DEPARTMENT OF PHYSICS

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari, Coimbatore – 641021

Syllabus for

B.Sc. Physics (I & VI Semester)

2019-2022 Batch on-wards

Vision and Mission of the Institution:

VISION
To emerge as a world renowned institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youth who can accelerate the overall development of India.

MISSION
To impart superior quality education at affordable cost, nurture academic and research excellence, maintain eco-friendly and future-ready infrastructure, and create a team of well qualified teaching professionals who can build global competency and employability.

CORE PURPOSE
Transform the youth into National Asset

Vision and Mission of the Department:

VISION
The department focus aims build a foundation for excellence in education develops the student community of the Institution as per the need of Industry by igniting and promoting Interest and Passion in the field of Physics through teaching, experimenting and also Research.

MISSION

1. To provide Quality Education and Research by Providing Higher Education in Physics with necessary needs by the industry.
2. The Department strives to provide the most up-to-date and purposeful curriculum and the highest quality laboratory facilities for the education of our students in a "student centric" approach to empower them in finding suitable employment with continuous improvement.

Program Educational Objectives (PEO)

PEO1 : Extending the acquired foundation level knowledge to higher education level.

PEO2 : To analyze the theoretical concepts through imparting innovative methods of active learning experience through classroom internship, laboratory and industrial visit.

PEO3 : Motivating the student to acquire the importance of research culture and self learning.

PEO4 : Improving the student ability to prepare them for industry.

Mapping of Institute Mission to PEO

Institute Mission	**PEO's**
Imparting Knowledge and Skill	PEO1, PEO2
Industry Connectivity	PEO2
Research Culture	PEO3, PEO4

Mapping of Department Mission to PEO

Department Mission	**PEO's**
Imparting Knowledge and Skill	PEO1, PEO3
Experimenting facts with Industry collaboration	PEO2
Research Culture	PEO3, PEO4
Career growth	PEO4

Program Outcomes (PO):

PO1 : To define the fundamental laws involved in physics.

PO2 : Developing the students communication skills such as reading, listening, speaking and through exhibitions which will help them in expressing their ideas and views clearly and effectively.

PO3 : Implementing the Socratic Method to trigger students in continuous development of their thinking ability.

PO4 : Building the students ability to improve their creativity, analytical mind, innovative thinking, clarity of thought which provides them chance for employability.

PO5 : Technology based on mathematics, like computation have made computational physics an active area of research.

PO6 : Analysing the development in any science and interdisciplinary approach helps in providing better solutions and new ideas for sustainable development.

PO7 : Developing the students scientific intuition ability techniques to tackle problems either theoretical and experimental in nature.

PO8 : To transform the students academic abilities, personal qualities which will give them an opportunity to develop them as responsible citizens.

PO9 : To arrive an innovative solution to a problem with due considerations to society and environment.

Correlation between the POs and the PEOs

Program Outcomes		PEO1	PEO2	PEO3	PEO4
PO1	:	√			
PO2	:	√			
PO3	:	√	√		√
PO4	:	√			
PO5	:	√		√	√
PO6	:	√	√	√	
PO7	:		√		√
PO8	:				√
PO9	:			√	√

Components considered for Course Delivery is listed below:

1. Class room Lecture
2. Laboratory class and demo
3. Assignments
4. Mini Project
5. Project
6. Online Course
7. External Participation
8. Seminar
9. Internship

Mapping of POs with Course Delivery:

Course delivery / program outcome	1	2	3	4	5	6	7	8	9
PO1	√	√	√					√	√
PO2		√			√		√		√
PO3	√	√	√			√		√	
PO4	√	√		√	√			√	
PO5	√	√		√	√			√	
PO6	√	√			√				
PO7	√	√		√	√			√	
PO8		√			√		√		√
PO9			√			√		√	

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Scheme of curriculum for B.Sc. Physics

for the students admitted in the Batch during

2019 - 2022 Board of Studies –Physics (UG)

S.No	Sem	Part	Type	Subject	Credit	Hour	Int	Ext	Total
1	1	1	L1	Language – I	4	4	40	60	100
2	1	2	L2	English for Communication – I	4	4	40	60	100
3	1	3	Core -I	Core - Properties of matter and Sound	4	4	40	60	100
4	1	3	Core Practical	Core Practical - Major practical - I	2	2	40	60	100
5	1	3	DSC	DSC 1C	4	4	40	60	100
6	1	3	DSC Practical	DSC Practical - 1C	2	1	50	0	50
7	1	3	Allied-I	DSA 1A	4	5	100	-	100
8	1	4		Ability Enhancement Course I	2	1			
9	1	6		Value Added Course - I%	2				
1	2	1	L3	Language – II	4	4	40	60	100
2	2	2	L4	English for Communication – II	4	4	40	60	100
3	2	3	Core -II	Core - Mechanics	4	4	40	60	100
4	2	3	Core Practical	Core Practical - Major practical - II	2	2	40	60	100
5	2	3	DSC	DSC 2C	4	4	40	60	100
6	2	3	DSC Practical	DSC Practical - 2C	2	1	50	-	50
7	2	3	Allied-II	DSA 2A	4	5	100	-	100
8	2	4		Ability Enhancement Course II	2	1			
9	2	6		Value Added Course - II %	2				
1	3	3	Core - III	Core - Optics	4	5	40	60	100
2	3	3	Core Practical	Core Practical - Major practical - III	2	2	40	60	100
3	3	3	DSC	DSC 3C	4	5	40	60	100
4	3	3	DSC Practical	DSC Practical - 3C	2	2	40	60	100
5	3	3	Allied-III	DSA 3A	4	5	40	60	100
6	3	4	SEC	Skill Enhancement Courses – I	2	3	50	-	50
7	3	4		Ability Enhancement Course III	2	1	100	-	100

8	3	6		Value Added Course - III %	2		-	100	100
9	3	6		Inter Department Learning – I#	2	2			

1	4	3	Core - IV	Core – Electricity and Magnetism	4	5	40	60	100
2	4	3	Core Practical	Core Practical - Major practical - IV	2	2	40	60	100
3	4	3	DSC	DSC 4C	4	5	40	60	100
4	4	3	DSC Practical	DSC Practical - 4C	2	2	40	60	100
5	4	3	Allied-IV	DSA 4A	4	5	40	60	100
6	4	4	SEC	Skill Enhancement Courses – II	2	3	50	-	50
7	4	4		ABE	2	1	100	-	100
8	4	6		Value Added Course - IV %	2		-	100	100
		6		Inter Department Learning – II#	2	2			
1	5	3	Core - V	Core - Classical mechanics	4	5	40	60	100
2	5	3	Core Practical	Core Practical -Major practical - V	2	2	40	60	100
3	5	3	DSC	DSC 5C	4	5	40	60	100
4	5	3	DSC Practical	DSC Practical - 5C	2	2	40	60	100
5	5	3	DSE	Elective - I – DSE 1E	4	4	40	60	100
6	5	3	DSE	Elective - II – DSE 2E	4	4	-	50	50
7	5	4	SEC	Skill Enhancement Courses – III	2	3	40	60	100
8	5	6		Value Added Course - V%	2		100	-	100
1	6	3	Core - VI	Core - Quantum Mechanics and Relativity	5	6	40	60	100
2	6	3	Core Practical	Core Practical -Major practical - VI	4	5	40	60	100
3	6	3	DSE	Elective – III – DSE 3E	4	5	40	60	100
4	6	3	DSE	Elective – IV – DSE 4E	4	3	40	60	100
5	6	3	Core Course - XI	Core Project	4	5	40	60	100
6	6	4	SEC	Skill Enhancement Courses – IV	4	6	40	60	100
7	6	5		Extension Activity- EX %	2	-	50	-	50
Overall Total					140 + 14	150	2030	2170	4200

Discipline Specific Core					
S.No	Course Code	Course	Pre-requesite	Offering Department	Mandatory
1	19BPHC01	Heat and Thermodynamics	-	Physics	Yes
2	19BPHCP1	Heat and Thermodynamics - lab		Physics	
3	19BPHC02	Nuclear Physics	-	Physics	Yes
4	19BPHC03	Electronics	-	Physics	Yes
5	19BPHCP3	Electronics lab		Physics	
6	19BPHC04	Digital Electronics	Sl. No 3	Physics	Yes
7	19BPHCP4	Digital Electronics lab		Physics	
8	19BPHC05	Solid State Physics	-	Physics	Yes
9	19BPHC06	Mathematical Phyiscs	-	Physics	Yes
10	19BPHC07	Atomic Physics and Spectroscopy	-	Physics	-
11	19BPHC08	Microprocessor and Microcontroller	Sl.No. 4	Physics	-
12	19BPHC09	Basics of Electromagnetic theory	Core IV	Physics	-
13	19BPHC10	Non linear Optics	Core III	Physics	-
14	19BPHC11	Energy Physics	-	Physics	-
15	19BPHC12	Material Science	-	Physics	-
16	19BPHC13	Atrophysics	-	Physics	-
17	19BPHC14	Elements of Modern Physics	have to study before 5th sem	Physics	-
18	19BPHC15	Mini project	-	Physics	-
19	19BPHC16	Professional Skills	-	Physics	-

Allied					
S.No	Course Code	Course	Pre-requesite	Offering Department	Mandatory
1	19BMAA10	Mathematics - I	-	Mathematics	
2	19BMAA11	Mathematics - II	S.No 1	Mathematics	
3	19BCHA01	Chemistry - I	-	Physics	
4	19BCHA02	Chemistry - II	S.No 3	Physics	
5	19BPHA02	NanoScience and Nanotechnology	-	Physics	
6	19BCSA03	Office Automation	-	Computer science	
7	19BCHA03	Biochemistry	-	Physics	
8	19BCSA04	Programming in C	-	Computer science	
	19BCCA03	Entrepreneurial Development		COMMERCE-I	

Skill Based Subject					
S.No	Course Code	Course	Pre-requesite	Offering Department	Mandatory
1	19BPHS01	Introduction to MATLAB	-	Physics	-
2	19BPHS02	Electrical circiuts and Network skill	-	Physics	-
3	19BPHS03	Basic Instrumentation Skill	-	Physics	-
4	19BPHS04	Radiology and Safety	DSC Sl. No. 2	Physics	-
5	19BPHS05	Computational Physics Skill	-	Physics	-
6	19BPHS06	Applied Electronics	-	Physics	-
7	19BPHS07	Introduction to Medical Physics	-	Physics	-
8	19BPHS08	Biophysics	-	Physics	-

Discipline Specific Elective					
S.No	Course Code	Course	Pre-requesite	Offering Department	Mandatory
1	19BPHE01	Principles of Communication systems	-	Physics	Yes
2	19BPHE02	Fibre optic communication systems	-	Physics	Yes
3	19BPHE03	Soil Physics	-	Physics	-
4	19BPHE04	Characterisation of Nanomaterials and its applications	-	Physics	-
5	19BPHE05	Atmospheric Physics	-	Physics	-
6	19BPHE06	Geophysics	-	Physics	-
7	19BPHE07	Optoelectronics	Core III	Physics	-
8	19BPHE08	Biomedical Instrumentation	-	Physics	-

Ability Enhancement Course					
S.No	**Course Code**	**Course**	**Pre-requesite**	**Offering Department**	**Mandatory**
1	19BCSAFC	Environmental Studies	-	CS	Yes
2	19BCMAFC	Women Studies	-	Commerce II	
3	19BCCAFC	Constitution of India	-	Commerce I	
4	19BPYAFC	Human Rights	-	Psychology	Yes
5	19BTAAFC	Yoga	-	Tamil	
6	19BVCAFC	NCC	-	Viscom	
7	19BENAFC	Communicative English	-	English	
8	19BMAAFC	Quantitative Apptitude	-	Mathematics	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core – I – Properties of matter and sound	**4**	**4**			**Core –I**

Subject description

To stimulate the key concepts underpinning the physical interpretations of different properties of matter and apply them in real world problems

Course Objective

To understand the basic concepts of gravitation and to get exposure to the properties of liquids and solids

Course Outcomes

CO1 : To understand the applications of the elastic properties of solids

CO2 : To remember the basic laws of Newton and kepler's laws.

CO3 : To implement the knowledge of properties for the thermal expansion of solids

CO4 : To determine the surface tension of various liquids.

CO5 : To classify the sound waves and its properties.

Unit I: [12 Periods]

ELASTICITY:

Elastic modules -Poisson's ratio-relation between (Poisson ratio, young' modulus, bulk modulus, rigidity modulus)-Expression for bending moment-determination of Young's modulus by uniform-determination of Young's modulus by non-uniform bending-I section girders-Static Torsion - Expression for couple per unit twist-Torsional oscillation.

Unit II: [12 Periods]

GRAVITATION

Kepler's laws-Newton's law of gravitation-Gravitational constant : Boy's Method-Gravitational field and Gravitational potential-Gravitational field at a point due to spherical shell-Variation of 'g' with latitude, altitude and depth-Potential energy-Escape velocity-Equipotential surface –Earthquakes-Seismic waves-Applications of Seismology

Unit III [12 Periods]

VISCOSITY

Viscosity - Coefficient of viscosity - Poiseuille's equation for the flow of liquid through a horizontal capillary tube - Experimental determination of coefficient of viscosity for a liquid - Motion in a viscous medium: Stoke's law - Determination of coefficient of viscosity of highly viscous liquid - Stoke's method.

Unit IV [12 Periods]

SURFACE TENSION

Surface tension - Surface energy-Excess pressure inside a liquid drop and soap bubble - Determination of surface tension of a bubble - Capillary rise - Energy required to raise a liquid in a capillary tube - Experimental study of variation of surface tension with temperature.

Unit V [12 Periods]

SOUND

Classification of Sound - Characteristic of Musical Sound - Intensity of Sound - Measurement of Intensity of Sound – Decibel – Phon(Definitions only) - Velocity of Transverse waves along a stretched string –Laws of transverse vibration of strings - Simple Harmonic vibration - Progressive waves – properties -Melde's experiment - beats – stationary waves - Transverse and longitudinal modes - Ultrasonics – Properties and application

Book for study:

1. Brijlal and N. Subramaniam, " Properties of Matter", Eurasia Publishing House Limited, 1993 (Unit I to Unit–IV)
2. Brijlal and N. Subramaniam, "Text Book of Sound", Vikas Publishing, 1992.(Unit–V).

Book for Reference :

1. Murugesan ,"Properties of matter", S. Chand and Co, 2015.
2. Sears Semansky and Ground University Physics, "Mechanics", Pearson 2011.
3. D.S. Mathur ,"Elements of Properties of Matter" S. Chand and Co, Edi 2014
4. D.S. Mathur and P.S.Hemne, "Mechanics", S. Chand and Co, Edition 2015.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	M	H					L		L
CO2	H				M			L	L
CO3							H		
CO4	H								M
CO5				H					

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core – I Properties of matter and sound lab	**2**			**2**	**Core practical**

List of Experiments

Properties of matter and sound lab

Properties of matter:

1. Young's modulus – uniform bending –Pin and microscope.
2. Young's modulus – Non uniform bending –Pin and microscope.
3. Viscosity by capillary flow method
4. Rigidity modulus and moment of inertia – Torsional Pendulum
5. Rigidity Modulus – Static Torsion
6. Measurement of Terminal velocity for different liquids by stokes method
7. Determination of surface tension and interfacial surface tension of a liquid by drop weight method.
8. Young's Modulus– Cantilever – Static method
9. Young' modulus – non – uniform bending method – optic lever
10. Young's modulus – uniform bending – Koenig's method
11. Young's modulus – non uniform bending – Koenig's method

Sound

12. Sonometer AC Frequency.
13. Melde's string – frequency of vibrator
14. Sonometer frequency of the tuning fork

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Mechanics	**4**	**4**			**Core – II**

Course Objective

- To acquire a complete knowledge about mechanics and sound

Course outcomes

CO1 : To remember the principles of rigid body, statics, dynamics and sound
CO2 : To understand the mechanics behind rigid body, projectiles and dynamics
CO3 : To analyze motion of projectile and its attributes
CO4 : To understand the concept of friction
CO5 : To acquire knowledge about the hydrodynamics.

Unit I: [12 Period]

Conservation Law – Impulse – Impact – Direct and oblique impact – Final velocity and loss of kinetic energy –Motion of a particle in a vertical circle – friction – Laws of friction – angle of friction – resultant reaction – cone of friction – Equilibrium of a body on a rough inclined plane to the horizontal and when the inclination in greater than the angle of friction.

Unit II:

Motion of rigid body [12 Period]

Moment of inertia (M.I) – Parallel and perpendicular axes theorem – M.I. of rectangular Lamina and triangular lamina – M. I of a solid sphere about an axis through it C.G. – Compound pendulum – torque and angular momentum – Relation – Kinetic rotation – conservation of angular momentum

Unit III

Projectiles [12 Period]

Composition of two simple harmonic motions along a line and at right angles – Lissajou's figures, uniform circular motion - Acceleration of a particle in a circle - Centripetal and centrifugal forces - Banking on curved tracks. Projectile - Motion in horizontal plane - Maximum height – Time of flight – Range – to prove the path of the Projectile is a parabola – Range and time of flight in a horizontal plane

Unit IV

Statics and Dynamics [12 Period]

Force of friction –Limiting friction – Laws of friction –Angle of friction - Definition and determination of centre of pressure – Expression for centre of pressure of a rectangular lamina with one side on the surface of the liquid – Laws of floatation–Definition for metacentre and metacentric height.

Unit V

Hydrodynamics [12 Period]

Steady or streamline flow and turbulent flow (qualitative analysis) – Lines and tubes flow – Equation of continuity of flow–Bernoulli's theorem.

Text Books

1. Mathur D.S. (1996). *Mechanics*. S.Chand & Company Ltd, New Delhi, (Units I & III).
2. Venkataraman M.K. (2014). *Dynamics*. Agasthiar Publications, Trichy, (Unit II).
3. Brijlal. N. Subramaniam. (2002). *Text Book of Sound*. Vikas Publications house Pvt Ltd, NewDelhi, (Unit IV & V).

Reference Books

1. Chakraborthy. B. K. *(2001.)Mechanics and General properties of matter*, (2001). Books & Allied (P) Ltd.
2. Rajendran. V,Marikani. A.(1997) *Applied Physics for Engineers.* Tata Mc-Graw Hill, New Delhi.
3. Mathur D.S. (2003). *Elements Of Properties Of Matter*. Shyam Lal Charitable Trust, New Delhi,

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	M	M	L	H	M				
CO2	H	M	M	M	H	M	M	H	M
CO3	H	M	M	M	M		M	M	H
CO4	M	H	L		H	H		M	M
CO5				L		H	H		M

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core V – Optics	**4**	**5**			**Core _ III**

Introduction

The paper aims to provide knowledge on optical instrument, nature and behavior of light, propagation of light, vibration of light laser and its application. To inspire interest for the knowledge of concepts is physical and geometrical optics

Course outcomes

CO1 : To gain knowledge about fundamental properties light, electromagnetic spectrum and Splitting of spectral lines.
CO2 : To apply the energy transfer for absorption and emission spectra
CO3 : To determine the wavelength refractive index of the liquid
CO4 : To recall the basic concept of polarization
CO5 : To know the concept of LASER

Unit I: **[12 Periods]**

Geometrical Optics

Dispersion by a prism – Cauchy's dispersion formula – dispersive power– achromatism in prism – deviation without dispersion – dispersion without deviation – Aberrations – Spherical aberrations in lens – chromatic aberration – chromatic aberrations in a lens – circle of least confusion – achromatic lens – condition for achromatism of two thin lenses separated by a finite distances– coma – Astigmatism.

Unit II **[12 Periods]**

Interference

Characteristics of wave motion **–** Transverse and longitudinal wave motion – Theory of interference – Fresnel's biprism experiment – Determination of wavelength – Interference due to reflected light – Colours of thin films – Air wedge – Testing the planeness of surfaces – Newton's rings – Determination of wavelength and refractive index of a liquid

Unit III **[12 Periods]**

Diffraction

Fresnel's explanation of rectilinear propagation of light – Zone plate – Zone plate as converging lens – Fresnel's diffraction at a circular aperture – Fraunhofer diffraction at a single slit – Theory of the plane transmission grating-Determination of wavelength.

Unit IV **[12 Periods]**

Polarisation

Polarisation of transverse waves – Plane of polarization – Brewster's law and Brewster's window – Polarization by refraction – Double refraction – Principal section and principal plane – Nicol prism – Nicol prism as an analyser – Theory of circularly and elliptically polarised light – Optical activity – Fresnel's explanation of rotation – Specific rotation – Laurent's half shade Polarimeter

Unit V **[12 Periods]**

Quantum Optics

Spontaneous and Stimulated emission – Einstein's A & B coefficients, Population Inversion – Metastable states – Optical pumping– Modes of resonators and coherence length, Ruby & He –Neon lasers– Basic principle–Making a Hologram–Reconstruction of the image from the Hologram– Mathematical theory–Applications of Holography– Holographic Interferometry & Microscopy

Book for study

1. Subrahmanyam, N. Brijlal, Avathanulu M, " A Textbook Of Optics" , S.Chand and Co Ltd., New Delhi, (2008). (Units I – III).
2. Colin N .Banwell, Elaine M. Mc Cash, "Fundamentals Of Molecular Spectroscopy" , Tata McGraw–Hill, New Delhi, (2004). (Unit – IV).
3. Gupta S.L. Kumar V. Sharma R.C, " Elements Of Spectroscopy", 16thedition, Pragati Prakashan, Meerut, (2001). (Unit – V).

Book for Reference

1. Halliday, Resnick, "Physics Part I & II"4th Edition, Wiley Eastern Ltd, New Delhi.(1999)

2. Jenkins, White, "Fundamentals of Optics", 4th Edition, Mc Graw–Hill., New York,(1981)

3. Manas Chanda, " Atomic Structure And Chemical Bond," 2nd edition, Tata McGraw Hill, New Delhi,(2000).

4. Gurdeep Chatwal, Sham Anand,. "Spectroscopy", 3rd edition, Himalaya Publishers, Mumbai. (1987)

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H						M	L	
CO2			H		H		M		L
CO3			H				H		L
CO4	H					M			L
CO5	H				M				

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core IV– Electricity & Magnetism	**4**	**5**			**Core – IV**

Introduction

This paper presents the basic principle of charged body, when they are in rest and also under motion. This paper gives the knowledge regarding the electrical energy and magnetic energy and to enable the students in order to learn the basic principles theory and concepts of electricity and magnetism.

Course outcomes

CO1 : To acquire the knowledge on fundamental concepts of electric and magnetic field

CO2 : To understand the concept of electric field, potential and electromagnetic induction

CO3 : To implement the ideas for making the electrical devices such as capacitor, inductor, resistance, etc.,

CO4 : To evaluate the basic and advanced problems in the field of electromagnetic theory

CO5 : To gain the knowledge about derivation of Maxwell's equations

Unit I: **[12 Periods]**

Electric Field and Potential

Concept of charge – Electric Field (E) – Potential difference (V) – Relation between E and V – Equipotential surfaces – Poisson's and Laplace equations – Potential and field due to an electric dipole – Potential and field due to a quadrupole – Potential and field due to uniformly charged disc – Potential due to two concentric spherical shells of charge – Potential energy due to charge distribution.

Unit II: **[12 Periods]**

Capacitors and Dielectrics

Capacitors – Parallel plate capacitor – Cylindrical capacitor – Spherical capacitor – Guard ring capacitor – Energy stored in a capacitor – Force of attraction between capacitor plates – Dielectric constant – Polar and nonpolar molecules – Polarisation of dielectric – Capacity of a parallel plate capacitor partially and completely filled with dielectric – Electric polarization vector P – Electric displacement vector D – Relation between D**,** E and P – Dielectric susceptibility and permitivity – Physical meaning of polarization – Dielectric strength.

Unit III: **[12 Periods]**

Magnetostatics and Magnetic Field

Magnetic effect of current – Lorentz force – Force on a current carrying wire – Magnetic flux – Gauss law in magnetostatics – Torque on a current carrying coil in uniform magnetic field – Potential energy of a current loop – Ballistic galvanometer – Deadbeat condition – Comparison of emfs and capacitances – Biot Savart law– field due to steady current in a long straight wire – Interaction between two long parallel wire carrying currents – Magnetic field along the axis of a circular coil – Field along the axis of a solenoid – Magnetic dipole – Ampere's law – Application to a current carrying conductor and solenoid.

Unit IV: **[12 Periods]**

Electromagnetic Induction

Faraday's laws of Electromagnetic induction – Deduction of Faraday's laws from Lorentz's force – Self inductance– Calculation of self inductance for a solenoid – Energy stored in magnetic field – Mutual inductance – Energy stored in two interacting circuits – DC circuit: Simple RL circuit – Growth and decay of current – RC circuit – Charging and discharging of a condenser – Ideal LC circuit – Series LCR circuit – Discharge of a condenser through inductance and resistance

Unit V: **[12 Periods]**

Maxwell's Equations and Electromagnetic Theory

Basic equations – Types of current – Vacuum displacement current – Maxwell's equations (No derivations) – Maxwell's equations in free space – Electromagnetic waves in free space – Electromagnetic waves in isotropic non– conducting media – Refractive index – Impedence of dielectric media – Energy density of – electromagnetic wave – Poynting theorem (statement only) – Energy per unit volume.

Book for study

1. Tewari K.K, "Electricity And Magnetism", Sultan chand and Co Ltd, New Delhi, (Units I – V), (2002).

Book for Reference

1. Tayal T.C, "Electricity And Magnetism",Himalaya publication house, Mumbai,(2001).
2. Murugesan R, "Electricity And Magnetism", S.Chand & Company Ltd, New Delhi,(1998)

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H				M			L	
CO2	H				M			L	
CO3		H	H						
CO4					M	H			H
CO5			H				L		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Classical Mechanics	**4**	**5**			**Core – V**

Course Objective

- To understand the fundamental concepts in the dynamic of a particle and system of particles.

Course outcomes

CO1 : To recollect the mechanics of a particle
CO2 : To define and demonstrate knowledge of the different formalisms in classical dynamics of a system
CO3 : To apply these formalisms to obtain equations of motion for simple systems
CO4 : To apply the Hamiltonian formulism for the simple problem
CO5 : To analyze how the Hamiltonian formulism works

Unit I

MECHANICS OF A PARTICLE [12 Period]

Linear momentum - Angular momentum-Work- Power- Kinetic energy Conservative forces- Potential energy- Conservation theorem for linear momentum Conservation theorem for angular momentum - Conservation theorem for energy - Motion of a particle under time dependent applied force –Motion of a free electron in oscillating field - Motion of a particle under damping forces - Motion of a particle under central force – Application to Projectile and simple harmonic vibrations

Unit II

MECHANICS OF SYSTEM OF PARTICLES [12 Period]

Conservation theorem for a system of particle; Conservation theorem for linear momentum, angular momentum and energy - Constrained motion - Types of constraints with examples - Forces of constraints - Degrees of freedom - Generalized coordinates - Generalized notation for Displacement, Velocity, Acceleration, Momentum, Force and Potential - Limitations of Newton's Law

Unit III

LAGRANGIAN FORMULATION [12 Period]

Delta-Variation process - Hamilton's principle - Deduction of Lagrange's equations of motion from Hamilton's principle - Principle of virtual work - D'Alembert's principle - Deduction of Lagrange's equations by D'Alembert's principle for both conservative system and non-conservative system - Deduction of Hamilton's principle from D'Alembert's principle - Deduction of Newton's second law of motion from Hamilton's principle - Applications of Lagrange's equation: Linear harmonic oscillator, Simple pendulum, Compound pendulum.

Unit IV

HAMILTONIAN FORMULATION OF MECHANICS [12 Period]

View points of the new development - Phase space and the motion of systems - Hamiltonian - Hamilton's canonical equations of motion - Cyclic coordinates - Physical significance of H - Advantages of Hamiltonian approach - Deduction of canonical equations from variational principle - Applications of Hamilton's equations of motion; Simple Pendulum, Compound pendulum, Linear harmonic oscillator.

Unit V

HAMILTON - JACOBI FORMULATION [12 Period]

Canonical or contact Transformations: Point Transformation, Canonical Transformation, Generating Function (Four forms) - Advantage of Canonical Transformations - Hamilton Jacobi method - Harmonic Oscillator problem by Hamilton Jacobi method - Hamilton Jacobi equation for Hamilton's Characteristic function.

Text Books

1. Gupta S.N. (1970). Classical Mechanics. Meenakshi Prakashan Publications, Meerut, (Unit I).
2. Gupta, Kumar, Sharma, (2006). Classical Mechanics. 21st Edition, Pragati prakasan, Meerut, (Units II – V).

Reference Books

1. Herbert Goldstein, (1985). Classical Mechanics. 2nd Edition, Narosa publishing House, New Delhi.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	L		M	S		S		
CO2	H	M	M	S	M			M	
CO3	H	M	L	M	M				M
CO4	H	M	H	H	L	M			L
CO5		H	H	L	M			L	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core paper VI Quantum Mechanics and Relativity	**5**	**6**			**Core – VI**

Subject Description: This paper presents the fundamentals of wave mechanics, Schrödinger's wave equation and its applications.

Objectives

- To acquire knowledge and apply it to various physical problems
- To enhance the problem solving ability.
- To motivate the students to apply Schrödinger's equation or solving problems in wave
- mechanics, nuclear physics etc.,

Course Outcome:

CO1 : To acquire basic knowledge about wave properties of matter

CO2 : To get the idea about uncertainity principles and its applications

CO3 : To acquire knowledge about Schordinger equations and postulates of quantum mechanics

CO4 : To effectively apply Schordinger equations

CO5 : To acquire knowledge about Relativity

Unit I Wave Properties of Matter [15 Periods]

Introduction – Phase velocity and Group velocity – Analytical expression for a group of waves – Nature of De'Broglie relation – Derivation of the De'Broglie relation – Phase velocity of De'Broglie waves – Relation between the Phase velocity and the wavelength of De'Broglie wave– De'Broglie wavelength associated with a particle of mass M and kinetic energy – Verification of De'Broglie relation – Davission and Germer's experiments – G P Thomson's experiments.

Unit II Uncertainty Principle [15 Periods]

Introduction – Heisenberg's Uncertainty Principle – Elementary proof between displacement and momentum – Energy and Time – Physical Significance – Illustration – Diffraction of electrons – Gamma ray microscope – Application – Non-existence of free electrons in the nucleus – Size and Energy in the ground state of Hydrogen atom

Unit III Schrödinger's Wave Equation [15 Periods]

Introduction – Wave function for a free particle – Schrödinger's One dimensional wave equation – Time-dependent and Time independent – Physical interpretation – Eigen function – Eigen Value – Eigen equation – Operator for Momentum, Kinetic Energy and Total Energy – Postulates of Quantum Mechanics –Proof

Unit IV Applications of Quantum mechanics [15 Periods]

Particle in a box – Particle in a rectangular three dimensional box – Simple Harmonic oscillator – Reflection at a step potential – transmission across a potential barrier: the Tunneling effect

Unit V – Relativity [15 Periods]

Introduction – Galilean Transformation equations – Ether Hypothesis – Michelson - Morley experiment – Explanation of the Negative results – Special theory of Relativity – Lorentz transformation equations – Length contraction – Time dilation – Addition of Velocities – Variation of Mass with velocity – Mass energy equivalence.

Books for Study:

1. Kamal Singh, S.P.Singh, "Elements of Quantum Mechanics", S. Chand and Company Pvt. Ltd., New Delhi, 2016.
2. R.Murugeshan. Er. Kiruthiga Siva Prasath, "Modern Physics", S.Chand and Company Pvt.Ltd., New Delhi, 2016

Books for Reference:

1. Leonard, Schiff, Jayendra Bandhyopadhyay, "Quantum Mechanics", Mc Graw Hill Education (India) Pvt. Ltd., New Delhi, 2016.
2. Gupta, Kumar and Sharma, "Quantum Mechanics", Jai PRakash Nath publications, Meerut, 2017.
3. J P Singh, "Relativistic Quantum Mechanics", I.K International Publishing House Pvt. Ltd, 2013.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	L		H	L	H				
CO2		L			H		M	M	M
CO3		H		H					
CO4		H		L		H			
CO5			L	H			L		M

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC01	DSC – Heat and Thermodynamics	4	4			DSC

Subject Description

The aim of this course is to acquire knowledge in heat transfer, entropy, production of low temperature and liquefaction of gases, thermal radiation and statistical thermodynamics

Course Objective

To understand of the fundamental laws and principles of thermodynamics and heat transfer.

Course outcomes

CO1 : To recognize the difference between heat and temperature
CO2 : To understand the fundamental laws and principles of heat transfer and theory of gases
CO3 : To acquire working knowledge on low temperature physics and its domestic applications
CO4 : To analyse and evaluate various thermodynamic cycles used for energy productions
CO5 : To know the laws of thermodynamics and concepts of entropy

Unit I: [12 Periods]

THERMOMETRY AND SPECIFIC HEATS

Concept of heat and temperature – Thermoelectric thermometer – Absolute zero and Ice point – Low temperature measurement – High temperature measurement – Specific heat of a gas – C_p & C_v– Determination of C_v by Joule's differential steam calorimeter – Determination of C_p by continuous flow electrical method – Dulong and Petit's law – Variation of Specific heat and Atomic heat with temperature

Unit II: [12 Periods]

KINETIC THEORY OF GASES

Kinetic theory of gases – Postulates – Derivation of gas equation – Maxwell's law of distribution of velocities – Experimental verification – Degrees of freedom and Maxwell's law of equipartition of energy – Vander waal's equation of state – Critical constants – Corresponding states of matter

Unit III: [12 Periods]

TRANSMISSION AND RADIATION OF HEAT

Thermal conductivity – Forbe's method – Radial and cylindrical flow of heat – Thermal conductivity of rubber – Stefan's law and experimental verification – Determination of Stefan's constant – Blackbody – Properties of thermal radiation – Distribution of energy in the spectrum of a black body.

Unit IV: [12 Periods]

LOW TEMPERATURE PHYSICS

Porous Plug experiment and theory – Cascade process – Liquefaction of Oxygen – Air (Linde's process) – Hydrogen (Cascade process) – Liquefaction of Helium – K.Onnes method – Helium I and Helium II – Production of low temperature – Conversion of magnetic temperature to Kelvin temperature – Electrolux refrigerator

Unit V: [12 Periods]

THERMODYNAMICS

Zeroth law of thermodynamics – Thermal equilibrium – Comparison of heat and work – First law of thermodynamics – Isothermal and Adiabatic process – Work done during Isothermal and Adiabatic process – Reversible and Irreversible process – Carnot's reversible engine – Carnot's theorem – Second law of thermodynamics –Entropy : Reversible and Irreversible process – Third law of thermodynamics – Temperature – Entropy diagram

Book for study

Brijlal and Subrahmanyam, "Thermodynamics and Statistical Mechanics", Sultan & Chand & Co Ltd, NewDelhi, (2000). (Units I –V).

Gupta, Kumar, " Elementary statistical mechanics", Pragati publishers, 2016

Book for Reference

Kakani S.L. "Thermodynamics and Statistical Mechanics", Raj Publications, Jaipur. (2001).

Singhal S.S. Heat, "Thermodynamics & Statistical Physics", Pragathi Pragason, Meerut, 1st edition. (2013)

Mapping of Course Outcomes with Program Outcomes:

	Program Outcome								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H		H	H	H				
CO2	L	H	H	M		H	L	L	M
CO3		L		H	M				
CO4	L		M		H		M		L
CO5	H	H			H	L			

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHCP1	**DSC practical – Heat and Thermodynamics lab**	**2**			**1**	**DSC practical**

Heat and Thermodynamics lab:

1. Co-efficient of Thermal conductivity – Lee's disc method
2. Spherical calorimeter
3. Temperature co- efficient of a resistance of a thermistor – post office box
4. Temperature co- efficient of resistance – Carey Foster's bridge
5. Potentiometer – E.M.F of a Thermocouple
6. Determination of specific gravity of liquid – Joule's calorimeter

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC02	DSC - Nuclear physics	4	4			DSC

Subject Description: This paper presents the fundamentals of formation of nucleus, composition of nucleus with their energy.

Objectives

To acquire knowledge and apply it to

- Study the structure of nucleus
- Know the formation of nucleus and their binding energy
- To motivate the students to analyze the energy released by the nucleus during the fission and fusion process.

CO1 : To highlight the properties of nucleus and its constituent particles
CO2 : To predict the particle by using the detector and accelerator
CO3 : To understand the concept of natural radioactivity and its constituent particles
CO4 : To examine the fission and fusion reaction of radiative materials
CO5 : To deduce the concept of cosmic rays and elementary particles.

Unit I - Introduction to the Nucleus **[12 Periods]**

General properties of Nucleus (Size, Mass, Density, Charge, Spin, Angular momentum, Magnetic dipole moment) – Binding energy – BE/A and stability of Nucleus – Packing fraction – Nuclear stability – Nuclear forces – Definition – Properties – Meson theory – Model of Nuclear Structure – The Liquid Drop model – Semi-Empirical mass formula – The Shell model – Evidence for Shell model –The collective model.

Unit II- Detector and Particle Accelerators **[12 Periods]**

Interaction between the energetic particles and matter : Heavy charged particles – Electrons – Gamma ray- Ionization chamber – Solid State detector: GM counter – Wilson Cloud chamber – Nuclear emulsion – Linear accelerators – Cyclotron – Betatron.

Unit III– Radioactivity **[12 Periods]**

Natural Radioactivity – Alpha, Beta and Gamma rays– Properties – Determination of e/m of Alpha particles – Determination of Charge of Alpha particles – Determination of e/m of Beta particle – determination of Wavelength of Gamma rays (Dumond Spectrometer) – Origin of Gamma rays – Laws of Radioactivity – Soddy - Fajan's displacement law – Law of Radioactive disintegration – Half life period – Mean life period– Units of Radioactivity – Artificial Radioactivity –Application of radio isotopes.

Unit IV- Nuclear Fission and Fusion Reactions **[12 Periods]**

Nuclear fission – Energy released in Fission – Bohr and Wheelers theory of Nuclear fission – Chain reaction: Multiplication factor – Critical size – Natural Uranium and chain reactions – Atom Bomb. Nuclear reactor – Nuclear fusion – Source of Stellar energy – Carbon Nitrogen cycle – Proton-Proton cycle – Hydrogen bomb – Controlled thermo nuclear reactions – Radioactive dating.

Unit V - Cosmic rays and Elementary particles **[12 Periods]**

Cosmic rays – Origin of cosmic rays – Latitude effect – Azimuth effect – Altitude effect - Primary and Secondary Cosmic rays - Cascade theory of cosmic ray shower – Pair production and Annihilation – Van Allen Belts. Elementary particles – Introduction – particles and antiparticles – Antimatter – The fundamental interactions – The Quark model.

Book for Study:

1. R.Murugeshan. Er. Kiruthiga Siva Prasath, "Modern Physics", S.Chand and Company Pvt. Ltd., New Delhi, 2016.

Book for Reference:

1. D.C.Tayal, "Nuclear Physics", Himalaya Publishing House, Mumbai, 2017.
2. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, " Concepts of modern Physics", Mc Graw Hill Education (India) Pvt. Ltd., New Delhi, 2016.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**M**		**H**	**L**	**H**		L		
CO2		**L**			**H**			M	
CO3	**H**	**H**		**H**			M		
CO4		**H**		**L**		H		L	
CO5	**L**		**L**	**H**					L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC03	DSC - Electronics	4	5			DSC

Subject Description:

This paper presents the fundamentals of electronics and its applications.

Objectives

- To enable the students to acquire the knowledge in electronics and to study the various electronics circuits.
- To motivate the students to apply the concepts of electronics in their day – to – day life.

Course Outcome

CO1 : To recall the basic concept of diodes and transistors

CO2 : To explain the application of transistor as an amplifier

CO3 : T o utilize the working of diodes as a multivibrator.

CO4 : To explain about working of diodes as a clipper and clamper.

CO5 : To discuss about SCR, UJT, Triac and diac

Unit I Diodes and Transistors [12 Periods]

Classification of solids – types of diodes – characteristics of junction diode and Zener diode – transistors Application: half wave and full wave rectifier, Voltage doubler – PNP and NPN transistors – Characteristics of transistor: CB mode, CE mode, CC mode.

Unit II Amplifiers [12 Periods]

Classification of an amplifier – RC coupled voltage amplifier – Power amplifiers – Class A power amplifier – Transformer coupled class A power amplifier – Collector dissipation – push pull class B power amplifier – Feedback amplifier: feedback and related terms – block diagram of a feedback amplifier.

Unit III Solid state switching circuits [12 Periods]

Introduction - Collector leakage current – Saturation collector current – Switching transistors – Switching action of an transistor – Multivibrator – Types of multivibrator –Astable multivibrator –mono stable multivibrator –Bistable multivibrator.

Unit IV Wave Shaping Circuits [12 Periods]

Differentiating circuit – Integrating circuit – Clipping circuit: positive clipper – negative clipper - biased clipper – combination clipper – applications of clipper- Clamping Circuits: Positive clamper – negative clamper.

Unit V Power Electronics [12 Periods]

Introduction –SCR – Construction, Working and characteristics – Triac – Construction – Operations – Characteristics – Applications of Triac – Diac – Operations – Applications of Diac: Lamp dimmer, Heat control – Uni-junction transistor – Constructions – Operations – equivalent circuit of UJT – Characteristics of UJT - advantages of UJT – UJT relaxations Oscillator – A/D and D/A converters.

Book for Study

1. D. Chattopadhyay, P C Rakshit, B.Saha, N.N. Purkait, "Foundations of Electronics", New Age International Publishers, New Delhi, 2015.
2. V.K.Mehta, Rohit Mehta, "Principles of Electronics", S.Chand and company, New Delhi, 2015.

Books for Reference

1. Jacob Millman, Christos Halkias, Chetan D. Pouikh," Integrated Electronics Analog and Digital Criciuts and Systems", Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2016.
2. Dr. R.S. Sedha, "A Textbook of Applied Electronics", S.Chand and Company Pvt. Ltd., New Delhi, 2016.
3. Millman and Halkias "Electronics devises and Circuits", Tata McGraw Hill India, 2007
4. Balbir Kumar and Shail B.Jain " Electronic Devices and Circuits" Kindle Edition

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H			L			L		
CO2	H						L		
CO3	L			L		M	H		
CO4	H								
CO5				L		M	H		L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHCP3	**DCS practical - Electronics lab**	**2**			**2**	**DCS practical**

Subject Description:

The experiment of this lab demonstrates the RC regulated power supply, voltage doubler and application of transistor as CB and CE mode.

List of experiments (any 8 experiments)

1. Construction and study of IC Regulated Power Supply
2. Voltage doubler.
3. Characteristics of transistor- common base mode
4. Characteristics of transistor- common emitter mode
5. RC-Coupled Amplifier –Single Stage
6. Feedback Amplifier
7. Emitter Follower
8. Hartley Oscillator
9. Astable multivibrator using Transistor
10. Monostable multivibrator using Transistor
11. FET characteristics
12. UJT Characteristics

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC04	DSC - Digital Electronics	4	5			DSC

Subject Description

The aim of this course is to acquire knowledge about Boolean algebra, logic circuits, designing counters and the basic concepts of memory and programmable logic device.

Objectives

- To study and apply various mathematical concepts to solve physical problems and matrices and linear system of equation
- To study of solved Laplace transform
- To learn the Concept of a group theory and numerical methods

CO1 : To understand the concepts and techniques in digital electronics

CO2 : To understand various number system and its importance in digital designing

CO3 : To acquire knowledge about internal circuitry and logic behind any digital system

CO4 : To analyze and construct various digital circuits

CO5 : To Design a combination and sequential circuits

Unit I Number Systems, [12 Periods]

Logic gates and Boolean algebra 12 Hrs Number Systems-Binary-octal-Hexadecimal and its conversions-Binary Codes- BCD codes-8421 code-Excess 3 code-Grey code-*Logic gates – AND, OR, NOT, NAND, NOR gates* – Boolean algebra- operators – logic expressions De-Morgan's theorem – laws and rules PS16C04 FUNDAMENTALS OF DIGITAL ELECTRONICS PS025 of Boolean algebra – truth table – reducing Boolean expressions – Karnaugh maps – simplification of digital circuits.

UNIT II Arithmetic circuits and Flip flops [12 Periods]

Half adder- full adder* – Parallel binary adder, half subtractor – full subtractor – Parallel binary Subtractor, parity generator – encoder – decoder. Flip flop – RS Flip Flop- Edge triggered RS Flip Flop, D and T Flip Flop - JK Flip Flop, Master Slave Flip Flop

UNIT III Registers and Counters [12 Periods]

Registers – Shift registers-Shift left and Shift right registers – Ring Counter – Johnson's Counter - Asynchronous / Ripple counters – modulus counter- Mod 8, 3, 5, 6, 7 and 9 counters - Decade counter - Synchronous Counters

UNIT IV A/D & D/Converters [12 Periods]

Digital to Analog (D/A) converter- Binary weighted resistor method – R / 2R Ladder Network - Analog to Digital (A/D) Converter – counter type - Dual slope integrator –- successive approximation A/D Converter.

UNIT V Semiconductor memory [12 Periods]

Read only memory – Random access memory – PROM – EPROM-SRAMs -DRAMs. Digital IC Characteristics –Resistor Transistor Logic (RTL) – Transistor Transistor Logic (TTL) – Schottky TTL – Emitter Coupled Logic (ECL).

Text Books

1. Malvino & Leach Digital principles and applications Tata Mc Graw Hill 1995 5 th Edition 2
2. M. Morris Mano Digital Logic & Computer Designs Prentice Hall Of India. 2014 4 th Edition 3
3. Vijayendran V Introduction to Integrated electronics S.Viswanathan (Printers & Publishers,Chennai)

Reference Books

1. Chatterji B.N - Digital Computer technology Khanna Publishers, Delhi 1986 2 nd Edition 2
2. Puri V K Digital Electronics circuits and systems Tata McGraw Hill Publishing Company Limited New Delhi 1997 1 st Edition
3. S Salivahanan S Arivazhagan Digital Circuits and Design Vikas Publishing House Private Limited

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		L	H		L	H	M		
CO2	L	H		H	L				
CO3			L	H		H	M	M	L
CO4	H	L				L		M	L
CO5			H	L	L				

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHCP4	**Digital Electronics and Microprocessor**	**2**			**2**	**DSC Practical**

Any 6 from each section

Section – A Digital Electronics

1. Logic gates using IC – Verification of truth tables and DeMorgan's theorem
2. NOR and NAND gates – Universal building blocks
3. Half adder and Full adder
4. Half subtractor and Full subtractor
5. Analog to Digital convertor
6. Digital to Analog convertor.
7. Op-Amp LM741 as adder, subtractor and scalar.
8. Op-Amp LM741 as inverting and non inverting amplifier

Section – B Microprocessor

1. 8085-ALP for 8 Bit addition, Subtraction
2. 8085-ALP for one's compliment, masking off most significant 4 bits and setting bits.
3. 8085-ALP for 8 Bit Multiplication and Division
4. 8085-ALP for finding the biggest element in the array and sum the element in the array
5. 8085-ALP to sort the array in descending order and ascending order
6. 8085-ALP to count the number of zeros, +ve, -ve number and square of a number
7. ALP- Matrix addition.
8. 8085-ALP for ASCII to decimal conversion, BCD to Hex conversion, Hex to Decimal conversion and Hex to binary form

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC05	**DSC Solid State Physics**	**4**	**5**			**DSC**

Subject Description:

This paper presents the fundamentals of solids and its bond theory which will be used for studying solids and how they are formed.

Objectives

To acquire knowledge of

- Various bond theory and to know the method of forming different alloys, conducting materials.
- To motivate the students in order to apply the principles of bond theory in their research studies.

Course Outcome:

CO1 : To know the basic concept of the crystal and study its structure.

CO2 : To know the characterization technique to study the structure of the material

CO3 : To acquire knowledge about the different types of bonding between the atoms and the molecules.

CO4 : To study the basic properties of the crystal by studying its properties by characterization techniques.

CO5 : To know the basic types of magnetic materials and classification according to its properties.

Unit - I Crystal Structure **[12 Periods]**

Chemical bonding (Qualitative ideas) - Crystal lattice – primitive and unit cell – seven types of crystal – Bravais Lattice –Miller Indices – Structure of crystals – simple cubic, hexagonal close packed structure, face centred cubic structure, body centred cubic structure – Sodium chloride structure - Zinc Blende structure - Diamond structure.

Unit – II Dielectric Properties **[12 Periods]**

Dielectric materials - Polarization, susceptibility and dielectric constant - Local field or internal field - Clausius - Mossoti relation - Sources of polarizability – Electronic polarizability - lonic polarizability - Orientational polarizability - Frequency and temperature effects on polarization - Dielectric breakdown – Properties of different types of insulating materials.

Unit - III Magnetic Properties **[12 Periods]**

Different types of magnetic materials - classical theory of diamagnetism (Langevin theory) - Langevin theory of paramagnetism - Weiss theory of paramagnetism - Heisenberg interpretation on internal field and quantum theory of ferromagnetism - Antiferromagnetism - Hard and soft magnetic materials.

Unit - IV Defects in Solids **[12 Periods]**

X ray diffraction – Bragg's law in one dimension – Experimental methods – Laue Method, powder crystal method and rotating crystal method. Defects in solids – Point defects - Frenkel and schottky defects - Equilibrium concentrations - Line defects – Edge dislocation and screw dislocation - Surface defects - Grain boundary - Effects of Crystal imperfections.

Unit –V Superconductors **[12 Periods]**

Superconductivity - General properties - Type I and II Superconductors – High–Temperature SuperConductor- Meissner effect - BCS theory - London equations- Superconductivity at high frequencies- applications of super conductors (squid, cryotron, magnetic levitation)

Book for study

1. S.O.Pillai "Solid State Physics", New Age International (P) Ltd., 2002.
2. Kittel "Introduction to Solid State Physics", Willey Eastern Ltd. 2003.

Book for Reference

2. A. J.Dekker "Solid State Physics", Macmillan India, 1985.
3. HC Gupta "Solid State Physics", Vikas Publishing House Pvt. Ltd., New Delhi, 2001.
4. M.Arumugam "Materials Science", Anuradha Agencies Publishers, 2002.
5. R L Singhal" Solid State Physics", Kedarnath Ram Nath & Co., Meerut, 2003.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	L		H		L		L	M	
CO2	H	L		L	H			L	M
CO3			H			L	M		M
CO4		L			H			L	L
CO5	H			L	H		M		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC06	**Mathematical Physics**	**4**	**5**			**DSC**

Subject Description

Vectors, matrices and linear system of equations, Laplace transform group theory and numerical methods

Objectives

- To study and apply various mathematical concepts to solve physical problems and matrices and linear system of equation
- To study of solved Laplace transform
- To learn the Concept of a group theory and numerical methods

CO1 : To study and apply various mathematical concepts to solve physical problems

CO2 : To study and concepts of matrices

CO3 : To study and solved Laplace transform

CO4 : To learn about concept of group theory

CO5 : To study and calculate about numerical methods

Unit I VECTORS **[12 Periods]**

Gradient of a scalar field – Line, Surface and Volume integrals – Divergence of a vector function – Curl of a vector function and its physical significance – Important vector identities – Gauss divergence theorem – Stokes theorem – Curvilinear co-ordinates – Cylinderical co-ordinates (r,θ) - Spherical polar co-ordinates (r,θ,Φ) – Grad, Divergence and curl in terms of curvilinear, cylindrical and spherical polar co- ordinates

UNIT II MATRICES AND LINEAR SYSTEM OF EQUATIONS **[12 Periods]**

Eigen values, Eigen vectors; Characteristic equation of a matrix - Finding inverse of a matrix using Cayley Hamilton Theorem - Some important theorems of eigen values and eigen vectors – Matrices in Physics : Rotation matrix – Pauli spin matrix – Dirac matrix

UNIT III LAPLACE TRANSFORM **[12 Periods]**

Laplace transform – Properties of Laplace transforms – Problems – Inverse Laplace transform: Properties of Inverse Laplace transform – Convolution theorem – Evaluation of Inverse Laplace transforms by convolution theorem - Problems

UNIT IV GROUP THEORY **[12 Periods]**

Concept of a group - Abelian group - Generators of finite group - Cyclic group - Group multiplication table (Qualitative analysis) - Group of symmetry of a square - The Rearrangement theorem - Subgroups - Lagrange's theorem for a finite group - Cosets- Conjucate elements and classes - Product of classes - Complexes - Isomorphism and Homomorphism.

UNIT V NUMERICAL METHODS **[12 Periods]**

Solution of algebraic and transcendental equations: The Bisection method -The iterative method - Method of false position - Newton-Raphson method - Solution of ODE: Taylor's series method - Euler's method - Runge Kutta II order method - Trapezoidal Rule - Simple problems

Text Books

1. Sathyaprakash, (2005). Mathematical Physics. Sultan Chand & Sons, New Delhi, (Units I - IV).
2. Sastry S.S. (2003). Introductory Methods of Numerical Analysis. 3rd Edition, Prentice Hall Of India, (Unit - V).

Reference Books

1. Gupta B.D. (1989). Mathematical Physics. 3rd Edition, Vikas Publication House, Noida.
2. Louis A.Pipes, Lawrence R.Harvill, (1970). Applied Mathematics For Engineers And Physicists -

Mc Graw Hill Kogakusha Ltd, New Delhi.
3. Chattopadhyay P.K. (1990). Mathematical Physics. Wiley Eastern Limited, New Delhi.
4. Venkataram M.K. Numerical Methods in Science and Engineering. The National Publishing Company, New Delhi.
5. Raman K.V. Group Theory. Tata McGraw - Hill publishing company Ltd, New Delhi.1.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		H	L		L	H		L	
CO2	L		H	H	L		M		H
CO3			L	H		L		L	
CO4	H	L					M		L
CO5			H	L	L	L			

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC07	Atomic physics and spectroscopy	4	5			DSC

Subject Description

Analysis of positive rays, isotopes, atomic structures, models in various aspects, spectral lines subjected to magnetic fields, light inducing electron emission, x –rays and their diffraction.

Objectives

- To provide a detailed study of positive rays and atomic models.
- To learn the impact of magnetic fields on spectra and the behaviour of atom in various states
- To provide a knowledge on the application of photoelectric and x-rays.

CO1 : To understand the concept of positive ray and its applications

CO2 : To predict the properties of atom through the existing theories

CO3 : To implement the theories to study about the atoms in magnetic field

CO4 : To apply the concept of light to study about the interaction between atom and light

CO5 : To understand the concept of spectroscopy by studying the IR and Raman spectra

Unit I Positive rays and particle properties of waves [12 Periods]

Discovery – Properties – Positive ray analysis : Thomson's Parabola method – determination of mass – discovery of stable isotopes– Limitations – Dempster's mass spectrograph –Aston's mass spectrograph-mass defect and packing fraction – polarization of X –rays – scattering of X- rays (Thomson's formula)

UNIT II Structure of the Atom [12 Periods]

The Bohr atom model – Basic postulates – Evidences in favour of Bohr's theory - Method of excitation of atoms – Critical Potentials - Experimental determination of critical potentials by Franck and Hertz's method - Sommerfeld's relativistic model– Vector atom model – Quantum numbers associated with Vector atom model – coupling schemes (LS, JJ coupling) – Pauli's exclusion principle – Periodic classification of elements

UNIT III Magneto Optical Properties of Spectrum [12 Periods]

Magentic dipole moment due to orbital motion of the electron – Magnetic dipole moment due to spin – The Stern and Gerlach experiment – Optical spectra – Fine Structure of the sodium D line – Zeeman effect – Experiments – Lorentz classical theory – Expression for the Zeeman shift – Larmor's theorem – Quantum mechanical explanation o f the normal Zeeman effect – Anomalous Zeeman effect – Paschen – Back effect – Stark effect

UNIT IV Photoelectric Effect [12 Periods]

Introduction – Richardson and Compton experiment: Relation between photoelectric current and retarding potentials – Relation between velocity of Photo electrons and the frequency of light –Experimental investigations on the photoelectric effect - Laws of Photoelectric emission – Failure of electromagnetic theory – Einstein's Photoelectric equation – Experimental verification Einstein's Photoelectric equation by Millikan's Experiments – Photo electric cells –Photo emission cell – Photo Voltaic cell – Photo conductive cell – Applications of Photo electric cell.

UNIT V Spectroscopy [12 Periods]

UV Spectroscopy: Introduction – Quartz spectrograph for near UV region – Littrow spectrograph – Concave grating vacuum spectrograph – IR Spectroscopy: Introduction - Absorption spectroscopy – Block diagram of an absorption spectrometer – Double beam infrared spectrometer – Raman Spectroscopy: Raman Spectrometer – Classical theory of Raman Effect – Vibrational Raman spectra of diatomic molecules.

Book for Study:

1. R.Murugeshan. Er. Kiruthiga Siva Prasath, "Modern Physics", S.Chand and Company Pvt. Ltd., New Delhi, 2016.

Books for Reference

1. N.K. Sehgal , K.L. Chopra , D.L. Sehgal, " Modern physics", Sultan Chand And Sons, 2014.

2. Colin N Banwell and Elaine M. McCash, " Fundamentals of Molecular Spectroscopy", Mc Graw Hill Education Pvt. Ltd., New Delhi, 2016.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		H	L		L	H			L
CO2	L		H	H	L		M		
CO3			L	H		L	L	L	L
CO4	H	L							
CO5			H	L	L	L			M

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC08	**Microprocessor and Microcontroller**	**4**	**5**			**DSC**

Subject Description:

This paper presents the Microprocessor Architecture, instruction set, conversion-binary

Objectives

- To enable the students to acquire the knowledge of Microprocessor and Microcontroller
- Study the Architecture of 8086 microprocessors and Architecture of 8051 microcontroller.

CO1 : To enable the students to acquire the knowledge of Microprocessor.
CO2 : To Study the Architecture of 8086 microprocessor
CO3 : To Learn the design aspects of I/O and Memory Interfacing circuits.
CO4 : To Study about the communication and bus interfacing
CO5 : To learnt about Study the Architecture of 8051 microcontroller.

Unit – I THE 8086 MICROPROCESSOR [12 Periods]

Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

Unit – II 8086 SYSTEM BUS STRUCTURE [12 Periods]

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors. 8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

Unit – III I/O INTERFACING [12 Periods]

Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

Unit – IV MICROCONTROLLER [12 Periods]

Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.

Unit – V [12 Periods]

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

Books for Study:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051
3. Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011
4. Ramesh S.Gaonkar Microprocessor Architecture, Programming and Applications with the 8085 Penram International Publications 2000, 4th Edition

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	H	H		L	H	L	M	L
CO2				L	L		M		
CO3	L	H	L	H		L		L	M
CO4		L	H		L	H	L	M	
CO5	L		H	L		H			L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC09	**DSC - Basics of Electromagnetic theory**	**4**	**5**			**DSC**

Introduction

To impart knowledge on the concepts of Electrostatic fields, electrical potential, energy density and their applications, Magneto static fields, magnetic flux density, vector potential and its applications. Different methods of emf generation and Maxwell's equations Electromagnetic waves and characterizing parameters

Course Outcomes

CO1 : To recollect the basic ideas about electric, magnetic fields and fourth state of matter.

CO2 : To understand the applications of electromagnetic field.

CO3 : To analyze incompletion of Ampere's law and completion of Maxwell's equation.

CO4 : To evaluate the basic and advanced problems in the field of electromagnetic theory.

CO5 : To enhance skill in solving problems by applying electromagnetic field expressions.

Unit I: **[12 Periods]**

Electrostatics And Magnetostatics

Electrostatics: Electric intensity – Electric potential – Gauss Law - Dielectric and its polarization - Electric displacement D – Dielectric constant ε_r – Polarisibiltiy α - Clausius-Mossotti relation (Non-polar molecules) – The Langevin equation (Polar molecules) – Electrostatic energy

Magnetostatics: Current density J – Ampere's law of force – Biot-Savart law – Ampere's circuital law – Magnetic scalar potential ϕ_m (no applications) – Magnetic vector potential A – Magnetisation and magnetization current – Magnetic intensity – Magnetic susceptibility and Permeability.

Unit II: **[12 Periods]**

Field Equation And Conservation Laws

Equation of continuity - Displacement currents - The Maxwell's equations derivations - physical significance - Poynting vector - Electromagnetic potentials A and ϕ - Maxwell's equations in terms of Electromagnetic potentials - Concept of gauge -Lorentz gauge - Coulomb gauge

Unit III: **[12 Periods]**

Propagation Of Plane Electromagnetic Waves

Electromagnetic waves in Free space - Isotropic dielectric - Anisotropic dielectric – Conducting media - Ionized gases.

Radiating systems: Oscillating electric dipole – Radiation from an oscillating dipole – Radiation from small current element.

Unit IV: **[12 Periods]**

Interaction of E.M.Waves with matter (Macroscopic):

Boundary conditions at interfaces - Reflection and refraction – Frenel's laws-Brewster's law and degree of polarization - Total internal reflection and critical angle.

Interaction of E.M.Waves with matter (Microscopic): Scattering and Scattering parameters - Scattering by a free electron (Thomson Scattering) - Scattering by a Bound electron (Rayleigh scattering) – Dispersion Normal and Anomalous – Dispersion in gases (Lorentz theory) – Dispersion in liquids and solids.

Unit V: **[12 Periods]**

Relativistic Electrodynamics

Purview of special theory of relativity – 4-vectors and Tensors - Transformation equations for charge and current densities J and ρ – For electromagnetic potentials A and ϕ - Electromagnetic field tensor $F_{\mu\nu}$ - Transformation equations for the field vectors E and B - Covariance of field equations in terms of 4-vectors - Covariance of Maxwell equations in 4-tensor forms – Covariance and transformation law of Lorentz force.

Books for study:

1. Sathyaprakash, (2013). Mathematical Physics. Sultan chand & sons, New Delhi, (Units I – V).

Books for Reference

1. Gupta B.D. (1989). Mathematical Physics. Vikas publication house, Noida, U.P.
2. Louis A.Pipes, Lawrence R. Harvill, (1970). Applied Mathematics For Engineers & Physicsts. McGraw Hill Kogakusha Ltd, New Delhi.
3. Chattopadhyay P.K. (1990). Mathematical Physics. Wiley Eastern Limited, New Delhi.
4. Bose R.K. Joshi M.C. (1984). Methods Of Mathematical Physics. Tata McGraw-Hill, New Delhi.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1		H	L		L	H	M		
CO2	L		H	H	L		L	L	L
CO3			L	H		L		L	
CO4	H	L							L
CO5			H	L	L	L	L		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC10	Non linear optics	4	5			DSC

Objectives

To study the basic principle and characteristics of Lasers.

To gain knowledge about the action of various types of Lasers, performance improvement and their applications.

To become familiar with the ideas and concepts of Non-linear optics and Laser Spectroscopy.

Course Outcomes

CO1 : To understand the basic principle of LASER

CO2 : To categorize the LASER on its working and construction

CO3 : To implement the concept of LASER to a proper medium and increase its efficiency

CO4 : To study the concept of non linearity in light

CO5 : To experiment the concept of LASER in spectroscopy

Unit I BASIC PRINCIPLES OF LASERS [12 Periods]

Energy levels - Thermal equilibrium - Relationship between Einstein's coefficients - Condition for large Stimulated emissions - Condition for light amplification - Line shape function - Population inversion - Pumping methods - Threshold condition - Critical population inversion - Line broadening - Cavity configurations - Modes - Laser rate equations for two, three & four level systems

Unit II LASER CHARACTERISTICS [12 Periods]

Spatial & Temporal coherence - Directionality - Monochromaticity - Intensity

TYPES OF LASERS

Ruby laser - Nd YAG laser - Helium Neon laser - Carbondioxide laser - Semiconductor diode laser - Excimer laser - Dye laser - Chemical laser - X ray laser - Free electron laser - Fiber laser - Color center laser

Unit III PERFORMANCE IMPROVEMENT OF LASER [12 Periods]

Q switching - Methods of Q switching - Peak power - Laser amplifiers - Mode locking - Distributed feedback laser APPLICATIONS OF LASER

Material working – Isotope separation - Holography - Measurement of distance - Laser in medicine

Unit IV NON-LINEAR OPTICS [12 Periods]

Harmonic generation - Second harmonic generation - Phase matching Third harmonic generation - Optical mixing - Parametric generation of light - Self focusing of light MULTIPHOTON PROCESSES Multiquantum Photoelectriceffect - Twophoton processes (Experiments)- Three photon processes - Second harmonic generation - Parametric generation - Parametric light Oscillator - Frequency up conversion - Phase conjugate optics

Unit V LASER SPECTROSCOPY [12 Periods]

Rayleigh and Raman scattering - Stimulated Raman effect - Hyper Raman effect (Classical treatment) - Coherent Anti Stokes Raman Scattering - Spin flip Raman Laser - Photo acoustic Raman Spectroscopy - Saturation absorption Spectroscopy - Doppler free two photon Spectroscopy - Multi photon ionization - Single atom detection with lasers - Laser cooling and Trapping of neutral atoms

Text Books

1. Avadhanulu M.N. (2001). Lasers Theory And Applications. S.Chand and Company Ltd, New Delhi, (Units I – III).
2. Laud B.B. (2001). Lasers And Nonlinear Optics. 2nd Edition, New age international private Ltd, New Delhi, (Units III - V).

Reference Books

1. Ghatak, Thyagarajan, Lasers Theory And Applications. Macmillan India Ltd.
2. Ralf Menzel, (2001). Photonics. Springer International Edition.
3. Abbi S.C. Ahmad S.A. (2001). Non Linear Optics And Laser Spectroscopy. Narosa publishing house.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	L			H		H		L	
CO2	H				M				
CO3							H		
CO4	H								
CO5				H				L	M

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC11	**Energy Physics**	**4**	**5**			**DSC**

Introduction

This paper presents the fundamentals of electrical, optical, atomic and molecular, thermal and non conventional energies

Course Outcome:

CO1 : To know about the conventional energy uses and its advantages
CO2 : To learn about the renewable energy sources and its applications in home appliances
CO3 : To gain knowledge about biomass energy and its fundamentals
CO4 : To acquire knowledge about biomass and its utilization
CO5 : To know about all forms of energy and its waves and tides.

Unit I **[12 Periods]**

Conventional Energy Sources

World's reserve - commercial energy sources and their availability – various forms of energy – renewable and conventional energy system – comparison – Coal, oil and natural gas – applications – Merits and Demerits

Unit II **[12 Periods]**

Solar Energy

Renewable energy sources – solar energy – nature and solar radiation – components – solar heaters – crop dryers – solar cookers – water desalination (block diagram) Photovoltaic generation – merits and demerits

Unit III **[12 Periods]**

Biomass energy fundamentals:

Biomass energy – classification – photosynthesis – Biomass conversion process

Unit IV Biomass Utilization **[12 Periods]**

Gobar gas plants – wood gasification – advantages & disadvantages of biomass as energy source

Unit V **[12 Periods]**

Other forms of energy sources

Wind energy : power in wind – types of wind energy systems – horizontal axis wind turbine -vertical axis wind turbine – Solar thermal – solar photovoltaic - Geothermal energy – Ocean thermal energy conversion – energy from waves and tides (basic ideas)

Books for Study:

1. D.P. Kothari, K.C. Singal & Rakesh Ranjan, -"Renewable energy sources and emerging Technologies", by Prentice Hall of India pvt. Ltd., New Delhi (2008)

Books for Reference:

1. S.A. Abbasi and Nasema Abbasi , "Renewable Energy sources and their environmental impact" – PHI Learning Pvt. Ltd., New Delhi (2008)
2. Donald H.Perkins, "Introduction to High Energy Physics", Fourth Edition, Addison Welsey Publishing Company, 2013.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	M			H				H
CO2	H								H
CO3	M				M	L		L	
CO4	H		M					L	
CO5	H								

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
19BPHC12	**Materials Science**	**4**	**5**			**DSC**

Subject Description:

This paper presents the Chemical Bonds, Modern Engineering Materials, Non Destructive Testing: New Materials, Mechanical Behavior of Materials.

Objectives

To make the students learn the chemical bonding behavior of Materials, testing methods and different types of materials

CO1 : To learn about fundamental concepts of chemical bonds

CO2 : To classify the different types of semiconducting materials

CO3 : To compare the various non destructive methods of testing materials

CO4 : To identify the various modern engineering materials

CO5 : To identify the factors affecting mechanical properties of materials

Unit I Chemical Bonds **[12 Periods]**

Review of Atomic structure – Inter atomic Forces – Different types of chemical bonds – Ionic covalent bond or homopolar bond – Metallic bond – Dispersion bond – Dipole bond – Hydrogen bond – Binding energy of a crystal – Elastic properties.

Unit II Modern Engineering Materials **[12 Periods]**

Classification of Polymers – Ceramics – Super strong materials – Cermets – High temperature materials – Thermo electric materials – Electrets – Nuclear engineering materials.

Unit III Non Destructive Testing: **[12 Periods]**

Radiographic methods – Photo elastic method - Magnetic methods – Electrical methods –Ultrasonic methods – Visual and other optical methods – Thermal methods – Surface defect detection by NDT – Equipments used in non destructive testing – Metallurgical microscope – Election microscope – Coolidge x-ray tube – Production of ultrasonic waves – Magnetostriction Ultrasonic generator - Pilzo electric ultrasonic generator.

Unit IV New Materials **[12 Periods]**

Metallic glasses – Fibre reinforced plastics – Metal matrix composites –Material for optical sources and detectors – Fiber optic materials and their applications – Display materials – Acoustic materials and their applications – SAW materials – Biomaterials – High temperature superconductors.

Unit V Mechanical Behavior of Materials **[12 Periods]**

Different mechanical properties of Engineering materials – Creep – Fracture – Technological properties – Factors affecting mechanical properties of a material – Heat treatment - cold and hot working – Types of mechanical tests – metal forming process – Powder – misaligning – Deformation of metals – Bauschinger effect – Elastic after effect – Deformation of crystals and poly crystalline materials.

Books for Reference:

1. S.O.Pillai Solid state Physics New age International Private Limited 2011 6 th Edition 2.

2. Khurmi Sedha Material Science S. Chand & Co. 2001, 4th edition

Books for study

1. Materials Science by M.Arumugam, Anuradha Publishers. 1990 Vidayalkaruppur, Kumbakonam.
2. M.Arumugam Materials Science Anuradha agenciesKumbakonam Revised 1990 1 st edition 1987
3.Materials Science and Engineering V.Raghavan Printice Hall India Ed. V 2004. New Delhi.

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Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	H	H		L	H			L
CO2				H	L		L	H	
CO3			L	H					M
CO4	H	L					L	M	
CO5			H	L					

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
19BPHC13	**Astrophysics**	**4**	**5**			**DSC**

Subject Description:

This paper presents the fundamentals of universe, galaxies, star and solar systems.

Objectives:

- To know about the sun, star and planetary motion
- To know about the astronomical instruments
- To know about the age and evaluation of earth

CO1 : To learn about fundamental universe

CO2 : To acquire knowledge about solar system

CO3 : To acquire basic knowledge about age and evolution of earth

CO4 : To calculate the distance and magnitude of stars

CO5 : To have a basic knowledge about astronomical instruments

UNIT I Theories of the universe, galaxies and star clusters [12 Periods]

Origin of the universe - the big bang theory - the steady state theory - the oscillating universe theory - Hubble's law

Galaxies : Types of galaxies - Milky Way - star clusters - globular clusters

UNIT II Solar System [12 Periods]

Mass and stability of the sun of the sun - solar constant - temperature of the sun - source of solar energy - solar wind - corona

Other members of the solar system : Mercury - Venus - Earth - Mars - Jupiter - Saturn - Uranus - Neptune - Moon - Bode's law

UNIT III Age and evaluation of earth [12 Periods]

Solar nebula theory – planetesimials theory – age of earth – radiative dating – exposure age of meteoroids – age of radiative elements – motion of the planets – evaluation of earth's atmosphere – formation of ozone layer – role of life in changing the earth's atmosphere

UNIT IV Distance and magnitude of stars [12 Periods]

Magnitude and brightness - apparent magnitude of stars - absolute magnetic of stars - relation between apparent magnitude and absolute magnitude of stars - Luminosities of stars - measurement of stellar distance

UNIT V Astronomical Instruments [12 Periods]

Optical telescope – reflecting telescope – types of reflecting telescope – advantages – antenna requirements for solar observations – parapoloid reflection antenna – broad band antennas – dipole arrays

Books for study:

1. K.S.Krishnaswamy , "Astrophysics: A modern perspective", New Age International Pvt Ltd, New Delhi, 1st Edition (2002)
2. A.B.Bhattacharya, S.Joardar, R.Bhattacharya, "Astronomy and Astrophysics", Overseas Press 2010.

Books for reference:

1. B.Basu , "An introduction to Astrophysics", Hall of India Pvt Ltd (2001)
2. R.Murugeshan. Er. Kiruthiga Siva Prasath, "Modern Physics", S.Chand and Company Pvt. Ltd., New Delhi, 2016.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	H	H		L	H	M	H	
CO2									
CO3			L	H	M		L		L
CO4	H	L				M		M	
CO5			H	L					L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHC14	Elements of modern physics	4	5			DSC

Introduction:

The course will give a idea about the updated version in the field of Physics

Course Outcomes

CO1 : To associate the concept of light with energy

CO2 : To examine the interaction of light with matter

CO3 : To apply the Schrodinger equation to solve the unsolved problems

CO4 : To execute the concept of statistics in the particle level

CO5 : To deduce the overall concept of light in this modern world

Unit I **[12 Periods]**

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering - Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.

Unit II **[12 Periods]**

Two slit interference experiment with photons, atoms and particles - linear superposition principle as a consequence - Matter waves and wave amplitude - Schrodinger equation for non-relativistic – particles - physical interpretation of wave function, probabilities and normalization - Probability and probability current densities in one dimension.

Unit III **[12 Periods]**

Schrodinger's equation for the Hydrogen atom – separation of variables – Quantum number – principal Quantum number – orbital Quantum number – magnetic Quantum number- radiative transition –selection rule

Unit IV **[12 Periods]**

One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering

Size and structure of atomic nucleus and its relation with atomic weight - Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle

Unit V **[12 Periods]**

Statistical distributions – Maxwell – Boltzmann statistics – molecular energies in an ideal gas – quantum statistics – Einstein's approach – specific heats of solids – electron energy distribution

Text Books:

3. R.Murugeshan. Er. Kiruthiga Siva Prasath, "Modern Physics", S.Chand and Company Pvt. Ltd., New Delhi, 2016

Reference book :

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	L		M			H			
CO2		H			M			L	
CO3							H		
CO4	H								
CO5				H					M

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BCHA03	**Biochemistry**	**4**	**5**			

Introduction:

Biochemistry is a branch of science which deals with the chemistry of living organisms and that of their biological processes. It deals with the ability to comprehend chemical combinations and reactions that occurs due to biological processes such as growth, reproduction, metabolism, heredity.

Course Outcome:

CO1 To provide the basics of Biochemistry and buffer systems.
CO2 To describe the process of Bioenergetics.
CO3 To understand the properties of vitamins and minerals.
CO4 To understand the types of Hormones and its functions.
CO5 To present the basis behind the inborn errors of metabolism.

Unit I: [12 Periods]

Buffer system

pH – acid base indicators - Henderson – Hasselbalch equation – buffer systems of blood and body fluids acidosis and alkalosis – distribution of fluids in the body – dehydration.

Unit II: [12 Periods]

Bioenergetics

Basic principles of thermodynamics – entropy, enthalpy and free energy. High energy phosphates, oxidation – reduction reactions – oxidases, dehydrogenases, oxygenases – organization of the respiratory chain in mitochondria.

Unit III: [12 Periods]

Vitamins and Minerals

Classification, properties and physiological functions of vitamins – fat soluble – (A,D,E and K) and water soluble (B and C) – deficiency – Macronutrients – Physiological importance of Calcium , Phosphorus, Magnesium, Sodium and Potassium – Trace elements – Physiological functions of Iron, Copper and Iodine

Unit IV: [12 Periods]

Hormones

General characteristics – classification – functions of thyroid stimulating hormone (TSH) – oxytocin – vasopressin – thyroid – thyrosine – pancreas – insulin – diabetes.

Unit V: [12 Periods]

Inborn errors of Metabolism

Hereditoryanemias – sickle cell anemia and thalassemia – errors of carbohydrate (galactosemia) and protein metabolism (phenylketonuria) – disease and syndromes.

Text Book:

1. Deb A.C., (2001) Fundamentals of Biochemistry, 9th edition, New Central Book Agency, Calcutta.
2. AmbikaShanmugam., (2016) Fundamentals of Biochemistry for Medical students, WMC Brown Publishers, New Delhi.
3. Sathyanarayana U. (2008) Biochemistry. Books and Allied Pvt. Ltd., New Delhi.

Reference Books:

1. Campbell, M.K. (2012) Biochemistry, 7th edition. Published by Cengage Learning.
2. Tymoczko, J.L., Berg, J.M., and Stryer, L. (2012) Biochemistry: A short course, 2nd edition. W.H.Freeman.
3. Berg, J.M., Tymoczko, J.L., and Stryer, L. (2011) Biochemistry, 2nd edition.W.H.Freeman and Company.
4. Lehninger A.L., and Nelson D.L., (2016) Principles of Biochemistry. Cox– CBS Publishers, New Delhi.
5. Willey, M.J., Sherwood, L.M., and Woolverton, C. J. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGrawHill.

Mapping of Course Outcome with Program Outcome

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	H	H	M	M	H	L
CO2	H	H	M	M	H	M	H	M
CO3	H	H	M	M	M	H	H	L
CO4	H	H	H	M	M	H	M	M
CO5	H	M	H	M	H	M	H	L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Allied Practical –Biochemistry Practical	**2**	**–**	**–**	**2**	**Practical**

Introduction:

The course aims to develop the skills in biochemical analysis and to develop the skills of the students in Qualitative and analysis of biomolecules. A successful student will be able to equip themselves with the basic biochemical tools and standard operation procedures.

Course Outcome:

CO1 To perform quantitativeidentification of carbohydrate.
CO2 To perform quantitative identification of proteins.
CO3 To perform separation of carbohydrates by paper chromatography.
CO4 To perform Separation of aminoacidsby paper chromatography.
CO5 To determine the acid number and iodine number of lipids.

List of Experiments [30 Periods]

QUALITATIVE ANALYSIS

1. Measurement of pH.
2. Preparation of Buffers – Acids and Alkaline Range.
3. Preparation of Solutions (Molar and Normal Solutions).
4. Protein estimation (Lowry *et al*).
5. Quantitative of determination protein by Bradford method.
6. Determination of Maximum absorption (µmax) spectra of standard Proteins.
7. Quantitative determination of carbohydrate by Anthrone method.
8. Estimation of Carbohydrates (DNSA method).

Text Book:

Reference Books:

1. Martin Holtzhauer. (2006). Basic Methods for the Biochemical Lab. 1st Edition. Springer, Germany.

Mapping of Course Outcome with Program Outcome

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	H	H	M	M	H	L
CO2	H	H	M	M	H	M	H	M
CO3	H	H	M	M	M	H	H	L
CO4	H	H	H	M	M	H	M	M
CO5	H	M	H	M	H	M	H	L

Semester: IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BCCA03	Introduction to Entrepreneurship	4	5			ALLIED

Introduction: This paper presents the importance of various government schemes and opportunities for entrepreneurs and to understand the financial ventures for new business.

Course Outcome:

CO1 : Able to become an ethical entrepreneur and to provide job for others.

CO2 : Analyze the business environment in order to identify business opportunities.

CO3 : Forecast the market opportunity through surveys.

CO4 : Interpret their own business plan and support the entrepreneurs by preparing project plan.

CO5 : Raise capital by submitting project plan to various financial institutes.

CO6 : Develop the knowledge about Professional ethics and management techniques

Unit-I **[12 Periods]**

Basics of Entrepreneurship- classification of Entrepreneurship- Importance of Entrepreneurship- difference between Entrepreneurship and employment – Entrepreneurial skills- current trends.

Unit – II **[12 Periods]**

Business management skills-Internal skills- Financial management – Operating management – Manpower management – Material and Inventory management.

Unit – III **[12 Periods]**

Business management skills- External skill – Marketing Management- Sales Management – Business opportunities – Market Survey and Strategy- investment and investors relations- Business Outreach and promotions.

Unit – IV **[12 Periods]**

Schemes and Funding- Banking – Lending schemes – Government sponsored schemes- MSME credit – MUDRA loan- PMEGP scheme- CGTMSE Scheme- start-up India.

Unit – V **[12 Periods]**

Business plan preparation: plan format- proposal preparation – business pitching – EDP-Feasibility Report-successful enterprises-case studies.

Reference Books:

1. C.B.Gupta and S.P.Srinivasan, Entrepreneurial Development.

2. S.S. Khanka, Entrepreneurial Development.

3. S. Anil Kumar, Entrepreneurship Development, New Age International, 2008.

4. Website: https://msme.giv.in/all-schemes

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**
CO1	√	√			√	√			
CO2	√			√	√			√	
CO3	√		√				√	√	
CO4		√		√			√		
CO5	√		√	√				√	
CO6		√				√			√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BCSA04	Programming in C	4	5			ALLIED

Introduction: This paper presents the importance of C language, its structure, Data types, Operators of C, Various control statements, Arrays, different types of functions and practical problems.

Course Outcome:

CO1 : Understand the concept of functional hierarchical code organization.

CO2 : Define and manage data structures based on problem subject domain.

CO3 : Understand the concept of decision making amd branching statements.

CO4 : Apply defensive programming and concept of object thinking within the framework of functional model.

CO5 : Develop knowledge about textual information, characters and strings.

CO6 : Discuss about arrays of complex objects and to handle possible errors during program execution.

UNIT – I **[12 Periods]**

Overview of C - Introduction - Character set - keyword & Identifiers -Constants - Variables - Data types - Defining Symbolic Constants – Expressions.

UNIT – II **[12 Periods]**

Arithmetic operators - Relational operators - logical operators –assignment operators –increment and decrement operates –Conditional operators – Special operators – formatted input and output.

UNIT – III **[12 Periods]**

Decision Making and Branching -The Switch statement - The GOTO statement - Decision Making and Looping -The WHILE statement - The DO statement - The FOR statement - Jumps in Loops.

UNIT – IV **[12 Periods]**

Functions – User defined functions –function types - Need for user Defined functions – A Multi-function program –Structures

UNIT – V **[12 Periods]**

Arrays – Character Arrays — Strings, standard string function - One and Two Dimensional arrays - Multidimensional arrays.

TEXT BOOK:

1. Programming in ANSI C – E.Balagurusamy, 3rd edition– Tata McGraw hill publishing Company Ltd., 2005.

Reference book:

1. Programming with ANSI and Turbo C – Ashok. N. N.Kamthane – Pearson Education.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	P01	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**
CO1	√	√			√	√			
CO2	√			√	√			√	
CO3	√		√				√	√	
CO4		√		√			√		
CO5	√		√	√				√	
CO6		√				√			√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BCSA03	**Office Automation**	**4**	**5**	**0**	**0**	**ALLIED**

Introduction: This subject deals with Microsoft Word, Microsoft Excel and access so that students will gain basic computer knowledge.

Course Outcome:

CO1 : Recall the basics of computer language.

CO2 : Develop skills in windows using , wordpad, notepad etc.

CO3 : Examine the concept of Microsoft office 2000 and access the knowledge about working in wordpad.

CO4 : Analyze the available tools to work with excel.

CO5 : Describe the usage of computers and the essential components in business and society.

CO6 : Develop the knowledge to work with Microsoft office.

UNIT I: [12 Periods]

Windows Operating System: Overview of different version of windows Opening, closing and resizing windows-enlarging-reverting, reducing the windows-basic windows elements-saving, printing file-qutting a program-file and folder-Working in Explorer-opening and closing a folder in Explore-Entertainment-working in paint-working in Wordpad and Notepad-system tools

UNIT II: [12 Periods]

Introduction to Microsoft Office 2000-Word Processing & Microsoft Word-Introduction to Word Processing-Some Important Terms of Word ProcessingStarting Word-Microsoft Word Screen-File Menu-Edit Menu-View Menu-Insert MenuFormat Menu Tools Menu-Table Menu-Window Menu-Help Menu-Formatting the TextAlignment of Text-Applying Fonts-Size of Text-Font of the Text-Color of the Text.

UNIT III: [12 Periods]

Spreadsheets & Microsoft Excel: Understanding Microsoft Excel for Windows-Starting Microsoft Excel 2000-Understanding Spreadsheets-File Menu-Edit Menu-View Menu-Insert Menu-Format Menu-Tools Menu-Data Menu-Window MenuHelp Menu.

UNIT IV: [12 Periods]

Creating a Worksheet in Excel for Windows-Copying Formula-Formulas That Make Decisions-Styles-Functions in Excel-Using Autosum-Using autocalculateReferences-Sum Function-Average Function-Creating Charts in Excel-Creating GraphsModifying Chart-Adding Data to Chart-Add a Data table to a Chart-Add a TrendlineCreating a Pivot Table Report-Modifying the Chart Type.

UNIT V: [12 Periods]

Introduction to Tables-Simple Queries-Form.

Text Book:

1. IT Tools and Applications-Vikas Gupta-Dreamtech Press-First edition-2003

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**P01**	**PO2**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**
CO1	√	√			√	√			
CO2	√			√	√			√	
CO3	√		√				√	√	
CO4		√		√			√		
CO5	√		√	√				√	
CO6		√				√			√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BMAA10	Allied I-Mathematics - I	4	5			ALLIED

Introduction: This course presents a study on theory of equations, matrices, trigonometry, Laplace transform and Fourier series.

Course Outcome:

CO1 : To recall the fundamental concepts of Theory of Equations.

CO2 : To build equations by using different types of roots.

CO3 : To make use of Eigen values and Eigen vectors to build the Inverse of the Matrix

CO4 : To compare the usage of Hyperbolic and Inverse Hyperbolic functions with respect to real life applications.

CO5 : To determine the possible ways to evaluate Laplace Transforms and Fourier series for improving results.

UNIT I: Theory of Equations: **[12 Periods]**

Polynomial Equations with real coefficients irrational roots, complex roots - symmetric function of roots – Transformation of equations by increasin g or decreasing roots by a constant – Reciprocal Equations - Newton's method to find a root approximately.

UNIT II: Matrices: **[12 Periods]**

Eigen Values and eigen vectors, Cayley-Hamilton theorem (without proof) – Verification and computation of inverse.

UNIT III: Trigonometry: **[12 Periods]**

Expansion in Series – Expansion of $\cos^n \theta$, $\sin^n \theta$, in a series of cosines and sines of multiples of θ – Expansions of $\cos n\theta$ and $\sin n\theta$ in powers of sines and cosines - hyperbolic functions and inverse hyperbolic functions.

UNIT IV: Laplace Transforms: **[12 Periods]**

Definition – Laplace Transform of Standard function s – Linearity property – First shifting theorem – Transform of $tf(t)$, $f(t)/t$ and derivatives – Inverse Laplace transforms of st andard functions.

UNIT V: Applications of Laplace transforms and Fourier Series: **[12 Periods]**

Applications of Laplace transforms of differential equations of first and second order – Fourier series of functions in $(0, 2\pi)$.

Treatment as in

1. "Allied Mathematics", Volume I and II, Kandasamy. P, Thilagavathi. K S.Chand and Company Ltd, New Delhi, 2004.

References:

1. Trigonometry - T.K. Manichavasagam Pillai and S.Narayanan, Viswanathan Publishers and Printers Pvt. Ltd. 2006
2. "Ancil lary Mathematics", S. Narayan and T.K. Manicavachagam Pillay Viswanathan Publishers and Printers Pvt. Ltd. - 2012

Mapping of Course Outcome with Program Outcome

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	H	H	M	M	H	L	L
CO2	H	H	M	M	H	M	H	M	
CO3	H	H	M	M	M	H	H	L	
CO4	H	H	H	M	M	H	M	M	M
CO5	H	M	H	M	H	M	H	L	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BMAA11	**Allied II-Mathematics - II**	**4**	**5**			**ALLIED**

Subject Description :

This course presents the idea of curvature, multiple integrals, partial differential equations and vectors. On successful completion of course the students should have series of knowledge about the curvature, Beta, Gamma functions and its application. Learn the partial differential equation types and integration of vectors

Course Outcome:

CO1 : To be able to understand application of integration for finding area of curves.

CO2 : To evaluate triple integrals and also to identify the relation between Beta and Gamma functions using multiple integrals.

CO3 : To gain knowledge about linear differential equations and its application.

CO4 : To acquire knowledge on partial differential equations and Lagrange's differential equation by the method of eliminating the arbitrary constants and functions

CO5 : To be able to understand application of integration for finding area of curves.

Unit I: **[12 Periods]**

Curvature – Radius of curvature – center of curvature – circle of curvature – Evaluation of double integrals - change of order of integration in double integrals- Application of double integral to find the area between curves.

Unit II: **[12 Periods]**

Evaluation of triple integrals – Beta and Gamma functions – relations between them – Evaluation of multiple integrals using Beta and Gamma functions.

Unit III: **[12 Periods]**

Solving second order linear differential equations with constant coefficients whose R.H.S is of the form ve^{mx}, where v is any function of x - Linear equations with variable coefficients.

Unit IV: **[12 Periods]**

Formation of partial differential equations by elimination of arbitrary constants and functions - Definitions of general, particular and complete solutions - solving standard forms f(p, q) = 0, f(x,p,q) = 0, f(y,p,q) = 0, f(z, p, q) = 0, f(x,p) = f(y,q), z = px +qy + f(p,q) - Lagrange's Differential equations Pp+Qq = R.

Unit V: **[12 Periods]**

Scalar and vector fields –Differentiation of vector s – Gradient, Divergence and Curl -Integration of vectors – line integral – surface integral – Green's theorem in the plane – Gauss divergence theorem – Strokes theorem – (Statements only).

Books for study:

1. P. Kandasamy, K .S.Thilagavathi, "Allied Mathematics", Volume I and II, by Chand and Company Ltd, New Delhi, 2004 (Unit -I to Unit-V)

Books for Reference :

1. S. Narayan and T.K. Manicavachagam Pillay Viswanathan "Ancillary Mathematics", Publishers and Printers Pvt. Ltd. – 2012

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H			H	H	L	L	L	
CO2		H			L				
CO3	H		L	H					
CO4	H		L	H	M	M	M		H
CO5	H	H			H	L			H

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BCHA01	Allied III- Chemistry-I	4	5			ALLIED

Introduction:

To introduce the concepts which gives knowledge about industrial chemistry. On successful completion of this paper the students should gain the knowledge about Bonding, Dye, Fertilizers, industrial chemistry, Chromatography and Stereoisomerism

Course Outcome:

CO1 : To understand the fundamental concepts of Chemical Bonding, fuels and Interhalogen compounds

CO2 : To understand the characteristics of Industrial Chemistry, fertilizers

CO3 : To apply the Concepts of Polymer chemistry, Stereoisomerism

CO4 : To analyze the concept of Terms and Dyes

CO5 : To build the solutions of liquid, Kinetics and Chromatography

UNIT-I: [12 Periods]

Chemical Bonding: Molecular orbital theory ,bonding, non bonding, anti bonding-molecular orbitals-MO configuration of H2,N2,O2,F2. Bond order, Diamagnetism and paramagnetism-Diborane:Preparation and properties, structure, preparation and uses of NaHB, Borazole-Chemistry- Interhalogen compounds:ICI,BrF3,if3-Preparation, properties,hybridization and structure,shape. Basic properties sodium hydrosulphite,peracids of sulphur: preparation,properties and uses. Structure of iodine.

UNIT-II: [12 Periods]

Indusrtial Chemistry: Synthesis,properties and uses of silicones. Fuel gases: natural gas,water gas,semi water gas, carbureted water gas, produces gas,oil gas(manufacturing details not requied)
Fertilizers urea,ammonium sulphate,ammonium nitrate,potassium nirate NPK fertilizer. Triple superphosphate. Pollution of air, water and soil-sources, remedies.

UNIT- III: [12 Periods]

Polymers: Classification of polymers-natural polymers and synthetic polymers. Synthetic polymers-Addition polymers, condensation polymers-Mechanism of polymerization,

Stereoisomerism:

Optical isomerismsymmetry, elements of symmetry. Cause of optical activity, tartaric acid, Racemisation, Resolution. Geometric isomerism of maleic and fumaric acids. Keto-enol tautomerism in Acetoacetic esters.

UNIT-IV [12 Periods]

Terms

chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect, hypsochromic effect.

Dyes: azo and triphenylmethane dyes- Preparation one example

UNIT-V [12 Periods]

Solutions

Types. Liquid in Liquid. Raoult's law. Deviation from ideal behaviour. Binary liquid mixtures. Fractional distillation.

Kinetics Rate, order, moleculality, pseudo first order, determination of order. Measurement of reaction. Effect of temperature on the rate. Energy of activation.

Chromatography Principle and application of column, paper and thin layer chromatography

Book for Study*:*

Dr. V. Veeraiyan.,"Text book of Ancillary chemistry", Volume I, High mount Publishing house, Chennai-14,Edition-2008 (Unit-I to Unit-V)

Book for Reference *:*

P.L. Soni, “Text Book of Inorganic Chemistry”, Sultan Chand &Sons, New Delhi, 2013.

Puri and Sharma, “Text book of Inorganic Chemistry”, Vishal publishing, 2014

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	√								
CO2	√	√						√	√
CO3		√	√						
CO4			√	√					√
CO5				√	√				√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BCHA02	Allied IV- Chemistry-II	4	5			ALLIED

Introduction:

To introduce the concepts which gives knowledge about industrial chemistry

On successful completion of this paper the students should gain the knowledge about Metals, Aromatic com pounds, Heterocyclic, organic acids and electrochemistry.

Course Outcome:

CO1 : To understand the fundamental concepts of Metals and Coordination Chemistry, Types of furnaces, Refining and Chelation Examples

CO2 : To understand the characteristics of Aromatic Compounds and Heterocyclics

CO3 : To apply the Concepts of Amino Acids and Carbohydaryes

CO4 : To analyze the concept of Energetics

CO5 : To build the solutions of Electrochemistry and Phase Equilibria

Unit I [12 Periods]

Metals

General methods of excitation of metals. Types of ores. Methods of ore dressing. Types of furnaces. Reduct ionn methods, electricalmethods, types of refining Van Arkel Zone refining. Extraction of U

Coordination Chemistry

Nomenclature. Theories of Werner, Sidge Wick, Pauling, Chelation examples. Haemoglobin, chlorophyll. Applications in qualitative and quantitative analysis EDTA.

Unit II: [12 Periods]

1.**Aromatic Compounds**

Electrophilic substitution in benzene mechanism of nitration, halogenation, alkylation, acylation, sulphonati on, Preparation, propertiesand structural education of naphathalene

2.**Heterocyclics:**

Preparation and properties of furan, thiophene, pyrrole and pyridine.

Unit III: [12 Periods]

Amino Acids: Classification, preparation and properties, preparation of peptides. Classification of proteins by physical properties

Carbohydartes: classification, preparation and properties of glucose and fructose. Discussion of open chai n ring structures ofglucose and fructose. Glucose-fructose interconversion.

Unit IV: [12 Periods]

Energetics:

Definition of first law thermodynamics. Types of sytems. Reversible, irreversible. Isothermal and adiabatic processes. Spontaneous processes,

JouleThomson effect. Enthalpy, bond energy. Need for the second law. Carnot cycle and Carnot theorem. Entropy and its significance. Free energy change.

Unit V: [12 Periods]

Electrochemistry:

Kohlraush's law. Measurement of conductance. pH determination. Conductometric titrations. Hydrolysis of salts: pH and buffer in living systems. Galvanic cells, e.m.f. standard electrode potentials, reference electrod es Electrochemical series, its applications. Principles of electroplating. pH determination.

Phase Equilibria:Definition of terms in phase rule. Study of a simple eutectic system Pb-Ag.

Book for Study

Dr. V. Veeraiyan.,"Text book of Ancillary chemistry", Volume I, High mount Publishing house, Chennai-14,Edition-2008(Unit-I to Unit-V)

Book for Reference *:*

1. P.L. Soni, "Text Book of Inorganic Chemistry", Sultan Chand &Sons, New Delhi, 2013.
2. Puri and Sharma, "Text book of Inorganic Chemistry", Vishal publishing, 2014

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	√								
CO2	√	√						√	√
CO3		√	√						
CO4			√	√					√
CO5				√	√				√

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Allied Chemistry lab	2				

Subject Description

To understand and apply volumetric analysis for standard solution and to determine the dissolving rate of a solution,

Demonstrating the reaction of acid with base.

ORGANIC ANALYSIS:

Systematic analysis

1. Detection of Elements (N, S, Halogens).
2. To distinguish between aliphatic and Aromatic.
3. To distinguish between saturated and unsaturated.
4. Functional group tests for Carbohydrates phenols, acids (mono and di), aromatic primary a mine, amide, diamide.
5. Functional groups characterized by confirmatory test.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHA02	**Nanoscience And Nanotechnology**	**4**	**5**			**ALLIED**

Introduction:

This paper presents the fundamentals of formation of nanomaterials and their properties

Course Outcome:

CO1 : To acquire knowledge about the solid material and analyze its strength.
CO2 : To know the types of synthesis and come to know how to prepare a sample.
CO3 : To study the various types of synthesis according to the applications.
CO4 : To characterize the sample in order to find its various behavior
CO5 : To gain knowledge about the properties of a solid material by analyzing it in different characterizations.

Unit I **[12 Periods]**

Systematic Development of materials

Introduction – Solid materials and their strength – perspective of length – Nanoscience and nanotechnology – Nanostructures in nature – Quantum structures – quantum confinement – Surface effects of Nanomaterials – prime materials – carbon nanostructures – oxides: Zinc oxide, Manganese oxide, Lanthanum – manganese based oxide.

Unit II **[12 Periods]**

Methods of generation of Nanomaterials : Physical approaches

Introduction – Nanomaterials synthesis – Physical approaches – arc discharge method – Laser ablation – Aerosol synthesis – inert gas condensation – High energy ball milling (mechanical alloying method) – Chemical Vapor deposition – plasma synthesis method – Electro deposition.

Unit III **[12 Periods]**

Methods of generation of Nanomaterials : Chemical approaches

Chemical Approaches – Solvothermal synthesis – Hydrothermal synthesis – Reverse micellar emulsion method – Sol - gel synthesis – microwave method – sonochemical process – Co – precipitation.

Unit IV **[12 Periods]**

Mechanical and optical properties of Nanomaterial

Introduction – Mechanical behavior – Mechanical properties of Nanomaterials – Optical properties – Optical properties of Nanomaterials – Applications of optical properties of Nanomaterials.

Unit V **[12 Periods]**

Electrical and magnetic properties of Nanomaterial

Introduction – Electrical properties – Dielectric materials and properties – Magnetic properties – Magnetic properties of Nanomaterials – Superparamagnetism – Electrochemical properties – Chemical sensing properties

Books for Study:

1. M.A.Shah, Tokeer Ahmad, "Principles of Nanoscience and Nanotechnology", Narosa publishing House Pvt. Ltd., 2015.

Books for reference

1. Nils O. Petersen, "Foundations for Nanoscience and Nanotechnology**"**, CRC Press; 1 edition (19 April 2017).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H		H	L	M		M		M
CO2	H				H				
CO3	M		H		H			M	
CO4	H				M				
CO5	H		M	H		H	L		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS01	MATlab					

Subject Description:
This paper aims to provide a first approach to the subject of Mechanics, which is one of the important aspects of advanced mathematics.

Objectives:
To Study this Paper is to introduce you to the software MATLAB for numerical computations and in particular familiarizing yourself with the Matlab Desktop, basic commands through the Command window and output through the Graph window.

Course Outcome:

CO1 : To introduce the concepts in MATlab
CO2 : To understand the concept of functions in MATlab
CO3 : To apply the concept of plots in MATlab
CO4 : To create new programs using the basic knowledge in programming
CO5 : To get overall knowledge about the Matlab comments

Unit I

Introduction- Basics of MATLAB, Input – Output, File types – Platform dependence – General commands. Interactive Computation: Matrices and Vectors – Matrix and Array operations

Unit II

Programming in MATLAB: Scripts and Functions – Script files – Functions files.

Unit III

Plotting: Two-dimensional plots - Three-dimensional plot.

Books for Reference:

1. William John Palm "Introduction to Matlab 7 for Engineers", McGraw-Hill Professional, 2005.

2. Dolores M. Etter, David C. Kuncicky "Introduction to MATLAB 7", Prentice Hall, 2004

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H		M	L	M		M		L
CO2	M				H				
CO3	M		H		H			L	
CO4				L		L		M	M
CO5		M		L			L	M	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Electrical circuits and network skills			–	–	

19BPHS02

The aim of this course is to enable the students to design and trouble shoots the electrical circuits, networks and appliances through hands-on mode

CO1 : To understand the principles of electricity
CO2 : To understand Electrical Circuits

CO3 : To apply the knowledge of electricity to draw circuit
CO4 : To know the application of resistor, AC and DC motors etc
CO5 : To basics of relay

Unit I

Basic Electricity Principles: Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Unit II

Understanding Electrical Circuits: Main electric circuit elements and their combination. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money.

Unit III

Electrical Drawing and Symbols: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.

Unit IV

Generators and Transformers: DC Power sources. AC/DC generators. Inductance, capacitance, and impedance. Operation of transformers.

Electric Motors: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor.

Solid-State Devices: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources

Unit V

Electrical Protection: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)

Electrical Wiring: Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits.

Reference Books:

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. Performance and design of AC machines - M G Say ELBS Edn.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	M		M	H	H	L	H	
CO2	M	L	M	H	H			L	
CO3	H	H	L	H	H	L			L
CO4	H		M	M	M	M		L	
CO5			M	M	M				

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS03	Basic instrumentation skill			–	–	

Subject description

This course is to get exposure with various aspects of instruments and their usage through hands-on mode. Experiments listed below are to be done in continuation of the topics.

CO1 : To understand the basics of measurement.
CO2 : To apply the basic concept to understand the electronic voltmeter

CO3 : To know the construction, principle, working and application of CRO
CO4 : To draw the block diagram of signal generator.
CO5 : To apply the concept of analog meters to know the working of digital instruments

Unit I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. **Multimeter:** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Unit II

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. **AC millivoltmeter:** Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter**,** specifications and their significance.

Unit III

Cathode Ray **Oscilloscope:** Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance.

Unit IV

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

Unit V

Digital Instruments: Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

Text Books:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.

Reference Books:

1. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M		M		M	H	L	H
CO2	M	L	M	H	L				
CO3	H	H	L	H		H	L		
CO4	H		M	M	L		M	L	M
CO5	L	M	H		M	M			

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS04	Radiaology safety					

Subject description:

- To learn about the principles of radiation protection standards and its recommendations.
- To understand about radiation dose and units, categories of exposures in occupational, public and medical exposures.
- To learn about the safety of medical uses of radiations and the classification of radioactive waste disposal mechanisms.
- To know about transport of radioisotopes, Legislation, Radiation Emergencies and their medical management systems.

Course Outcomes

CO1 : To know how to protect human and biological object from radiation

CO2 : To compare the radiation protection levels

CO3 : To implement the safety in medical uses of radiation

CO4 : To determine the applications and safety in the industrial uses of radiation

CO5 : To link the principles of radiation detection and dosimeters

Unit I Radiation Protection Standards

Radiation dose to individuals from natural radioactivity in the environment and man made sources. Basic concepts of radiation protection standards -Historical background - International commission on Radiological Protection and its recommendations - The system of radiological Protection - Justification of practice,

Unit II Radiation Protection levels

Optimization of Protection and individual dose limits - Radiation and tissue weighting factors, equivalent dose, effective dose, committed equivalent dose, committed effective dose - Concepts of collective dose - Potential exposures, dose and dose constraints - System of protection for intervention.- Categories of exposures - Occupational, Public and Medical Exposures - Factors governing internal exposures

Unit III Safety in Medical uses of Radiation

Planning of medical radiation installations - General considerations Protective measures to reduce radiation exposures to staff and patients - Radiation hazards in Brachytherapy departments and Tele- therapy departments and radioisotopes laboratories; Evaluation of radiation hazards in medical diagnostic therapeutic installations - Radiation monitoring procedures - Protective measures to reduce radiation exposure to staff and patients

Unit IV Applications and Safety in the Industrial uses of Radiation

Physical principles of industrial radiography - Comparison of X-ray radiography and gamma radiography - Choice of source - Exposure containers - Photographic film technique - Radiographic contrast Definition of sensitivity - Intensifying screens - Pentameters; Industrial Fluoroscopy - Comparison of fluoroscopy and radiography - Image intensifier Special techniques - Micro-radiography, flash radiography - stereo radiography - X-ray diffraction

UNIT V PRINCIPLES OF RADIATION DETECTION AND DOSIMETERS

Principles of Radiation detection – properties of dosimeters - Theory of gas filled detectors – Ion chamber dosimetry systems - free air ion chamber – parallel plate chamber - ionization chamber – proportional chamber - GM counter – condenser type chambers and thimble chambers working and different applications – film dosimetery- Luminescence dosimetry – semiconductor dosimetry – Gel dosimetry

Books for Study and Reference:

1. H. Cember and T. E. Johnson, Introduction to Health Physics, 4th Ed. (McGraw Hill, 2008).
2. K. Thayalan, Handbook of Radiological Safety (Jaypee Brothers,Medical Publishers, 2009)

Reference

1. R. F. Mould Radiation Protection in Hospital (Adam Hilger Ltd., Bristol, 1985).

2. A. Martin, S. Harbison, K. Beach and P. Cole, An Introduction to Radiation Protection, 6th Ed. (CRC Press, 2013)
3. AERB Radiation Protection Rules, 2004

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1			M	H					M
CO2	H			M				M	
CO3							H		
CO4	H								
CO5			H					L	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS05	Computational physics skills			–	–	

Subject description

The aim of this course is not just to teach computer programming and numerical analysis but to emphasize its role in solving problems in Physics.

- Highlights the use of computational methods to solve physical problems
- Use of computer language as a tool in solving physics problems (applications)
- Course will consist of hands on training on the Problem solving on Computers.

Course Outcome

CO1 : To understand the concept of algorithm and flowchart
CO2 : To apply in real time problems as example

CO3 : To understand the basic concepts of fortan language
CO4 : To analyze the problem with respect to the concept taught
CO5 : To analyze the Branching statements looping statements and jumping statements

Unit I

Introduction: Importance of computers in Physics, paradigm for solving physics problems for solution**.** Usage of linux as an Editor. Algorithms and Flowcharts**:** Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types.

Unit II

Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

Unit III

Scientific Programming: Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program.

Unit IV

Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems.

Unit V

Control Statements: Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical **IF**, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO-WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO)

Reference Books:

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. LaTeX–A Document Preparation System", Leslie Lamport (Second Edition, Addison- Wesley, 1994).
4. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi(1999)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	L		H	H				
CO2	M	M	M	H	H	M	M	M	
CO3	H	H	L	M	M			M	M
CO4	H	H	H	H	M	M		M	M
CO5				L		H	H		

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS06	**Applied Electronics**					

Subject Description:
This paper presents the applications of electronics and its usage.

Objectives

- To enable the students to acquire the knowledge in electronics and to study the various electronics circuits.
- To motivate the students to apply the concepts of electronics in their day – to – day life.

Outcome

CO1 : To understand the concept of op - amp
CO2 : To know the application of waveform and analog computation

CO3 : To apply diode to construct the timer and trigger
CO4 : To implement the concept of semiconducting materials in memory devices
CO5 : To gain the basic knowledge about memory devices

Unit I

Operational Amplifier fundamentals:
Characteristics – Op-Amp parameters - inverting amplifier-non-inverting amplifier - unity follower - summing amplifier-difference amplifier - Differentiator, integrator, comparator using OP-Amps.

Unit II

Analog computation and wave form generation:
Solving simultaneous equations and second. order differential equations. Square wave generation (astable operation) and sine wave generation (Wien's Bridge oscillator).

Unit III

Timer and applications:
Timer 555 - Internal block diagram and working - Applications of timer 555 - Schmitt trigger, Astable and Monostable operations.

Unit IV

D/A and A/D converters
DIA converter - binary weighted resistor and R-2R ladder method - A/D converter - Flash - Counter type - Successive approximation techniques.

Unit V

Semiconductor Memories
Basics - ROM, PROM, EPROM, EEPROM - RAM - Dynamic RAM - basic ROM cell - basic RAM cell (both using gates) - block diagram of 2Kx8 ROM and 2Kx8 RAM and different signals associated with these chips

Book for Study:

1. Jacob Millman, Christos Halkias, Chetan D. Pouikh," Integrated Electronics Analog and Digital Criciuts and Systems", Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2016.(Unit I –V)

Book for Reference :

1. Dr. R.S. Sedha, "A Textbook of Applied Electronics", S.Chand and Company Pvt. Ltd., New Delhi, 2016.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1			L		H				
CO2	M			H	H	M	M	M	
CO3		H			M			L	M
CO4	H	H	H	H	M	M		M	M
CO5		M		L		L	L		L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS07	Introduction to medical physics					

Introduction

An introduction to key physical principles as applied to medical imaging and radiation therapy.

The material in this section is designed to teach the basics of radiological physics, interaction of radiation with matter, basic dosimetric concepts and radiation detectors.

Subject Objectives

- Develop basic understanding of medical physics concepts,
- Develop problem-solving and critical-thinking skills,
- Learn to integrate and apply various physics concepts to a single problem, • Develop scientific communication skills.

Course Outcomes

CO1 : To understand the basic concept of atomic and nuclear transformation

CO2 : To predict the interaction of radiation of matter

CO3 : To judge the effect of radiation on biological object

CO4 : To examine the radiation hazard evaluation and control.

CO5 : To illustrate the radiation monitoring instruments

UNIT I ATOMIC PHYSICS AND NUCLEAR TRANSFORMATION

Structure of matter - atom - nucleus -atomic mass and energy units -distribution of orbital electrons - atomic energy levels -nuclear forces -nuclear energy levels- particle radiation -Electro magnetic radiation- Binding energy - General properties of alpha, beta and gamma rays - Laws of equilibrium – modes of radioactive decay – nuclear isomerism -nuclear reactions - natural and artificial radioactivity.

UNIT II INTERACTION OF RADIATION WITH MATTER

Interaction of electromagnetic radiation with matter, Thomson scattering, Rayleigh scattering, Compton scattering (Klein-Nishina differential cross section), Photoelectric absorption, Pair production – Interaction of light (electrons and positrons) and heavy charged particles with matter –specific ionization – Cerenkov radiation-mass-energy attenuation and absorption coefficient

UNIT III - BIOLOGICAL EFFECTS OF RADIATION:

Physics of radiation absorption - Cancer biology - Cell survival curves - Fractionation in Radiation therapy- dose rate effect - Oxygen Enhancement Ratio (OER) - Relative Biological Effectiveness (RBE) – Linear Energy Transfer (LET) - Molecular mechanism of DNA & chromosomal damage and repair – 4 R's of Radiobiology

UNIT IV - RADIATION HAZARD EVALUATION AND CONTROL:

Basic concepts of Radiation protection standards - philosophy behind radiation protection - External radiation protection - ICRP recommendations - Radiation dose limits - system of radiological protection - Equivalent dose, effective dose, committed dose - radiation exposures - Evaluation of external and internal radiation hazards and control - ALI-DAC- MPBB - planning and shielding calculations - radioactive waste disposal - Radiation emergencies, medical management and legislation.

UNIT V RADIATION MONITORING INSTRUMENTS 9

Introduction – operational quantities for Radiation monitoring – Area survey meters – Ionization chambers – proportional counters – neutron area survey meters – GM survey meters – scintillation detectors – Personal monitoring – film badge – TLD – Properties of personal monitors

TEXT BOOKS:

1. Radiation oncology physics : A Handbook for teachers and students. IAEA publications 2005.
2. F.M.Khan,The Physics of Radiation Therapy,Third Edition,Lippincott Williams and Wilkins,U.S.A.,2003.

REFERENCES

1. H. E. Jones, J. R. Cunningham, The Physics of Radiology, Charles C. Thomas, New York, 2002.
2. W. J. Meredith and J. B. Massey, Fundamental Physics of Radiology, John Wright and Sons,U. K., 2000.

3. W. R. Handee, Medical Radiation Physics, Year Book Medical Publishers Inc., London, 2003.
4. Donald T. Graham, Paul J. Cloke, Principles of Radiological Physics, Churchill Livingstone, 2003

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1					M	H			
CO2	H				M			M	
CO3		L		L			H		
CO4	H								
CO5				H					L

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHS08	**Biophysics**					

Subject Description:

This paper presents the fundamentals of biomolecules and its studies.

Objectives:

- To Facilitate the knowledge about biomolecules
- To Explore the trends of optical techniques.

Course Outcome:

CO1 : To study the basic concepts of bio molecules and its various structures
CO2 : To know about the kinetics of molecules and its process
CO3 : To study the significance of molecules and its characteristics.
CO4 : To know the characterization techniques of biological samples.
CO5 : To study about the bioelectricity and radioactivity.

Unit I Structure of Biomolecules [12 Periods]

Introduction - Atomic structure - Hydrogen atom - Bonds between atoms and molecules - secondary or weak bonds - Bond energy - Disulphate bonds – Peptide bond - Structure of Proteins - Molecular weight determination - Kinetic methods - Static methods - Structure of nucleic acids - DNA - RNA.

Unit II Kinetics of Molecules I [12 Periods]

Diffusion Factors affecting diffusion·- Simple diffusion – Fick's law of diffusion - Diffusion of electrolytes - Biological significance of diffusion

Osmosis: Osmosis - Osmotic pressure - Laws of osmosis - osmometry - osmotic pressure of electrolytes.

Filtration: Filtration - Passage of fluid though blood vessels - Formation of Urine- Dialysis Principle of dialysis in artificial kidney - kinds of dialysis.

Unit III Kinetics of Molecules II [12 Periods]

Adsorption: Adsorption - Factors affecting adsorption - Adsorption of ions by Solids and Liquids - adsorption of Gases by solids - Biological significance of adsorption.

Hydrotropy : Hydrotropy - Biological importance of hydrotropy.

Precipitation: Precipitation - Biological significance.

Colloids: Types of colloids - characteristics of colloids - stability of colloids - Gel - Emulsions - Techniques for the separation of colloids - Biological importance of colloids – Gibb's Donnan Equilibrium.

Unit IV Optical Techniques in Biological Studies [12 Periods]

Characteristics of light- compound· microscope - Ultraviolet microscope - Electron microscope - Transmission electron microscope - Scanning Electron microscope - Monochromator - Light sensitive detectors- Spectrophotometer - Atomic absorption flame photometer - Electromagnetic radiation Spectroscopy - Ultraviolet, visible, infrared and fluorescent spectroscopy - Atomic absorption and emission spectroscopy - mass spectroscopy - Raman spectroscopy – x ray diffraction crystallography.

Unit V Bioelectricity and Radiation Biology [12 Periods]

Membrane potential - Resting membrane potential - Action potential and nerve impulse conduction Rate of nerve impulse conduction- Recording of nerve impulses by C.R.O - Resting membrane potential -.J Injury potential- Monophasic and diphasic action potentials - Radioactivity - Natural radioactivity Artificial or induced radioactivity - Radioactive disintegration - units of Radioactivity.

Books for Study

1. M.A. Subramanian, "Biophysics Principles and Techniques ", MJP Publishers – Chennai

Books for reference

1. Dr.S.Palanichamy & Dr.M.Shanmugavelu, "Principles Of Biophysics", Palani Paramount Publications – Palani.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H				L	M	L	L	M
CO2			L	H			L	M	
CO3			H		L	L	M		
CO4				H				L	M
CO5	H					L			

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE01	**Principles of Communication systems**					

Subject Description:

This paper presents the fundamentals of electronics and its communication principles.

Objectives

- To enable the students to acquire the knowledge in electronics and to study the various electronic circuits.
- To motivate the students to apply the concepts of electronics and its principles in their day -to - day life.

Course Outcome

CO1 : To gain basic knowledge about modulation and its different types.

CO2 : To know about the demodulation of signals and the receivers.

CO3 : To acquire the basic knowledge about television and its transmission

CO4 : To study about the different types of antenna and transmission lines

CO5 : To know about the digital codes and LEDs and its uses in communication.

Unit I Amplitude and Frequency Modulation [12 Periods]

Modulation - Definition - Types of modulation AM-FM- PM – Expression for amplitude modulated voltage - Wave form of amplitude modulated wave - Collector modulation circuit - Single side band generation - Balanced modulator - AM transmitter - Block diagram and explanation - Frequency modulation - Expression for frequency modulated voltage - Side bands in FM- AM production by transistor modulator - Comparison of AM-FM- PM.

Unit II Transmission Lines [12 Periods]

Demodulation - Definition - Diode detection of AM signals - FM detection - Foster Seely discriminator - Radio receivers - Straight receivers - TRF receivers - Super heterodyne receivers - Block diagram - Explanation of each stage - FM receivers – Block diagram – Single and independent side band receiver- Demodulation of SSB and receiver types - Transmission Lines – Characteristics impedance - Losses in transmission line - Standing waves - Smith chart and its applications.

Unit III Television Fundamentals [12 Periods]

Television systems and standards – Black and white transmission - Black and white reception - Plumbicon - Vidicon - Scanning and interlaced scanning – Block diagram of TV transmitter and receiver - Colour TV - Generation R, G, B signals - Simplified block diagram of colour TV transmitter and receiver – TV transmitting antennas - dipole panel - TV receiving antenna - Yagi antenna - Log antenna - Log periodic antenna.

Unit IV

Radar Systems [12 Periods]

RADAR - Principle of radar – Radar performance factors - Radar equation – Radar - Pulsed systems - Basic pulsed radar system - Antennas and scanning - Display methods - Pulsed radar systems - Moving target indication - Radar beacons - Transmitting systems - Radar antennas - Duplexer - Radar receivers uses of radar - Optoelectronic devices - Photoconductive cell - Solar cell - Phototransistor - LED -LCD construction and working and other radar systems.

Unit V

Digital Communications [12 Periods]

Digital communications - Digital technology - Fundamentals of data communication systems - Binary number system - Digital electronics – Emergence of data communication systems - Characteristics of data transmission circuits – Digital codes - Error detection and correction - Data sets and inter connection - Requirements - Modern classification - Modern interfacing- Network organizations- Switching systems – Network Protocols.

Books for study

1. Gupta and Kumar, “Hand book of Electronics”, Pragati Prakhasan, 2005.
2. Kennedy and Davis, “Electronics Communication Systems”, TMH, 2009.

Books for References

1. Wayne Tomasi, “Electronic communication systems”, Dorling Kindersely India Pvt Ltd., 2009.
2. Roy Blake, “Electronic communication system”, Delmar/Thomson Learning, 2002.
3. Bakshi U.A. and Godse A.P, “Basic Electronics Engineering”, Technical Publication, 2009.
4. Godse A.P.and Bakshi U.A, “ Basic Electronics” ,Technical Publication,2009.
5. Tomasi, Wayne, “Advanced Electronic Communication System” Prentice Hall PTR, 1993
6. Haykin Simon S, “Communication Systems”, Wiley , Fifth edition, 2007.
7. K.N. Hari Bhat D. Ganesh Rao “Principles of Communication Systems” ,Cengage India Private Limited,February 2017.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1			L	H			H		L
CO2				H		L	H		
CO3			H					H	L
CO4	H		H	L			H		M
CO5	H					H			

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE02	Fibre Optic Communication Systems					

Subject Description:

This paper presents the fundamentals of Fibre optic and its applications in communications

Objective:

- To facilitate the knowledge about optical and fiber resources and transmission techniques.
- To enrich the idea of optical and fiber networks.
- To explore the trends of optical fiber measurement systems.

Course Outcome:

CO1	:	To develop knowledge in the basics of fibre optics
CO2	:	To understand the fabrication technique
CO3	:	To acquire knowledge about losses and dispersion in optics
CO4	:	To get idea about LED
CO5	:	To acquire knowledge about the applications of fibre optics in satellite link.

Unit I Fibre Classification **[12 Periods]**

Propagation of light waves in an optical fibre – Acceptance angle and Acceptance cone of a fibre – Numerical Aperture (NA) – NA of a graded Index fibre – Mode of propagation- Fibres – classification – stepped index fibre – stepped index mono mode fibre – Graded index multimode fibre – Comparison of step and graded index fibres.

Unit II Fibre Fabrication and Cables **[12 Periods]**

Classification of Techniques – External chemical vapour deposition – Characteristics – Internal chemical vapour deposition (1^{st} method only) – Characteristics – Phasil system - Fibre cable construction – losses incurred during installation of cable – Testing of cables– cable selection criteria.

Unit III Fibre Losses And Dispersion In Optics **[12 Periods]**

Attenuation in optic fibre– Rayleigh Scattering losses – Absorption losses – Bending losses – Radiation induced losses – Inherent defect losses – Core and Cladding losses-Dispersion in an Optical Fibre – Inter-modal dispersion – Material Chromatic Dispersion– Dispersion Power penalty – Total Dispersion delay.

Unit IV

Light Sources For Optical Fibres **[12 Periods]**

LED – The process involved in LEDS – Structures of LED – Fibre – LED Coupling Modulation bandwidth and Spectral Emission of LEDS.

Unit V Applications **[12 Periods]**

Introduction – Video Link Satellite Link – Computer Link – Nuclear Reaction Link – Community Antenna Television – Switched Star CATV – Networking

Books for study:

1 . Deshpande N.D, Deshpande D.A and Rangole P.K ,"Communication Electronics", Tata McGraw Hill Publishers Ltd (1996).
2. Dr. Subir Kumar Sarkar, " Optical Fibres and Fibre optics Communication System", S.Chand and Company Pvt. Ltd., New Delhi, 2014.
3. A.M.Dhake, "Television and Video Engineering ", Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2012.

Book for reference:

2. MGeorge Kennedy ," Electronic Communication Systems", Tata McGraw Hill Publishers Ltd, New Delhi (2008).
3. Sanjeeva Gupta ,"Electronics Communication Systems", Khanna Publications, Salem (1992).
4. Bernard Grob , "Basic Television and Video Systems", McGraw Hill, New York (1997).
5. Govind P. Agrawal, "Fiber-Optic Communication Systems",3rd Edition, Kindle Edition.April 2008.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1			H		L	H			
CO2				H	L		L	H	
CO3			L	H				L	M
CO4	H	L				M		L	M
CO5			H	L					

SEMESTER-VI

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE03	Soil Physics	-	-	-		

Subject Description:

This paper presents the fundamentals of properties of soil.

Objectives

- To acquire knowledge about properties of soil.
- To acquire knowledge about texture of soil.

Course Outcome:

CO1	:	To gain knowledge about the soil
CO2	:	To understand soil properties
CO3	:	To acquire knowledge about water flow
CO4	:	To idea about stress and strain in the soil surface
CO5	:	To applying and understanding the concept of water content in soil

Unit I

Soil properties: Introduction Soil properties: Mass-volume relationship Soil properties: Soil texture

Unit II

Soil properties: Soil structure Soil moisture: Fluid properties - Energy state - Total water potential and components

Soil - water characteristic curves

Unit III

Water flow in soil: Saturated flow - Unsaturated flow

Unit IV

Composite Phenomena: Stress, strain, and strength - soil temperature and heat flow -Field water: Surface runoff

Unit V

Field water: Evaporation - Field water: Soil-water-plant relationship

Textbook:

1. Hillel. D, "Environmental Soil Physics*",* Elsevier, 1998.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1			M		L	H			
CO2				M	H		H	M	
CO3			L					L	M
CO4	H	L				M		L	M
CO5			H	L					

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE04	Characterization of Nanomaterials and its Applications					

Introduction:

This paper presents the fundamental methods of formation of nanomaterials and their analysis studies.

Course Outcome:

CO1 : To understanding the different methods of biological sample preparation

CO2 : To examine structure of nanomaterials using most powerful techniques.

CO3 : To summarize the different types of Electron microscopy methods.

CO4 : To summarize the different types of Spectroscopy Techniques.

CO5 : To determine the properties of a materials by using various spectroscopic and microscopic techniques.

Unit I

Methods of sample preparation

Introduction – Chemical fixation technique – Cyro Fixation Technique – Dehydration – Embedding Biological samples Sectioning – Staining – Mechanical milling – Chemical etching – Ion etching – Conductive coating

Unit II

Structure of Nanomaterials

Introduction – Structure of Nanomaterials – X - ray diffraction (XRD) – The Laue method – The rotating crystal method – The powder method – Determination of grain size/ crystallite size using X - ray line broadening studies (Scherrer's formula) – Determination of crystallite size distribution using X - ray line Shape analysis – X- ray diffraction pattern and analysis of some commercially important oxides – Small angle X- ray scattering

Unit III

Electron microscopy

Introduction – Principles of electron microscopy – Scanning electron microscope (SEM) – Strength and limitations of Scanning electron microscopy – Energy dispersion X-ray Analysis (EDX) – Transmission Electron microscope (TEM) – Scanning Tunneling Microscope – Atomic Force microscope (AFM)

Unit IV

Spectroscopy Techniques

Introduction – The regions of spectrum – Characterization of electromagnetic radiations – The quantization of energy – Absorption spectroscopy – Photoluminescence – Fourier transform infrared spectroscopy – Raman spectroscopy

Unit V

Applications of Nanomaterials

Introduction – Nanomaterials in medicine – Longer - lasting medical implants – Nanomaterials in energy sector – Kinetic energy (KE) penetrators with enhanced lethality – High energy density batteries- Nanomaterials in catalysis – High - sensitivity sensors – Nanomaterials for water purification – Nanomaterials in food –Nanomaterials for the environment – Elimination of pollutants

Book for study:

1. M.A.Shah, Tokeer Ahmad, " Principles of Nanoscience and Nanotechnology", Narosa publishing House Pvt. Ltd., 2015.

Books for reference

1. Nils O. Petersen, "Foundations for Nanoscience and Nanotechnology**"**, CRC Press; 1 edition (19 April

2017).

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	M	H		H			L	
CO2	M			H	M				
CO3			H				H		
CO4	H		H		M				M
CO5			H		H				L

Subject Code	Subject Title	Lecture	Tutorial	Practical	Credit	Type
19BPHE05	Atmospheric science					

Subject Description:

This paper presents the fundamentals of earth system, atmospheric thermodynamics, radiative transfer, atmospheric dynamics, and climate dynamics.

Objectives

To enable the learners to understand

- The science behind the Atmosphere.

Course Outcome

CO1	:	To recall the basic concept of atmospheric science
CO2	:	To explain the structure and evolution of atmospheric thermodynamics.
CO3	:	To apply mathematical tools to study radiative transfer.
CO4	:	To explain the principles behind, and use of atmospheric dynamics
CO5	:	To demonstrate critical and analytical skills to interpret and predict climate dynamics.

Unit I

Introduction and Earth system - Atmosphere-A brief survey (Pressure, Temperature and Chemical composition) - (Vertical structure of the atmosphere) - The Earth system – Oceans - The Earth system – Marine biosphere - The Earth system – Hydrological cycle - The Earth system – Carbon cycle - The Earth system – Carbon in the oceans and Earth's crust.

Unit II

Atmospheric Thermodynamics - Introduction - The hydrostatic equation - Hypsometric equation and pressure at sea level - Basic Thermodynamics - Concept of air parcel and dry adiabatic lapse rate - Potential temperature and problems - Skew-T ln-P chart - Lifting Condensation Level (LCL) - Saturated adiabatic and Pseudo-adiabatic processes - Saturated adiabatic lapse rate - Tutorial on using Skew-T ln-P chart - Normand's rule and static stability - Conditional and convective stability - Second law of Thermodynamics – Clausius - Clayperon equation.

Unit III

Radiative transfer - Introduction- Quantitative description of radiation - Concept of Black body and Stefan-Boltzmann law - Radiative properties of non-black surfaces - Kirchoff's law - Physics of Absorption, Emission and Scattering in the atmosphere - Equation of Radiative Transfer (RTE) - Radiative cooling rates.

Unit IV

Atmospheric Dynamics - An Introduction - Hydrostatic and Geostrophic approximations - Cyclostrophic approximation and Thermal winds – Atmospheric boundary layer - Surface energy

balance and bulk aerodynamic formulae - Vertical structure.

Unit V

Climate Dynamics - Introduction - Climate sensitivity and feedback - Transient and equilibrium response - Tutorial on climate dynamics.

References:

1. J.M.Wallace and P.V.Hobbs, Atmospheric science An Introductory Survey", 2nd Edition, Academic Press, London, 2006.
2. A.A.Tsonis, An Introduction to Atmospheric Thermodynamics", 2nd Edition, Cambridge University Press, Cambridge, 2007.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H								
CO2	H			L					
CO3	L				H				M
CO4		L	L			M			
CO5						H	H	L	H

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE06	Geo physics					

Subject Description:

This paper presents the fundamentals of geographic state of earth through physics.

Objectives

- To acquire knowledge about Seismology.
- To acquire knowledge about earth quakes.

Course Outcome:

CO1 : To know about Seismology and its various factors.
CO2 : To learn about surface waves and Seismometry.
CO3 : To learn about the earthquakes and and gravity.
CO4 : To acquire knowledge about Geomagnetism and Internal structure of the Earth
CO5 : To study about the Geochronology and Geothermal Physics

Unit I Introduction and Seismology:

Introduction - Seismology: P waves, S waves, their velocities - Time distance curves and the location of epicenters - Effect of boundaries - Major discontinuities and resulting phase of seismic waves - Derivation of properties from the velocities.

Unit II Surface Waves and Seismometry:

Surface waves: Rayleigh waves and Love waves – and Study of earth by surface waves.
Seismometry: Horizontal seismograph and seismography equation – Strain seismograph.

Unit III Earthquakes and Gravity:

Earthquakes: Focus, magnitude, frequency - Detection and prediction - Gravity: The potential (Laplace's equation and Poisson's equation) - Absolute and relative measurements of gravity - Hammond Faller method - Worden gravimeter.

Unit IV Geomagnetism and Internal structure of the Earth:

Geomagnetism: Fundamental equations - Measurements: method of Gauss, saturation induction magnetometers, proton precession magnetometers, alkali vapour magnetometers - Theories of earth's magnetism - Causes of the main field -Dynamo theories – Internal structure of the earth: The core Variation of mechanical properties with depth - Materials and equation of state of the interior of the earth.

Unit V Geochronology and Geothermal Physics:

Geochronology: Radioactivity of the earth - Radioactive dating of rocks and minerals Geological time scale - The age of the earth - Geothermal physics: Flow of heat to the surface of the earth - Sources of heat within the earth - Process of heat transport internal temperature of the earth.

Books For Study:

1. Garland, G.D., “Introduction to Geophysics”, 11 Ed., WB Saunder Company, London, l 979.
2. Cook, A. H., “Physics of the Earth and Planets”, I Ed., McMillan Press, London, 1973.

Books For Reference

1. Dr. El-Arabi H. Shendi, “Introduction Of Geophysics”, Suez Canal University,2007.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H		H		H	H		H	M
CO2	L					H		L	
CO3	H			L	H				
CO4			H				L	L	L
CO5	L			H	L				

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE07	Optoelectronics					

Introduction:

The subject gives a basic knowledge about the optoelectronic devices.

OBJECTIVES:

- To understand the basics of solid state physics.
- To understand the basics of display devices.
- To understand the optical detection devices.
- To understand the design of optoelectronic integrated circuits.

Course Outcomes

CO1 : To understand the basic concept of light

CO2 : To apply the concept of light to design a devices

CO3 : To demonstrate the optoelectronic devices

CO4 : To know the real time application of optics in electronics

CO5 : To structure the semiconductor with respect to light

Unit I : Elements Of Light And Solid State Physics

Wave nature of light – Polarization - Interference – Diffraction - Light Source - review of Quantum Mechanical concept - Review of Solid State Physics - Review of Semiconductor Physics - Semiconductor Junction Device

Unit II : Display devices and Lasers

Introduction - Photo Luminescence - Cathode Luminescence - Electro Luminescence - Injection Luminescence - Injection Luminescence – LED - Plasma Display - Liquid Crystal Displays - Numeric Displays- Laser: Emission, Absorption, Radiation - Population Inversion - Optical Feedback - Threshold condition - Laser Modes - Classes of Lasers -Mode Locking - laser applications.

Unit III : Optical Detection Devices

Photo detector - Thermal detector - Photo Devices - Photo Conductors - Photo diodes -Detector Performance.

Unit IV : Semiconductor Photon Sources: Display Devices

Electroluminescence. The LED: Device structure, materials and characteristics, LED drive circuitry, Plasma displays, liquid crystals: properties, LCD, Numeric displays

Semiconductor Photon Sources: LASER

The Semiconductor Laser: Basic structure, theory and device characteristics; direct current modulation. Quantum-well lasers; DFB-, DBR- and vertical-cavity surface-emitting lasers (VCSEL); Laser diode arrays. - Device packages and handling.

Unit V : Semiconductor Optical Amplifiers & Modulators:

Semiconductor optical amplifiers (SOA), SOA characteristics and some applications, Quantum confined Stark Effect and Electro-Absorption Modulators.

Semiconductor Photodetectors:

Types of photodetectors, Photoconductors, Single junction under illumination: photon and carrier-loss mechanisms, Noise in photodetection

Photodiodes, PIN diodes and APDs: structure, materials, characteristics, and device performance - Photo-transistors, solar cells, and CCDs - Optoelectronic integrated circuits – OEICs

TEXTBOOKS:

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2. Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw-Hill International Edition, 1998

REFERENCES:

1. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.
2. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall, 1995

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	M	H							
CO2	H				M				
CO3							H		
CO4	H								
CO5				H		L		L	M

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
19BPHE08	**Biomedical instrumentation**					

Subject Description
To give a complete exposure of various recording mechanism and physiological parameters measured for diagnostic application.

Objectives

- To study different types of electrodes used in biopotential recording.
- To understand the characteristics of bioamplifiers and different types of recorders.
- To understand how to measure various biochemical and nonelectrical parameters of human system.
- To study the instrumentation concerned with measuring the blood flow volume, velocity and number of particles in the blood.

Course Outcomes

CO1 : To know different types of electrodes used in biopotential recording

CO2 : To understand the characteristics of bioamplifiers and different types of recorders.

CO3 : To apply the known concept to construct the biomedical instruments

CO4 : To acquire knowledge about the biomedical instrument by using the physics princip

CO5 : To acquire knowledge about blood flowmeter

Unit I
Bio-potential electrodes

Electrode electrolyte interface, half-cell potential, polarisation and non- polarisable electrode, calomel electrode, needle and wire electrode, microelectrode-metal micropipete.

Unit II
Recording system

Low-Noise preamplifier, main amplifier and driver amplifier, inkjet recorder, thermal array recorder, photographic recorder, magnetic tape recorder, X-Y recorder, medical oscilloscope.

Unit III
Bio-chemical measurement

pH, pO_2, pCO_2, $pHCO_3$, Electrophoresis, colorimeter, spectro photometer, flame photometer, auto analyser.

Unit IV
Non-electrical parameter measurements

Respiration, heart rate, temperature, pulse blood pressure, cardiac output, O_2, CO_2 measurements.

Unit V
Blood flow and blood cell counting

Electromagnetic and ultrasonic blood flowmeter - indicator dilution method - thermo dilution method - manual and automatic counting of RBC, WBC and platelets - Electro Cardiography - Electro Myograph (EMG) - Ultrascan.

Book for Study:

1. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 1997.

Book for Reference :

1. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 1998.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 1997.
3. Joseph J.carr and John M. Brown, “introduction to Biomedical equipment technology”, John Wiley and sons, New York, 1997.

Mapping of Course Outcomes with Program Outcomes:

	Program Outcomes								
Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	H	M		L			L		L
CO2	H				M				
CO3						M	M		
CO4	M		M	L					
CO5			M		H		L		L