DEPARTMENT OF PHYSICS

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari, Coimbatore – 641021

Syllabus for

B.Sc. Physics

2021-22 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.

MOTTO

Transform the youth into National Asset.

Vision and Mission of the Department:

VISION

The department focuses to builds a foundation for excellence in education and develops the student community of the Institution as per the need of Industry by igniting the interest in the field of Physics through teaching, experimenting and 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
A world renowned industry-integrated institution	PEO3, PEO4
Imparts knowledge, skill, and research culture in young men and women to suit emerging young India.	PEO1, PEO2

Mapping of Department Mission to PEO

Department Mission	PEO's
To provide Quality Education and Research by Providing Higher Education in Physics with necessary needs by the industry.	PEO2
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.	PEO1, PEO3, PEO4

Program Outcomes (PO)

PO1	**:**	Gain knowledge and understand the fundamental laws in physics to explore it.
PO2	**:**	Develop the Socratic Method to trigger the students to project their creativity.
PO3	**:**	Comprehend the student's ability to promote their innovative ideas to seek opportunities.
PO4	**:**	Learn how to apply the mathematical and computer - oriented skills in Physics.
PO5	**:**	Analyses and interpret in the interdisciplinary sectors and find solutions for the sustainable environment.
PO6	**:**	Design the techniques to identify and tackle the problems in theoretical and practical.
PO7	**:**	Execute the ability in academic and non-academic to promote the ethical values.
PO8	**:**	Evaluate the student's knowledge to mould them for handling problem and solution in the circumstance.
PO9	**:**	Inculcate the communicative skill to provoke their LSRW skills effectively.

Program Specific Outcomes (PSO)

PSO1	**:**	Students acquire knowledge right from fundamentals to advance level of the course.
PSO2	**:**	Make aware and handle the instruments/equipments
PSO3	**:**	Graduates will acquire a job efficiently in diverse fields such as, Science and Engineering, Education, Banking, Public Services.
PSO4	**:**	Entrepreneurship for small scale industries like electronics components, LED manufacturing, LASER.

Correlation between the POs and the PEOs

Program Outcomes		PEO1	PEO2	PEO3	PEO4
PO1	:	3	3	3	2
PO2	:	3	3	2	2
PO3	:	2	3	3	1
PO4	:	3	3		2
PO5	:	1	2	3	2
PO6	:	2	2	2	2
PO7	:	3		3	2
PO8	:	2	2	2	2
PO9	:	1	2	3	2
PSO1	:	1	2	2	3
PSO2	:	2	2	2	2
PSO3	:	2	2	2	2
PSO4	:	2	3	3	3

Components considered for Course Delivery is listed below:

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

Mapping of POs with Course Delivery:

Program Outcomes	Course Delivery								
	1	2	3	4	5	6	7	8	9
PO1	3	3	3	3	3	3	2	2	2
PO2	1	1	2	2	2	2	2	2	2
PO3	2	2	2	2	1	1	1	2	2
PO4	2	2	2	2	2	2	2	2	2
PO5	1	3	3	3	3	3	3	3	2
PO6	1	2	2	2	1	1	2	1	
PO7	1	2	2	2	1	1	1	2	2
PO8		2	3	3	3	3	2	2	1
PO9	2	2	2	2	2	2	2	2	1
PSO1	1	1	1	1	1	1	1	2	1
PSO2	1	1	2			2	2		2
PSO3	2	2	2	1		1	1	1	1
PSO4	1	2	1	1	2	1	2	1	1

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)
B.Sc. Physics Curriculum Structure - Regulation - 2021
(For the students admitted from 2021 onwards)

S. No.	Sem	Part	Sub Type	Sub Code	Subject	Credit	Hours	INT	EXT	Total
1	1	1	L1		Language – I	4	4	50	50	100
2	1	2	L2		English for Communication – I	4	4	50	50	100
3	1	3	Core		Core - Properties of Matter and sound	4	4	50	50	100
4	1	3	Core Practical		Core Practical - Properties of Matter and sound	2	4	25	25	50
5	1	3	DSC		DSC 1C	4	4	50	50	100
6	1	3	DSC Practical		DSC Practical - 1C	2	4	25	25	50
7	1	3	Allied-I		DSA 1A	4	4	50	50	100
8	1	4	AEC		Ability Enhancement Course I	2	2	50		50
9	1	6	VAC		Value Added Course – I Fundamentals in Mathematics	2	-	50		50
						28	**30**			
1	2	1	L1		Language – II	4	4	50	50	100
2	2	2	L2		English for Communication – II	4	4	50	50	100
3	2	3	Core		Core - Mechanics	4	4	50	50	100
4	2	3	Core Practical		Core Practical - Mechanics	2	4	25	25	50
5	2	3	DSC		DSC 2C	4	4	50	50	100
6	2	3	DSC Practical		DSC Practical - 2C	2	4	25	25	50
7	2	3	Allied-II		DSA 2A Mathematics – II	4	4	50	50	100
8	2	4	AEC		Ability Enhancement Course II	2	2	50		50
9	2	6	VAC		Value Added Course - II Fundamentals of Physics	2	-	50		50
						28	**30**			
1	3	3	Core		Core - Electricity and Magnetism	4	5	50	50	100
2	3	3	Core Practical		Core Practical –Electricity and Magnetism lab	2	4	20	30	50
3	3	3	DSC		DSC 3C	4	5	50	50	100
4	3	3	DSC Practical		DSC Practical - 3C	2	4	25	25	50
5	3	3	Allied-III		DSA 3A	4	5	50	50	100
6	3	4	SEC		Skill Enhancement Courses – I	2	5	25	25	50
7	3	4	AEC		Ability Enhancement Course III	2	2	50		50
8	3	6	VAC		Value Added Course - III	2	-	50		50
9	3	6	ITR		Industrial Training Report-I	2		50		50
10	3	6	IDL		Inter Department Learning – I	2	-	50		50
						26	**30**			
1	4	3	Core		Core – Nuclear Physics	4	5	50	50	100
2	4	3	Core Practical		Core Practical – General lab -I	2	4	50	50	50

3	4	3	DSC		DSC 4C	4	5	50	50	100
4	4	3	DSC Practical		DSC Practical - 4C	2	4	25	25	50
5	4	3	Allied-IV		DSA 4A	4	5	50	50	100
6	4	4	SEC		Skill Enhancement Courses – II	2	5	25	25	50
7	4	4	AEC		ABE	2	2	50		50
8	4	6	VAC		Value Added Course - IV	2	-	50		50
9	4	6	IDL		Inter Department Learning – II	2	-	50		50
						24	**30**			
1	5	3	Core		Core – Mathematical Physics and Classical Mechanics	4	5	50	50	100
2	5	3	Core Practical		Core Practical – Electronics lab – II	2	5	25	25	50
3	5	3	DSC		DSC 5C Solid State Physics	4	5	50	50	100
4	5	3	DSC Practical		DSC Practical - 5C Digital Electronics lab –I	2	5	25	25	50
5	5	3	Elective I		Elective - I	4	5	50	50	100
6	5	3	Elective II		Elective - II	4	5	50	50	100
7	5	4	SEC		Skill Enhancement Courses – III Comprehensive Exam	2		50		50
8	3	6	ITR		Industrial Training Report-II	2		50		50
9	5	6	VAC		Value Added Course – V	2	-	50		50
						26	**30**			
1	6	3	Core		Core – Quantum Mechanics and Relativity	4	6	50	50	100
2	6	3	Core Practical		Core Practical – Microprocessors lab	2	4	25	25	50
3	6	3	Elective III		Elective – III	4	6	50	50	100
4	6	3	Elective IV		Elective – IV	4	6	50	50	100
5	6	3	Core Course - XI		Core Project	8	4	80	120	200
6	6	4	SEC		Skill Enhancement Courses – IV	2	4	20	30	50
7	6	5	EX		Extension Activity- EX %*	2	-	50		50

* Optional Credit Component

Discipline Specific Core

S. No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Heat and Thermodynamics	Physics	Yes
2			Optics	Physics	Yes
3	Optics		Non Linear Optics	Physics	Yes
4			Electronics	Physics	Yes
5			Solid State Physics	Physics	Yes
6			Low temperature Physics	Physics	
7			Material science	Physics	
8			Astrophysics	Physics	
9			Basics of Electromagnetic Theory	Physics	
10			Energy Physics	Physics	
11			Elements of Modern Physics	Physics	
12			Professional Skills	Physics	

Discipline Specific Core - Practical

S. No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Heat and Thermodynamics Lab	Physics	Yes
2			Optics lab	Physics	Yes
3			Advance Optics Lab	Physics	Yes
4			Electronics Lab -I	Physics	Yes
5			Digital Electronics Lab –I	Physics	Yes

Allied

S. No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Mathematics – I	Mathematics	Yes
2			Mathematics – II	Mathematics	Yes
3			Chemistry – I	Physics	Yes
4			Chemistry- II	Physics	Yes
5			Office Automation	Computer Science	
6			Biochemistry	Physics	
7			Programming in C	Computer Science	
8			Entrepreneurial Development	Commerce - I	

Skill Enhancement Courses

S. No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Introduction to MATLAB	Physics	
2			Electrical circuits and Network skill	Physics	
3			Research Methodology	Physics	Yes
4			Internet of Things and Arduino	Physics	
5			Basics Instrumentation Skill	Physics	
6			Radiology and Safety	Physics	
7			Computational Physics Skill	Physics	
8			Introduction to Medical Physics	Physics	
9.			Bio Physics	Physics	
10.			Internet of things and Arduino	Physics	
11.			Comprehensive Exam	Physics	Yes

Elective

S. No.	Pre-requisite	Sub Code	Subject	Offering Department	Mandatory
1			Nanoscience and Nanotechnology	Physics	
2			Atomic Physics and Spectroscopy	Physics	Yes
3			Principle of Communication Systems	Physics	
4			Fibre optics communication system	Physics	
5			Soil Physics	Physics	
6			Characterization of Nanomaterials and its applications	Physics	
7			Atmospheric Physics	Physics	
8			Biomedical Instrumentations	Physics	
9			Energy Physics	Physics	
10			Agriculture Physics	Physics	
11			Digital Electronics and Microprocessor	Physics	Yes
12			Geo Physics	Physics	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core I: Properties of matter and Sound	4	4	0	0	Theory

Subject description

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

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

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

CO2 : To remember the basic laws of Newton and Kepler's law

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: ELASTICITY 12 periods

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: GRAVITATION 12 periods

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: VISCOSITY 12 periods

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 – Bernoulli Theorem and applications

UNIT IV: SURFACE TENSION 12 periods

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 – Simple problems.

UNIT V: SOUND 12 periods

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 – Ultrasonic's Production Method - Properties and application.

***Industrial visit**

Textbooks

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).

Reference books

1. R.Murugesan, "Properties of matter", S. Chand and Co, 2015.
2. D.S. Mathur, "Elements of Properties of Matter" S. Chand and Co, Edi 2014

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3									3		2	
CO2	3									3		2	
CO3	3			2						3		2	
CO4	3		2	2	1					3	2	2	
CO5	3				2					3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core II: Mechanics	4	4	0	0	Theory

Course Objective

To acquire a complete knowledge about mechanics.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To remember the principles of rigid body, statics, dynamics

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: CONSERVATION LAW 12 periods

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 periods

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 periods

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 periods

Friction and it types - 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 periods

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

Textbooks

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2								3	1	2	3
CO2	3		2							3		2	3
CO3	3			2	2					3		2	3
CO4	3			2		2				3	1	2	3
CO5	3									3		2	3

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core III: Electricity & Magnetism	4	5	0	0	Theory

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 focus on : **Skill Development** / Entrepreneurship / Employability / Research

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: ELECTRIC FIELD AND POTENTIAL 12 periods

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: CAPACITORS AND DIELECTRICS 12 periods

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 permittivity – Physical meaning of polarization – Dielectric strength.

Unit III: MAGNETOSTATICS AND MAGNETIC FIELD 12 periods

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: ELECTROMAGNETIC INDUCTION 12 periods

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: MAXWELL'S EQUATIONS AND ELECTROMAGNETIC THEORY 12 periods

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 – Impedance of dielectric media – Energy density of – electromagnetic wave – Poynting theorem (statement only) – Energy per unit volume.

Textbooks

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

Reference books

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3									3			
CO2	3			2								2	
CO3	3	2	2		1							2	3
CO4	3			2				2		3		2	
CO5	3		2	2						3		1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core IV - Nuclear physics	4	4	0	0	Theory

Subject Description

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

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

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 analyses and evaluate various thermodynamic cycles used for energy productions

CO5 : To know the laws of thermodynamics and concepts of entropy

Unit I: : THERMOMETRY AND SPECIFIC HEATS 12 periods

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

Unit II: KINETIC THEORY OF GASES 12 periods

Kinetic theory of gases – Postulates – Derivation of gas equation – Max well'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: TRANSMISSION AND RADIATION OF HEAT 12 periods

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: THERMODYNAMICS 12 periods

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

UNIT V: STATISTICAL PHYSICS 12 periods

Statistical Basis – Probability – some basic rules of probability theory –macrostate and microstate – Thermodynamic Probability – Most probable state – Ensemble (its types) and average properties – Degrees of freedom – phase space - Fundamental postulate of statistical Mechanics – Density of Quantum States of Energy of a particle – Maxwell – Boltzmann statistics, Bose – Einstein's Statistics, Fermi – Dirac statistics (Elementary ideas)

Textbooks

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

Reference books

2. Kakani S.L. "Thermodynamics and Statistical Mechanics", Raj Publications, Jaipur. (2001).
3. Singhal S.S. Heat, "Thermodynamics & Statistical Physics", Pragathi Pragason, Meerut, 1st edition (2013).
4. Gupta, Kumar, " Elementary statistical mechanics", Pragati publishers, 2016

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3	3	2	2	2	2	3	2	1	1
CO2	3	3	3	2		3	1	1	3	3	2	1	1
CO3	3	1		3	2					3	2	2	
CO4	3		2		3		2		1	3	2	2	
CO5	3	3			3	1				3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core V: Mathematical Physics and Classical Mechanics	4	5	0	0	Theory

Subject Description

Vectors, matrices and linear system of equations, Laplace transform group theory , numerical methods, Lagrangian Formulation and Hamiltonian Formulation of Mechanics

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

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 apply these formalisms to obtain equations of motion for simple systems

CO5 : To apply the Hamiltonian formulism for the simple problem

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: LAGRANGIAN FORMULATION 12 periods

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 V: HAMILTONIAN FORMULATION OF MECHANICS 12 periods

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.

Textbooks

1. Sathyaprakash, (2005). Mathematical Physics. Sultan Chand & Sons, New Delhi, (Units I - IV).
2. Gupta, Kumar, Sharma, (2006). Classical Mechanics. 21st Edition, Pragati prakasan,
Meerut, (Units II – 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
3. Kogakusha Ltd, New Delhi.3. Herbert Goldstein, (1985). Classical Mechanics. 2nd Edition, Narosa publishing House, New Delhi

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3			3	2			2		3		2	
CO2	3		2	3	2	1		2		3		2	
CO3	3			3	2					3		2	
CO4	3			2	2					3		2	
CO5	3			2	2					3		2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core VI: Quantum Mechanics and Relativity	4	6	0	0	Theory

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 focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To acquire basic knowledge about wave properties of matter

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

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

CO4 : To effectively apply Schrödinger equations

CO5 : To acquire knowledge about Relativity

Unit I: WAVE PROPERTIES OF MATTER 12 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 12 periods

Introduction – Heisenberg's Uncertainty Principle – Elementary proof between displacement and momentum – Energy and Time – Simple problems - 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 12 periods

Introduction – Wave function for a free particle – Schrödinger's One dimensional wave equation – Time- dependent and Time independent – Schrodinger's equation: steady state form- Physical interpretation – Physical significance of ψ - Orthogonal and normalized wave function **-** 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 12 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 12 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 - General theory of relativity

Textbooks

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

Reference books

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1					2				3		2	2	3
CO2			2	2					3		2		3
CO3		2	2	2					3		2		3
CO4			2						3		2		3
CO5	2		2						3		2		3

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - Properties of Matter and Sound lab	2	0	0	2	Practical

Subject Description

The list of experiment given in this lab is help to understand the properties of the objects.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To apply the concept of Young's modulus by various methods
CO2 : To examine the concept of viscosity by various methods
CO3 : To examine the concept of Sound

List of experiments
(choose any five)

Properties of matter

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.(orientation)
2. Young's modulus – uniform bending –Pin and microscope.
3. Young's modulus – Non uniform bending –Pin and microscope.
4. Viscosity by capillary flow method
5. Rigidity modulus and moment of inertia – Torsional Pendulum
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 – non uniform bending – Koenig's method

Sound

9. Sonometer frequency of the tuning fork
10.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2			2			2		3	2	2	
CO2	3	2		2	2			2		3	2	2	
CO3	3	2			2			2		3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - Mechanics Lab	2	0	0	2	Practical

Subject Description

The list of experiment given in this lab is help to understand the various physical properties.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To apply the concept of Young's modulus by various methods
CO2 : To examine the height of buildings

List of experiments
(choose any five)

1. To determine the Height of a Building using a Sextant.
2. To determine the Moment of Inertia of a Flywheel.
3. To determine the Young's Modulus of a Wire by Optical Lever Method.
4. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
5. To determine the Elastic Constants of a Wire by Searle's method.
6. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g
7. Young's modulus –Non-uniform bending method – optic lever
8. Young's modulus –uniform bending – Koenig's method
9. Young's Modulus– Cantilever – Static method
10. Young's modulus –uniform bending method – optic lever

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3			2		3	3	2	
CO2	3	3	2		3			2		3	3	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - Electricity and Magnetism lab	2	0	0	1	Practical

Subject Description

The list of experiments given in this lab is help to understand and calibrate various instruments.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To Understand the concept of Ballistic Galvanometer by various methods
CO2 : To examine the working of Potentiometer and its application
CO3 : To illustrate the working of deflection Magnetometer

List of experiments
(choose any five)

1. Calibration of low range voltmeter – Potentiometer
2. Calibration of low range ammeter – Potentiometer
3. Calibration of high range voltmeter – Potentiometer
4. Potentiometer – Specific resistance of given coil
5. Moment of magnet Tan C position
6. Moment of a magnet – circular coil – Deflection Magnetometer
7. Figure of Merit – B.G.
8. Capacity of a condenser – B.G.
9. Determination of high resistance by charging – Ballistic galvanometer
10. Determination of mutual inductance – Ballistic Galvanometer
11.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		2	2		2		2		3	2	2	
CO2	3		2	2		2		2		3	2	1	
CO3	3		2	1		2		2		3	2	1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - General Lab	2	0	0	1	Practical

Subject Description

The list of experiments given in this lab is help to understand the various physical properties

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To understand the acceleration due to gravity with working of compound pendulum
CO2 : To apply the concept of Rigidity modulus to understand the elasticity property of given material
CO3 : To Understand the concept of Ballistic Galvanometer by various methods

List of experiments
(choose any five)

1. Acceleration due to gravity – Compound pendulum
2. Rigidity Modulus – Static Torsion
3. Young's modulus – uniform bending – Koenig's method
4. Determination of velocity of ultrasonic waves in a given liquid using ultrasonic's interferometer
5. Melde's string – frequency of vibrator
6. Determination of high resistance by leakage – Ballistic galvanometer
7. Sonometer AC Frequency.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		2		2	2		2		3	2		1
CO2	3		2		2	2		2		3		2	
CO3	3		2		2	2		2		3	2		

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - Advance Electronics Lab	2	0	0	1	Practical

Subject Description

The list of experiment given in this lab is help to understand about various practical application based circuits.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To acquire knowledge about the working transistors and its applications

CO2 : To acquire knowledge about the working diodes and its applications

List of experiments
(choose any five)

1. RC-Coupled Amplifier –Single Stage
2. Feedback Amplifier
3. Emitter Follower
4. Hartley Oscillator
5. Astable multivibrator using Transistor
6. Monostable multivibrator using Transistor
7. Construction and study of IC Regulated Power Supply
8. Voltage doubler
9. Clipper and Clamper

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		3	2				3		3	2	2	
CO2	3		2					3		3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical - Microprocessor	2	0	0	1	Practical

Subject Description

The list of experiment given in this lab is help to understand the microprocessors

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To experiment the application of microprocessor by hands-on

List of experiments
(choose any five)

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	2				3		3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC- Heat and Thermodynamics	4	4	0	0	Theory

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 focus on : **Skill Development** / Entrepreneurship / Employability / Research

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 analyses and evaluate various thermodynamic cycles used for energy productions

CO5 : To know the laws of thermodynamics and concepts of entropy

Unit I: : THERMOMETRY AND SPECIFIC HEATS 12 periods

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: KINETIC THEORY OF GASES 12 periods

Kinetic theory of gases – Postulates – Derivation of gas equation – Max well'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: TRANSMISSION AND RADIATION OF HEAT 12 periods

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: THERMODYNAMICS 12 periods

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

UNIT V: STATISTICAL PHYSICS 12 periods

Statistical Basis – Probability – some basic rules of probability theory –macrostate and microstate – Thermodynamic Probability – Most probable state – Ensemble (its types) and average properties – Degrees of freedom – phase space - Fundamental postulate of statistical Mechanics – Density of Quantum States of Energy of a particle – Maxwell – Boltzmann statistics, Bose – Einstein's Statistics, Fermi – Dirac statistics (Elementary ideas)

Textbooks

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

Reference books

1. Kakani S.L. "Thermodynamics and Statistical Mechanics", Raj Publications, Jaipur. (2001).
2. Singhal S.S, Heat, "Thermodynamics & Statistical Physics", Pragathi Pragason, Meerut, 1st edition (2013).
3. Gupta, Kumar, " Elementary statistical mechanics", Pragati publishers, 2016

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3		2	2	2	2	3	2	1	1
CO2	3	3	3	2		3	1	1	3	3	2	1	1
CO3	3	1		3						3	2	2	
CO4	3		2				2		1	3	2	2	
CO5	3	3				1				3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC - Optics	4	4	0	0	Theory

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 focus on : **Skill Development** / Entrepreneurship / Employability / Research

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 Fiber Optics

Unit I: GEOMETRICAL OPTICS 12 periods

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: INTERFERENCE 12 periods

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: DIFFRACTION 12 periods

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: POLATISATION 12 periods

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 – CO_2 LASER – Resonant cavities – Threshold condition for LASER

UNIT V: FIBER OPTICS 12 periods

Fiber optics: Total Internal Reflection – Optical fiber(Step and Multi-mode) – Numerical aperture – Attenuation in optical fiber - multimode fibers – pulse dispersion – power law profile – fiber optic sensors.

Textbooks

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).

Reference books

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3									3			
CO2	3	2								3	3		
CO3	3		2							3			
CO4	3			2	1					3		2	
CO5	3					2				3	2	3	3

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC: Non-Linear Optics	4	5	0	0	Theory

Subject Description

This paper presents the basic principle and characterization of laser light and its applications and concept of Non linear optics and their applications.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

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 PRINCIPLE OF LASER 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 AND CHARECTERISTICS 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

Multi quantum Photo electric effect – Two photon 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 theorem – Second law of thermodynamics –Entropy : Reversible and Irreversible process – Third law of thermodynamics – Temperature – Entropy diagram.

Textbooks

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	2	3	2	1		3	2	2	1
CO2	3	2	2		2	2				3			
CO3	3	2	3		2	2	3	2		3	1	2	
CO4	3	2				1				3			
CO5	3	1		3		1		1		3		2	2

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC - Electronics	4	5	0	0	Theory

Subject Description

This paper presents the fundamentals of electronics and its applications.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To recall the basic concept of diodes and transistors

CO2 : To explain the application of transistor as an amplifier

CO3 : To 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.

Textbooks

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

Reference books

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	2	3	2	1	2	3	2	2	1
CO2	3	2	2		2	2				3			
CO3	3	2	3		2	2	3	2	2	3	1	2	
CO4	3	2				1				3			
CO5	3	1		3		1		1	2	3		2	2

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC: Solid State Physics	4	5	0	0	Theory

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.

Course focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

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

Crystal Structures: Distinction between crystalline and amorphous solids - 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 Super Conductor- Meissner effect - BCS theory - London equations- Superconductivity at high frequencies- applications of super conductors (squid, cryotron, magnetic levitation)

Textbooks

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

Reference books

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3				1		1	1	1	3	2		2
CO2	3	1	3		3					3		3	
CO3	3	1	3	2	3	2	3	3	3	3	2	3	2
CO4	3		3		3				3	3	2	3	2
CO5	3	1		2	3		3	3	1	3	2		2

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC: Low Temperature Physics	4	5	0	0	Theory

Subject Description

This paper presents the fundamentals, production, measurements of low temperature and refrigeration and air conditioning.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To understand the general scientific concepts and production of low temperature physics

CO2 : To understand the measurements of low temperature physics

CO3 : To acquire knowledge about solid and liquid cryogens

CO4 : To study the electrical and magnetic properties of superconductivity

CO5 : To understand the concepts of refrigeration and air conditioning.

Unit I: PRODUCTION OF LOW TEMPERATURE 12 periods

Introduction – Joule Thomson effect – Regenerative cooling – Vacuum pumps – liquefaction of air – Hydrogen – Helium – Maintenance of low temperature – production of temperature below 1 K – Adiabatic demagnetization – Evaporative cooling of He–3 – Dilution refrigeration – Laser cooling – Nuclear demagnetization

Unit II: MEASUREMENT OF LOW TEMPERATURE 12 periods

The gas thermometer and it corrections – Secondary thermometers– resistance thermometers, thermocouples– vapour pressure thermometers– magnetic thermometers.

Unit III: LIQUID AND SOLID CRYOGENS 12 periods

Liquid Nitrogen – Liquid oxygen -Liquid hydrogen – Liquid He –4 and He –3 – Solid He– 4 and He –3 – Lamda point – Superfluidity – Density – Compressibility factor – viscosity and thermal properties – Velocity of sound in liquid helium.

Unit IV: ELECTRICAL AND MAGNETIC PROPERTIES 12 periods

Experimental observations – Theories of sommerfield and block – Superconductivity – magnetic properties of superconductors – Thermal properties of superconductors – penetration depth and high frequency resistance – Ferromagnetism – Diamagnetism – paramagnetism – Paramagnetic saturation.

UNIT V: REFRIGERATION AND AIR CONDITIONING SYSTEMS 12 periods

Latent heat of vaporization – Determination of latent heat of Steam – Cooling effect due to vaporization and its examples – Refrigeration – Ammonia ice plant – Solid CO_2 (dry ice) – Vapour pressure of liquids – Triple points – Gibb's phase rule –Ozone hole and role of CFCs – Air conditioning systems – Equipments used in Air conditioning systems – criteria of comfort Air conditioning – Summer and winter Air conditioning systems - factor affecting comfort air conditioning

Textbooks

1. Brijlal and Subrahmanyam "Heat & thermodynamics and statistical Physics", S. Chand & Co Ltd, New Delhi, 2015(Unit I – V)

Reference books

1. Jack Ekin, *Experimental Techniques for Low–Temperature Measurements*, OUP, Oxford, 2006.
2. Charles P. Poole Jr., Horacio A. Farach, Richard J. Creswick and Ruslan Prozorov, *Superconductivity* Elsevier Ltd, 2007.
3. John Wilks, *Properties of Liquid and Solid Helium*, Oxford University Press, 1967.
4. Jackson L.C., *Low Temperature Physics*, Methuen and Company,1962.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3			2	1		1		1	3	2		2
CO2	3	1	3		3					3		3	
CO3	3	2	3	2	3	2	3		3	3	2	3	2
CO4	3		3		3				3	3	2	3	2
CO5	3	1	1	2	3		3		2	3	2		2

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC-Materials Science	4	5	0	0	Theory

Subject Description

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

Course focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

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.

Textbooks

1. S.O. Pillai Solid state Physics New age International Private Limited 2011 6th Edition 2.
2. Khurmi Sedha Material Science S. Chand & Co. 2001, 4th edition

Reference books

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3			3			1	3	3	3	
CO2	3	1		3	2		1		3	3	1		3
CO3	3		1	3	2		1			3		1	3
CO4	3	2								3	2		
CO5	3		3	1						3		3	1

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC- Astro Physics	4	5	0	0	Theory

Subject Description

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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: MODERN ENGINEERING MATERIALS 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 – planet esimials 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

Textbooks

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

Reference books

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3			3	3	3		3	3	3	
CO2	3		1		1		1			3		1	
CO3	3		1	3	2			2	1	3		1	3
CO4	3	2				2				3	2		
CO5	3		3	1					1	3		3	1

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC- Basics of Electromagnetic Theory	4	5	0	0	Theory

Subject Description

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 focus on : **Skill Development** / Entrepreneurship / Employability / Research

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: ELECTROSTATICS AND MAGNETOSTATICS 12 periods

Electrostatics: Electric intensity – Electric potential – Gauss Law - Dielectric and its polarization - Electric displacement D – Dielectric constant – Polarisibiltiy - 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 (no applications) – Magnetic vector potential A – Magnetisation and magnetization current – Magnetic intensity – Magnetic susceptibility and Permeability.

UNIT II: FIELD EQUATION AND CONSERVATION LAWS 12 periods

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

Unit III: PROPAGATION OF PLANE ELECTROMAGNETIC 12 periods

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: INTERACTION OF E.M.WAVES WITH MATTER (MACROSCOPIC) 12 periods

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: RELATIVISTIC ELECTRODYNAMICS 12 periods

Purview of special theory of relativity – 4-vectors and Tensors - Transformation equations for charge and current densities– For electromagnetic potentials A and □ - Electromagnetic field tensor - 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

Textbooks

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

Reference books

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3			3	3			3	3	3	
CO2	3		1		1		1			3		1	
CO3	3		1	3	2				1	3		1	3
CO4	3	2				2				3	2		
CO5	3		3	1					1	3		3	1

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC-Energy Physics	4	5	0	0	Theory

Subject Description

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To learn about conventional energy sources

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: CONVENTIONAL ENERGY SOURCES 12 periods

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

Unit II: SOLAR ENERGY 12 periods

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: BIOMASS ENERGY FUNDAMENTALS 12 periods

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

Unit IV: BIOMASS UTILIZATION 12 periods

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

Unit V: OTHER FORMS OF ENERGY SOURCES 12 periods

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

Textbooks

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)

Reference books

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	3		1	3	1			3	3	3		1
CO2	3		2		3				3	3		2	
CO3	3	3		1		1			2	3	3		1
CO4	3	3	3		2					3	3	3	
CO5	3					1				3			

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSC- Elements of Modern physics	4	5	0	0	Theory

Subject Description

This paper presents the course will give a idea about the updated version in the field of Physics

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

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 eigen values and eigen functions, 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

Textbooks

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

Reference books

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3			3				3	2	3	
CO2	3	3			3					3	3		
CO3	3		3			2	3			3		3	
CO4	3	2		1	1	2			2	3	2		1
CO5	3	2	2	3	1				3	3	2	2	3

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSP: Heat and Thermodynamics Lab	2	0	0	1	Practical

Subject Description

The list of experiment given in this lab is help to understand the concepts of heat and thermodynamics

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To determine the temperature co-efficient by using various methods

CO2 : To Understand the Specific heat of a given materials

List of Experiments
(Choose any 5 experiments)

1. Co-efficient of Thermal conductivity – Lee's disc method
2. Determination of specific heat - 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 heat of liquid – Joule's calorimeter
7. Verification of Ohms law by Joule's Calorimeter.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3					2		1		3	3	2	1
CO2	3	2				2		1		3	3	1	3

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSP : Optics	2	0	0	1	Practical

Subject Description

The list of experiments given in this lab are help to understand and calculate the various optical parameters

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To acquire knowledge about refractive index of the materials by using spectrometer
CO2 : To examine the working of grating and its applications

List of Experiments
(Choose any 5 experiments)

1. Refractive index of a solid prism – Spectrometer
2. Wavelength of a spectral lines- Grating – Normal incidence method- Spectrometer
3. Spectrometer – hollow prism
4. Newton's ring – refractive index of lens
5. Wavelength of Mercury Spectral lines – grating – minimum deviation – Spectrometer
6. Dispersive power of grating – spectrometer

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2		2	2	1			3	3	2	
CO2	3	1			2	2	1			3	3	1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSP : Advanced Optical lab	2	0	0	1	Practical

Subject Description

The list of experiments given in this lab are help to understand and calculate the various optical parameters

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To acquire knowledge about refractive index of the materials by using spectrometer
CO2 : To examine the working of grating and its applications
CO3 : To understand the Basics of LASER

List of Experiments
(choose any 5 Experiments)

1. Refractive index of a solid prism (i-d) curve – spectrometer
2. Refractive index of a prism (i-i') – Spectrometer
3. Cauchy's constant – Spectrometer grating
4. Determination of wavelength and particle size using LASER
5. Determination of acceptance angle in an optical fiber using LASER
6. Thickness of a thin wire – Air wedge method

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		3			2		2		3	3	2	
CO2	3		2			2				3	3		2
CO3	3	3	2	2		2				3	3	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSP : Electronics Lab	2	0	0	1	Practical

Subject Description

The list of experiment given in this lab is help to understand and study the characteristics of diode and transistors

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To Understand and apply the transistor

CO2 : To acquire basic Knowledge of basic logic gate

List of Experiments

(Choose any 5 experiments)

1. Characteristic of a PN junction diode
2. Characteristics of Zener diode
3. Band gap of semiconductor
4. Verification of truth table for NOT, AND, OR, NOR, NAND, XOR, XNOR
5. Characteristics of transistor- common base mode
6. Characteristics of transistor- common emitter mode
7. FET characteristics
8. UJT Characteristics
9. Half Wave and Full Wave rectifier

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		2			1		2		3	3	2	
CO2	3	2	2			2		2		3	3	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	DSP : Digital Electronics Lab	2	0	0	1	Practical

Subject Description

The list of experiments given in this lab is help to understand and construct various circuits.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To apply the Logic gates to build the subtrator and adder
CO2 : To acquire basic knowledge about Op-amp

List of Experiments
(Choose any 6 experiments)

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
9. Solving Simple Boolean equation using ICs.
10. Verification of RS flip – flop
11. Verification of JK Flip - flop

Mapping of Course Outcomes with Program Outcomes

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2		2				2		3	3	2	
CO2	3	2		2				2		3	3	2	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Allied - Mathematics - I	4	5	0	0	Theory

Introduction

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

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : Recall the fundamental concepts of Theory of Equations.

CO2 : Make use of Eigen values and Eigen vectors to build the Inverse of the Matrix

CO3 : Determine and Expansion of Cosines and Sines.

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

CO5 : Discover and usage of new Beta Gamma Function.

Unit I: THEORY OF EQUATIONS 12 periods

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

Unit II: MATRICES 12 periods

Fundamental Concepts-Rank of a matrix- 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. Exponential Series and Hyperbolic Functions.

Unit IV: CURVATURE 12 periods

Polar Curves-Equation of a straight Line- Length of arc in polar coordinates- Pedal Equations-Radius of curvature – center of curvature – circle of curvature

Unit V: BETA GAMMA FUNCTION 12 periods

The Gamma Function-Relationship between Beta and Gamma Function
Multiple Integrals: Double Integral and Triple Integral.-Simple Problems.

Textbooks

1. " Mathematics for B.Sc. Branch I", Volume I & Volume II, , Kandasamy. P, Thilagavathi. K S.Chand and Company Ltd, New Delhi, 2004.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1		1		2		2			3	2		1	
CO2		2	2				3	3			2		1
CO3	1		3	2		3			2	1		3	
CO4		3			3	2	2				2		3
CO5	2		1		2	3		1	3	2		3	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Allied - Mathematics - II	4	5	0	0	Theory

Introduction

This course presents the idea of curvature, multiple integrals, partial differential equations and vectors.

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

CO1 : To apply the concept of geometry and its related applications..

CO2 : To demonstrate the concept of sphere and its properties.

CO3 : To experiment the fundamental concepts of statics with respect to real life mechanism.

CO4 : To analyze the concept of resultant of coplanar forces in different planes.

CO5 : To examine the concept of couples and parallel forces in different systems.

Unit I: CO-ORDINATE GEOMETRY 12 periods

Distance between two points-The angle between two lines- The plane-The straight line-Two straight Lines.

Unit II: SPHERE 12 periods

The equation of a sphere-The plane and the sphere-Centre and radius of a sphere.

Unit III: 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 standard functions.

Unit IV: APPLICATIONS OF LAPLACE TRANSFORMS 12 periods

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

Unit V: DIFFERENTIAL EQUATIONS 12 periods

Introduction- Equations of the first order and of degree Higher than one- Linear equations- Linear equations with constant coefficients-Determination of Particular integral and complement function.-Simple Problems.

Textbooks

1. " Mathematics for B.Sc. Branch I", Volume III , Kandasamy. P, Thilagavathi. K S.Chand and Company Ltd, New Delhi, 2004.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Allied-Chemistry- I	4	5	-	2	Allied

Introduction

To introduce the concepts this 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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To understand the fundamental concepts of chemical bonding, of carious elements

CO2 : To understand the characteristic of industrial chemistry and fertilizers.

CO3 : To apply the concepts of polymer chemistry and Stereoisomerism.

CO4 : To analyze the concepts of Terms and Dyes. To apply and understand the volumetric analysis for standard solution and to determine the dissolving rate of the reaction.

CO5 : To build the knowledge on solutions of liquids, kinetics and systems chromatography.

Unit I: CHEMICAL BONDING 12 periods

Molecular orbital theory, Bonding, Anti-bonding and non-bonding orbitals. Molecular orbitals. MO configuration of H_2, N_2, O_2, F_2. Bond order, Diamagnetism and paramagnetism – Diborane: Preparation, properties, structure, preparation and uses of NaHB, Borazole; Interhalogen halogen compounds: ICl, BrF_3, IF_3- Preparation, hybridization and structure, shape. Basic properties sodium hydrosulphite, peracids of sulphur: preparation, properties and uses. Structure of Iodine.

Unit II: SPHERE 12 periods

Synthesis, properties and uses of silicones- Fuel gases: natural gas, water gas, semi water gas, carburetted water gas, producer gas, oil gas (manufacturing details not required)- Fertilizers-Urea, Ammonium sulphate, ammonium nitrate, potassium nitrate-NPK fertilizer- Triple super phosphate. Pollution of air, water and soil- sources, remedies.

Unit III: POLYMERS 12 periods

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

Stereoisomerism

Optical isomerism-: symmetry, 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: TERMS 12 periods

Chromophore, Auxochrome, bathochromic shift, hypsochromic shift, hyperchromic effect, hypsochromic effect.

DYE- Azo and triphenylmethane dyes- Preparation one example.

VOLUMETRIC ANALYSIS-(practical)

Estimation of sodium hydroxide using standard sodium carbonate- Estimation of hydrochloric acid- standard oxalic acid- Estimation of oxalic acid- standard sulphuric acid- Estimation of ferrous sulphate- standard Mohr salt solution- Estimation of oxalic acid- standard ferrous sulphate- Estimation of potassium permanganate- standard sodium hydroxide.

Unit V: SOLUTIONS 12 periods

Types- Liquid in Liquid. Raoult's law. Deviation from ideal behavior. 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.

Textbooks

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

Reference

1. P.L Soni, "**Text book of inorganic chemistry**", Sultan Chand & Sons, New Dehli, 2013
2. Puri and Sharma, "**Text book of inorganic Chemistry**", Vishal publishing, 2014

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2	3		2		1		3		2	1		3
CO2	1		3			2			2		3	2	
CO3	3	2					3	3		1		2	
CO4		1		2		2			3		2		1
CO5	1	1				2			3			3	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Allied - Chemistry- II	4	5	-	2	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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To understand the fundamental concepts of Metals and Coordination Ch 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 Energetic

CO5 : To build the solutions of Electrochemistry and Phase Equilibrium

Unit I: **METALS** 12 periods

General methods of excitation of metals. Types of ores. Methods of ore dressing. Types of furnaces. Reduction methods, electrical methods, types of refining Van Arkel Zone refining. Extraction of Coordination Chemistry

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

Unit II: 12 periods

Aromatic Compounds

Electrophilic substitution in benzene mechanism of nitration, halogenation, alkylation, acylation, sulphonati on, Preparation, properties and structural education of naphthalene

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

Carbohydrates: classification, preparation and properties of glucose and fructose. Discussion of open chai n ring structures of glucose and fructose. Glucose-fructose inter conversion.

Unit IV: 12 periods

Energetics:

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

Textbooks

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

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	1									2	1		3
CO2	2	2		2							3	2	
CO3		2	1	1	1					1		2	
CO4			1		1						2		1
CO5					1							3	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Allied -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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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.

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 Processing Starting Word-Microsoft Word Screen-File Menu-Edit Menu-View Menu-Insert Menu Format Menu Tools Menu-Table Menu-Window Menu-Help Menu-Formatting the Text Alignment 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 Menu Help 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.

Textbooks

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	1	1						1					
CO2	1	2		2					1				
CO3		2	1	1	1						1		
CO4			1		1								
CO5					1								

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Allied -Bio Chemistry	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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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: BUFFER SYSTEM 12 periods
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: BIOENERGETICS 12 periods
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: VITAMINS AND MINERALS 12 periods
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: HORMONES 12 periods
General characteristics – classification – functions of thyroid stimulating hormone (TSH) – oxytocin – vasopressin – thyroid – thyrosine – pancreas – insulin – diabetes.

Unit V: INBORN ERRORS OF METABOLISM 12 periods
Hereditoryanemias – sickle cell anemia and thalassemia – errors of carbohydrate (galactosemia) and protein metabolism (phenylketonuria) – disease and syndromes.

Textbooks

1. AmbikaShanmugam., (2016) Fundamentals of Biochemistry for Medical students, WMC Brown Publishers, New Delhi.

Reference Books

1. Campbell, M.K. (2012) Biochemistry, 7th edition. Published by Cengage Learning.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2	1						1					
CO2	1												
CO3			2	1	1				2		1		
CO4			1		2								
CO5			1		1								

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Allied - Programming in C	4	5	0	0	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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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 and 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.

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.

Textbooks

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

Reference Books

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2	1						1					
CO2	1												
CO3			2	1	1				2		1		
CO4			1		2								
CO5			1		1								

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Allied - Entrepreneurial Development	4	5	0	0	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 focus on : Skill Development / **Entrepreneurship** / Employability / Research

Course Outcomes

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.

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.

Textbooks

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

Reference Books

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	1		1					1					
CO2	1			1				1					
CO3		3	1	1	1				1		1		
CO4									1				
CO5					1								

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	SEC: Introduction to MATLAB	2	5	0	0	Theory

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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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 MATLAB comments

Unit I: 6 periods

Introduction- Basics of MATLAB, Input – Output, File types – Platform dependence – General commands

Unit II: 6 periods

Interactive Computation: Matrices and Vectors – Matrix and Array operations

Unit III: 6 periods

Programming in MATLAB: Scripts and Functions – Script files – Functions files- Language specific features – Advanced Data objects.

Unit IV: 6 periods

Plotting: Two-dimensional plots - Three-dimensional plot

Unit V: 6 periods

Applications – Linear Algebra - Solving a linear system – Finding Eigen values and Eigen vectors – Matrix Factorizations.

Textbooks

1. Rudra Pratap, Getting Started with MATLAB-A Quick Introduction for Scientists and Engineers, Oxford University Press, 2003.

Reference Books

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:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1		2		2						3		2	
CO2			2	2						3		2	
CO3		2		2		1		2		3		2	
CO4			2	2		2		2		3		2	
CO5		2	2	2	1	2		2		3		2	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	SEC: Electrical Circuits and Network Skills	2	5	0	0	Theory

Introduction:

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

Course focus on : **Skill Development** / Entrepreneurship / Employability / Research

Course Outcomes

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 study the basics of relay

Unit I: BASIC ELECTRICITY PRINCIPLES 6 periods

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 CIRCUIT 6 periods

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 6 periods

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

Unit IV: ELECTRICAL DEVICE 6 periods

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 AND WIRING 6 periods

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. only).

Textbooks

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.

Reference Books

1. Performance and design of AC machines - M G Say ELBS Edn.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3				2			2		3		2	
CO2	3		2			2				3	2		2
CO3	3	2						2		3		2	
CO4	3	2								3	2	2	
CO5	3	2								3	2	2	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	SEC: Research Methodology, Ethics and IPR	2	5	0	0	Theory

Introduction:

This course aims to give exposure to the students on research methodology

Course focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

CO1 : To understand the basics of research methodology

CO2 : To understand the different types of research design and know the concepts on experimentaldesign

CO3 : To learn the fundamentals of optical and thermal property related instrumentation techniques.

CO4 : To Understand the working principles of magnetic property and compositional analysis relatedinstrumentation techniques.

CO5 : To solve the numerical problems through numerical problems

Unit I: BASICS OF RESEARCH METHODOLOGY 6 periods

Selection of a research problem - literature survey - choosing a problem - current status of the problem - analysis of the problem - inferences - art of publishing research articles, reports.

Unit II: RESEARCH DESIGN 6 periods

Meaning of Research Design – Need for Research Design – Features of Good Design – Concepts – Different Research Design – Basic Principles of Experimental Designs

Unit III: RESEARCH ETHICS 6 periods

Introduction to ethics and Research ethics – Science and Ethics – Cloning research – Moral Ethical Theory – Standards of Ethical Conduct in Science – Objectivity in research – Honesty in research – misconduct in Science – Publication issues

Unit IV: INTELLECTUAL PROPERTY AND PATENT 6 periods

Intellectual Property – Definition – Intellectual Property vs Physical Property, Importance of Intellectual Properties – Patent – History of patent in India – Process and Product Patent – Procedure for Grant of Patent – Opposition to Grant of Patent – Rights of Patentee

Unit V: COPYRIGHT AND TRADEMARK 6 periods

Copyright – Types of Copyright – Meaning of Publication – Copyright board and Office in India – Copy right Registration – Ownership of copyright – Trademark – Condition for Trademark Registration – Register of Trademarks – Procedure for Trademark Registration in India – Certification Trademark

Textbooks

1. Research methodology, C.R. Kothari, New age international publishers, 2005.
2. An ethics of Science : An Introduction, David B. Resnik, Taylor and Francis 2005.
3. Intellectual Property Rights, Neeraj Pande Khushdeep Dharani 2014, PHI Learning Private Limited

Reference Books

1. Research methodology, A step by step guide for beginners, Ranjit Kumar, Sage, 2005.
2. Related Research Papers

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2				2	2		3		2	2
CO2	3	2	2			3	3	2		3		2	
CO3	3	2								3	2		2
CO4	3						2			3	2		
CO5	3	2			3			2		3			1

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	SEC: Internet of Things and Arduino	2	5	0	0	Theory

Subject Description:

This paper presents the fundamentals Internet of things, Microcontroller and Arduino.

Objectives

- To acquire knowledge about Internet of Things
- To acquire knowledge about Microcontroller and Arduino

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To learn and understand the basic concept of Internet of things

CO2 : To understand the different types of research design and know the concepts on experimentaldesign

CO3 : To learn the fundamentals of optical and thermal property related instrumentation techniques.

CO4 : To Understand the working principles of magnetic property and compositional analysis relatedinstrumentation techniques.

CO5 : To solve the numerical problems through numerical problems

Unit I: INTERNET OF THINGS 6 periods

Introduction to IOT – Definitions – Enabling technologies – open problems – future challenges – Applications IOT PROTOCOLS, IOT Communication Models, IOT Communication APIs, IOT Enabling Technologies – -Cyber crime precautions in internet security

Unit II: MICROCONTROLLER 6 periods

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

Unit III: INTERFACING MICROCONTROLLER 6 periods

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

Unit IV: ARDUINO 6 periods

Introduction – install the software – The integrated development environment (IDE) –

operators – statements: IF, ELSE, WHILE, FOR – Arrays – library functions - Circuits and programs

Unit V: PROGRAMMING IN ARDUINO 6 periods

Programs using IF, ELSE, WHILE, FOR statements – programs using Arrays – Circuit and program: one button and an LED, two buttons and an LED, potentiometer, RGB LEDs, Simple note, music

Textbooks

1. Kenneth J. Ayala, Dhananjay V. Gadre, "The 8051 Microcontroller and Embedded systems using Assembly and C", Cengage Learning Pvt. Ltd., New Delhi. 2010.
2. Alan G. Smith," Introduction to Arduino", 2011.

Reference Books

1. Arshdeep Bahga & Vijay audisetti," Internet of Things: A Hand - on Approach", UniversitY Press,2010.
2. "Internet of Things", PackT Open-Source publishers, 2016.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1		2	2		2			2		3	2		
CO2			2		2			2		3			
CO3	2		2							3	2	2	
CO4					2			2		3	2	2	
CO5		2	2		2			2		3	2	2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	SEC: Basics Instrumentation Skill	2	5	0	0	Theory

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.

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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: BASICS OF MEASUREMENTS 6 periods

Instrument's 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 6 periods

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 6 periods

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 6 periods

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 6 periods

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

Textbooks

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

Reference Books

1. Performance and design of AC machines - M G Say ELBS Edn.
2. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
3. Logic circuit design, Shimon P. Vingron, 2012, Springer.
4. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
5. 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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2			3	2					3		1	
CO2	2	2	2		2					3	2	1	
CO3	2	2	2	3						3	2	1	
CO4	2	1	2		2	2				3	2	1	
CO5	2	2	2			2				3		1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	SEC: Radiology and Safety	2	5	0	0	Theory

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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

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 6 periods

Radiation dose to individuals from natural radioactivity in the environment and manmade 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 6 periods

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 exposure

Unit III: SAFETY IN MEDICAL USES OF RADIATION 6 periods

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 6 periods
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 6 periods
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

Textbooks

1. H. Cember and T. E. Johnson, Introduction to Health Physics, 4th Ed. (McGraw Hill, 2008).

Reference Books

1. K. Thayalan, Handbook of Radiological Safety (Jaypee Brothers,Medical Publishers, 2009
2. R. F. Mould Radiation Protection in Hospital (Adam Hilger Ltd., Bristol, 1985).
3. A. Martin, S. Harbison, K. Beach and P. Cole, An Introduction to Radiation Protection, 6th Ed. (CRC Press, 2013)
4. AERB Radiation Protection Rules, 2004

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2								2	3		1	
CO2	2	2		2						3		1	
CO3	2								2	3		1	
CO4	2		2	2						3		1	
CO5	2			2						3		1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	SEC: Computational Physics Skills	2	5	0	0	Theory

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.

Objectives

- 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 focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

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 6 periods

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 6 periods

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 6 periods

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 6 periods

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 STATEMENT 6 periods

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, ComputedGOTO, Assigned GOTO)

Textbooks

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.

Reference Books

1. Computer Programming in Fortran 77". V. Rajaraman (Publisher: PHI).
2. LaTeX–A Document Preparation System", Leslie Lamport (Second Edition, Addison- Wesley, 1994).
3. 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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2									3		1	1
CO2	2	2		2				2		3		1	
CO3	2							2		3		1	
CO4	2	2	2	2						3		2	
CO5	2			2			2			3		1	1

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	SEC: Introduction to Medical Physics	2	5	0	0	Theory

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 dosimetry concepts and radiation detectors.

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 focus on : Skill Development / Entrepreneurship / Employability / **Research**

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 6 periods

Structure of matter - atom - nucleus -atomic mass and energy units -distribution of orbital electrons - atomic energy levels -nuclear forces -nuclear energy levels- particle radiation - Electromagnetic 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 6 periods

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 6 periods

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 6 periods

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 6 periods

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

Textbooks

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI 1.
   Radiation oncology physics : A Handbook for teachers and students. IAEA publications 2005.

Reference Books

1. F.M. Khan,The Physics of Radiation Therapy,Third Edition,Lippincott Williams and Wilkins,U.S.A.,2003
2. H. E. Jones, J. R. Cunningham, The Physics of Radiology, Charles C. Thomas, New York, 2002.
3. W. J. Meredith and J. B. Massey, Fundamental Physics of Radiology, John Wright and Sons,U. K., 2000.
4. W. R. Handee, Medical Radiation Physics, Year Book Medical Publishers Inc., London, 2003.
5. Donald T. Graham, Paul J. Cloke, Principles of Radiological Physics, Churchill Livingstone, 2003

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2				2					3		1	2
CO2	2	2		2				2		3		1	
CO3	2				1			2		3		1	2
CO4	2	2	2	2						3		2	
CO5	2			2	2		2			3		1	2

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	SEC: Bio Physics	2	5	0	0	Theory

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 focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To study the structure of biomolecules

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 6 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 6 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 6 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 6 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 6 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.

Textbooks

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

Reference Books

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2									3		1	
CO2	2	2		2				2		3		1	
CO3	2					1		2		3		1	2
CO4	2		2	2						3		2	
CO5	2	1		2		2	2			3		1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Elective-Nanoscience And Nanotechnology	2	5	0	0	Theory

Subject Description:

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

Course focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

CO1 : To acquire knowledge about the solid material and analyze

CO2 : To know preparation of nanomaterials by physical methods

CO3 : To know preparation of nanomaterials by chemical methods

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: SYSTEMATIC DEVELOPMENT OF MATERIALS 12 periods

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: METHODS OF GENERATION OF NANOMATERIALS : PHYSICAL APPROACHES 12 periods

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- Thermal evaporation, sputtering Spray Pyrolysis method for thin film preparation

Unit III: METHODS OF GENERATION OF NANOMATERIALS : CHEMICAL APPROACHES 12 periods

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

Unit IV: MECHANICAL AND OPTICAL PROPERTIES OF NANOMATERIAL 12 periods

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

Unit V: ELECTRICAL AND MAGNETIC PROPERTIES OF NANOMATERIAL 12 periods

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

Textbooks

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

Reference Books

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	2									3		1	1
CO2	2	2		2				2		3		1	
CO3	2							2		3		1	
CO4	2		2	2						3		2	
CO5	2	1		1		2		2		3		1	1

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Elective – Atomic physics and spectroscopy	5	5	0	0	Theory

Introduction

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.

Course focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

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 Rama spectra.

Unit I: 12 periods

POSITIVE RAYS AND PARTICLE PROPERTIES OF WAVES

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 - Rutherford Alpha scattering experiment- 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) – Correspondence principle 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 of 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 Photsoelectric 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.

Textbooks

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

Reference Books

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1		1		2		2			3	2		1	
CO2		2	2				3	3			2		1
CO3	1		3	2		3			2	1		3	
CO4		3			3	2	2				2		3
CO5	2		1		2	3		1	3	2		3	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Elective – Principles of Communication systems	4	5	0	0	Theory

Introduction

Course focus on : Skill Development / **Entrepreneurship** / Employability / Research

Course Outcomes

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 12 periods

AMPLITUDE AND FREQUENCY MODULATION

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.

Uni 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: 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.

Textbooks

1. Gupta and Kumar, "Hand book of Electronics", Pragati Prakhasan, 2005.

Reference Books

1. Haykin Simon S, "Communication Systems", Wiley , Fifth edition, 2007.
2. Godse A.P.and Bakshi U.A, " Basic Electronics" ,Technical Publication,2009.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1		1		2		2			3	2		1	
CO2		2	2				3	3			2		1
CO3	1		3	2		3			2	1		3	
CO4		3			3	2	2				2		3
CO5	2		1		2	3		1	3	2		3	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Elective – Fiber Optic Communication Systems	4	5	0	0	Theory

Introduction

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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

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

Textbooks

1 . Deshpande N.D, Deshpande D.A and Rangole P.K ,"Communication Electronics", Tata McGraw Hill Publishers Ltd (1996).

Reference Books

1. MGeorge Kennedy ," Electronic Communication Systems", Tata McGraw Hill Publishers Ltd, New Delhi (2008).
2. Sanjeeva Gupta ,"Electronics Communication Systems", Khanna Publications, Salem (1992).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		3	3	1	3				3		3	3
CO2	3			3	1	1	1			3			3
CO3	3	1	2	3	1	2			1	3	1	2	3
CO4	3				1	1			1	3			
CO5	3	2	3	1			1		1	3	2	3	1

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Elective – Soil Physics	4	5	0	0	Theory

Introduction

This paper presents the fundamentals of properties of soil.

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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: 12 periods

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

Unit II 12 periods

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

Unit III: 12 periods

Water flow in soil: Saturated flow - Unsaturated flow

Unit IV: 12 periods

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

Unit V: 12 periods

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

Textbooks

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

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3		3		1	3				3		3	
CO2	3			2	3			2		3	1		2
CO3	3		1			1		1		3		1	
CO4	3				1	2		1		3	1		
CO5	3		3	1				1		3		3	1

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – Characterization Nanomaterials and its Applications	4	5	0	0	Theory

Introduction

This paper presents the fundamentals of Nano materials and its applications.

Course focus on : Skill Development / Entrepreneurship / Employability / **Research**

Course Outcomes

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 12 periods

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 12 periods

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 - Simple problems (XRD parameters)

Unit III: ELECTRON MICROSCOPY 12 periods

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 12 periods

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 12 periods

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 - Nanomaterials in fabric industry, automobile and ceramic industries

Textbooks

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

Reference books

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1	3			1		3	2	3	1
CO2	3			3	2			1		3		1	3
CO3	3						3	1		3		3	
CO4	3	2		3	2			1		3	2	3	3
CO5	3				3					3		3	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – Atmospheric Physics	4	5	0	0	Theory

Introduction

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

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 radioactive 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 12 periods

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 12 periods

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 12 periods

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 12 periods

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 12 periods

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

Textbooks

1. J. M.Wallace and P.V.Hobbs, Atmospheric science An Introductory Survey", 2nd Edition, Academic Press, London, 2006.

Reference books

2.A.A.Tsonis, An Introduction to Atmospheric Thermodynamics", 2nd Edition, Cambridge University Press, Cambridge, 2007.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3									3			
CO2	3	1		1			1			3	1		1
CO3	3				3					3			
CO4	3	1	1			2				3	1	1	
CO5	3		1			3	3	1		3		1	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – Biomedical instrumentation	4	5	0	0	Theory

Introduction

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

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 principle

CO5 : To acquire knowledge about blood flowmeter

Unit I: BIO-POTENTIAL ELECTRODES 12 periods

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

Unit II : RECORDING SYSTEM 12 periods

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 12 periods

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

Unit IV: NON-ELECTRICAL PARAMETER MEASUREMENTS 12 periods

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

Unit V: BLOOD FLOW AND BLOOD CELL COUNTING 12 periods

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.

Textbooks

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

Reference books:

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.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2		1			1			3	2		1
CO2	3				2					3			
CO3	3			1		2	3			3			1
CO4	3	1	2	1						3	1	2	1
CO5	3		2		3		1			3		2	

Subject code	Title	**Credit**	**Lecture**	**Tutorial**	**Practical**	**Type**
	Elective - Agriculture Physics	4	5	0	0	Theory

Introduction

This paper presents the Fundamentals of soil physics, water physics, hygrometry, pumps and solar collector and their application.

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To know about the soil nature and physics behind soils

CO2 : To learn about the water and physics behind water

CO3 : To gain knowledge about fundamentals about Alternative Current

CO4 : To acquire knowledge about various types of pumps

CO5 : To know about solar collector and its applications

Unit I: SOIL PHYSICS 12 periods

Mechanical composition of soil – physical properties of soil, pore space, bulk density, particle density – classification – significance of clays – plasticity, shrinkage, flocculation and deflocculation – Soil structure – soil colour – Thermal properties of soil and soil temperatures

Unit II : WATER PHYSICS 12 periods

Water qualities – Rain fall – Ground water – surface water pollution – instrumentation and sampling – water quality monitoring

Unit III: ALTERNATIVE CURRENT 12 periods

Principle of production of A.C. – Average value of A.C. voltage or current – R.M.S. value of alternating voltage or current – power consumed in A.C. Circuits – kilo watt hour – A.C. generator – Three phase A.C. – Distribution of three phase A.C. Three phase four system – The choke- The transformer – Transmission of electric power over long distances

Unit IV: HYGROMETRY AND PUMPS 12 periods

Hygrometry: Absolute Humidity – Relative Humidity – Dew point, Daniell's Hygrometer, Regnault's hygrometer. Advantages of Regnault's hygrometer – wet and

Dry and Bulb hygrometer

PUMPS: Water pumps – common pump – force pump – Fire engine, inflator (or) compression pump – pressure after n strokes – Exhaust pump (or) common air pump.

Unit V: SOLAR COLLECTOR AND APPLICATIONS 12 periods

Solar Air heaters- Application of solar air heaters. Solar Drying with various driers – Heating and Drying of Agricultural products – Theory of solar drying – moisture content and its measurement – solar ponds – Application of solar ponds.

Textbooks

1. H.O. Buckman and Brady, "Nature and properties of Soil" Macmillan (1974).

Reference books

1. L.D. Bavar, Walter H. Gardner and Silford R. Gardner, "Soil physics"
2. H. KohnKoe , "Soil physics"

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2			3				3	2	2		
CO2	3	2	1	1					3	3		1	1
CO3	3				2	1			1	3			
CO4	3	1	2	1	1	1		1	1	3	1	2	1
CO5	3	2				1		1		3		2	

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – Digital Electronics and Microprocessor	4	5	0	0	Theory

Introduction

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To learn the number system and binary arithmetic operations.

CO2 : To acquire basic knowledge of logic gates and its applications.

CO3 : To understand the action and application of flip flops and counters

CO4 : To knows the Arithmetic, Data processing circuits and Shift Register

CO5 : To get a deep knowledge of Microprocessor

Unit I: 12 periods

NUMBER SYSTEM, BINARY ARITHMETIC AND BINARY CODES

Decimal , Binary , Octal , Hexadecimal number system – Conversion from one system to another system-Binary arithmetic operations-Representation of negative number-Binary subtraction using 1's and 2's compliment-weighted codes-non weighted codes-alpha numeric codes: ASCII code – EBCDIC - Parity : even parity and odd parity method of single bit error detection

Unit II : 12 periods

LOGIC GATE, LOGIC CIRCUITS, BOOLEAN ALGEBRA AND KARNAUGH MAP

Basic Logic gates (NOT,OR,AND) – Universal building blocks (NAND and NOR gates) – EX-OR and EX-NOR gates- construction of basic gates using discrete components - Law of Boolean algebra- DeMorgan's theorems– Simplifications of Boolean expressions – Karnaugh maps - constructions – Simplification of Boolean expressions using Karnaugh maps.

Unit III: FLIP- FLOPS AND COUNTERS 12 periods

R-S flip flop – D flip flop- JK flip flop – Master slave J-K flip flop –Edge triggered flip flops. Asynchronous and synchronous counters - Ring counters- Modulus counters - Mod 3, Mod 5 and Decade counters.

Unit IV: 12 periods

ARITHMETIC, DATA PROCESSING CIRCUITS AND SHIFT REGISTER

Half and full adder – half and full subtractor – parallel binary adder and subtractor – Multiplexer- De- multiplexer-Encoder-Decoder-Serial in serial out shift register-Parallel in parallel out shift registers.

Unit V: MICROPROCESSOR 12 periods

Basic concept – Organization of Microprocessor – Organization of 8085 – Data and Address bus addressing – The I/O devices – Registers in 8085 – Instruction types – Classification of Instruction – Addressing modes – Programming 8085 – The programming process – machine language programming – Assembly language Programming – The instruction format, Assembler directives, Constant in assembly programming – Language for writing algorithms – The Stack – Subroutines.

Textbooks

1. Digital principles and applications, Albert Paul Malvino & Donald P Leach, Tata McGraw Hill, New Delhi
I(1999).

Reference books

1. Introduction to Integrated electronics digital and analog, V.Vijayendaran, S.Vishwanathan Printers and Publishers Pvt.Ltd (reprint 2011).
2. A K Singh, "Digital Principles Foundation of Circuit Design and Application", New Age International Publishers,2014.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3				3								
CO2				3						3			
CO3	1	3			2	1							
CO4	3	1		3	1	1		1					
CO5								1		3			

Subject code	Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – Geo physics	4	5	0	0	Theory

Introduction

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

Course focus on : Skill Development / Entrepreneurship / **Employability** / Research

Course Outcomes

CO1 : To know about Seismology and its various factors.

CO2 : To learn about surface waves and Seismometry.

CO3 : To learn about the earthquakes 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 12 periods

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 12 periods

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

Unit III: EARTHQUAKES AND GRAVITY 12 periods

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 12 periods

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 12 periods

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

Textbooks

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)

Reference books

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									Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	3	2			3			1		2	2		1
CO2	3		1	1		1				3		1	1
CO3	3	1			2	1				3		1	1
CO4	3	1	2	1	1	1		1		3	1	2	1
CO5	3				1			1		3			2

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDL- Principles of Electronics	**2**	**2**	**-**	**-**	**IDL**

Subject Description: This subject is the introductory for electronics, it presents the basic components theorems, devices and circuits

Objectives: Upon completion of the subject, the student should understand the Basic components and its operations Gain knowledge about Electric and Electronic circuits and Network theorems

Unit I Semiconductor Devices **[6 Periods]**

Conductor – Semiconductor – Intrinsic semiconductor – Extrinsic semiconductor – P type and N -type semiconductor – PN junction diode V-I characteristics - Zener diode V-I characteristics – Insulator.

Unit II Passive Circuit Components **[6 Periods]**

Resistors: Types of resistor- Fixed resistor– Variable resistor– Color coding. **Capacitors:** Basic structure and symbol – Fixed capacitor – Variable capacitors. **Inductors:** Inductance of the coil – Fixed inductors Variable inductors.

Unit III AC and DC Circuits Fundamentals **[6 Periods]**

Alternating current – peak value – average value – rms value – frequency – time period – wavelength – phase - phase difference - Ohm's law – Kirchoff's law – Voltage divider – Current divider.

Unit IV Network Theorem **[6 Periods]**

Superposition theorem – Thevenin's theorem –Norton theorem – Millman's theorem – Maximum power transfer theorem- applications of the Maximum power transfer theorem- Simple problems.

Unit V **[6 Periods]**

Introduction – V-I characteristics of JFET– MOSFET – SCR– DIAC–TRIAC– UJT.

Book for Study:

1. R.S.Sedha "A Text Book Of Applied Electronics" S. Chand and Company Ltd., 2005 Unit(1-5)

Book for Reference :

1. Bernard Grob "Basic Electronics" Tata McGraw – Hill, 9th edition 2003.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDL - Basic Embedded System and Microcontroller	**2**	**2**	**-**	**-**	**IDL**

Subject Description

The aim of this course to provide the student with a detailed understanding of to Microcontrollers and Embedded systems. The course covers fundamentals, The 8051 Architecture, Assembly Language Programming, Instruction set, Serial Communication and Interfacing techniques of 8051 Microcontroller

Unit I **[6 Periods]**

Introduction to Microcontrollers and Embedded Processors – Microcontrollers survey-four bit, eight bit, sixteen bit, thirty two bit Microcontrollers --Comparing Microprocessors and Microcontrollers-Overview of the 8051 family

Unit II **[6 Periods]**

The 8051 Architecture- Hardware- Oscillator and clock-program counter –data pointer registers-stack and stack pointer-special function registers- -memory organization-program memory-data memory -Input / Output Ports –External memory-counter and timer-serial data Input / output-Interrupts

Unit III **[6 Periods]**

8051 Assembly Language Programming-Structure of Assembly language-Assembling and running an 8051 program

Unit IV **[6 Periods]**

Addressing modes-Accessing memory using various addressing modes- Instruction set- Arithmetic operations and Programs-Logical operations and Programs -Jump and Call instructions.

Unit V **[6 Periods]**

Microcontroller Interfacing -Key Board - Displays- Pulse Measurement - D / A and A/D conversion –stepper motor-traffic light signals-DC motors

Book for Study:

1. Kenneth .J.Ayala, " The 8051 Microcontrollers Architecture, programming & Applications", Cengage learning India (P) ltd, India (2010). (Unit V)

Book for Reference :

1. Muhammed Ali Mazidi, "The 8051 Microcontrollers and Embedded Systems", Pearson Education India(2007).

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDL - Digital electronics	**2**	**2**	**-**	**-**	**IDL**

Subject Description

This paper presents basic principles of digital electronics. Students can acquire knowledge regarding number systems, arithmetic building blocks, memories and data processing circuits

Objectives

To give description for the students in order to
earn the circuits

- Acquire basic knowledge of binary addition
- Understand the action and application of counters

Unit I **[6 Periods]**

Number System, Binary Arithmetic and Binary Codes

Decimal, Binary , Octal , Hexadecimal number system – Conversion from one system to another system-Binary arithmetic operations- -Binary subtraction using 1's and 2's compliment

Unit II **[6 Periods]**

Logic gate, Logic circuits, Boolean algebra and Karnaugh map

Basic Logic gates (NOT,OR,AND) – Universal building blocks (NAND and NOR gates) – EX-OR and EX-NOR gates- construction of basic gates using discrete components - Law of Boolean algebra- DeMorgan's theorems– Simplifications of Boolean expressions

Unit III **[6 Periods]**

Flip- flops and Counters

R-S flip flop – D flip flop- JK flip flop – Master slave J-K flip flop –Edge triggered flip flops. Asynchronous and synchronous counters - Ring counters

Unit IV **[6 Periods]**

Arithmetic, Data processing circuits and Shift Register

Half and full adder – half and full subtractor – parallel binary adder and subtractor –Multiplexer- De- multiplexer-Encoder-Decoder-Serial in serial out shift register-Parallel in parallel out shift registers.

Unit V **[6 Periods]**

Memory devices

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM – RAM — Write operation – Read operation – Memory cycle - Timing wave forms – Memory decoding – memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell.

Book for Study:

1. Floyd," Digital fundamentals", Tata McGraw Hill, New Delhi(1995). Unit(1-5)
2. Albert Paul Malvino & Donald P Leach," Digital principles and applications", Tata McGraw Hill, New Delhi I(1999).

Book for Reference :

1. V.Vijayendaran," Introduction to Integrated electronics digital and Analog", S.Vishwanathan Printers and Publishers Pvt.Ltd (reprint 2011).
2. M.Morris Mano ,"Digital logic and computer design", Prentice-Hall of India Pvt.Ltd, NewDelhi (2006).

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDC - Fibre Optic Communication Systems	**2**	**2**	**-**	**-**	**Theory**

Subject Description

This paper presents basic principles of digital electronics. Students can acquire knowledge regarding number systems, arithmetic building blocks, memories and data processing circuits

Unit I **[6 Periods]**

Fibre Classification

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 - Fibre classification – stepped index fibre – Graded index fibre – Comparison of step and graded index fibres.

Unit II **[6 Periods]**

Fibre Fabrication and Cables

Classification of Techniques – External chemical vapour deposition – Characteristics – Internal chemical vapour deposition (1^{st} method only) – Characteristics –Axial Vapour Deposition– Phasil system – Multi-element– Fibre cable construction– Testing of cables.

Unit III **[6 Periods]**

Fibre Losses and Dispersion In Optics

Attenuation in optic fibre– Impurity losses –Rayleigh scattering losses – Radiation induced losses – Inherent defect losses – Core and Cladding losses - Dispersion in an Optical Fibre – Inter-modal dispersion – Material Chromatic Dispersion.

Unit IV **[6 Periods]**

Light Sources for Optical Fibres

LED – The process involved in LEDS – Structures of LED – S-LED – E-LED Modulation bandwidth of LED and Spectral Emission of LEDS and simple problem.

Unit V **[6 Periods]**

Applications

Telecommunications – Active and passive sensors - Temperature and pressure Sensors – displacement sensor - medical endoscope - engineering application-Medical application - advantage of optic fibre communication over radio wave communication.

Book for Study:

1. Dr. Subir Kumar Sarkar, " Optical Fibres and Fibre optics Communication System", S.Chand and Company Pvt. Ltd., New Delhi, 2014. Unit(1-5).

Book for Reference :

1. R.K.Puri and V.K. Babbar, "Optical Fibres and Fibre Optic Communication Systems"

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDL - Applied Electronics	**2**	**2**	**-**	**-**	**IDL**

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.

Unit I **[6 Periods]**

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 **[6 Periods]**

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 **[6 Periods]**

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

Unit IV **[6 Periods]**

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 **[6 Periods]**

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.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDL - Space Science	2	2	-	-	**IDL**

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

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.

Unit I: Universe **[6 Periods]**
Planets - interior planets - exterior planets - crust, mantle and core of the earth - different - region of earth's atmosphere - rotation of the earth - magnetosphere - Van Allen belts - Aurora.

Unit II: Comets, Meteors, Asteroids **[6 Periods]**
Composition and structure of comets - periodic comets – salient features of asteroids, meteors and its use

Unit III: Sun **[6 Periods]**
Structure of photosphere, chromosphere, corona - sunspots – solar flares - solar prominences - solar piages - satellites of planets -structure, phases and their features of moon.

Unit IV: Stars **[6 Periods]**
Constellations - binary stars - their origin and types star clusters –globular clusters - types of variable-Stars - types of galaxies.

Unit V: Origin of Universe **[6 Periods]**
Big bang theory - pulsating theory - steady state theory – composition of universe expansion

Book for study and reference :

1. K.D. Abyankar, "Astrophysics of the solar system, University press", India (1999)

2. BaidyanathBasu, Sudhindra Nath Biswas and Tanuka Chattopadhyay, "An Introduction To Astrophysics, Prentice Hall Of India", New Delhi (2010)

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	IDL -Biomedical instrumentation	2	2	-	-	IDL

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.

Unit I **[6 Periods]**
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 **[6 Periods]**
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 **[6 Periods]**
Bio-chemical measurement

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

Unit IV **[6 Periods]**
Non-electrical parameter measurements

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

Unit V **[6 Periods]**
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.

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
IDL -	**Agriculture Physics**	**2**	**2**	**-**	**-**	**IDL**

Subject Description:
This paper presents the Fundamentals of soil physics, water physics, hygrometry, pumps and solar collector and their application.

Objectives
To enable the students to acquire the knowledge of Physics in Agriculture.

Unit I **[6 Periods]**

Soil physics
Mechanical composition of soil – physical properties of soil, pore space, bulk density, particle density – classification – significance of clays – plasticity, shrinkage, flocculation and deflocculation – Soil structure – soil colour – Thermal properties of soil and soil temperatures

Unit II **[6 Periods]**

Water physics
Water qualities – Rain fall – Ground water – surface water pollution – instrumentation and sampling – water quality monitoring

Unit III **[6 Periods]**
Principle of production of A.C. – Average value of A.C. voltage or current – R.M.S. value of alternating voltage or current – power consumed in A.C. Circuits – kilo watt hour – A.C. generator – Three phase A.C. – Distribution of three phase A.C. Three phase four system – The choke- The transformer – Transmission of electric power over long distances.

Unit IV **[6 Periods]**

Hygrometry
Absolute Humidity – Relative Humidity – Dew point, Daniell's Hygrometer, Regnault's hygrometer. Advantages of Regnault's hygrometer – wet and Dry and Bulb hygrometer

PUMPS
Water pumps – common pump – force pump – Fire engine, inflator (or) compression pump – pressure after n strokes – Exhaust pump (or) common air pump.

Unit V **[6 Periods]**

Solar Collector and Applications
Solar Air heaters- Application of solar air heaters. Solar Drying with various driers – Heating and Drying of Agricultural products – Theory of solar drying – moisture content and its measurement – solar ponds – Application of solar ponds

Book for Study:

1. H.O. Buckman and Brady, "Nature and properties of Soil" Macmillan (1974). (Unit I – V)

Book for Reference :

1. L.D. Bavar, Walter H. Gardner and Silford R. Gardner, "Soil physics"
2. H. KohnKoe , "Soil physics"
3. John C. Rodda, Richard A. Downing, Frank M. Law, "Systematic Hydrology" Newnes Butterworths (1976).

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
IDL -	**Food Chemistry**	**2**	**2**	**-**	**-**	**IDL**

Subject Description:

1. To have an idea about food adulteration and food preservation techniques.
2. To understand the chemistry of vinegar, fruit juices, vegetable acids and beverages.
3. To analyze and characterize chemical aspects of milk.

Unit I : Nutrition Values Of Food Materials And Food Adultration **[6 Periods]**

Nutritional values of carbohydrates, vitamins, proteins and fats-Definition – Food standards – Food Standards in India – Standards for ensuring quality of Products – Common adulterants in different foods – Contamination of foods with toxic chemicals, pesticides and insecticides. Contamination of food with harmful microorganisms – Bacterial infections – Fungal contaminations of foods.

Unit II: Impact Of Food Preservatives **[6 Periods]**

Introduction –Types of preservation methods - Chemical Preservatives - Cold Storage - Foods preserved in Tinned Iron and Glass Containers - Inspection of Tinned foods - Arsenic in foods - The Gutzeit test for Arsenic – Examination of glucose for the presence of Arsenic, Antimony in beverages.

Unit III : Amino Acids In Vegetables, Vinigar And Fruit Juices **[6 Periods]**

Biological importance of Amino acids – Leucine – Isoleucine – Lysine – Tryptophan. Preparation and properties of Vinegar. Examination of Vinegar – Determination of Total Solids and examination of residue, Total acidity, Mineral acids in Vinegar, Hydrogen ion Concentration, pH Value, Methods of determining pH, detection of mineral acids in Vinegar by pH Value, Alcohol in Vinegar. Fruit Juices and Vegetable Acids: Examination of Lime Juice, Lemon Squash, etc.,

Unit IV: Commercially Important Beverages **[6 Periods]**

Introduction – Types of beverages - Tea - Nature and Properties of Tea - Adulteration of Tea - Tea Infusions. Coffee - Nature and Properties of Coffee - Adulteration of Coffee with Chicory. Cocoa and Chocolate - Nature and properties of Cocoa and Chocolate - Adulteration of Cocoa. Alcoholic Beverages - Introduction - Determination of Alcohol - Proof Spirit - Denaturing of Alcohol.

Unit V : Milk **[6 Periods]**

General characteristics of Cows' milk – The determination of the specific gravity – use of lactometer – Determination of total solids – Determination of ash – Determination of fat- Gerber, gottlieb – rose, Werner – Schmid and Adams methods] – Calculation of extent of adulteration - Determination of total protein – Determination of lactose – Determination of acidity – Added coloring matter in milk – Preservatives in milk [Boric acid, formaldehyde, etc.] – Boiled and pasteurized milk – Homogenized milk – Cream – Reconstituted cream – Synthetic cream – Condensed milk – Dried milk.

Book for Study:

1. C. Kenneth Tinkler and Helen Masters,(2005) **Applied Chemistry**, Vol. II, London.
2. M. Swaminathan, (2003) **Advanced Text Book on Food and Nutrition,** Vol. II, .
3. B. Sri Lakshmi, (2002) **Nutrition science**, New Age International Pvt. Ltd., New Delhi.

Book for Reference :

1. M. Swaminathan, (2003) **Handbook of Food and Nutrition**, The Bangalore Printing andPublishing Co. Ltd.,
2. B. Sri Lakshmi, (2003) **Food Science**, New Age International Pvt. Ltd., New Delhi.
3. S. D. Venkataiah,(2004) **Nutrition Education**, Anmol Publication Pvt. Ltd.,