-rays, experimental techniques and applications.	K1, K2, K3
CO3	Comprehend the types of magnetism, concepts of superconductivity and its applications.	K1, K2, K3
CO4	Acquire knowledge concerned to the electrical behaviour of dielectric materials.	K1, K2
CO5	Understand the behavior of electrons and holes in semiconductors.	K1, K2, K3

K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	S	S
CO 4	S	S	M	M	S	S	S	S	M
CO 5	S	S	S	S	S	S	S	S	S

Programme : B.Sc. Physics				
Semester VI	**Code: 18UPHC11**	**Core Course - XI WAVE MECHANICS AND NUCLEAR PHYSICS**	**Credit:5**	**Hours: 5/Week**

Course Objective:
The aim of the course is to impart basic concepts of nucleus properties of nuclear particles, mechanism of natural radioactivity, particle accelerators, nuclear models, fission and fusion process, matter and antimatter and origin of cosmic rays.

SYLLABUS

Unit	Content	Hrs
I	**WAVE MECHANICS** Particle and wave nature of matter – de Broglie theory of matter waves – Electron microscope - Uncertainity Principle - Postulates of Wave Mechanics - Wave function – Physical significance - Non-relativistic Schrodinger equation - Eigen values – Normalisation of eigen function – rigid rotator – Hydrogen atom.	15
II	**RELATIVITY** Michelson Moreley experiment – Explanation of negative result – Lorentz transformation equation – Length Contraction - Time dilation - Laws of addition of velocities – Variation of mass with velocity - Equivalence of mass and energy relation –Elementary ideas of general theory of relativity.	15
III	**RADIOACTIVITY** Fundamental Laws of radioactivity - Derivation for half life, mean life – Law of successive disintegration- secular and transient equilibrium – Age of earth - Geiger - Nuttal Law – Characteristics of α spectrum – β ray spectrum and neutrino theory – Gamma Ray Spectra –origin of gamma ray spectra. Geiger Muller counters – Scintillation counter.	15
IV	**PARTICLE ACCELERATORS** Betatron- Synchro cyclotron – Proton and electron Synchrotrons. **NUCLEAR MODELS** Liquid drop model – Shell model. **FISSION AND FUSION** Types of nuclear reactions - Energy balance and Q value - Nuclear	15
V	**COSMIC RAYS** Primary and secondary cosmic rays –cosmic ray showers – mesons – Van Allen belts – Origin of cosmic rays. **ELEMENTARY PARTICLES** Types of elementary particles :Baryons, Hyperons – Strange particles – Leptons – Matter and Antimatter – Particles and Antiparticles – The four fundamentals interactions –conservation laws of linear momentum, angular momentum – Energy, Charge, Baryon number, lepton number.	15

Books for Study

1. Modern Physics - R..Murugesan, S.Chand& Co, New Delhi (2018).

Books for Reference

1. Concepts of Modern Physics - Arthur Beiser, TMH, New Delhi (2015).
2. Elements of Nuclear Physics - M.L.Pandya and R.P.S.Yadav, KedarnathRamnath Publishing (2009).
3. Nuclear physics - D.C.Tayal, Himalaya Publishing House (2009).

Web Resources

1. https://houseofphy.blogspot.in/ Modern Physics Notes(HRK) By Muhammad Ali Malik
2. http://www.freebookcentre.net/Physics/Modern-Physics-Books.htmlnuclear Physics books
3. http://www.freebookcentre.net/Physics/Nuclear-Physics-Books.html

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand and use the ideas of wave-particle duality and the uncertainty principle to solve simple problems in quantum mechanics.	K_2,K_3
CO2	Understand the concepts and the consequences of special and general theory of relativity and apply it to solve variety of problems.	K_2,K_3,K_4
CO3	Understand the concept of nuclear decay processes, origin and characteristics of α, β and γ spectra and their detection. Solve applied nuclear problems with critical thinking and analytical reasoning.	K_2,K_4,K_5, K_6
CO4	Gain knowledge in the field of nuclear fission and fusion reactions and its application in day to day life, demonstrate nuclear models and categorize different nuclear reactors. Understand the basic of nuclear safely management.	K_2,K_3,K_4
CO5	Understand the classification of elementary particles and their quantum numbers.	K_2, K_3

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	M	S	S	S	M	S
CO 2	S	S	S	S	M	S	S	M	S
CO 3	S	S	M	M	S	S	S	S	M
CO 4	S	S	S	S	M	M	M	M	S
CO 5	S	S	S	S	S	M	M	M	S

Programme : B.Sc. Physics				
Semester VI	**Code: 18UPHC12**	**Core Course – XII MATHEMATICAL PHYSICS**	**Credit:5**	**Hours:5/ Week**

Course Objective:

The aim of the course is to provide extensive mathematical formalism for understanding and interpreting various physical problems.

SYLLABUS

Unit	CONTENT	Hrs
I	**MATRICES** Solutions of linear equations – Cramer's rule – Cayley – Hamilton theorem – Inverse of a matrix - characteristic matrix and characteristic equations of a matrix – Eigen values and eigen vectors –Diagonalisation of 3 x 3 symmetric matrices using orthogonal transformation.	15
II	**VECTOR ANALYSIS** Gradient, divergence and curl of vector point function – Solenoidal and irrotational – Integration of vectors – Line, surface and volume integrals – Gauss theorem – statement and proof - Applications of Gauss theorem – Equation of continuity and Euler's equation of motion.	15
III	**COMPLEX VARIABLES** Functions of a complex variable – Continuity of a function of two real variables – Analytic function – Cauchy-Riemann equation – Necessary conditions for f(z) to be analytic – Properties of analytic function.	15
IV	**BETA AND GAMMA FUNCTIONS** Definition of Beta and Gamma functions - relation between beta and gamma functions – properties - Transformation of gamma function – Evaluation of definite integrals in terms of Beta and gamma functions – Applications.	15
V	**THEORY OF ERRORS AND PROBABILITY** Errors – Types of errors – Most probable value and Residual – Gaussian error curve – Principle of least squares – Errors and Residuals – Various measures of precision – Probable error of a function – Rejection of observations – Empirical formulae – line of regression. Mathematical definition of probability – Independent events – Theory of compound probability – Conditional probability.	15

Books for Study

1. Mathematical Physics - B.D. Gupta, Vikas Publishing House, NewDelhi,2008.
2. Mathematical Physics - Satyaprakash, Sultan Chand & Sons, New Delhi, 2010.
3. Statistics -N.P.Bali , Golden Maths Series, Laxmi Publications,1994.
4. Mathematical Physics - H.K.Dass, S.Chand& Co, 2014.
5. Mechanics and Mathematical Methods – R.Murugeshan, S.Chand& co, 2005.

Books for Reference

1. Mathematical Methods for Physicists - G. Arfken and H.J. Weber, 4th ed. Prism Books, Bangalore, (1995).
2. Advanced Engineering Mathematics - M.D. Greenberg , 2nd ed. International ed., Prentice – Hall International NJ, (1998).
3. Advanced Engineering Mathematics - E. Kreyszig , 8th ed. Wiley, NY, (1999).
4. A text book of Mathematical Physics – Suresh Chandra, Narosa Publishing House, (2009).
5. Mathematical Physics – A.K.Saxena, Narosa Publishing House, (2015).

Web Resources

1. Mathematical Tools for Physics, www.physics.miami.edu/nearing/mathmethods/mathematical_methods-three.pdf

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Apply matrices to solve simultaneous linear equations and evaluate eigen values and eigen vectors of a matrix.	K_3, K_5
CO2	Develop the use of mathematical methods and apply for the formulation of physical theories.	K_6, K_3
CO3	Create the knowledge about complex variables.	K_6
CO4	Apply special mathematical functions appropriately in solving problems arising in physics	K_3
CO5	Understand and analyse the basic concepts of errors and probability.	K_2, K_4

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	L	M	L	L	S	S	M	S
CO 2	S	S	S	M	M	S	S	M	S
CO 3	S	M	M	L	L	S	S	M	S
CO 4	S	S	S	S	S	S	S	M	S
CO 5	S	S	S	S	M	S	S	M	S

Programme : B.Sc. Physics				
Semester VI	**Code: 18UPHEC3**	**Elective – III DIGITAL ELECTRONICS AND COMMUNICATION**	**Credit: 5**	**Hours: 5 / Week**

Course Objective:

The aim of the course is to enable the students to acquire the basic and fundamental knowledge in both theory and practical.

SYLLABUS

Unit	Content	Hrs
I	**NUMBER SYSTEMS, ARITHMETIC OPERATIONS AND CODES** Decimal, Binary, Octal and Hexadecimal numbers - Conversion - Binary addition, subtraction, multiplication and division - 1's and 2's complement method. Codes: Binary coded decimal - 8421 code - Excess 3 code - Alpha numeric codes - gray to binary - Binary to grey - ASCII - EBCDIC - Seven segment display code and its applications.	**15**
II	**LOGIC FAMILIES AND LOGIC GATES** Logic families - Diode transistor logic (DTL) - transistor logic (TTL) - Emitter coupled logic (ECL). Logic gates - AND, OR,NOT,NOR,NAND gates - XOR and XNOR gates - Logic symbol , action ,truth table and construction of circuits(diode and transistors) - Boolean algebra - De-Morgan's theorem - laws of Boolean algebra - Reduction of Boolean expressions (Simple problems) - NAND and NOR gates as universal building blocks.	**15**
III	**FLIP FLOPS, REGISTERS AND COUNTER** Flip Flops - Definition - Clocked RS Flip Flop - D - Flip Flop - T - Flip Flop - JK Flip Flop - Master slave JK Flip Flop- Construction using NAND gates- Logic symbol- Action - truth table. Registers - Definition - Shift register - serial shift register - parallel shift register - Counters - Definition - synchronous counter - asynchronous counter (wave form and truth table) - BCD counter - Modulus counters - Mod6 to Mod 9 and decade counter.	**15**
IV	**MODULATION AND DEMODULATION** Modulation Definition - Types of modulation Amplitude modulation - Expression for amplitude modulated voltage - Wave form of Am wave - FM - wave - expression for frequency modulated voltage - waveform of FM wave - Comparison between AM and FM - phase modulation Demodulation Definition - Diode detection - Amplitude and frequency demodulation - single side band detection - Simple radio receiver - Super heterodyne receiver - Block diagram.	**15**
V	**TELEVISION, RADAR AND FIBRE OPTIC** Television - Iconoscope - image orthicon - scanning - Monochrome TV transmission and reception -block diagram - Colour TV(Basic idea) - Colour mixing principle. RADAR - Principle -working - Block diagram - RADAR range equation - Applications of RADAR. Fiber optics- Introduction- Acceptance angle and numerical aperture (qualitative study) - Classification of optical fibers - Advantages of optical fibers - Applications of fiber optic communications.	**15**

Books for Study

1. Digital circuits and Design-S.Salivahanan&S.Arivazhagan, Vikas publishing house PVT., LTD.(2018).
2. Introduction to Integrated Electronics Digital &Analog-V.Vijayendran, S.Viswanathan (Printers and Publishers), PVT., LTD. (2007).
3. Digital Fundamentals- Floyd & Jain Published by Dorling Kindersley(India) Pvt.Ltd, 8th Edition,(2009).

Books for Reference

1. Electronics Fundamental and applications - D.Chattopadhya, New Age International (P) Ltd, 5th Edition, (2003).
2. Modern digital electronics - R.P. Jain, McGraw- Hill education, 2003.
3. Applied Electronics - A. Subramaniyam, National Publishing Company, 2nd Edition, 2003.

Web Resources

1. http://www.inf.fu-berlin.de/lehre/WS00/19504-V/Chapter1.pdf
2. https://www.eecs.tufts.edu/~dsculley/tutorial/flopsandcounters/flopsFrame.html

Course Outcomes: At the end of the course the student should be able to:

CO Number	CO Statement	Knowledge Level
CO1	Understand the number systems and apply it for arithmetic operations, binary codes - BCD code, excess-3 code, graycodes, boolean algebra.	K_2, K_3
CO2	Understand and analyse the working principles of the logic families and Karnaugh Map method.	K_2, K_4
CO3	Apply, understand and analyse the knowledge about Design procedure, Half and Full adders.	K_2, K_3, K_4
CO4	Understand and analyse knowledge in the field of the sequential logic.	K_2, K_3
CO5	Understand the principle and analyse the counter operations such as ripple counters, design of synchronous counters and Asynchronous counters-synchronous BCD decade counter.	K_2, K_3, K_5

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	PO					PSO			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	S	S	S
CO 2	S	M	S	S	S	S	S	S	S
CO 3	S	S	S	S	S	S	S	M	S
CO 4	S	S	S	S	S	S	S	S	S
CO 5	S	S	S	S	M	S	S	S	S

Programme : B.Sc. Physics				
Semester: VI	**Code: 19UPHSEC3**	**Elective – III ENVIRONMENTAL PHYSICS**	**Credit: 5**	**Hours: 5/Week**

Course Objective:
The aim of the course is to enable the students to acquire the basic knowledge of the environment and it covers energy exploitation, climatic changes, pollution, interaction of electromagnetic fields and nuclear radiations with matter and environmental policy.

SYLLABUS

Unit	Content	Hrs
I	**ESSENTIALS OF ENVIRONMENTAL PHYSICS** The economic system - Living in the green house – Enjoying the sun-transport of matter, Energy and momentum - The Global climate - The energy balance – a Zero – Dimensional greenhouse model – Radiative forcing – Elements of weather and climate - Reynold's number.	15
II	**BASIC ENVIRONMENTAL SPECTROSCOPY** Introduction to the solar spectrum - Blackbody radiation - The emission spectrum of the sun – Interaction of light with matter – The transition electric dipole moment – The Einstein coefficients – Lambert – Beer's law – Bio molecules, Ozone & UV light – The spectroscopy of bio molecules – Solar – UV and life - The ozone filter.	15
III	**ENVIRONMENTAL CHANGES** Renewable energy sources – Solar heat and Solar electricity – Solar collectors – Electricity by solar heat – wind energy – Betz limit – waves – Converters – Bio energy – Efficiency – Hydropower – Fuel cells – Nuclear energy – Power from Nuclear fission and fusion – Radiation and safety (Qualitative study only).	15
IV	**TRANSPORT OF POLLUTANTS** Diffusion – Flow in rivers – ground water flow – the equations of fluid dynamics - turbulence – Turbulent diffusion – Gaussian plumes in the air – Turbulent jets and plumes.	15
V	**NOISE** Basic Acoustics – Velocity of sound – wave equation – Human perceptions and noise criteria – loudness – Reducing the transmission of sound – Active control of sound.	15

Books for Study

1. Egbert Boeker and Rienk Van Groundelle, Environmental Physics - John Wiley.

Books for Reference

1. J.T.Widdell and J.Weir, Renewable energy resources - ELBS (1988).
2. J.T.Hougton, The Physics of Atmosphere - Cambridge university press (1977).

Web Resources

1.www.imperial.ac.uk
2.http://djelatnici.unizd.hr

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Create awareness and develop basic skills about environment, energy resources.	K_3 K6
CO2	Acquire working knowledge on environmental spectroscopy and apply it in to day to day life	K_2,K_4
CO3	Evaluate the various environmental changes qualitatively. Give the importance of various energy convert into electricity	K_3 K5
CO4	Analyse the various transport pollutants, creates concern among the students on energy conservation and environmental protection.	K_2,K_3
CO5	Analyse the characteristics of sound and requisites of good acoustics.	K_5,K_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	S	S	S	S	M	S	S
CO 2	S	M	S	S	S	S	S	M	S
CO 3	S	S	S	S	S	S	S	S	S
CO 4	S	S	M	S	S	S	S	M	S
CO 5	S	S	S	S	S	S	S	S	S

Programme : B.Sc. Physics				
Semester V& VI	**Code: 18UPHQC3**	**CORE PRACTICAL - III**	**Credit:3**	**Hours: 3/ Week**

Course Objective:
The course aims to develop the skill to gain knowledge in Physics Lab.

SYLLABUS
Any Fifteen Experiments

S.No.	Content	Hrs
1.	Young's Modulus - Uniform bending - Koenig's method.	**90**
2.	Young's Modulus - Cantilever - Pin and Microscope.	
3.	Surface Tension – Capillary Rise Method.	
4.	Potentiometer - Emf of a thermocouple - First method.	
5.	B.G - Determination of absolute capacity of a condenser.	
6.	BG- Emf of a thermocouple - Direct deflection method.	
7.	Spectrometer - Grating - Normal incidence – Dispersive power.	
8.	Spectrometer -Narrow Angled Prism.	
9.	Newton's ring - Refractive index of convex lens.	
10.	Specific heat capacity of a liquid and emissivity of surface by Newton's law of cooling.	
11.	NAND and NOR gates as universal building blocks	
12.	Characteristics of FET	
13.	IC Regulated Dual power supply (12V-0-12V)	
14.	Verification of De Morgan's law using IC's	
15.	Half adder and Half subtractor using NAND Gates	
16.	RC Coupled Amplifier - Single Stage	
17.	SCR - Characteristics.	
18.	Principle of Multi-meter.	

Books for Study

1. Practical Physics and Electronics - C.C.Ouseph, U.J.Rao, V.Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007).
2. A text book of Practical Physics - M.N.Srinivasan and others, Sultan Chand and Sons (2014).

Books for Reference

1. B.Sc Practical Physics - C.L.Arora, S.Chand (1995).

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand and analyze the experimental ideas related with matter, heat, electricity magnetism and electronics experiments.	K_2, K_4, K_5
CO2	Identify the link between theory and designing workable circuits.	K_3, K_2, K_5
CO3	Understand and apply the knowledge of theory to experiments, as well as to analyze and interpret data.	K_2, K_5, K_6

K_6-Create; K_5-Evaluate; K_4-Analyse; K_3-Apply; K_2-Understand; K_1-Recall

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	S	S	S	S	S
CO 2	S	S	S	S	S	S	S	M	S
CO 3	S	S	S	M	S	S	S	S	S

Programme : B.Sc. Physics				
Semester: VI	**Code: 18UPHQC4**	**CORE PRACTICAL-IV**	**Credit:3**	**Hours: 3/Week**

Course Objective:

The aim of the course is to develop practical skills in mechanical, electrical, heat and optics experiments.

SYLLABUS
Any Fourteen Experiments

S.No.	Content	Hrs
1.	Young's Modulus – Non-uniform bending - Koenig's method.	**60**
2.	Young's Modulus – Cantilever – Mirror and Telescope.	
3.	Carey Foster's Bridge – Temperature co-efficient.	
4.	B.G. – Comparison of Mutual Inductance.	
5.	B.G. – Absolute determination of Mutual Inductance of a pair of coils.	
6.	Potentiometer – Calibration of High Range Voltmeter.	
7.	Field along the axis of the coil-B_H determination.	
8.	Melde's string – Transverse mode and longitudinal mode.	
9.	Spectrometer – (i-i') curve – Verification of Stoke's formula.	
10.	Spectrometer – Cauchy's constant.	
11.	OP- Amp – Summing and Difference Amplifiers.	
12.	Integrator and Differentiator Op –Amp.	
13.	UJT Characteristics.	
14.	Full adder and Full Subtractor using NAND gates.	
15.	Hartley oscillator using Transistor	
16.	Colpitt's oscillator using Transistor.	
17	LVDT – Voltage Measurement.	

Books for Study

1. Practical Physics and Electronics - C.C.Ouseph, U.J.Rao, V.Vijeyendran, SV Printers and Publishers Pvt. Ltd., (2007).
2. A text book of Practical Physics - M.N.Srinivasan and others, Sultan Chand and Sons (2014).

Books for Reference

1. B.Sc Practical Physics - C.L.Arora, S.Chand (1995).

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Apply the theory of heat, light, electricity and sound to laboratory experiments to arrive solutions to physical problems.	K_3, K_5
CO2	To get familiarize with electronics through experiments.	K_2, K_6
CO3	Understand the working principle of various instruments.	K_3, K_5

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*

Mapping of CO with PO and PSO

CO	**PO**					**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	S	S	M	S	S	S	S	S	S
CO 2	S	S	M	M	S	S	S	S	S
CO 3	S	S	M	S	S	S	S	S	S

Programme : III BA/B.Sc./B.Com				
Semester VI	**Code: 18UPHNSC2**	**Non-Major Skill Based - II PHYSICS IN EVERYDAY LIFE**	**Credit:2**	**Hours: 2/Week**

Course Objective:
The aim of the course is to Impart knowledge about the working principles and mechanisms of the things and phenomena around us.

SYLLABUS

Unit	Content	Hrs
I	**MECHANICS** Motion, Force and Newton's laws – Momentum - Projectile and Circular motions - Gravitation - Planetary motion - Rotational motion - Earth satellites - Communication satellites.	**6**
II	**PROPERTIES OF MATTER** Three states of matter – Elasticity - Hooke's law – Moduli of elasticity – Pascal's law - Archimedes Principle – Capillary action- Bernoulli's Principle -Viscosity.	**6**
III	**HEAT** Measurement of heat and temperature – Clinical thermometer – Heat transfer – Thermos flask – Change of state – Effect of pressure on melting point and boiling point-Regelation-Superheating-Super cooling.	**6**
IV	**OPTICS** Light – Optical instruments – Camera – Telescope – Microscope – Projector – Basic principles (No derivation)- Lasers- Principle- Spontaneous and Stimulated emission of radiation-Kinds of lasers and its uses (qualitative study only).	**6**
V	**SOUND AND ELECTRICITY** Sound and music – Reverberation – Acoustics of building – Recording and reproduction of sound in film-Elementary idea. Coulomb's law– Electric potential – Capacitor – Principle – Capacitors in series and parallel – Current and resistance, Equation of continuity- ohm's law.	**6**

Books for Study

1. Fundamentals of physics – Halliday, Resnick, Walker, 6th Edition Wiley (2008).
2. Heat and Thermodynamics – Brijlal and N.Subramaniam, S.Chand& Co., (2002).
3. A Text book of Optics –Brijlal and N.Subramaniam, 23ed Edition S.Chand& Co., (2006).

Books for Reference

1. Mechanics by Brijlal&Subramaniam, S.Chand& Co.
2. Applied Physics – M. Arumugam, Educational PUB (1999).
3. Allied Physics –Ponnuswamy
4. Electricity and Magnetism, R. Murugeshan 6th Edition S.Chand& Co., (2001).

Web Resources

1. https://web.uri.edu/newstudent/files/StudyTipsPhysics.pdf

Course Outcomes: At the end of the course the student should be able to:		
CO Number	**CO Statement**	**Knowledge Level**
CO1	Understand the basics of Physics and its applications in everyday life.	K_2
CO2	Remember the principles properties of matter, heat and mechanics.	K_1
CO3	Analyse the characteristics of sound and requisites of good acoustics.	K_4
CO4	Recollect the physical properties of different states of matter and change of state.	K_1,K_3
CO5	Understand the role of optical instruments in day-to-day life.	K_5, K_2

K_6-*Create*; K_5-*Evaluate*; K_4-*Analyse*; K_3-*Apply*; K_2-*Understand*; K_1-*Recall*