B.Sc. PHYSICS SYLLABUS

(UNDER CHOICE BASED CREDIT SYSTEM)

Applicable to the candidates admitted from 2020 onwards

OUTCOME - BASED EDUCATION (OBE)

PG & RESEARCH DEPARTMENT OF PHYSICS

BISHOP HEBER COLLEGE (AUTONOMOUS)

AFFILIATED TO BHARATHIDASAN UNIVERSITY

(NATIONALLY REACCREDITED AT THE 'A' GRADE BY NAAC WITH A CGPA OF 3.58 OUT OF 4)

RECOGNIZED BY UGC AS 'COLLEGE WITH POTENTIAL FOR EXCELLENCE'

TIRUCHIRAPPALLI – 620 017

VISION

To ignite the young minds to achieve excellence in physics through whole person education, to provide opportunities to explore the laws of nature and enable them to contribute to nation building.

MISSION

- Impart quality education, endorse scientific temper and create a passion for Physics through competitive curriculum and effective teaching.
- Explore the skills through hands on experiences by providing state of art research facilities.
- Striveforholisticdevelopmentbyimbibingethicalandsocialvaluesandbuildscientific, communicative and leadership competencies to face the global challenges.

B.Sc. PHYSICS

PROGRAMME OUTCOMES

On successful completion of the B.Sc. Physics Course, the graduates will be able to

KNOWLEDGE

PO1 - Demonstrate comprehensive knowledge of basic concepts, fundamental laws, principles and Conceptualize theories related to Physical phenomena and their applications in day to day life.

PO2 - Critically analyze physical science problems and develop appropriate methods to obtain precise solutions using latest techniques and models.

PO3 - Exhibit scientific and research outlook to analyze and develop creative solutions for socially and environmentally pressing problems.

SKILL

PO4 - Exhibit practical ability to handle scientific instruments and tools with skill and ease, acquire systematic data, analyze and interpret the results using mathematical and ICT tools.

PO5 - Analytically solve problems, evaluate the results rationally and arrive at objective conclusions.

PO6 - Exhibit intra and inter-personal skills including oral and written skills with scientific approach as an individual and with a team spirit working in core or multidisciplinary environment.

ATTITUDE

PO7 - Demonstrate self - directed and lifelong learning and contribute to diverse teams through scientific, constructive, innovative and collaborative skills.

ETHICAL AND SOCIAL VALUES

PO8 - Practice ethical, professional, environmental and social values in personal and social life and would contribute to build a cultured and civilized society.

PO9 - Recognize the potential impact of local and global issues including energy crisis and Sustenance and involve in constructive community service.

PROGRAMME SPECIFIC OUTCOMES

PSO1 - Comprehend the physical principles and relate the theory and applications in core domains such as Properties of matter, Mechanics, Optics, Thermodynamics, Electricity and magnetism, Atomic and Molecular, Nuclear, Solid state Physics and Electronics.

PSO2 - Determine the physical properties of materials, analyze and interpret the data using mathematical and computational techniques.

PSO3 - Evaluate mechanical, electrical and electronic systems and exhibit practical skills in solving real time problems

PSO4 - Relate theory and applications, harness new ideas related to physics and allied sectors and contribute to multidisciplinary and interdisciplinary domains.

B.Sc. Physics

Structure of the Curriculum (2020)

Parts of the curriculum	No. of Courses	Credits
Core	**8**	**39**
Elective	**3**	**15**
Project	**1**	**5**
Part I	**4**	**12**
Part II	**4**	**12**
NMEC	**2**	**4**
SBEC	**3**	**6**
Allied	**5**	**19**
Major Practical	**6**	**18**
Allied Practical	**1**	**3**
VLOC	**1**	**2**
Gender Studies	**1**	**1**
Env. Studies	**1**	**2**
Soft Skills	**1**	**1**
Extension Activities	**1**	**1**
Total	**42**	**140**

SYLLABUS STRUCTURE

Sem.	Part	Course	Course Title	Course Code	Hours / week	Credits	Marks		
							CIA	ESE	Total
I	I	Tamil I /*	செய்யுள்,உரைநடை, மொழிப்பயிற்சி	U18TM1L1	6	3	25	75	100
	II	English I	Literature and Language : Prose and Short Stories	U20EGNL1	6	3	40	60	100
	III	Core I	Properties of Matter and Acoustics	U16PH101	6	5	25	75	100
		Core Prac. I	Major Practicals - I	U16PH1P1	3	3	40	60	100
		Allied I	Algebra, Calculus and Analytical	U20MAY1	5	4	25	75	100

			Geomentry of Three Dimensions	1					
	IV	Env. Studies	Environmental Studies	U16EST11	2	2	25	75	100
		Val. Edu.	Value Education (RI/MI)	U15VL1:1/ U15VL1:2	2	2	25	75	100
					Sem. I Credits :	22			
II	I	Tamil II /*	செய்யுள்,சிறுகதைத்திரட்டு, மொழிப்பயிற்சி	U18TM2L2	6	3	25	75	100
	II	English II	Literature and Language : Poetry and Shakespeare	U20EGNL2	6	3	40	60	100
	III	Core II	Mechanics	U16PH202	5	4	25	75	100
		Core Prac. II	Major Practicals - II	U16PH2P2	3	3	40	60	100
		Allied II	Vector Calculus and Trigonometry	U20MAY22	4	4	25	75	100
		Allied III	Differential Equations, Laplace Transforms and Fourier Series	U20MAY23	4	4	25	75	100
		SBEC I	Bio Physics and Biomedical Instrumentation	U16PH2S1	2	2	25	75	100
					Sem. II Credits :	23			
III	I	Tamil III /*	செய்யுள், நாவல், மொழிப்பயிற்சி	U18TM3L3	6	3	25	75	100
	II	English III	English for Competitive Examinations	U16EGNL3	6	3	40	60	100
	III	Core III	Thermal Physics	U16PH303	6	5	25	75	100
		Core Prac. III	Major Practicals - III	U16PH3P3	3	3	40	60	100
		Allied IV	Allied Chemistry - I	U19CHY34	4	3	25	75	100
	IV	Allied Prac. I	Volumetric and Organic Analysis	U19CHYP1	3	--	--	--	--
		NMEC I	Students have to opt from other Major	--	2	2	25	75	100
					Sem. III Credits :	19			
IV	I	Tamil IV /*	செய்யுள், நாடகம், மொழிப்பியிற்சி	U18TM4L4	5	3	25	75	100
	II	English IV	English through Literature	U16EGNL4	5	3	40	60	100
	III	Core IV	Optics	U16PH404	6	5	25	75	100
		Core Prac. IV	Major Practicals - IV	U16PH4P4	3	3	40	60	100
		Allied V	Chemistry for Physicists	U19CHY45	4	4	25	75	100

		Allied Prac.I	Volumetric and Organic Analysis	U19CHYP1	3	3	40	60	100
	IV	NMEC II	Students have to opt from other Major	--	2	2	25	75	100
		Soft Skills	Life Skills	U16LFS41	2	1	--	--	100
	V	Extension Activities	NSS, NCC, Rotaract,Leoclub, etc …	U16ETA41	--	1	--	--	--
					Sem. IV Credits :	25			
V	III	Core V	Electricity Magnetism and Electromagnetism	U16PH505	5	5	25	75	100
		Core VI	Electronic Devices	U16PH506	5	5	25	75	100
		Core Prac. V	Major Practicals - V	U16PH5P5	6	3	40	60	100
		Core Project	Project	U16PH5PJ	5	5	--	--	100
		Elective I	Atomic Physics/ Communication System / Astronomy and Astrophysics/ Python	U16PH5:1 /U16PH5:A / U20PH5:B/ U20PH5:C	5	5	25	75	100
	IV	SBEC II	Concepts Through Animations	U16PHPS2	2	2	40	60	100
		SBEC III	Web Designing (Theory and Practical)	U16PHPS3	2	2	40	60	100
					Sem. V Credits :	27			
VI	III	Core VII	Nuclear Physics, Wave Mechanics and Relativity	U16PH607	6	5	25	75	100
		Core VIII	Solid State Physics	U16PH608	6	5	25	75	100
		Core Prac. VI	Major Practicals - VI	U16PH6P6	6	3	40	60	100
		Elective II	Digital Electronics / Crystal Growth and Thin Film Physics / Energy Physics/ Mathematical Methods for Physicists	U16PH6:1/ U16PH6:A/ U20PH6:B / U20PH6:C	6	5	25	75	100
		Elective III	Programming in C / Spectroscopy and Lasers / Non - Destructive Testing and Evaluation/ Statistical Methods	U16PH6:3 / U16PH6:D / U20PH6:E/ U20PH6:F	6	5	25	75	100
	V	Gender Studies	Gender Studies	U16GST61	--	1	--	--	100
					Sem. VI Credits :	24			
SBEC : Skill Based Elective Courses NMEC : Non Major Elective Courses						Total Credits :	140		

*** Other Languages :**	Hindi Sanskrit French		Hindi Sanskrit French
Semester I:	U18HD1L1 U17SK1L1 U18FR1L1	Semester III :	U18HD3L3 U17SK3L3 U18FR3L3
Semester II :	U18HD2L2 U17SK2L2 U18FR2L2	Semester IV :	U18HD4L4 U17SK4L4 U18FR4L4

Part I : 4 Part II : 4 Core Theory : 8 Core Practical : 6 Core Project : 1 Elective : 3 Allied Theory : 6 Allied Practical : 4	Total Courses : 42
SBEC : 3 NMEC : 2 Value Education : 1 Env. Studies : 1 Soft Skills : 1 Extension Activities : 1 Gender Studies : 1	

NMEC offered by the Department:	1. Simple Appliances	U16PH3E1
	2. Audio and Video Systems	U16PH4E2

CORE-I: PROPERTIES OF MATTER AND ACOUSTICS

SEMESTER: I **CODE: U16PH101**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Measure different kinds of moduli of elasticity.	**K5**	**I**
CO2	Interpret the concept and consequences of gravitation and its applications	**K5**	**II**
CO3	Classify the liquids based on viscous property.	**K4**	**III**
CO4	Estimate surface tension of liquids subjected to boundary conditions	**K5**	**IV**
CO5	Correlate the wave nature and analyze the laws of transverse vibrations	**K4**	**V**
CO6	Investigate the factors affecting the acoustics of buildings	**K3**	**V**

2. A. SYLLABUS

Unit-I: Elasticity (15 Hours)

Stress–Strain – Hooke's law – Different moduli of elasticity – Young's modulus (E) – Rigidity modulus(G) – Bulk modulus(K) – Poisson's ratio – work done in linear, shearing and volume strain – Relation connecting elastic constants and Poisson's ratio – Twisting couple - work done in twisting a wire – Torsion – Torsional oscillations of a body – Rigidity modulus by Torsion pendulum – Bending of beams – Bending couple–Plane of bending – Neutral axis – Expression for bending moment – Cantilever depression and oscillation – Measurement of Young's modulus by non-uniform bending, uniform bending.

Unit-II: Gravitation (15 Hours)

Newton's law of gravitation – Mass and density of earth – Inertial mass –Gravitational mass – Kepler's laws – Deduction of Newton's law from Kepler's laws – Boys method of finding G – Gravitational field – Intensity of gravitational field –Gravitational potential – Equipotential surface – Gravitational field and potential due to spherical shell – Gravitational field and potential due to solid sphere – Variation of acceleration due to gravity with latitude, altitude and depth – Escape velocity – Orbital velocity – Geostationary orbit – Satellite communication (Basic ideas only).

Unit-III: Viscosity (15 Hours)

Viscosity – Streamline flow and Turbulent flow – Critical velocity – Expression for critical velocity – Reynold's number and its significance – Poiseuille's formula for the flow of a liquid through a capillary tube – Poiseuille's method for the determination of co-efficient of viscosity of a liquid (variable pressure head) – Terminal velocity –Stoke's method for the co-efficient of viscosity of a viscous liquid – Variation of viscosity with temperature and pressure – Friction and Lubrication.

Unit-IV: Surface Tension (15 Hours)

Surface tension – Molecular forces – Explanation of surface tension on the basis of kinetic theory – Work done in increasing the area of a surface – Angle of contact – Pressure difference across a liquid surface – Excess pressure inside a liquid drop, soap bubble and a curved liquid surface – Experimental determination of surface tension – Jaeger's method – Quincke's method – Drop weight method – Capillary rise method.

Unit-V: Acoustics (15 Hours)

Composition of two simple harmonic motions along a straight line and at right angles to each other – Lissajou's figures – laws of transverse vibration – verification by sonometer and Melde's experiment.

Ultrasonic and Acoustics: Sound (types) – Production, properties and applications of Ultrasonics – Acoustics of buildings – Reverberation time – Sabine's formula – decibel – Intensity measurements and Doppler effect.

B. TOPICS FOR SELF STUDY

1. **Applications of Elasticity**
   https://www.youtube.com/watch?v=PRYtw9EQhug
   https://www.youtube.com/watch?v=YI9ke-cy_1g

2. **Material Strength, Ductility and Toughness**
   https://www.youtube.com/watch?v=WSRqJdT2COE

3. **Satellite Communication**
   https://www.tutorialspoint.com/satellite_communication/index.htm

4. **Understanding Bernoulli's Equation**
   https://www.youtube.com/watch?v=DW4rItB20h4

C. TEXT BOOKS

1. R. Murugeshan, Properties of Matter, S. Chand and Co., New Delhi, 2004.
2. N. Subrahmanyam and BrijLal, A Text Book of Sound, Vikas Publishing House Pvt. Ltd., New Delhi, 1999.
3. V. Rajendran and A. Marikani, Applied Physics, Tata Mcgraw Hill Publishing Co. Ltd, New Delhi, 2003.

D. REFERENCE BOOKS

1. Brij Lal and N. Subrahmanyam, Properties of Matter, Eurasia Publishing House Ltd., New Delhi,1993.
2. R.L. Saigal, Text book of Sound, S.Chand and Co., New Delhi, 1990.
3. D. S. Mathur, Elements of Properties of Matter, S. Chand & Co., New Delhi, 2008.
4. R.P. Feynman, Feynman Lectures on Physics, Vol-I, Pearson, New Delhi, 2009.
5. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics 6e, John Wiley & Sons, 2006.
6. Paul A. Tipler and G. Mosca, Physics for Scientist and Engineers, W.H.Freeman, New York, 2003.

E. WEBLINKS

1. https://nptel.ac.in/courses/115/106/115106119/
2. https://physics.info/elasticity/
3. https://physics.info/viscosity/
4. https://www.tutorialspoint.com/physics_part1/physics_gravitation.htm

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of Transaction
I	**Elasticity**		
1.1	Stress–Strain	Define stress and strain.	**K1**
1.2	Hooke's law	State and recall Hooke's law.	**K1**
1.3	Different moduli of elasticity – Young's modulus (E) – Rigidity modulus(G) – Bulk modulus(K)	Explain different kinds of moduli of elasticity.	**K2**
1.4	Work done in linear, shearing and volume strain	Deduce work done in different kinds of strain.	**K5**
1.5	Relation connecting elastic constants and Poisson's ratio	Construct relations connecting different elastic constants.	**K3**
1.6	Twisting couple - work done in twisting a wire	Determine the expression for twisting couple and work done in twisting a wire.	**K5**
1.7	Torsion – Torsional oscillations of a body – Rigidity modulus by Torsion pendulum	Illustrate torsional oscillations of a body and determine rigidity modulus by using torsion pendulum.	**K5**
1.8	Bending of beams – Bending couple–Plane of bending – Neutral axis	Define beam, bending couple, plane of bending and neutral axis	**K1**
1.9	Expression for bending moment – Cantilever depression and oscillation	Derive the expression for bending moment in Cantilever depression and oscillation	**K4**
1.10	Measurement of Young's modulus by non-uniform bending, uniform bending.	Estimate the Young's modulus expression for non-uniform bending and uniform bending.	**K5**
II	**Gravitation**		

2.1	Newton’s law of gravitation	Recall Newton’s law of gravitation.	**K1**
2.2	Mass and density of earth – Inertial mass –Gravitational mass	State gravitational constant G and outline the expression for mass and density of earth.	**K2**
2.3	Kepler's laws – Deduction of Newton's law from Kepler's laws	State and recall Kepler's laws of motion and retrieve Newton's law from Kepler's law.	**K3**
2.4	Boy's Method of finding G	Determine G by using Boy's experiment.	**K5**
2.5	Gravitational field – Intensity of gravitational field – Gravitational potential	Define gravitational field, intensity and potential.	**K1**
2.6	Equipotential surface	Explain equipotential surface.	**K2**
2.7	Gravitational field and potential due to spherical shell – Gravitational field and potential due to solid sphere	Evaluate gravitational field and potential for the case of spherical shell and solid sphere.	**K5**
2.8	Variation of acceleration due to gravity with latitude, altitude and depth	Determine the expression of acceleration due to gravity with variation in latitude, altitude and depth.	**K5**
2.9	Escape velocity – Orbital velocity	Define escape and orbital velocity. Deduce the expression for escape and orbital velocity.	**K5**
2.10	Geostationary orbit – Satellite communication (Basic ideas only).	Define Geostationary orbit. Explain the basic ideas of satellite communication.	**K2**
III	**Viscosity**		
3.1	Viscosity – Streamline flow and Turbulent flow	Define viscosity and coefficient of viscosity. List different types of liquid flow.	**K1**
3.2	Critical velocity Expression for critical velocity – Reynold’s number and its significance	Define critical velocity and deduce the expression for critical velocity to demonstrate the distinction between stream line flow and turbulent flow.	**K5**

3.4	Poiseuille's formula for the flow of a liquid through a capillary tube	Construct Poiseulle's equation for volume of liquid flow through a capillary tube.	**K3**
3.5	Poiseuille's method for the determination of co-efficient of viscosity of a liquid (variable pressure head)	Explain Poiseuille's method of measuring co-efficient of viscosity of a liquid.	**K2**
3.6	Terminal velocity - Stoke's method for the co-efficient of viscosity of a viscous liquid	Derive Stoke's formula for terminal velocity and the co-efficient of viscosity of a liquid.	**K4**
3.7	Variation of viscosity with temperature and pressure	Illustrate the variation of viscosity with temperature and pressure	**K2**
3.8	Friction and Lubrication.	Define Friction and Lubrication.	**K1**
IV	**Surface tension**		
4.1	Surface tension – Molecular forces.	Define surface tension of a liquid and recall types of molecular forces.	**K1**
4.2	Explanation of surface tension on the basis of kinetic theory.	Illustrate the concept of surface tension of a liquid based on kinetic theory.	**K2**
4.3	Work done in increasing the area of a surface	Deduce the expression for work done in increasing the surface area of a liquid.	**K5**
4.4	Angle of contact	Define Angle of contact	**K1**
4.5	Pressure difference across a liquid surface – Excess pressure inside a liquid drop, soap bubble and a curved liquid surface	Determine the expression for excess of pressure inside different liquid surfaces.	**K5**
4.6	Experimental determination of surface tension – Jaeger's method – Quincke's method – Drop weight method – Capillary rise method.	Discuss different experimental methods of measuring surface tension of a liquid.	**K5**
V	**Acoustics**		

5.1	Composition of two simple harmonic motions along a straight line and at right angles to each other	Define simple harmonic motions Derive the expression of resultant wave form of composition of two simple harmonic waves along a straight line and at right angles to each other.	**K4**
5.2	Lissajou's figures	Illustrate Lissajou's figures with examples.	**K2**
5.3	Laws of transverse vibration	State the laws of transverse vibration	**K1**
5.4	Verification by sonometer and Melde's experiment.	Explain the method of verifying the laws of transverse vibration by sonometer and Melde's experiment.	**K2**
5.5	Ultrasonics and Acoustics: Sound (types)	Define and recall ultrasonics	**K1**
5.6	Production of Ultrasonics	Explain the methods of producing ultrasonic waves.	**K2**
5.7	Properties and applications of Ultrasonics	Discuss the properties and applications of ultrasonic waves.	**K5**
5.8	Acoustics of buildings Reverberation time	Define Reverberation time.	**K1**
5.9	Sabine's formula	Derive the expression of Sabine's reverberation time formula.	**K4**
5.10	Decibel–Intensity measurements and Doppler effect.	Define and recall Decibel. State and recall Doppler effect.	**K1**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH101	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO8	PSO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	L	H	H	L	M	L	L	H	H	M	H
CO2	H	M	L	H	M	L	M	L	M	H	M	M	M
CO3	H	H	M	H	M	L	M	L	L	H	M	M	M
CO4	H	M	M	H	H	M	L	L	L	H	H	H	M
CO5	H	M	M	L	M	M	M	M	L	H	M	M	M
CO6	H	H	M	M	H	L	M	L	L	H	H	M	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Internal Assessment Test I & II
2. Open book test, learning report, Assignment, Seminar and Problem solving.
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Dr.D.Giridharan

CORE - II: MECHANICS

SEMESTER: II **CODE: U16PH202**

CREDITS : 4 **NO OF HOURS/WEEK: 5**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Explain the concept of Centre of gravity, friction and Equilibrium of a body in the presence and absence of external force.	**K2**	**I**
CO2	Estimate the physical parameters involved in projectile motion using Newton's equation of motion.	**K5**	**II**
CO3	Calculate moment of inertia of regular geometric structures using parallel and perpendicular axes theorem.	**K5**	**III**
CO4	Determine the value of 'g' using different pendulums (Compound, Kater's) and explain the theory of oscillation.	**K5**	**IV**
CO5	Explain certain static and dynamic properties of fluids.	**K2**	**V**
CO6	Outline the applications of Bernoulli's and Torricelli's theorem.	**K2**	

2. A. SYLLABUS

Unit - I: Statics **(15 hours)**

Center of gravity – C.G. of solid hemisphere; hollow hemisphere; tetrahedron hollow cone and solid cone. Friction – laws of friction – cone of friction – angle of friction – static and dynamic friction – equilibrium of a body on a rough inclined plane with and without the application of external force – friction clutch.

Unit- II: Dynamics **(15 hours)**

Projectile – Horizontal projection – Oblique projection – Path of a projectile – Resultant velocity – Time of flight – Vertical height – Range – Impulse and Impact – Laws of Impact – Direct and Oblique impact – Loss of kinetic energy due to direct impact – Motion of two interacting bodies- reduced mass.

Unit- III: Dynamics of Rigid Bodies (15 hours)

Moment of Inertia – Kinetic energy of rotating body and Angular momentum – Parallel and Perpendicular axes theorems – Moment of inertia of a rod, rectangular lamina, sphere, shell, cylinder and fly wheel – Kinetic energy of rolling body – body rolling down an inclined plane

Unit- IV: Simple Harmonic Motion (15 hours)

Definition – Theory of free vibrations -damped vibrations - forced vibrations – sharpness of resonance – Power dissipation and quality factor – Compound pendulum – reversibility of centres of oscillation and suspension – Determination of 'g' and radius of gyration of a compound pendulum – Kater's pendulum– Bessel's Modification formula.

Unit- V: Hydrostatics and Hydrodynamics (15 hours)

Fluid pressure and its properties – Thrust on plane and curved surfaces – Centre of pressure – Centre of pressure of irregular, rectangular and circular lamina – Equations of continuity of flow – Euler's equation for unidirectional flow –Bernoulli's theorem – Venturimeter- Pitot's tube - Torricelli's theorem.

B. TOPICS FOR SELF STUDY

1. Basic of Statics
2. Rigid Body Systems
3. Basic Terminology in Vibrations
4. Pendulum Theory & Modelling Oscillations – Fluid mechanics and its Application.

C. TEXT BOOKS

1. RM.Narayanamoorthy and N.Nagaratnam, Dynamics, The National Publishing Company, Chennai, 2002 (UNITS I,II,III& IV).
2. M.Narayanamoorthy and N.Nagarathnam, Statics, Hydrostatics and Hydrodynamics, the National Publishing Company, Chennai, 1989 (UNIT V).
3. D.S. Mathur, Mechanics, S.Chand and Co., Ltd., New Delhi, 2000

D. REFERENCE BOOKS

1. R.P. Feynman, Feynman Lectures on Physics, Vol – I, 2008.
2. Halliday, Resnick and Walker, Fundamentals of Physics, VI Edition, John Wiley& Sons, Inc, 2006.
3. Mechanics (In SI Units) : Berkeley Physics, Kittel . C, Knight. W.ET.AL
Published by Mc Graw Hill India (2012)

E. WEBLINKS

1. Advanced statics - https://nptel.ac.in/courses/112/106/112106180/
2. Advanced Dynamics - https://nptel.ac.in/courses/112/105/112105304/
3. Engineering Mechanics – https://onlinecourses.nptel.ac.in/noc21_me70/preview
4. Applications of Equations of motion and mechanical Energy - https://nptel.ac.in/content/storage2/courses/112104118/lecture-16/16-1a_hydro_static_pressure.htm

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Statics**		
1.1	Introduction to center of gravity	Define Center of gravity	**K1**
	C.G of Solid hemisphere C.G of Hollow hemisphere C.G of Tetrahedron, C.G of hollow Cone and Solid Cone	Determine the position of center of gravity of different geometric objects (Solid hemisphere, hollow hemisphere etc…)	**K5**
1.2	Friction	Define friction	**K1**
	Laws of friction	Explain laws of friction	**K2**
	Cone of friction and Angle of friction. Types of friction (Static and Dynamic)	Define Cone of friction and Angle of friction	**K1**
		Classify the types of friction	**K4**
	Equilibrium of a body on a rough inclined plane with and without the application of external force	Illustrate friction on an inclined plane with and without application of external force.	**K2**
	Friction Clutch	Explain the function of friction clutch	**K2**
II	**Dynamics**		
2.1	Projectile	Define a projectile	**K1**
	Horizontal projection, Oblique projection, Path of a projectile. Resultant velocity, Time of flight – Vertical height – Range	Explain horizontal and Oblique projection and Time of flight – Vertical height	**K5**

2.2	Impulse and Impact	Define impulse and impact	**K1**
	Laws of Impact	Explain laws of impact	**K2**
	Direct and Oblique impact	Classify different types of impact	**K4**
	Loss of kinetic energy due to direct impact	Obtain expression for kinetic energy and its loss due to impact.	**K3**
	Motion of two interacting bodies, reduced mass.	Explain the motion of interacting bodies and reduced mass.	**K2**
III	**Dynamics of rigid bodies**		
3.1	Moment of Inertia	Define moment of inertia	**K1**
	Moment of inertia of a rod, rectangular lamina, sphere, shell, cylinder and fly wheel	Obtain expression for Moment of inertia of different objects.	**K3**
3.2	Kinetic Energy	Define kinetic energy	**K1**
	Kinetic energy of rotating body and Angular momentum	Explain kinetic energy and angular momentum of a rotating body.	**K5**
	Kinetic energy of rolling body, body rolling down and inclined plane	Calculate kinetic energy of rolling body down and inclined plane.	**K5**
3.3	Parallel and Perpendicular axes theorems	Explain the theorems on moment of inertia.	**K2**
IV	**Simple harmonic motion**		
4.1	Theory of Vibrations	Define simple harmonic motion	**K1**
	Free vibrations -damped vibrations - forced vibrations	Compare the different types of vibrations.	**K2**
	Sharpness of resonance – Power dissipation and quality factor	Explain the concept of resonance and its quality factor	**K5**
	Reversibility of centers of oscillation and suspension	Infer the suspension and reversibility of different pendulums	**K4**
4.2	Determination of ‘g’ and radius of gyration	Define gravity and radius of gyration	**K1**
	compound pendulum and Kater's pendulum	Determine ‘g’ using different pendulums	**K5**
		Determine ‘I’ for different pendulums	**K5**
4.3	Bessel's Modification formula	Outline the modifications in kater’s pendulum using Bessel’s modification formula.	**K2**

V	**Hydrostatics and hydrodynamics**		
5.1	Centre of pressure	Define center of pressure	**K1**
	Fluid pressure and its properties	Explain fluid pressure and its properties.	**K2**
	Thrust on plane and curved surfaces	Explain thrust on solid surfaces.	**K2**
	Centre of pressure of irregular , rectangular and circular lamina	Interpret the center of pressure for different objects.	**K2**
5.2	Equations of continuity of flow	Explain the equation of continuity of flow of fluids	**K2**
	Euler's equation for unidirectional flow	Explain the Euler's equation of flow	**K2**
	–Bernoulli's theorem Venturimeter-Pitot's tube - Torricelli's theorem	Explain Bernoulli's Theorem and Torricelli's theorem	**K2**
		Apply Bernoulli's Theorem to construct Venturimeter, Pitot's tube.	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH202	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	H	H	M	M	M	M	L	L	L	H	H	H	L
CO 2	H	H	H	M	M	M	L	L	L	H	H	H	L
CO 3	H	H	H	M	M	M	L	L	L	H	H	H	L
CO 4	H	H	H	H	H	M	M	L	L	H	H	H	M
CO 5	H	H	H	M	M	M	L	L	L	H	H	H	H
CO 6	H	H	H	M	M	M	L	L	L	H	H	H	H

L – Low M – Moderate H – High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Internal Assessment Test I & II
2. Open book test, learning report, Assignment, Seminar and Problem solving.
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator : Mr.N.Raja

CORE- III: THERMAL PHYSICS

SEMESTER: III **CODE: U16PH303**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Recall the fundamental laws of thermodynamics, radiation and statistical mechanics and their importance	**K2**	**I, III, V**
CO2	Summarize the theories related to low temperature, radiation and specific heat of solid, liquid and gas.	**K2**	**II, III, IV**
CO3	Model internal combustion engine, different experimental methods for production of low temperature, measurement of high temperature and specific heats of solid, liquid, gas.	**K3**	**I, II, III, IV**
CO4	Analyze the distribution of energy in black body spectrum, system of boson and fermions, variation of specific heat of solids and gases with respect to temperature.	**K4**	**III, IV, V**
CO5	Evaluate specific heat capacity of solid, liquid and gas theoretically.	**K5**	**III, IV, V**
CO6	Estimate the energy distribution in black body radiation, system of bosons and fermions.	**K6**	**III, V**

2. A. SYLLABUS

Unit-I: Thermodynamics **(15 Hours)**

Thermodynamic system - Zeroth law - Concept of heat and work - Internal energy - First law of thermodynamics - Applications - Gas equation during adiabatic process - Work done during an

isothermal process - Work done during an adiabatic process - Reversible process - Irreversible process - Second law of thermodynamics - Carnot's theorem - Internal Combustion engine (Petrol Engine) - Concept of entropy - Change of entropy in reversible process - Irreversible process - Third law of thermodynamics - Temperature entropy diagram.

Unit-II: Low Temperature Physics (15 Hours)

Joule Thompson (Kelvin) effect - Production of low temperature - Theory of Porous plug experiment - Liquefaction of gases - Linde's air liquefier - Adiabatic expansion process - adiabatic demagnetization - Liquefaction of Helium and Hydrogen - Practical application of low temperature - Refrigeration machine - Electrolux refrigerator - Air conditioning machines.

Unit-III: Radiation (15 Hours)

Radiation - Stefan's Boltzmann law - Experimental determination of Stefan's constant - Blackbody radiation - Distribution of energy in Blackbody spectrum - Rayleigh Jean's law - Wien's Displacement Law - Planck's law derivation – Bolometer - Disappearing filament optical Pyrometer - Solar constant - Angstrom's Pyrheliometer.

Unit-IV: Specific Heat (15 Hours)

Specific heat of solids - Dulong and Petit's law - Einstein's theory of specific heat - Debye's theory - Specific heat of gases - Determination of C_P by Ragnault's method - Variation of specific heat of diatomic gases with temperature - Newton's law of cooling – specific heat of liquid - Joule's method.

Unit -V: Statistical Mechanics (15 Hours)

Phase space - Microstates - Macrostates - Statistical Equilibrium - Probability theorems in statistical thermodynamics - Maxwell-Boltzmann distribution - Ideal gas - Fermi-Dirac distribution - Electron gas - Bose-Einstein distribution – Photon gas.

B. TOPICS FOR SELF STUDY

1. Kinetic theory of matter

https://courses.lumenlearning.com/introchem/chapter/the-kinetic-molecular-theory-of-matter/

https://youtu.be/XgfOVwmlS1g

2. Transport phenomena

https://youtu.be/4NKMjOcN6R0

https://youtu.be/lYfdvjb65Qc

3. Thermodynamic functions

https://youtu.be/4xjtvw0NPzQ

https://youtu.be/SRz29HpyFZ8

4. Applications of Thermodynamics.

https://youtu.be/tZYsVKUjn9E

https://youtu.be/AKyJwI5jkjs

C. TEXT BOOKS

1. BrijLal, N. Subrahmanyam and P.S. Hemne, Heat, Thermodynamics and Statistical Physics, S.Chand and Co., New Delhi, 2016.

D. REFERENCE BOOKS

1. D.S. Mathur, Heat and Thermodynamics, S. Chand and Co., New Delhi, 2008.

2. SathyaPrakash and J.P. Agarwal, Statistical Mechanics, KedarnathRamnath & Co., Meerut, 2019.

3. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics 11th Edition, John Wiley & Sons, 2018.

E. WEBLINKS

1. https://onlinecourses.nptel.ac.in/noc20_ce27/preview

2. https://onlinecourses.swayam2.ac.in/noU16_me01/preview

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Thermodynamics**		
1.1	Introduction to Thermodynamic system	Define a Thermodynamic system	**K1**
1.2	Zeroth law	State Zeroth law	**K1**
1.3	Concept of heat and work	Explain the relation between heat and work	**K2**
1.4	Internal energy	Define and explain Internal energy	**K2**
1.5	First law of thermodynamics	State First law of thermodynamics	**K1**
1.6	Applications – Gas equation during adiabatic	Analyze the gas equation for an adiabatic process	**K4**

	process		
1.7	Work done during an isothermal process	Explain the work done by an ideal gas during Isothermal process	**K5**
1.8	Work done during an adiabatic process	Explain the work done by an ideal gas during Adiabatic process	**K5**
1.9	Reversible process – Irreversible process	Estimate the work done by ideal gas in a a reversible and irreversible process	**K5**
1.10	Second law of thermodynamics	State Second law of thermodynamics	**K1**
1.11	Carnot's theorem	Estimate efficiency of engines using Carnot's theorem	**K5**
1.12	Internal Combustion engine (Petrol Engine)-	Demonstrate the function of Internal combustion engine	**K3**
1.13	Concept of entropy	Explain the Concept of entropy	**K2**
1.14	Change of entropy in reversible process – Irreversible process	Explain the change of entropy in reversible process and Irreversible process	**K5**
1.15	Third law of thermodynamics	State Third law of thermodynamics	**K1**
1.16	Temperature entropy diagram	Construct temperature entropy diagram and assess entropy	**K5**
II	**Low Temperature Physics**		
2.1	Joule Thompson Effect	Describe Joule Thompson experiment and discuss its result	**K2**
2.2	Production of low temperature	Summarize the methods of producing low temperatures. Freezing Mixture, Evaporation under reduced pressure, Adiabatic expansion of Gas, Joule Thompson effect, Regenerative cooling and Adiabatic demagnetization.	**K2**
2.3	Porous plug experiment.	Analyze the behavior of gases under very high pressure and define Boyle's Temperature	**K4**
2.4	Boyle's temperature, temperature of inversion	Relate Boyle's temperature, temperature of inversion and critical temperature	**K2**

2.5	Theory of Porous plugs experiment.	Correlate the initial temperature of the gas and the effect it produces when it undergoes throttled expansion.	**K4**
2.6	Linde's air liquefier	Explain in detail the procedure of liquefying air using Linde's apparatus with schematic diagram	**K2**
2.7	Liquefaction of Hydrogen	Construct a set to liquefy hydrogen and explain its with schematic diagram	**K3**
2.8	Liquefaction of Helium	Construct a set up to liquefy helium and explain its working with schematic diagram	**K3**
2.9	Adiabatic demagnetization	Express the favorable conditions for producing very low temperature by adiabatic demagnetization of paramagnetic salt. (Theory of adiabatic demagnetization)	**K6**
2.9.1	Lowest temperatures produced by adiabatic demagnetization.	States the names of the Salts and the low temperatures produced by them.	**K1**
3.10	Practical applications of low temperature.	Discuss the various applications, Peculiar properties of Helium at very low temperature and its applicability	**K2**
3.11	Refrigeration Machines.	Definition of refrigerants and their properties. Examples. Large- and small-scale refrigeration.	**K1**
3.12	Electrolux refrigerators	Construct the Electrolux refrigerator and explain its working.	**K3**
3.13	Air conditioning Machines	Comfort chart. Definition of Air conditioning.	**K1**
3.13.1	Air conditioning Machines	Design hot and cold air conditioner and explain its working with schematic diagram.	**K6**
III	**Radiation**		
3.1	Radiation – Stefan's Boltzmann law	Explain Radiation and Relate radiant energy to absolute temperature	**K2**
3.2	Experimental determination of Stefan's constant	Determine Stefan's constant	**K5**
3.3	Blackbody radiation, Distribution of energy in Black body spectrum	Explain Blackbody Radiation	**K2**
3.4	Rayleigh Jean's law	Determine expression for the distribution of energy with varying wavelengths.	**K2**

3.5	Wien's Displacement Law	Infer that the temperature rise shifts the emitted radiations to shorter wavelengths.	**K2**
3.6	Planck's law derivation	Derive Planck's law using Planck's quantum postulates and analyze black body radiation	**K4**
3.7	Bolometer	Elaborate the construction and working of Bolometer	**K2**
3.8	Disappearing filament optical Pyrometer	Analyze the construction and working of optical pyrometer	**K2**
3.9	Solar constant	Define Solar constant	**K2**
3.10	Angstrom's Pyrheliometer.	Elaborate the construction and working of pyrheliometer	**K2**
IV	**Specific Heat**		
4.1	Specific heat of solids	Define Specific heat	**K2**
4.2	Dulong and Petit's law	State Dulong and Petit's law	**K1**
4.3	Einstein's theory of specific heat	Explain specific heat of solids a low temperature.	**K4**
4.4	Debye's theory	Explain specific heat of solids and discuss Limitations over Debye's theory	**K4**
4.5	Determination of C_P by Ragnault's method	Describe Regnault's method to determine Cp	**K5**
4.6	Variation of specific heat of diatomic gases with temperature	Analyze specific heat of diatomic gases	**K4**
4.7	Newton's law of cooling	Explain specific heat of liquids by cooling.	**K5**
4.8	Specific heat of liquid - Joule's method.	Demonstrate specific heat of liquids	**K3**
V	**Statistical Mechanics**		
5.1	Phase space	Explain the concept of Phase space	**K2**
5.2	Microstates, Macrostates	Define and classify Microstates and Macrostates	**K2**
5.3	Statistical equilibrium	Explain the nature of Statistical equilibrium	**K2**
5.4	Probability theorems in statistical thermodynamics	Apply probability in statistical thermodynamics	**K3**
5.5	Maxwell-Boltzmann distribution, Ideal gas	Deduce Maxwell-Boltzmann distribution apply it to ideal gas	**K3**

5.6	Fermi-Dirac distribution, Electron gas	Deduce Fermi-Dirac distribution apply it to electron gas	**K3**
5.7	Bose-Einstein distribution, Photon gas	Deduce Bose-Einstein distribution apply it toPhoton gas	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH303	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	H	M	L	M	L	M	-	L	M	M	-	-	-
CO2	H	L	L	L	M	L	-	M	-	M	L	-	M
CO3	H	L	H	M	L	L	-	L	M	M	L	M	L
CO4	M	H	-	L	H	L	L	L	-	M	M	-	L
CO5	M	L	-	L	M	-	L	L	-	M	L	M	-
CO6	-	L	L	-	L	L	-	-	L	M	-	-	L

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test, Assignment, Seminar, Group Presentation, Project report, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator: Dr.I. Devadoss

CORE - IV: OPTICS

SEMESTER IV **CODE :U16PH404**

CREDITS: 5 **NO OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Develop the theory of interference for various optical waves	**K3**	**I**
CO2	Determine the wavelength and thickness of transparent film using different interferometer	**K5**	**I**
CO3	Apply the phenomenon of diffraction of light in analyzing pulse dynamics in optical media	**K3**	**II**
CO4	Analyze the polarization evolution in optical systems	**K4**	**III**
CO4	Classify the types of aberrations in lens	**K2**	**IV**
CO6	Determine the resolving and dispersive power of various optical instruments.	**K5**	**V**

2. A. SYLLABUS

Unit-I: Interference **(17 hours)**

Principle of Superposition – Interference – Theory of interference - Young's Double slit experiments – Fresnel biprism – Experimental arrangement – Determination of wavelength of light - plane parallel film - Interference due to reflected light - Variable thickness film (Air wedge) - Theory of Newton's Rings - Michelson interferometer and its applications – Determination of wavelength and thickness of thin transparent sheet – Fabry-Perot interferometer - Determination of wavelength and difference in wavelength.

Unit-II: Diffraction **(15 hours)**

Huygen – Fresnel's theory - Half period zones – Types of diffraction - Fresnel's diffraction – Diffraction at a circular aperture - straight edge – Fraunhofer diffraction at a single slit (calculus method) – Double slit – Missing order in a double slit - diffraction pattern – N slits (calculus method)- Plane diffraction grating with theory- Standardization of the grating and Determination of wavelength.

Unit-III: Polarization **(17 hours)**

Polarization - Plane of polarization and vibration-Superposition of linearly polarized waves at right angles - Types of polarization - Double refraction – Huygen's explanation – Nicol prism – Double image polarizing prism - Production and Detection of plane, partially, elliptically and circularly polarized lights – Quarter wave plate – Half wave plate – Babinet's compensator – Optical activity – Laurents half shade polarimeter – Specific rotatory power.

Unit-IV: Lens Aberrations **(13 hours)**

Aberrations - First order theory - Types of Aberrations – Spherical aberration–Methods of reducing spherical aberration - Coma – Aplanatic points – Astigmatism – Curvature of the field – Meniscus lens – Distortion – Chromatic aberration – Gradient index lens (GRIN).

Unit-V: Optical Instruments **(13 hours)**

Objective and Eye piece - Huygens's eyepiece - Ramsden's eyepiece - Resolving power – Rayleigh's criterion of resolution – Resolving power of a telescope, microscope, prism – Dispersive power and resolving power of a grating – the Echelon grating.

B. TOPICS FOR SELF STUDY

1. Properties of optical materials
   https://www.newport.com/n/optical-material-properties
   https://www.rp-photonics.com/optical_materials.html
2. Nonlinear Optics – Nonlinear Polarization – Second Harmonic Generation – Self Phase Modulation
   https://www.nature.com/subjects/nonlinear-optics
   https://www.youtube.com/watch?v=5Rx2_GxlNvg
3. Fibre Optics
   https://www.synopsys.com/optical-solutions/learn/gentle-intro-to-optical-design.html
   https://www.youtube.com/watch?v=F7H0KJP6_is
4. Lens Design
   https://www.synopsys.com/optical-solutions/learn/gentle-intro-to-optical-design.html
   https://www.youtube.com/watch?v=nZdp3hU9ZF0

C. TEXT BOOKS

1. Brij Lal, Avadhanulu and N. Subrahmanyam, A Text Book of Optics, S. Chand and Co., New Delhi, 2012.
2. Ajoy Ghatak, Optics 5e, Mcgraw Hill Education, New Delhi, 2012.

D. REFERENCE BOOKS

1. Singh Devraj, Fundamentals of Optics, Prentice Hall India, New Delhi, 2010.
2. E. Hecht, Optics 4e, Addison Wesley Publishing, CA, 2016.

E. WEBLINKS

1. https://www.classcentral.com/course/swayam-optical-engineering-17714
2. https://onlinecourses.nptel.ac.in/noc20_ph07/preview

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of Transaction
I	**Interference**		
1.1	Principle of Superposition	Recollect the basic concepts of superposition and interference	**K1**
1.2	Interference - Theory of interference	Define the interference of light (K1) State the fundamental conditions for the production of interference fringes (K2) Explain the theory of interference (K2)	**K2**
1.3	Young's Double slit experiments	Describe Young's Double slit experiment and derive an expression for the intensity at a point on the screen and fringe width	**K2**
1.4	Fresnel biprism - Experimental arrangement - Determination of wavelength of light	Determine the wavelength of light using Fresnel Biprism	**K3**
1.5	Plane parallel film - Interference due to reflected light - Variable thickness film (Air wedge)	Explain the formation of interference due to reflected light in plane parallel film (K2) Deduce the condition for maxima and minima by forming interference pattern in plane parallel film (K4) Apply the concept of interference to find the thickness of a thin sheet using an air – wedge arrangement (K3)	**K3**
1.6	Theory of Newton's Rings	Explain how Newton's Rings are formed (K2) Bring out the condition for the formation of Newton's bright and dark fringes. (K3) Determine the wavelength of light by forming Newton's rings (K4)	**K4**
1.7	Michelson interferometer and its applications – Determination of	Explain the principle and working of Michelson Interferometer (K2) Determine the wavelength and thickness of thin sheet using Michelson	**K5**

	wavelength and thickness of thin transparent sheet	Interferometer (K5)	
1.8	Fabry-Perot interferometer - Determination of wavelength and difference in wavelength.	Explain the principle and working of Fabry-Perot Interferometer (K2) Determine the wavelength of light by forming fringes using Fabry – Perot Interferometer and identify the difference in wavelengths (K5)	**K5**
II	**Diffraction**		
2.1	Huygen – Fresnel's theory - Half period zones	Define diffraction (K1) Explain the Huygen – Fresnel's theory of diffraction (K2) What are half period zones (K1)	**K2**
2.2	Types of diffraction - Fresnel's diffraction – Diffraction at a circular aperture - straight edge –	Classify the types of diffraction (K2) Explain Fresnel's diffraction (K2) Explain the phenomenon of diffraction due to a circular aperture / straight edge (K2)	**K2**
2.3	Fraunhoffer diffraction at a single slit (calculus method) – Double slit – Missing order in a double slit - diffraction pattern – N slits (calculus method)-	Explain Fraunhoffer diffraction Explain the Fraunhoffer pattern obtained with a narrow at a single slit / double slits (K2) Elucidate the intensity distribution in Fraunhoffer diffraction pattern formed due to a single slit (K2) Compare Fresnel and Fraunhoffer diffraction (K2)	**K2**
2.4	Plane diffraction grating with theory- Standardization of the grating and Determination of wavelength	Explain the theory of plane diffraction grating (K2) Apply the theory of transmission grating to the wavelength of the spectral lines using plane transmission grating (K3)	**K3**
III	**Polarization**		
3.1	Polarization - Plane of polarization and vibration- Superposition of linearly polarized waves at right angles	Define polarization (K1) Define plane of polarization (K1) Classify polarized and unpolarised light (K2) Explain the superposition of linearly polarized waves at right angles (K2)	**K2**

3.2 3.3	Types of polarization - Double refraction – Huygen's explanation	List the types of polarization (K2) Explain Hygen's explanation on double refraction	**K2**
	Nicol prism – Double image polarizing prism	Outline the construction of a Nicol prism (K2) Explain the role Nicol prism as polarizer and analyser (K4)	**K4**
3.4	Production and Detection of plane, partially, elliptically and circularly polarized lights - Quarter wave plate – Half wave plate	Classify different types of polarized waves (K2) Explain the production and detection of elliptically / circularly polarized lights using quarter wave plate (K2) Explain how the plane of polarization can be rotated using half wave plate (K2)	**K2**
3.5	Optical activity – Laurent's half shade polarimeter – Specific rotatory power.	Define optical activity (K1) Describe the construction and working of Laurent's half shade polarimeter (K2) Determine the specific rotatory power of a solution using Laurent's half shade polarimeter (K4)	**K4**
IV	**Lens Aberrations**		
4.1	Aberrations - First order theory - Types of Aberrations	Define aberrations (K1) Explain first order theory and categorize the types of aberrations (K2)	**K2**
4.2	Spherical aberration– Methods of reducing spherical aberration -	Explain how spherical aberrations are produced by a lens (K1) Explain the methods to reduce the spherical aberration in lenses (K2)	**K2**
4.3	Coma – Aplanatic points – Astigmatism – Curvature of the field – Meniscus lens – Distortion	Explain the defects coma, astigmatism curvature and distortion	**K2**
4.4	Chromatic aberration – Gradient index lens (GRIN).	Explain how chromatic aberrations are produced in lenses (K2) Outline the advantages of GRIN over spherical lenses (K2)	**K2**
V	**Optical Instruments**		
5.1	Objective and Eye piece	Explain the function of objective and eyepiece	**K2**

5.2	Huygens's eyepiece	Explain the construction and working of Huygen's eyepiece	**K2**
5.3	Ramsden's eyepiece	Explain the construction and working of Ramsden's eyepiece (K2) Compare Ramsden eyepiece with Huygen's eyepiece (K4)	**K4**
5.4	Resolving power – Rayleigh's criterion of resolution – Resolving power of a telescope, microscope, prism	Define resolving power (K1) Explain Rayleigh's criterion of resolution (K2) Estimate the resolving power of telescope / microscope / prism (K5)	**K5**
5.5	Dispersive power and resolving power of a grating – the Echelon grating.	Define dispersive power (K1) Determine the dispersive power and resolving power of grating (K5)	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH404	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	H	M	-	H	M	-	M	L	L	H	M	-	L
CO2	H	H	L	M	L	L	-	L	L	H	H	L	-
CO3	H	H	L	M	L	H	L	L	L	M	L	-	-
CO4	H	H	M	M	L	M	-	L	L	H	H	H	M
CO5	H	M	M	H	M	L	-	L	L	H	M	M	L
CO6	H	M	M	H	M	M	M	L	L	H	M	M	M

L-Low M-Moderate H-High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co – ordinator: Ms. K.C. Mercy Gnana Malar

CORE-V: ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

SEMESTER : V **CODE : U16PH505**

CREDITS : 5 **NO.OF HOURS/WEEK :5**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Explain the fundamental laws of Electrostatics, Magnetostatics and electromagnetism.	**K2**	**I, II, III & V**
CO2	Explain the principles behind the electric and magnetic instruments.	**K2**	**I, II & III**
CO3	Organize experiments to determine the absolute values of inductance, Figure of merit of Galvanometer, Q factor and power factor of LCR circuits.	**K3**	**II, III & IV**
CO4	Analyse the behavior of circuits containing Inductance, Capacitance and Resistance connected in different combinations.	**K4**	**IV**
CO5	Evaluate the electric, magnetic and electromagnetic fields due to different electric structures and current circuits.	**K5**	**I, II & III**
CO6	Estimate the energy involved in sharing of charges, Magnetization and in electromagnetic waves.	**K6**	**I, III & V**

2. A. SYLLABUS

Unit-I: Electrostatics **(15 Hours)**

Coulomb's inverse square law – Gauss theorem & its applications - intensity at a point due to a charged sphere and cylinder – Principle of a capacitor – Capacity of spherical and cylindrical capacitors – Parallel plate capacitor – Effect of introduction of a dielectric - Energy stored in a capacitor – Loss of energy due to sharing of charges.

Unit-II: Magnetic effect of Current **(15 Hours)**

Magnetic flux, magnetic induction – relation – Ampere's force law – Biot Savart's law – direction of magnetic field – magnetic induction on the axis of a circular coil carrying current – magnetic field inside a long solenoid, toroid – Lorentz force on a moving charge – direction of force – torque on a current loop in a uniform magnetic field – moving coil Ballistic Galvanometer (BG) – theory – experiment to find the figure of merit

Unit-III: Electromagnetic Induction (15 Hours)

Laws of electromagnetic induction – self-induction – self-induction of a solenoid – determination of self-inductance – Anderson's method – mutual induction– coefficient of coupling – determination of mutual inductance using B.G –Magnetisation – permeability and susceptibility – relation between M, B and H – Theory of Hysteresis – B–H curve by Ballistic method – Energy dissipation.

Unit-IV: AC Circuits (15 Hours)

AC – average and rms value – AC through L and R in series vector diagram method – AC through C and R in series vector diagram method – AC through L and C in series vector diagram method – LCR series and parallel circuit – sharpness of resonance – Q factor, Power factor, choke coil.

Unit-V: Maxwell's equations and Electromagnetic waves (15 Hours)

Fundamentals of electromagnetism – Modification of Ampere's circuital law – The concept of displacement current – Maxwell's equations – Electromagnetic wave equation in free space and dielectric – Plane wave solutions - Energy in electromagnetic waves – Poynting vector - Energy transport.

B. TOPICS FOR SELF STUDY

1. Types of capacitors
   https://www.electronics-tutorials.ws/
2. Secondary cells
   http://www.chem.libretexts.org/
3. Three phase AC generators
   https://www.toppr.com/
4. The method of electrical images.
   https://web.mit.edu/

C. TEXT BOOKS

1. R. Murugeshan, Electricity and Magnetism, S. Chand and Co., New Delhi, 2017.(UNIT I,II,IV and V)
2. Brij Lal and N. Subrahmanyam, Electricity and Magnetism, Ratan PrakashanMandir, Agra, 2000.(UNIT III)

D. REFERENCE BOOKS

1. D. N. Vasudeva, Fundamentals of Magnetism and Electricity, S. Chand & Co, 2013.
2. N.K. Sehgal, K.L. Chopra and D.L. Sehgal, Electricity and Magnetism, Sultan Chand and Sons, New Delhi, 2014.
3. K.K. Tiwari, Electricity and Magnetism, S. Chand and Company, New Delhi, 2018.
4. David J. Griffith, Introduction to Electrodynamics, Prentice Hall of India, 2015.
5. Paul A. Tipler and G. Mosca, Physics for Scientist and Engineers, W.H.Freeman, New York, 2003.

E. WEBLINKS

1. https://www.edx.org/course/electricity-and-magnetism
2. https://nptel.ac.in/courses/115/106/115106122/
3.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Electrostatics**		
1.1	Coulomb's Inverse square Law	Explain Coulomb's Inverse square Law	**K2**
1.2	Gauss theorem	Explain Gauss theorem	**K2**
1.3	Applications of Gauss's theorem	Deduce an expression for electric field intensity at a point due to a charged sphere and cylinder	**K3**
1.4	Principle of a capacitor	Outline the principle of a capacitor	**K2**
1.5	Capacity of spherical capacitor	Deduce an expression for Capacity of spherical capacitor	**K5**
1.6	Capacity of cylindrical capacitor	Deduce an expression for Capacity of cylindrical capacitor	**K5**
1.7	Parallel plate capacitor	Deduce an expression for Capacity of Parallel plate capacitor	**K5**
1.8	Effect of introduction of a dielectric	Examine the effect of introduction of a dielectric in Parallel plate capacitor	**K3**
1.9	Energy stored in a capacitor	Deduce an expression for energy stored in a capacitor	**K5**
1.10	Loss of Energy due to sharing of charges	Estimate loss of energy due to sharing of charges	**K6**
II	**Magnetic effect of Current**		
2.1	Magnetic flux, magnetic induction – relation	Define and relate Magnetic flux and magnetic induction	**K1**
2.2	Ampere's force law –	Outline the Ampere's force law	**K2**
2.3	Biot Savart's law –	Make use of Ampere's force law to obtain the Biot Savart's law	**K3**
2.4	Direction of magnetic field	Find the direction of magnetic field	**K1**
2.5	Magnetic induction on the axis of a circular coil carrying current	Deduce an expression for magnetic induction on the axis of a circular coil using Biot Savart's law	**K5**

2.6	Magnetic induction on the axis of a inside a long solenoid, toroid	Apply Biot Savart's law to find magnetic induction at any point on the axis of long solenoid and toroid	**K3**
2.7	Lorentz force on a moving charge – direction of force	Outline Lorentz force Law on a moving charge	**K2**
2.8	Torque on a current loop in a uniform magnetic field	Apply Lorentz force Law to find torque on a current loop in a uniform magnetic field	**K3**
2.9	Moving coil Ballistic Galvanometer (BG)- Theory	Explain the theory of BG	**K5**
2.10	Experiment to find the figure of merit	Organize a circuit to calculate the figure of merit using BG	**K3**
III	**Electromagnetic Induction**		
3.1	Laws of electromagnetic induction	Illustrate Laws of electromagnetic induction	**K2**
3.2	Self-induction	Define self-induction	**K1**
3.3	self-induction of a solenoid	Deduce an expression for self-inductance of a solenoid	**K5**
3.4	Determination of self-inductance – Anderson's method	Deduce an expression to determine self-inductance using Anderson's method	**K5**
3.5	Mutual induction	Define mutual induction	**K1**
3.6	Coefficient of coupling	Deduce an expression for coefficient of coupling	**K5**
3.7	Determination of mutual inductance using B.G	Determine mutual inductance between two circuits or coils using B.G	**K5**
3.8	Magnetization – permeability and susceptibility – relation between M, B and H	Define and relate magnetization, permeability and susceptibility	**K1**
3.9	Theory of Hysteresis -B–H curve by Ballistic method	Organize an experiment to draw to draw B-H curve using ballistic method	**K3**
3.10	Energy dissipation	Estimate energy dissipation using B-H curve	**K6**
IV	**AC Circuits**		
4.1	Average and rms value	Define average and rms value	**K1**
4.2	AC through L and R in series vector diagram	Apply vector diagram method to find emf in LR series circuit	**K3**

	method		
4.3	AC through C and R in series vector diagram method	Apply vector diagram method to find emf in CR series circuit	**K3**
4.4	AC through L and C in series vector diagram method	Apply vector diagram method to find emf in LC series circuit	**K3**
4.5	LCR series circuit – sharpness of resonance – Q factor	Combine L, R and C in series to find the emf in LCR circuit & Calculate sharpness of resonance and Q factor	**K5**
4.6	LCR parallel circuit – sharpness of resonance – Q factor	Combine L, R and C in parallel to find the emf in LCR circuit & Calculate sharpness of resonance and Q factor	**K5**
4.7	Power factor	Deduce an expression for power factor	**K5**
4.8	Choke coil	Explain the function of choke coil	**K5**
V	**Maxwell's equations and Electromagnetic waves**		
5.1	Fundamentals of electromagnetism	Explain the fundamentals of electromagnetic waves	**K2**
5.2	Modification of Ampere's circuital law	Modify Ampere's law	**K3**
5.3	The concept of displacement current	Interpret the of concept displacement current in modified Ampere's law	**K5**
5.4	Maxwell's equations	Explain Maxwell's equations	**K2**
5.5	Electromagnetic wave equation in free space and dielectric - Plane wave solutions	Rewrite Maxwell's equations for free space and dielectric medium and construct their respective wave equations	**K5**
5.6	Energy in electromagnetic waves	Explain the energy carried by electromagnetic waves	**K2**
5.7	Poynting vector - Energy transport.	Solve electromagnetic wave equations to obtain the Poynting vector and interpret find energy transport	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH505	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO 1	H	M	L	-	M	L	M	-	M	H	M	M	M

CO 2	M	-	M	H	-	-	-	M	-	M	H	M	-
CO 3	M	M	-	H	M	M	L	L	M	M	H	H	L
CO 4	M	-	M	M	M	M	L	-	L	M	-	M	L
CO 5	-	H	L	-	H	M	L	-	M	M	-	M	-
CO 6	M	-	M	-	M	M	-	L	M	M	L	-	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Project report, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co – ordinator: Mr.K.Karthikeyan

CORE - VI: ELECTRONIC DEVICES

SEMESTER: V **CODE: U16PH506**

CREDITS: 5 **NO. OF HOURS/WEEK: 5**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO. No.	Course Outcomes	Level	Unit Covered
CO1	Analyze the physical operation and applications of semiconductor devices like diodes, rectifiers and filters	**K4**	**I**
CO2	Explain the basic operations of BJT and FET in various configuration	**K2**	**II**
CO3	Categorize the different power amplifier circuits, their design and use in electronics and communication circuits	**K4**	**III**
CO4	Infer the characteristics of feedback amplifier circuits	**K4**	**IV**

CO5	Analyze different oscillator circuits for various range of frequencies	**K4**	**IV**
CO6	Construct circuits for various mathematical operations using operational amplifier	**K6**	**V**

2. A. SYLLABUS

Unit-I: Semiconductors and Diodes (15 hours)

Metals, Insulators and semiconductors – Intrinsic and Extrinsic semiconductors – PN Junction – Junction theory – V-I characteristics of a PN Junction diode – Use of Diode – Half wave – full wave and Bridge Rectifier – Performance of Half wave and full wave rectifier - filter – Shunt capacitor filter – π filter – LC filter.

Unit-II: Transistor (BJT & FET) (15 hours)

Junction transistor structure – Action of a transistor – working of a transistor – Three configuration of transistors (CB, CE and CC) - CE amplifier circuit – Biasing and DC load line – JFET – Structure – Characteristics – Parameters.

Unit-III: Small – Single Amplifiers and Power Amplifiers (BJT) (15 hours)

Single stage transistor Amplifier – Graphical Method - Equivalent Circuit Method - Need for Power Amplifier – Voltage Amplifier Vs. Power Amplifier - Power loss – Classification of amplifiers - Push Pull Amplifier – Distortion – Advantages.

Unit-IV: Feedback in Amplifier and Oscillator (BJT) (15 hours)

Feed back in Amplifier – types of feedback – Voltage feedback Amplifier – Barkhausen criterion - Negative feedback – RC Coupled Amplifier – classification of oscillators - positive feedback - amplifier as an oscillator – LC, Tuned collector, Hartley, Colpitt's , Phase shift and Wien bridge Oscillators.

Unit-V: Operational Amplifier (15 hours)

Operational amplifier characteristics - concept of virtual ground – Inverting – Non Inverting Amplifiers – Scalar – Adder – Subt ractor – Integrator – differentiator – Comparator – D/A Conversion – Binary weighted and R-2R Ladder Method - A/D Successive Approximation Method – Active Filters - First order low pass and high pass filters.

B. TOPICS FOR SELF STUDY

1. Characteristics, Working and Applications of LED

https://www.youtube.com/watch?v=IEju3AT1olk

2. MOSFET structure and characteristics

https://www.youtube.com/watch?v=l9LBIy9Ioxo

C. TEXT BOOKS

1. N.N. Bhargava, D.C. Kulshreshtha and S.C. Gupta, Basic Electronics and Linear Circuits, McGraw Hill Education (India) Private Limited, New Delhi, 2015.
2. V.K. Mehta, Rohit Mehta, Principles of Electronics 7e, S. Chand, New Delhi, 2005.

D. REFERENCES BOOKS

1. M.C. Gupta, Principles of Electronics, DhanpatRai and Sons, New Delhi, 1997.
2. T. L. Floyd, Electronic Devices, Pearson Education, New York, 2004.
3. David A. Bell, Electronic Devices and Circuits, Oxford University Press, New Delhi, 2008.

E. WEBLINKS

1. https://www.electronics-tutorials.ws/diode/diode_8.html
2. https://nptel.ac.in/courses/115/102/115102103/
3. https://nptel.ac.in/courses/115/102/115102103/#watch
4. https://nptel.ac.in/courses/115/102/115102014/#watch
5. https://nptel.ac.in/courses/115/102/115102014/#watch
6. https://www.coursera.org/learn/freeform-electronics

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic level of transaction
I	**Semiconductors and Diodes**		
1.1	Metals, Insulators and semiconductors	Recollect the basic concepts of solid materials	**K2**
1.2	Intrinsic and Extrinsic semiconductors	Explain the two types of semiconductors	**K5**
1.3	PN Junction – Junction theory	Explain the operation principle of diode	**K2**
1.4	V-I characteristics of a PN Junction diode	Illustrate the operational characteristics of a PN Junction diode	**K5**
1.5	Use of Diode	Explain the applications of junction diode	**K2**
1.6	Half wave – full wave and Bridge Rectifier	Categorize the functions of rectifiers	**K4**
1.7	Performance of Half wave and full wave rectifier	Estimate the efficiency of rectifiers	**K5**

1.8	Filter – Shunt capacitor filter – π filter – LC filter.	Analyze the operations of filters	**K4**
II	**Transistor (BJT & FET)**		
2.1	Junction transistor structure – Action of a transistor	Explain the basic design and action of a transistor	**K2**
2.2	Working of a transistor	Explain the function of a transistor	**K2**
2.3	Three configuration of transistors (CB, CE and CC)	Analyze the working of transistors in various configuration modes (CB, CC, CE)	**K4**
2.4	CE amplifier circuit	Explain the amplification in CE amplifier circuits with transistors.	**K2**
2.5	Biasing and DC load line	Analyze the transistor dc biasing using load line	**K4**
2.6	JFET – Structure	Show the basic structure of Junction field effect transistor	**K2**
2.7	JFET- Characteristics	Interpret the output characteristics of JFET	**K4**
2.8	JFET- Parameters.	Explain the JFET parameters and establish the relation between them	**K2**
III	**Small – Single Amplifiers and Power Amplifiers (BJT)**		
3.1	Single stage transistor Amplifier	Summarize the working of single stage transistor amplifier	**K3**
3.2	Graphical Method	Interpret the graphical method of analysis of single stage transistor amplifier	**K5**
3.3	Equivalent Circuit Method	Analyze the DC and AC equivalent circuits of single stage transistor amplifier Interpret the load line analysis of DC and AC equivalent circuits	**K4** **K5**
3.4	Need for Power Amplifier	Outline the importance of power amplifier	**K2**
3.5	Voltage Amplifier Vs. Power Amplifier	Compare the Voltage Amplifier with Power Amplifier	**K2**

3.6	Power loss	Infer the power loss in amplifiers	**K2**
3.7	Classification of amplifiers	Categorize the types of amplifiers	**K4**
3.8	Push Pull Amplifier	Explain the operation of Push Pull Amplifier circuit	**K2**
3.9	Push Pull Amplifier - Distortion – Advantages.	Explain the distortion and advantages in Push Pull Amplifier	**K2**
IV	**Feedback in Amplifier and Oscillator (BJT)**		
4.1	Feed back in amplifier – types of feedback	Classify the types of feedback	**K2**
4.2	Voltage feedback amplifier	Illustrate the working of voltage feedback amplifier	**K2**
4.3	Barkhausen criterion	Calculate the Barkhausen criterion	**K3**
4.4	Negative feedback – RC Coupled Amplifier –	Construct the negative feedback RC coupled amplifier	**K3**
4.5	Classification of oscillators	Classify the types of Oscillators	**K2**
4.6	Positive feedback	Illustrate the positive feedback circuit	**K2**
4.7	Amplifier as an oscillator	Illustrate the functioning of amplifier as an oscillator	**K2**
4.8	LC, Tuned collector, Hartley, Colpitt's, Phase shift and Wien bridge Oscillators.	Examine the performance of various oscillator circuits	**K4**
V	**Operational Amplifier**		
5.1	Operational amplifier characteristics - concept of virtual ground	Describe the basic characteristics of operational amplifier circuits	**K2**
5.2	Inverting Amplifiers	Explain the inverting amplifier circuit	**K2**
5.3	Non Inverting Amplifiers	Explain the non-inverting amplifier circuit	**K2**
5.4	Scalar – Adder – Subtractor	Construct the circuits using operational amplifier to perform mathematical operation of addition and subtraction	**K3**
5.5	Integrator – differentiator	Construct the circuits using operational amplifier to	**K3**

		perform mathematical operation of integrator and differentiator	
5.6	Comparator	Utilize operational amplifier to compare the two input voltages	**K3**
5.7	D/A Conversion – Binary weighted and R-2R Ladder Method	Perform digital to analog conversion using operational amplifiers	**K3**
5.8	A/D Successive Approximation Method	Perform analog to digital conversion using operational amplifiers	**K3**
5.9	Active Filters	Outline the use of active filters	**K2**
5.10	First order low pass and high pass filters.	Inspect the working of low pass and high pass filters	**K4**

4. MAPPING SCHEME (PO, PSO& CO)

U16PH506	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	H	H	M	M	L	L	M	H	M	H	L
CO2	H	M	H	H	L	L	L	M	L	H	L	H	M
CO3	H	M	M	H	L	L	M	M	L	H	L	M	L
CO4	H	M	L	M	L	L	L	L	M	M	L	H	L
CO5	H	M	L	M	M	L	L	M	M	H	L	M	L
CO6	H	M	H	M	L	L	L	M	M	H	M	H	L

L-Low M-Moderate H- High

5. COURSEASSESSMENTMETHODS

Direct

1. Continuous Internal Assessment Tests I & II
2. Model Exam
3. Open book test, Assignment, Quiz, Seminar, Group Presentation, Poster preparation, Problem solving etc.
4. End Semester Examination

Indirect

1.Course-end survey

Course Co – ordinator: Mrs. R. Vidhya

CORE - VII: NUCLEAR PHYSICS, WAVE MECHANICS AND RELATIVITY

SEMESTER: VI **CODE: U16PH607**

CREDITS: 5 **NO. OF HOURS/ WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO No.	Course Outcomes	Level	Unit Covered
CO1	Explain the basic properties of nuclei, postulates of wave mechanics and relativity.	**K2**	**I, IV, V**
CO2	Explain the limitations of Newton's law of motion and black body radiation from Planck's hypothesis	**K2**	**III, V**
CO3	Identify the elementary particles based on the quantum numbers, select suitable method of detection for various nuclear radiations and model nuclear reactors, atom bomb, Electron microscope.	**K3**	**I, II**
CO4	Analyze various experiments that reveal the dual nature of matter and theories related to nuclear reactions.	**K4**	**II, III**
CO5	Assess relativistic variation in mass, velocity, time and position, binding energy of nucleus and the energy released in nuclear reactions.	**K5**	**I, II, V**
CO6	Formulate Schrödinger equation for simple quantum mechanical systems and solve it to find the wave function and energy.	**K6**	**IV**

2. A. SYLLABUS

Unit-I: Properties of nucleus and elementary particles (15 Hours)

Basic properties of nucleus – Classification of nuclei - Properties of nuclei - Binding energy – Stability of nuclei - GM counter – Wilson's cloud chamber - Photographic emulsion techniques - Classification

of subatomic particles– Antiparticles – Strangeness – Isospin – Hypercharge - quarks and their quantum numbers.

Unit-II: Nuclear models and energy (15 Hours)

Liquid drop model– Shell model – Magic numbers - Nuclear reaction– Types of nuclear reaction – Nuclear fission – Bohr and Wheeler's theory of nuclear fission – Energy released in fission – Q value – Nuclear reactor (basic ideas only) – Atom bomb – Nuclear fusion - Thermonuclear reactions – Source of stellar energy.

Unit-III: Dual nature of matter (15 hours)

Planck's hypothesis – Derivation of Planck's law of radiation – de–Broglie waves (Duality) – Wave packet, phase and group velocities – Davisson and Germer experiment – G.P. Thomson experiment – Uncertainty principle – Gamma ray microscope – Electron microscope.

Unit-IV: Schrödinger equation and its applications (15 hours)

Postulates of wave mechanics – Derivation of Schrödinger wave equation (time dependent and time independent forms) – Significance of wave function – conservation of total probability - Particle in an infinite one dimensional square well potential –One dimensional harmonic oscillator – Zero point energy.

Unit-V: Relativity (15 hours)

Newton's laws and their limitations – Concept of space, time and mass - Inertial frames – Galilean transformations – Michelson-Morley experiment and its importance – Einstein's postulates – Lorentz transformations – Addition of velocities - Length contraction – Time dilation - Variation of mass with velocity – Einstein's mass energy relation.

B. TOPICS FOR SELF STUDY

1. The standard model
   https://theoreticalminimum.com/courses/particle-physics-2-standard-model/2010/winter
2. Particle accelerators
   https://home.cern/science/physics
3. Application of quantum mechanics
   https://phys.libretexts.org/Bookshelves/University_Physics

4. General theory of relativity.
   https://ocw.mit.edu/courses/physics/8-962-general-relativity-spring-2020/index.htm

C. TEXT BOOKS

1. R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics, S. Chand & Co. Ltd, New Delhi, 2016.
2. Arthur Beiser, Shobit Mahajan and S Rai Choudhury, Concepts of Modern Physics, Tata McGraw Hill, 2017.

D. REFERENCE BOOKS

1. J. B. Rajam, Modern Physics, S. Chand & Co. Ltd, New Delhi, 1967.
2. D.C. Tayal, Nuclear Physics, Himalaya Publication, Mumbai, 2015.
3. P.M. Mathews and K. Venkatesan, Quantum Mechanics, Tata McGraw Hill, 2017.
4. Paul A. Tipler and G. Mosca, Physics for Scientist and Engineers, W.H. Freeman, New York, 2003.

E. WEBLINKS

1. https://nptel.ac.in/courses/115/104/115104043/
2. https://nptel.ac.in/courses/115/103/115103101/
3. https://nptel.ac.in/courses/115/104/115104096/
4. https://nptel.ac.in/courses/115/106/115106066/
5. https://nptel.ac.in/courses/115/101/115101011/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Properties of Nucleus and Elementary Particles**		
1.1	Basic properties of nucleus - Classification of nuclei	Classify the different types of nuclei	**K4**
1.2	Properties of nuclei	Explain the basic properties of nuclei.	**K2**
1.3	Binding energy	Explain the concept of binding energy. **(K2)** Evaluate the binding energy of nucleus. **(K5)**	**K5**
1.4	Stability of nuclei	Analyze the stability of nuclei	**K4**
1.5	GM counter	Illustrate the method of detection of nuclear radiation using GM counter	**K2**
1.6	Wilson's cloud chamber	Explain the method of detection of nuclear radiation using Wilson's cloud chamber	**K2**
1.7	Photographic emulsion techniques	Explain the method of detection of nuclear radiation using Photographic emulsion technique	**K2**
1.8	Classification of subatomic particles	List the different types of subatomic particles	**K1**
1.9	Antiparticles	Define the antiparticles	**K1**
1.10	Strangeness – Isospin – Hypercharge	Categorize the elementary particles on the basis of quantum numbers	**K4**
1.11	quarks and their quantum numbers.	Explain the concept of quarks and their quantum numbers	**K2**
II	**Nuclear Models and Energy**		
2.1	Liquid drop model	Analyze the similarity between an atomic nucleus and a liquid drop.	**K4**
2.2	Shell model - Magic numbers	Analyze the similarity between energy structure of the nucleus and electron shells in atom **(K4)** Define the magic numbers **(K1)**	**K4**
2.3	Nuclear reaction - Types of nuclear reaction	Explain the different types of nuclear reactions	**K2**
2.4	Nuclear fission	Illustrate the nuclear fission reaction	**K2**
2.5	Bohr and Wheeler's theory of nuclear fission	Make use of the features of liquid drop model to explain nuclear fission reaction	**K3**
2.6	Energy released in fission -	Evaluate the Q value for the	**K5**

	Q value	nuclear reactions	
2.7	Nuclear reactor (basic ideas only)	Outline the basic structure of a nuclear reactor	**K2**
2.8	Atom bomb	Discuss the principle behind an atom bomb	**K2**
2.9	Nuclear fusion	Define the nuclear fusion	**K1**
2.10	Thermonuclear reactions	Analyze the factors responsible for controlled thermonuclear reactions.	**K4**
2.11	Source of stellar energy	Explain the nuclear fusion reaction in stars	**K2**
III	**Dual Nature of Matter**		
3.1	Planck's hypothesis	State the Planck's hypothesis	**K1**
3.2	Derivation of Planck's law of radiation	Apply hypothesis to derive Planck's law of radiation	**K3**
3.3	de–Broglie waves (Duality)	Outline the de Broglie's theory of matter waves.	**K2**
3.4	Wave packet, phase and group velocities	Distinguish between phase velocity and group velocity in wave motion.	**K4**
3.5	Davisson and Germer experiment	Justify the wave nature of matter using Davisson and Germer experiment	**K5**
3.6	G.P. Thomson experiment	Analyse the wave nature of electron using G.P. Thomson experiment	**K4**
3.7	Uncertainty principle	State the uncertainty principle	**K1**
3.8	Gamma ray microscope	Support the principle of uncertainty using Gamma ray microscope	**K5**
3.9	Electron microscope	Explain the function of Electron microscope	**K2**
IV	**Schrödinger Equation and Its Applications**		
4.1	Postulates of wave mechanics	List the postulates of wave mechanics	**K1**
4.2	Derivation of Schrödinger wave equation (time dependent and time independent forms)	Develop the time dependent and time independent form of Schrodinger equation	**K5**
4.3	Significance of wave function	Interpret the nature of wave function	**K5**
4.4	Conservation of total probability	Illustrate that the total probability is conserved	**K2**
4.5	Particle in an infinite one-dimensional square well potential	Formulate Schrodinger equation for particle in a box and solve it to find its energy value and wave function.	**K6**
4.6	One dimensional harmonic oscillator - Zero-point energy	Formulate Schrodinger equation for one dimensional harmonic oscillator and solve it to find its energy value and wave function.	**K6**
V	**Relativity**		
5.1	Newton's laws and their limitations	Discuss the limitations of Newton's laws	**K2**

5.2	Concept of space, time and mass	Interpret the concept of space, time and mass	**K2**
5.3	Inertial frames - Galilean transformations	Explain the different frames of reference and the transformation equations between two inertial frames	**K2**
5.4	Michelson-Morley experiment and its importance	Explain the Michelson-Morley experiment	**K5**
5.5	Einstein's postulates	Summarize postulates of special theory of relativity	**K2**
5.6	Lorentz transformations	Develop the transformation equation with the concept of the invariance of light velocity in free space.	**K3**
5.7	Addition of velocities	Prove that the velocity of light is the maximum attainable velocity.	**K5**
5.8	Length contraction	Explain the concept of length contraction	**K2**
5.9	Time dilation	Explain the concept of Time dilation	**K2**
5.10	Variation of mass with velocity	Develop the relativistic formula for the variation of mass with velocity	**K3**
5.11	Einstein's mass energy relation.	Deduce mass energy relation	**K5**

4. MAPPING SCHEME (CO, PO, PSO)

U16PH607	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	H	M	L	-	-	L	L	-	L	H	L	L	M
CO 2	H	H	M	L	L	-	L	L	-	H	L	L	M
CO 3	H	H	H	H	M	L	L	L	M	H	L	M	M
CO 4	H	H	M	M	M	-	L	-	M	H	L	M	M
CO 5	M	H	L	L	H	L	L	L	-	H	L	M	L
CO 6	H	M	M	L	H	-	L	-	L	H	L	L	L

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Project report, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-end survey

Course Co-ordinator : Dr.N.Ananth

CORE VIII: SOLID STATE PHYSICS

SEMESTER: VI **CODE : U16PH608**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. No.	Course Outcomes	Level	Unit Covered
CO1	Explain the basics of crystal structure	**K2**	**I**
CO2	Compare the types of bonding in solids	**K4**	**II**
CO3	Analyze electrical and thermal properties of metals	**K4**	**III**
CO4	Interpret electrical conductivity of semiconductors	**K5**	**IV**
CO5	Explain the theories and properties of semiconductors and superconductors	**K5**	**IV,V**
CO6	Categorize the superconductors based on their properties	**K4**	**V**

2. A. SYLLABUS

Unit- I: Crystal Structure **(14 hours)**

Crystalline and amorphous solids – Basis and crystal structure–Crystal translation vectors – Symmetry operations – Unit cell and primitive lattice cell – Symmetry elements – Point groups and space groups – Bravais lattices – Miller indices – Number of atoms per unit cell – Coordination number – Atomic packing – Atomic radius – Simple cubic structure – Body centred cubic structure – Face centred cubic structure – Hexagonal closely packed structure–Structure of NaCl and Diamond.

Unit- II: Bonding in Solids **(14 hours)**

Force and potential between two atoms – cohesive energy – types of bonds - Ionic bond – bond energy of NaCl molecule – lattice energy of ionic crystals – Madelung constant – Born-Haber cycle – properties of ionic crystals – covalent bond – properties of covalent crystals – metallic bond – properties of metallic crystals – inter molecular bonds – van der Waal's bond – dispersion bond – dipole bond – hydrogen bond – comparison between bonds.

Unit- III: Electron Theory of Metals (14 hours)

Free electron theory – Effect of impurity and temperature on electrical resistivity – Limitations of the free electron model - Fermi – Dirac distribution - Fermion – Free electron gas - Drude – Lorentz electron theory – density of energy states – Fermi surface – Electrical conductivity – Thermal conductivity – Wiedemann-Franz law – Electrical resistivity versus temperature – Sommerfeld model.

Unit- IV: Semiconductors (14 hours)

Energy band diagram – direct and indirect band gap semiconductors – Chemical bonds in semiconductors – valence band, conduction band, Forbidden energy gap – Intrinsic and extrinsic semiconductors – donor and acceptor levels – carrier concentration for intrinsic and extrinsic semiconductors – Fermi level – Mechanism of current flow - Mobility – drift velocity – Conductivity in semiconductors – Drift and diffusion current – Hall effect.

Unit- V: Superconductivity (14 hours)

Introduction – Properties of superconductors – Critical temperature and critical field – Meissner effect - Type – I and Type – II superconductors – Thermodynamic properties (Qualitative study) – isotopic effect – Energy gap – London equations – BCS theory – AC and DC Josephson effects (definitions only) – High temperature superconductors – Applications of superconductors.

B. TOPICS FOR SELF STUDY

1. Quasi crystals

https://www.youtube.com/watch?v=lmr4kETnwi0
http://home.iitk.ac.in/~anandh/presentations/Quasicrystals_Nobel.pdf

2. Advanced Magnetoresistive Materials: Giant Magnetoresistance, Magneto Tunnel

https://www.routledge.com/rsc/downloads/ch_2_9781315119595.pdf
https://www.youtube.com/watch?v=7qHbv9QFoC0
https://www.youtube.com/watch?v=hCcb-w58IY0

3. Synthesis of High temperature superconductors

https://physlab.org/wp-content/uploads/2016/04/Superconductor_manual1.pdf
https://www.youtube.com/watch?v=RdlCCxOXcoM

C. TEXT BOOKS:

1. S.L. Gupta and V.Kumar, Solid State Physics, K.Nath & Co., Meerut, 2013.
2. S.O. Pillai, Solid State Physics 8thedition, New Age International, 2018.
3. M.A. Wahab, Solid State Physics, 2011, Narosa Publications

D. REFERENCE BOOKS:

1. Charles Kittel, Introduction to Solid State Physics 8e, Wiley India Pvt. Ltd., New Delhi, 2012.
2. R.L. Singhal, Solid State Physics, Kedar Nath Ram Nath & Co., Meerut, 2012.

3. Neil W. Ashcroft and N. David Mermin, Basic Solid State Physics, Brooks/Cole Publishing Company, CA, USA, 1976.
4. A.Raychaudhuri, Basic Solid State Physics, Sarat Book House, Kolkata, 2014.
5. V. Rajendran and A. Marikani, Applied Physics, Tata Mcgraw Hill Publishing Co. Ltd, New Delhi, 2003.
6. S. O. Kasap, Principles of Electronic Materials and Devices, Mcgraw-Hill Education, Dubuque, 2017.

E. WEBLINKS

1. https://nptel.ac.in/courses/115/104/115104109/
2. https://nptel.ac.in/courses/115/105/115105099/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of transaction
I	**Crystal Structure**		
1.1	Crystalline and amorphous solids	Classify crystalline and non crystalline materials Contrast basis and crystal structure	**K2**
1.2	Basis and crystal structure	Relate basis and crystal structure	**K2**
1.3	Crystal translation vectors	Outline the role of translation vectors in constructing crystal systems	**K2**
1.4	Symmetry operations	Explain various symmetry operations	**K2**
1.5	Unit cell and primitive lattice cell	Relate Unit and Primitive cells	**K2**
1.6	Symmetry elements	Illustrate symmetry elements	**K2**
1.7	Point groups and space groups	Identify Point and Space groups for the crystal structure	**K3**
1.8	Bravais lattices	Explain Bravais lattices	**K2**
1.9	Miller indices	Infer miller indices for crystal plane	**K4**
1.10	Number of atoms per unit cell – Coordination number – Atomic packing – Atomic radius	Explain unit cell properties	**K2**
1.11	Simple cubic structure (SC) - Body centered cubic structure (BCC) - Face centered cubic structure (FC)	Evaluate packing factor value of SC, BCC and FC	**K5**
1.12	Hexagonal closely packed structure	Estimate Packing factor value for	**K6**

		hexagonal closely packed structure incorporating all the unit cell parameters	
		Determine the axial ratio for hexagonal closely packed structure	**K5**
1.13	Structure of NaCl and Diamond	Explain the structure of NaCl Obtain the packing factor value of Diamond	**K2**
II	**Bonding in Solids**		
2.1	Force and potential between two atoms – cohesive energy	Discuss the force and potential variation with atomic distance and estimate cohesive energy	**K5**
2.2	Types of bonds	Categorize the types of bonds	**K4**
2.3	Ionic Bond	Explain bonding mechanism in materials Label the potential energy diagram of ionic crystals	**K2**
2.4	Bond energy of NaCl molecule	Calculate the bond energy NaCl	**K3**
2.5	lattice energy of ionic crystals - Madelung constant	Evaluate the lattice energy of ionic crystals and Madelung constant	**K5**
2.6	Born Haber cycle	Evaluate the enthalpy of formation of NaCl	**K5**
2.7	Properties of ionic crystals	List out the properties of ionic crystals	**K4**
2.8	Covalent bond -properties covalent crystals	Explain the covalent bond mechanism List the properties of covalent crystals	**K2**
2.9	Metallic bond –properties of metallic crystals	Explain the metallic bond mechanism List the properties of metallic crystals	**K2**
2.10	Intermolecular bonds –	Classify the intermolecular bonds	**K4**
2.11	Van der Waal's bond - dispersion bond – dipole bond – hydrogen bond	Explain van der Waal's bond - dispersion bond – dipole bond – hydrogen bond	**K2**
2.12	Comparison between bonds	Compare the properties of various bonds in solids	**K5**
III	**Electron Theory of Metals**		
3.1	Classical Free electron (CFE) theory	Explain free electron theory with conventional flow of current	**K2**
		Discuss the limitations of free electron model Explain CFE theory	**K2**

3.2	Effect of impurity and temperature on electrical resistivity	Inspect the effect of temperature on electrical resistivity	**K4**
3.3	Limitations of the free electron model	Justify that the free electron theory needs to be amended	**K5**
3.4	Fermi-Dirac distribution -	Explain Fermi – Dirac distribution	**K5**
3.5	Fermion	Define: Fermion	**K1**
3.6	Free electron gas	Explain free electron gas model	**K2**
3.7	Drude-Lorentz electron theory	Explain Drude-Lorentz theory	**K2**
3.8	density of energy states	Evaluate the density of energy states	**K5**
3.9	Fermi surface	Define Fermi surface	**K1**
3.10	Electrical conductivity	Define: Electrical conductivity	**K2**
		Derive the expression for electrical conductivity of metals	**K5**
3.11	Thermal conductivity	Define: Thermal conductivity	**K1**
		Derive the expression for thermal conductivity of metals	**K4**
3.12	Wiedemann - Franz law	Apply Wiedemann - Franz law to obtain Lorentz number	**K3**
3.13	Electrical resistivity versus temperature	Explain the variations in electrical resistivity with respect to temperature	**K5**
3.14	Bohr's theory	Explain Bohr's atomic model	**K5**
3.15	Sommerfeld model	Explain Sommerfeld atomic model and compare this model with other proposed atomic models	**K5**
IV	**Semiconductors**		
4.1	Energy band diagram	Illustrate the energy band diagrams of conductors, semiconductors and superconductors	**K2**
4.2	Direct and indirect band gap semiconductors	Compare direct and indirect band gap semiconductors	**K4**
4.3	Chemical bonds in semiconductors	Explain chemical bonds in semiconductor	**K2**
4.4	Valence band, conduction band, Forbidden energy gap	Explain valence band, conduction band and Forbidden energy gap	**K2**
4.5	Intrinsic and extrinsic semiconductors	Distinguish Intrinsic and Extrinsic semiconductors	**K4**

4.6	Carrier concentration for intrinsic and extrinsic semiconductors	Estimate carrier concentration of intrinsic, n-type and p-type semiconductors	**K5**
		Define: Fermi level	**K1**
4.7	Fermi level	Calculate the probability of electron occupancy in energy levels at T<0, T=0 and T>0	**K5**
4.8	Mechanism of current flow	outline the mechanism of current flow in semiconductors	**K2**
4.9	Mobility - drift velocity	Derive the expression for mobility and drift velocity of the charge carriers in semiconductors	**K5**
4.10	Conductivity in semiconductors	Explain conductivity in semiconductors	**K5**
4.11	Hall Effect	Outline Hall effect and estimate Hall coefficient	**K5**
V	**Superconductivity**		
5.1	Introduction	Summarize the history of superconductors	**K2**
5.2	Properties of superconductors	Explain the properties of superconductors in detail	**K5**
5.3	Critical temperature and critical field	Define critical temperature and Critical field for superconductor	**K1**
5.4	Meissner effect	Explain Meissner effect	**K2**
5.5	Type-I and Type-II superconductors	Classify Type – I and Type – II superconductors	**K4**
5.6	Thermodynamic properties (Qualitative study)	Explain the thermodynamic properties of superconductors	**K5**
5.7	Isotopic effect - Energy gap	Outline the isotopic effect in superconductors and energy gap	**K2**
5.8	London equations	Deduce London equation	**K5**
		Explain the drawbacks of London equations	**K2**
5.9	BCS theory	Explain BCS theory	**K5**
5.10	AC and DC Josephson effects (definitions only)	Define AC and DC Josephson effects	**K2**

5.11	High temperature superconductors	Discuss on high temperature superconductors	**K2**
5.12	Applications of superconductors	Summarize the applications of superconductors	**K2**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH608	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	M	M	M	L	M	H	L	L	L	L	L	L	M
CO2	L	M	H	M	L	M	M	L	L	H	M	M	L
CO3	M	L	M	M	M	L	L	L	L	L	L	H	M
CO4	M	H	M	H	M	H	M	L	L	H	M	L	L
CO5	H	M	M	M	H	M	M	L	L	H	M	M	M
CO6	M	M	H	L	L	L	H	L	L	M	L	M	H

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test I & II
2. Assignment, Group Discussion, Quiz, Slip test, Seminar and End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Mr.John Samuel

ELECTIVE - I: ATOMIC PHYSICS

SEMESTER: V **CODE: U16PH5:1**

CREDITS: 5 **NO. OF HOURS / WEEK: 5**

1. COURSE OUTCOMES (CO)

After the completion of this course the student will be able to:

CO NO.	Course Outcomes	Level	Unit Covered
CO1	Explain the basic properties of positive rays, models of atoms, atomic spectra, photo-electricity, X-rays and classify elements.	**K2**	**I - V**
CO2	Make use of atom models to explain the spectral behavior of atoms when they are free and under the influence of external magnetic fields and model photovoltaic cells.	**K3**	**II & V**
CO3	Organize experiments to determine e/m of positive rays, critical potential, Planck's constant and structure of crystals and to prove Vector atom model.	**K3**	**I, II, III & V**
CO4	Analyze the interactions of electromagnetic waves with matter	**K4**	**IV & V**
CO5	Evaluate Zeeman shift, Lande's g-factor, magnetic dipole moment of electron, structure of crystals.	**K5**	**II, III & V**
CO6	Construct a basic photovoltaic cell.	**K6**	**IV**

2. A. SYLLABUS

Unit-I: Positive ray analysis **(13 Hours)**

Properties – e/m of positive rays – Thomson's parabola method – Aston's Mass spectrograph, Bain bridge mass spectrograph – Excitation and Ionisation Potential – Atomic Excitation – Experimental Determination of critical potential – Frank and Hertz experiment.

Unit-II: Atom models **(13 Hours)**

Bohr's atom model – Hydrogen spectra – Sommerfeld's relativistic atom model – Elliptical orbits – Relativistic variation of electronic mass – Vector atom model – Spatial quantization – Spinning electron hypothesis – Quantum numbers – electronic configuration and classification of elements – Magnetic dipole moment of electron – Stern and Gerlach experiment.

Unit-III: Fine structure and spectral lines **(13 Hours)**

Spectral terms and notation – selection rules – fine structure of D lines – explanation for splitting of D_1 and D_2 lines – alkali spectra – fine structure – Zeeman effect – Larmor's theorem – Debye's quantum mechanical explanation of normal Zeeman effect – Anomalous Zeeman effect – theoretical explanation – Lande's g factor – Paschen Back effect.

Unit-IV: Photo electricity **(13 Hours)**

Photo electric effect – Lenard's experiment – Richardson and Compton experiment – Einstein's photoelectric equation – Verification by Millikan's experiment – Determination of Planck's constant – Photo voltaic cells – Photo conductive cells – Photo emissive cells – Photo multiplier – Applications.

Unit-V: X–Rays **(13 Hours)**

X-ray Spectra – Continuous and characteristic X-ray spectrum – Moseley's law and its importance – Bragg's law – Bragg's X–ray diffractometer – Powder crystal method – Laue Method – Rotating Crystal Method – Compton effect – Derivation of expression for change in wavelength – Experimental verification.

B. TOPICS FOR SELF STUDY

1.The development of the atomic model
https://www.wired.com/2009/09/the-development-of-the-atomic-model/
2.Theory, experiment and fine structure
https://physicsworld.com/a/theory-experiment-and-fine-structure/
3.Photoelectric effect questions and answers
https://study.com/learn/photoelectric-effect-questions-and-answers.html
4. Basics of X-ray powder diffraction
http://prism.mit.edu/xray/Basics%20of%20X-Ray%20Powder%20Diffraction.pdf
5.Advances in atomic physics
https://www.science.gov/topicpages/a/a-z+atomic+physics
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4563599/?tool=pmcentrez

C. TEXT BOOKS

1. R. Murugesan, Modern Physics, S. Chand & Co. Ltd., New Delhi, 2003. **(Unit-1 to Unit-5)**
2. Arthur Beiser and Shobit Mahajan, Concepts of Modern Physics, Tata McGraw Hill, 2009.**(Unit-2 & Unit-3)**

D. REFERENCE BOOKS

1. Brij Lal, N. Subrahmanyam and Jivan Seshan, Atomic and Nuclear Physics, S. Chand, New Delhi, 2006.
2. J.B. Rajam, Atomic Physics 7e, S. Chand and Co., New Delhi, 2004.
3. Mark Fox, A Student's Guide to Atomic Physics, Cambridge University Press, 2018.
4. Paul Ewart, Atomic Physics, IOP Concise Physics, 2019.

E. WEBLINKS

1. https://nptel.ac.in/courses/115/105/115105100/
2. https://nptel.ac.in/courses/115/106/115106057/
3. https://nptel.ac.in/courses/115/101/115101003/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Positive ray analysis**		
1.1	Properties of positive rays	Explain the characteristics of positive rays	**K2**
1.2	e/m of positive rays	Explain the specific charge of an electron	**K2**
1.3	Thomson's parabola method	Organize an experiment to determine the e/m of ions	**K3**
1.4	Aston's Mass spectrograph	Organize an experiment to determine the e/m of ions with improved traces intensity	**K3**
1.5	Bain bridge mass spectrograph	Organize an experiment to determine the e/m of ions with higher accuracy	**K3**
1.6	Excitation and ionization potential	Define ionisation and excitation potentials	**K2**
1.7	Atomic Excitation	Explain the two methods of exciting an atom	**K2**
1.8	Experimental Determination of critical potential - Franck and Hertz's experiment	Understand the experimental determination of critical potentials	**K3**

II	**Atom models**		
2.1	Bohr's atom model	Explain the atom model proposed by Bohr	**K5**
2.2	Hydrogen spectra	Interpret the spectral lines of hydrogen atom	**K5**
2.3	Sommerfeld's relativistic atom model	Explain the improved atom model by Sommerfeld's with relativistic approach	**K5**
2.4	Elliptical orbits	Deduce the condition that determines the allowed elliptical orbits	**K5**
2.5	Relativistic variation of electronic mass	Explain the variation of mass of the electron with velocity	**K3**
2.6	Vector atom model	Explain the complex spectra of atoms and their relation to atomic structure	**K5**
2.7	Spatial quantization	Explain the fact that the projections of the quantised orbits on the field direction must themselves be quantised	**K3**
2.8	Spinning electron hypothesis	Explain the concept of spinning electron	**K3**
2.9	Quantum numbers	Summarize the various quantum numbers associated with vector atom model	**K2**
2.10	Electronic Configuration and Classification of Elements	Explain the distribution of electrons in various sub shells around the nucleus of the atom and the arrangement of different elements that exist in nature based on their chemical properties and atomic numbers	**K3**
2.11	Magnetic dipole moment of electron	Explain the magnetic dipole moment due to orbital motion and spin of the electron	**K3**
2.12	Stern and Gerlach experiment	Explain the direct evidence for the existence of magnetic moments of atoms and their space quantisation	**K5**
III	**Fine structure and spectral lines**		
3.1	Spectral terms and notation	Compare the atoms based on the valence electrons they have and distinguish the states of the atoms	**K2**
3.2	Selection rules	Apply the rules that satisfies a transition of an electron between two levels	**K3**

3.3	Fine structure of D lines	Identify the doublet fine structure of Sodium D lines	**K3**
3.4	Explanation for splitting of D_1 and D_2 lines	Explain the splitting of spectral lines	**K2**
3.5	Alkali spectra	Explain the one electron spectra of the alkali metals	**K2**
3.6	Fine structure	Identify the fine structure associated with the alkaline spectrum	**K3**
3.7	Zeeman effect	Explain the effect of magnetic field on the line spectrum of a light source	**K5**
3.8	Larmor's theorem	Apply Larmor's theorem to explain Larmor's precession	**K3**
3.9	Debye's quantum mechanical explanation of normal Zeeman effect	Explain the normal Zeeman effect without the concept of electron spin based on quantum mechanics	**K3**
3.10	Anomalous Zeeman effect	Explain the splitting of a spectral line into more than three components in ordinary weak magnetic field	**K2**
3.11	Theoretical explanation	Explain the anomalous Zeeman effect with the concept of electron spin based on quantum mechanics	**K5**
3.12	Lande's g factor	Explain the scale of splitting	**K2**
3.13	Paschen Back effect	Explain the transition phenomenon of anomalous into normal Zeeman effect	**K2**
IV	**Photo electricity**		
4.1	Photo electric effect	Outline the process of emission of photoelectrons	**K2**
4.2	Lenard's experiment	Analyse the e/m of photoelectrons	**K4**
4.3	Richardson and Compton experiment	Examine the photoelectric effect	**K4**
4.4	Einstein's photoelectric equation	Illustrate the photoelectric equation proposed by Einstein	**K4**
4.5	Verification by Millikan's experiment	Analyse the Einstein's photoelectric equation experimentally	**K4**
4.6	Determination of Planck's constant	Explain the experimental determination of Planck's constant	**K2**

4.7	Photo voltaic cells	Construct a basic photo voltaic cell	**K6**
4.8	Photo conductive cells	Explain photo conductive cell	**K2**
4.9	Photo emissive cells	Explain photo emissive cell	**K2**
4.10	Photo multiplier	Explain photo multipliers	**K2**
4.11	Applications	Outline the applications of photo cells	**K2**
V	**X-rays**		
5.1	X-ray Spectra	Analyse the X-ray beam	**K4**
5.2	Continuous and characteristic X–ray spectrum	Examine the salient features of X-ray spectra	**K4**
5.3	Moseley's law and its importance	Illustrate the importance of Moseley's law	**K2**
5.4	Bragg's law	Outline the law that explains X-ray diffraction	**K2**
5.5	Bragg's X–ray diffractometer	Analyse the construction and working of X-ray spectrometer	**K4**
5.4	Powder crystal method	Estimate the structure of the crystal	**K5**
5.6	Laue Method	Inspect the crystal for solid state experiments	**K4**
5.7	Rotating Crystal Method	Identify the interplanar spacing of a single crystal experimentally	**K3**
5.8	Compton effect	Explain Compton scattering	**K2**
5.9	Derivation of expression for change in wavelength	Deduce Compton wavelength	**K5**
5.10	Experimental verification	Organize an experiment to verify Compton effect	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH5:1	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	M	L	M	-	-	L	L	-	L	H	M	L	M
CO2	M	H	M	M	M	L	L	L	L	H	M	L	M
CO3	M	-	M	H	M	M	L	-	-	M	M	L	-
CO4	M	M	M	H	H	M	M	L	M	H	-	-	M
CO5	M	M	M	M	M	L	L	-	L	M	L	-	L
CO6	M	L	M	L	-	L	L	L	L	M	-	L	-

L- Low M-Moderate H-High

5. COURSE ASSESMENT METHODS

Direct

1. Surprise Class tests and Quizzes
2. Continuous Assessments (Two Internal Tests)
3. Group Discussions and Seminar Presentations
4. End Semester Examinations

Indirect

1. Assignments and Industry/Field visits
2. Course end survey/Feedbacks

Course Co-ordinator: Dr.S.Franklin

ELECTIVE - I : COMMUNICATION SYSTEM

SEMESTER: V **CODE: U16PH5:A**

CREDITS: 5 **NO. OF HOURS/WEEK: 5**

1. COURSE OUTCOMES (CO)

After the completion of this course the student will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Outline the basics of noise in communication	**K2**	**I**
CO2	Classify the modulations on the basis of frequency	**K3**	**II**
CO3	Apply the concept of different type of pulse modulation in communication	**K3**	**III**
CO4	Analyze the network and controls in data communication	**K4**	**IV**
CO5	Utilize the analog and digital modulation schemes in fiber optical communication	**K3**	**V**
CO6	Explain the emitter design and detector design in fiber optical communication	**K4**	**V**

2. A. SYLLABUS

Unit -I: Basics of Communication (15 hours)

Communication systems – modulation - need for modulation - bandwidth requirements- noise - thermal noise - noise calculations - signal to noise Ratio - noise figure - calculation of noise figure - measurement of noise figure.

Unit-II: Analog Communication (15 hours)

Amplitude modulation - frequency spectrum of AM wave - power relations in the AM wave - frequency modulation - mathematical representation of FM - frequency spectrum - phase modulation - comparisons: frequency and phase modulation, frequency and amplitude modulations.

Unit -III: Pulse Communication (15 hours)

Importance of pulses in Digital communication – Pulse communication – pulse modulation types: pulse amplitude modulation – pulse width modulation – pulse position modulation – pulse code modulation – telegraphy - telemetry.

Unit -IV: Data Communication (15 hours)

Data communication systems - data transmission circuits - error detection and correction - interconnection requirements - modern classification- network and control considerations.

Unit -V: Fiber Optical Communication (15 hours)

Optical fiber cables – types - losses in fibers - measurements of fiber characteristics - analog and digital modulation schemes - fiber optical communication systems - operating wavelength - emitter design - detector design - fiber choice.

B. TOPICS FOR SELF STUDY

Fibre optic communication system – Techniques - Telecommunication

https://nptel.ac.in/courses/108/104/108104113/

Digital modulation – frequency - correction

https://nptel.ac.in/courses/117/101/117101051/

C. TEXT BOOK

1. George Kennedy, Electronic Communication System, McGraw-Hill International Editions, 1987.
2. G. Jose Robin and A. Ubald Raj, Communication Electronics, Indira Publications, Martandam, 2002.

D. REFERENCES BOOKS

1. John Gowar, Optical Communication Systems, Prentice Hall India, New Delhi, 1993.
2. Gerd Keiser, Optical Fiber Communications, McGraw Hill, Singapore, 2000.
3. Joseph C. Palais, Fiber Optic Communications, Prentice Hall International, USA, 2001.
4. B. P. Lathi, Communication systems, Wiley Eastern Ltd, New Delhi, 1968.
5. J.F.B. Hawkes, Optoelectronics: An Introduction, J. Wilson, Prentice Hall of India, 1992.

E. WEBLINKS

1.https://www.tutorialspoint.com/principles_of_communication/principles_of_optical_fiber_communications.htm

2.https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_pulse_modulation.htm

3. https://byjus.com/jee/communication-systems/

4.https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf

5. https://en.wikipedia.org/wiki/Fiber-optic_cable

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Basics of Communication**		
1.1	Communication systems - modulation	Define modulation	**K2**
1.2	Bandwidth requirements	Utilize the concept of modulation	**K3**
1.3	Noise - Thermal noise	Describe thermal noise	**K3**
1.4	Noise calculation	Explain noise calculation	**K4**
1.5	Signal to noise ratio	Analyze the signal to noise ratio	**K4**
1.6	Calculation of noise figure	Analyze the calculation of noise figure	**K4**
1.7	Measurement of noise figure	Outline measurement of noise figure	**K3**
II	**Analog Communication**		
2.1	Amplitude modulation - frequency spectrum of AM wave	Illustrate amplitude modulation. Outline frequency spectrum of AM wave.	**K2** **K2**
2.2	Power relations in the AM wave	Construct the power relations in AM wave	**K3**
2.3	frequency modulation - mathematical representation	Analyze the importance of frequency modulation and mathematical representation	**K4**

	of FM	of FM	
2.4	frequency spectrum	Analyze the frequency spectrum in analog communication	**K4**
2.5	phase modulation	Describe phase modulation in analog communication	**K3**
III	**Pulse Communication**		
3.1	Importance of pulses in Digital communication	Analyze the importance of pulses in digital communication.	**K4**
3.2	Pulse communication	Analyze pulse communication	**K4**
3.3	pulse modulation types:pulseamplitude modulation	Examine the types of pulse modulation Outline pulseamplitude modulation	**K4** **K2**
3.4	Pulse width modulation	Compare pulse width modulation and pulseamplitude modulation	**K3**
3.5	Pulse position modulation	Utilize the pulse position modulation in pulse communication	**K3**
3.6	pulse code modulation	Summarize the pulse code modulation	**K2**
3.7	telegraphy	Describe telegraphy in pulse communication	**K2**
3.8	telemetry	Illustrate telemetry	**K2**
IV	**Data Communication**		
4.1	Data communication system	Explain the data communication system	**K2**
4.2	Data transmission circuits	Outline the data transmission circuits	**K2**
4.3	error detection and correction	Categorize the error detection and coreection in data communication	**K4**
4.4	Interconnection	Describe interconnection in data communication	**K3**
4.5	modern classification network	Categorize the modern classification network	**K4**

4.6	control considerations	Outline the control system in data communication	**K4**
V	**Fiber Optical Communication**		
5.1	Optical fiber cables – types	Classify the types of optical fiber cables	**K2**
5.2	Losses in fibers	Outline the loses in fibers	**K2**
5.3	Measurements of fiber characteristics	Describe the measurements of fiber characteristics	**K3**
5.4	Analog and digital modulation schemes	Analyze the analog and digital modulation schemes	**K4**
5.5	Fiber optical communication systems	Explain the fiber optical communication systems	**K2**
5.6	operating wavelength	Discuss the operating wavelength in fiber optical communication	**K3**
5.7	emitter design - detector design	Analyze the emitter design and detector design	**K4**
5.8	fiber choice	Summarize fiber choice in fiber optical communication	**K2**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH5: A	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO4**
CO1	M	H	H	H	H	M	M	L	L	M	H	H	H
CO2	M	H	H	H	M	M	M	L	L	M	M	M	M
CO3	M	M	M	M	M	M	L	L	L	L	M	M	L
CO4	M	L	M	M	M	L	L	L	L	M	M	M	L
CO5	M	M	L	M	M	M	L	M	L	M	M	H	L
CO6	L	M	L	L	L	M	L	L	L	L	L	L	M

L-Low M-Moderate H- High

4. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator: Dr. C. Indumathi

ELECTIVE - I: ASTRONOMY AND ASTROPHYSICS

SEMESTER: V **CODE: U20PH5:B**

CREDITS: 5 **NO OF HOURS/WEEK: 5**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Explain the concept of naked eye astronomy for identification of stars or group of stars in the night sky, earth rotation and other moving body in the space.	**K2**	**I**
CO2	Estimate the accurate position of the objects in the space by Co-ordinate system and find sunset, sunrise, sidereal time and season.	**K5**	**II**
CO3	Explain the concept of basic structure of sun with other planets and comets, meteors, asteroids.	**K5**	**III**
CO4	Discuss Kepler law, law of motion, Newton gravitation theory, Hubble's law and Einstein Gravitation theory.	**K5**	**IV**
CO5	Explain milky way and galaxies, origin and evolution.	**K2**	**V**
CO6	Explain importance of expanding universe and its stability, life in the universe.	**K2**	

2. A. SYLLABUS

Unit-I: Introduction to naked eye Astronomy **(15 hours)**

The constellation and their identification - Identification of some individual stars - Identification of Instantaneous phenomena-A sense of scale and time-A historical perspective Copernican revolution, Earth rotation and other motions, Eclipses - Interesting objects in the night sky.

Unit-II: Spherical Geometry **(15 hours)**

Geometry of the sphere-the alt-azimuth co-ordinate system - the equatorial co-ordinate system - ecliptic co-ordinate system - galactic co-ordinate system - sun set and sunrise - sidereal time - The mean solar time - Ephemeris time - The season - twilight - zero shadow day.

Unit-III: Sun and Solar system **(15 hours)**

The basic structure of sun - The solar constant - solar energy for earth - origin of the solar system - The planets and their origin- The moon- The planets mercury- Venus and mars- The planets Jupiter- Saturn- Uranus- Neptune and Pluto- Comets- meteors and asteroids.

Unit-IV: Basic concept of Astrophysics **(15 hours)**

Kepler's law- Newton's law of motion- Universal law of Gravitation- Hubble's law- Lorentz transformation- Introduction to special theory of relativity- tensors- Einstein field equations- Einstein general theory of relativity- Schwarzschild radius- Black holes- Time travel.

Unit-V: Identification of Universe **(15 hours)**

Components of the milky way- Spiral structure of the Galaxy- The Big Bang theory- The primordial background radiation- Types of Galaxies- Hubble's classifications- the origin and evolution of galaxies- the expanding universe- life in the universe.

B. TOPICS FOR SELF-STUDY

1. https://www.digimat.in/nptel/courses/video/115105046/L01.html
2. https://onlinecourses.swayam2.ac.in/arp19_ap73/preview\

C. TEXT BOOKS

1. The Physics fluids and plasmas: An introduction for Astrophysicists, Arnab Rai Choudhury, Cambridge University Press (1998).
2. Astrophysics for Physicists, Arnab Rai Choudhury, Cambridge University Press (2010).

D. REFERENCE BOOKS

1.Concept in space science, R.R. Daniel Universities press 2002.

2.Understanding our Universe, Palen, Kay, Smith, Blumenthal. Nortan&Company, Inc,2012.

3.The universe, David Bergamini, Time -Life Books,1970.

4.Text Book of Astronomy and Astrophysics with elements of Cosmology. Bhatia, Narosa Publication.

5.Spherical Astronomy, M.L. Khanna, Jaiprakash Nath&Co,12 the edition, 1992.

E. WEBLINKS

1. https://www.youtube.com/watch?v=i8U9ZjRXClI.

2.https://www.youtube.com/watch?v=8tKUvuurqsY&list=PLybg94GvOJ9E9BcCODbTNw2xU4b1cWSi6&index=7.

3. https://www.youtube.com/watch?v=FASOx8EaYIY.

4. https://www.youtube.com/watch?v=b-2GV0T5Zpc

5. https://www.youtube.com/watch?v=Z5hfHntWv_A

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of Transaction

I	**Introduction to Naked Eye Astronomy**		
1.1	Introduction to naked eye Astronomy	List objects in the night sky by naked eye.	**K1**
1.2	The constellation and their identification, Identification of some individual stars,	Compare individual stars and group of stars in the night sky during every month.	**K2**
1.3	Identification of Instantaneous phenomena.	Demonstrate any one of the instantaneous phenomena in detail.	**K2**
1.4	A sense of scale and time.	Explain a sense of scale and time.	**K2**
1.5	A historical perspective Copernican revolution, Earth rotation and other motions.	Explain historical perspectiveof Copernicanrevolution, earth rotation and other motion.	**K5**
1.6	Interesting objects in the night sky.	Categorize interesting objects in the night sky.	**K4**
II	**Spherical Geometry**		
2.1	Geometry of the sphere	Explain geometry of sphere	**K1**
2.2	The alt-azimuth co-ordinate system, the equatorial co-ordinate system, ecliptic co-ordinate system, galactic co-ordinate system	Discussalt-azimuth co-ordinate system, the equatorial co-ordinate system, ecliptic co-ordinate system, galactic co-ordinate system with suitable mathematical functions.	**K6**
2.3	Sun set and sunrise,	Explain science behind sunset and sunrise.	**K2**
2.4	Sidereal time,	Explain sidereal time?	**K2**
2.5	The mean solar time.	Explain solar time?	**K2**
2.6	Ephemeris time	What is Ephemeris time?	**K1**
2.7	The season,	Analyze the season in the earth	**K5**
2.8	Twilight,	Tell about twilight	**K1**
2.9	Zero shadow day	Demonstrate Zero shadow day and mention the date.	**K2**
III	**Sun and Solar system**		

3.1	The basic structure of sun.	Prove the basic structure of sun	**K5**
3.2	The solar constant	Explain solar constant.	**K2**
3.3	Solar energy for earth.	Measure solar energy for earth and explain light spectrum.	**K5**
3.4	Origin of the solar system,	Develop concept of origin of the solar system.	**K3**
3.5	The planets and their origin, The moon, The planets mercury, Venus and mars, The planets Jupiter, Saturn, Uranus, Neptune and Pluto.	Elaborate characteristics of individual planets and its moons.	**K6**
3.6	Comets, meteors and asteroids.	Classify the nature of comets, meteors and asteroids.	**K4**
IV	**Basic concept of Astrophysics**		
4.1	Kepler's law	Explain planetary motion using Kepler's law.	**K2**
4.2	Newtons law of motion.	Recall Newtons law of motion.	**K1**
4.3	Universal law of Gravitation	Explain Universal law of Gravitation.	**K2**
4.4	Hubble's law	Make use of Hubble's law and find expanding universe.	**K3**
4.5	Introduction of special theory of relativity.	Explain postulates of theory of relativity.	**K5**
4.6	Lorentz transformation	Derive Lorentz transformation	**K5**
4.7	Tensors	What is tensor?	**K1**
4.8	Introduction of general theory of relativity.	Prove Einstein field equation.	**K5**
4.9	Schwarzschild radius	Deduct mathematically Schwarzschild radius.	**K5**
4.10	Black holes	Explain theory of Black holes	**K5**

4.11	Time travel	Develop concept of time travel?	**K6**
V	**Identification of Universe**		
5.1	Components of the milky way	Explain components of the milky way.	**K5**
5.2	Spiral structure of the Galaxy	Discuss spiral structure of the galaxy.	**K6**
5.3	The Big Bang theory	Propose the concept of Big Bang theory.	**K6**
5.4	The primordial background radiation	Measure the primordial background radiation	**K5**
5.5	Types of Galaxies, Hubble's classifications.	Classify types of Galaxies, Hubble's classifications.	**K4**
5.6	The origin and evolution of galaxies	Explain the origin and evolution of galaxies	**K5**
5.7	The expanding universe	Discuss the expanding universe	**K6**
5.8	Life in the universe.	Recommend Life in the universe.	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U20PH5:B	PO									PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	H	H	M	M	M	M	L	L	L	H	H	H	L
CO 2	H	H	H	M	M	M	L	L	L	H	H	H	L
CO 3	H	H	H	M	M	M	L	L	L	H	H	H	L
CO 4	H	H	H	H	H	M	M	L	L	H	H	H	M
CO 5	H	H	H	M	M	M	L	L	L	H	H	H	H
CO 6	H	H	H	M	M	M	L	L	L	H	H	H	H

L – Low M – Moderate H – High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Internal Assessment Test I & II
2. Open book test, learning report, Assignment, Seminar and Problem solving.
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-Ordinator: Mr. A. Veerapandian

ELECTIVE - I: PYTHON

SEMESTER: VI **CODE: U20PH5:C**

CREDITS: 5 **NO. OF HOURS/WEEK: 5**

1. COURSE OUTCOMES (CO)

After the completion of this course the student will be able to:

CO.NO.	Course outcomes	Level	Unit Covered
CO1	Recall the basic structure of python program using constants, variables, datatypes and list.	**K1**	**I**
CO2	Demonstrate the conditional and looping statements to understand the concept of programming language	**K2**	**II**
CO3	Apply the different categories of user defined function and classes in python	**K3**	**III**
CO4	Analyse the appropriate functions and libraries for drawing the plots and data analysis	**K4**	**IV**
CO5	Evaluate the fundamental data structures and associated algorithms for solving substantial problems in python	**K5**	**III, IV, V**
CO6	Design and develop programs to solve real time problems numerically	**K6**	**V**

2. A. SYLLABUS

Unit- 1: Introduction to Python **(15 hours)**

Python on different operating systems - Variables –Strings – Numbers – Comments – List – Changing, Adding and Removing Elements –Organizing a List – Looping through List – Making Numerical List.

Unit-II: Conditions and Loops **(15 hours)**

Conditional Tests - If statements with Lists – Dictionaries – Nesting - While statement – Infinite loops – – Continue statement – For loops – Counting and summing loops – Maximum and minimum loops - Loop with Lists and Dictionaries.

Unit-III: Functions and Class **(15 hours)**

Functions – Styling - Creating and Using a Class – Importing classes – Opening files – Text files – Reading files – Searching through files – Selecting files names from user – Writing files –Testing a Function – Testing a Class.

Unit-IV: Python Libraries (15 hours)

Basic Numpy: 2D Numpy Arrays - Pandas: Basic data manipulation - Matplotlib: Basic plotting – Plot types - Image functions - Axis functions - Figure functions - 2D and 3D plots - Annotations and texts

Unit-V: Numerical Analysis using Python (15 hours)

Solution of Algebraic and Transcendental Equation: Bisection method - Newton's method – Solution of System of equations: Gauss elimination - Least squares approximation – Interpolation Methods: Lagrange, Newton, Piecewise linear – Solving ODEs: Euler method, Runge-Kutta method - Numerical Integration: Trapezoidal, Simpson's rule.

B. TOPICS FOR SELF STUDY

Web applications: Django – Starting an App – Making pages – Building an additional page.

C. TEXT BOOKS

1. Eric Matthes, Python Crash Course - 2nd Edition, No Starch Press (2019)
2. Wes McKinney, Python for Data Analysis - O'Reilly Media (2013)
3. Charles R. Severance, Python for Everybody: “Exploring data using Python 3”, Schroff Publishers, 1ed, 2017, ISBN 978-9352136278.
4. Timothy Sauer, Numerical Analysis, 2nd Edition, Pearson (2012)

D. REFERENCES BOOKS

1. Allen Downey, Think Python: “How to think like a computer scientist”, Schroff’ReillyPublishers, 2ed, 2016, ISBN 978-9352134755.
2. Timothy C. Needham, Python for Beginners: A crash course guide to learn python in 1 week, 2017.

E. WEBLINKS

1. https://wiki.python.org/moin/BeginnersGuide
2. https://learning.edx.org/course/course-v1:Microsoft+DAT208x+1T2020a/home
3. https://www.tutorialspoint.com/matplotlib/matplotlib_pyplot_api.htm

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom’s Taxonomic Levels of Transaction
I	**Introduction to Python**		
1.1	Python on different operating systems	Outline the steps to set up python on different operating systems.	**K2**

1.2	Variables	How to store the data in variables and use those variables in programs	**K1**
1.3	Strings	How to display strings using lowercase, uppercase and title case	**K1**
1.4	Numbers	Define the integers and float in Numerical data	**K1**
1.5	Comments	Build an explanatory comment to make programme code easier	**K3**
1.6	List – Changing, adding and removing elements	How to define list and how to add and remove elements	**K1**
1.7	Organizing a list	Examine the sort lists permanently and temporarily for display purpose.	**K3**
1.8	Looping through list	Extend the list with for loop	**K2**
1.9	Making Numerical list	Construct simple numerical lists	**K3**
II	**Conditions and Loops**		
2.1	Conditional tests	Select the condition to examine the program	**K1**
2.2	If statements with lists	Identify the particular conditions using the if statement	**K3**
2.3	Dictionaries	Model a variety of real-world objects using dictionaries	**K3**
2.4	Nesting	Build a nest list in a dictionary and nest a dictionary inside a dictionary	**K6**
2.5	While statement	Utilize the while loop in the program	**K3**
2.6	Infinite loops – Continue Statement	Control the flow of a while loop by setting an active flag, using the break statement, and using the continue statement	**K4**
2.7	For loops	Construct a definite loop using a for statement	**K3**
2.8	Counting and summing loops	Construct a loop to count and sum the number of items in a list	**K3**
2.9	Maximum and minimum loops	Construct a loop to find the largest and smallest value	**K3**
2.10	Loops with lists and Dictionaries	Utilize while loops with lists and dictionaries	**K3**
III	**Functions and Class**		
3.1	Functions – passing arguments	How to write function and to pass arguments	**K1**
3.2	Creating and using a class	Explain the storing information in a class using attributes	**K5**
3.3	Importing classes	Relate the classes which need into the files	**K2**
3.4	Opening files	How to work with the files	**K1**

3.5	Text files Reading files	Explain the command to open, reading the files	**K2**
3.6	Searching through files - Selecting files names from user	Combine the pattern for reading a file with string methods to build simple search mechanism	**K6**
3.7	Writing files	Explain the write mode for writing and reading strings	**K2**
3.8	Testing a function – Testing a class	Develop the code to test function and class	**K6**
IV	**Python Libraries**		
4.1	Basic Numpy: 2D Numpy Arrays	Use this package for high performance scientific computing	**K3**
4.2	Pandas: Basic data manipulations	Explain the use of pandas for data analysis	**K2**
4.3	Matplotlib: Basic plotting	Drawing the plots using the Matplotlib package	**K3**
4.4	Image functions Axis functions Figure functions	Label the different functions in plots.	**K1**
4.5	Plot types 2D and 3D plots	Develop the different type of plots using Matplotlib	**K3**
4.6	Annotations and texts	List the different labels in plots with suitable examples	**K1**
V	**Numerical Analysis using Python**		
5.1	Solution of Algebraic and Transcendental Equation: Bisection method - Newton's method	Develop the program to find the root of algebraic and transcendental equation using Bisection method and Newton's methods	**K6**
5.2	Solution of System of equations: Gauss elimination - Least squares approximation	Develop the program to solve the system of equations using Gauss eliminationand Least squares approximation methods	**K6**
5.3	Interpolation Methods: Lagrange, Newton, Piecewise linear	Develop the program to interpolate the set of data using Lagrange, Newton, Piecewise linear methods.	**K6**
5.4	Solving ODEs: Euler method, Runge-Kutta method	Develop the program to solve ordinary differential equations using Euler method, R-K method	**K6**
5.5	Numerical Integration: Trapezoidal, Simpson's rule.	Develop the program to solve integral equations using Trapezoidal, Simpson's rule.	**K6**

4. MAPPING SCHEME (PO, PSO & CO)

U20PH5:C	PO									PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	M	H	M	H	H	H	M	M	L	M	H	H	H
CO 2	M	H	M	H	H	H	M	M	L	M	H	H	H
CO 3	M	H	H	H	H	H	M	M	L	L	H	H	H
CO 4	M	H	H	M	H	H	M	L	L	L	H	H	H
CO 5	M	H	H	M	H	H	M	L	L	L	H	H	H
CO 6	M	H	M	H	H	H	H	H	L	M	H	H	H

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Project report, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-Ordinator: Dr. N. Ananth

ELECTIVE - II: DIGITAL ELECTRONICS

SEMESTER: VI **CODE: U16PH6:1**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course outcomes	Level	Unit Covered
CO1	Classify and convert the different types of number systems used in digital communication	**K2**	**I**
CO2	Apply Boolean laws and Karnaugh map to construct most simplified digital circuits	**K3**	**I, II**
CO3	Analyze different types of digital circuits using logical tools	**K4**	**III**
CO4	Asses the various sequential logical circuits for particular operation	**K5**	**IV**
CO5	Explain the architecture, organization and operation of the 8085 microprocessor.	**K5**	**V**
CO6	Develop assembly language programme to perform mathematical operations in 8085 microprocessor	**K6**	**V**

2. A. SYLLABUS

Unit -I: Number System and Logic Gates (14 hours)

Binary, octal, decimal and hexadecimal number system – conversion from one number system to another–BCD code – Excess 3 code – Gray code – subtraction by 1's and 2's complement. Boolean algebra – Basic laws of Boolean algebra – Duality theorem - De Morgan's theorem – Basic logic gates – NAND & NOR as universal gates.

Unit-II: Simplification of Boolean Expressions (14 hours)

Introduction to combinational logic circuits – SOP and POS forms of expressions – Minterms and Maxterms - Reducing Boolean expressions using Boolean laws – Karnaugh map – pairs, quads, octets – 2,3 and 4 variables – sum of products method – product of sum methods.

Unit-III: Combinational Logic System (15 hours)

Half adder – Full adder – Half subtractor – Full subtractor – BCD adder – BCD subtractor - Encoder – 8 line to 3 line encoder – 16 line to 4 line encoder Decoder – 3 line to 8 line decoder – 4 line to 16 line decoder - Multiplexer – 4 input data multiplexer – 8 input data multiplexer – Demultiplexer – 1 line to 2 line demultiplexer – 1 line to 4 line demultiplexer.

Unit-IV: Sequential Logic System (14 hours)

R-S flip-flop using universal gates – Clocked R-S flip-flop - D flip-flop – T flip-flop – J-K flip flop - Master-Slave J-K flip-flop - 3 bit register using flip-flop – Controlled Shift Register – Counters – Up Counters – Down Counters – Ring Counters – Mod-10 Counters.

Unit-IV: Microprocessors (15 hours)

8085 Microprocessor – architecture – Register – ALU – Instruction set – Addressing modes – Type of instruction – Assembly language programming – Programs for 8-bit addition, subtraction, multiplication, division, biggest and smallest from a given list – sum of N numbers – ascending and descending order.

B. TOPICS FOR SELF STUDY

1. 555 timer

https://www.iitr.ac.in/departments/PH/uploads/Teaching%20Laboratory/Electronics/8.%20Timer%20555_manual.pdf

2. Microcontroller, Arduino.

https://electronics.howstuffworks.com/microcontroller1.htm
https://www.arduino.cc/en/guide/introduction

C. TEXT BOOKS

1. Digital principle and Application, Malvino and Leach, Tata McGraw Hill, New Delhi, 1991
2. Digital Electronics, William H. Gothmann, Prentice Hall of India, New Delhi, 2006.
3. Microprocessor, B.Ram, DhanpatRai, New Delhi, 2007, Edn 2007.
4. Introduction to Integrated Electronics, Digital & Analog, V.Vijayendran, S.Viswnathan (Printers & Publishers) PVT., LTD. 2008.

D. REFERENCE BOOKS

1. Microprocessor Architecture Programming and Application with 8085/8085 A, Gaonkar, Wiley Eastern Ltd, London. 2000.
2. Digital Logic and Computer Design, Morris and Mano, Prentice-Hall, New Delhi, 1999.
3. Digital Computer Electronics, Albert Paul Malvino, McGraw Hill, New Delhi, 2000.

E. WEBLINKS

1. https://youtu.be/EGmreVQ-yNM
2. https://youtu.be/iXSXIJn_Xwc?list=PLm_MSClsnwm9hEIDpFfDnOEu-6kVnF4ug
3. https://youtu.be/zJ-LqeX_fLU
4. https://freevideolectures.com/course/4238/nptel-digital-electronic-circuits
5. https://nptel.ac.in/courses/108/105/108105132/
6. https://nptel.ac.in/courses/108/105/108105102/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic levels of transaction
I	**Number System and Logic Gates**		
1.1	Binary, octal, decimal and hexadecimal number system – conversion from one number system to	What are number systems? List the different types of number systems Convert one number system to another	**K2**
1.2	BCD code – Excess 3 code – Gray code	Explain the BCD / Excess 3 / Gray Code with examples	**K2**
1.3	Subtraction by 1's and 2's complement.	Subtract two numbers using 1's / 2's complement method	**K2**
1.4	Boolean algebra – Basic laws of Boolean algebra	What is Boolean algebra Explain the basic laws of Boolean algebra with truth tables	**K2**
1.5	Duality theorem - De Morgan's theorem	State and Prove Duality / De – Morgan's theorem	**K2**
1.6	Basic logic gates – NAND & NOR as universal gates.	Explain the various basic logic gates with their truth tables What is the specialty of universal gate Show that NAND / NOR is a universal gate Construct basic logic gates using NAND / NOR gate	**K3**

II	**Simplification of Boolean Expressions**		
2.1	Introduction to combinational logic circuits – SOP and POS forms of expressions – Minterms and Maxterms	What is a combinational circuit? Explain SOP / POS Compare SOP and POS	**K2**
2.2	Reducing Boolean expressions using Boolean laws	What is Boolean algebra? Simplification of expressions using Boolean Laws	**K3**
2.3	Karnaugh map – pairs, quads, octets – 2,3 and 4 variables	What do you understand by don't care condition Explain Karnaugh map method of solving expressions Simplification of Boolean expressions using K – map	**K3**
2.4	sum of products method – product of sum methods.	Describe sum of products / product of sum methods	**K2**
III	**Combinational Logic System**		
3.1	Half adder – Full adder	Design a half adder using basic logic gates / universal gates What is a full adder? Explain how a full adder is built using two half adder with a neat circuit diagram	**K3**
3.2	Half subtractor – Full subtractor	Design a half Subtractor using basic logic gates / universal gates What is a full subtractor? Explain how a full subtracter is built using two half subtractor with a neat circuit diagram	**K3**
3.3	BCD adder - BCD subtractor	Describe the condtruction and working of BCD adder / subtractor	**K4**

3.4	Encoder - 8 line to 3 line encoder – 16 line to 4 line encoder	What is an encoder? Construct 8 line to 3 line encoder /16 line to 4 line encoder with a neat circuit diagram	**K3**
3.5	Decoder – 3 line to 8 line decoder – 4 line to 16 line decoder	What is decoder? Construct 3 line to 8 line / 4 line to 16 line decoder with a neat circuit diagram Distinguish between encoder and decoder	**K4**
3.6	Multiplexer – 4 input data multiplexer – 8 input data multiplexer	What is the role of multiplexer in a computer? Explain the working of a 4 input data / 8 input data multiplexer	**K2**
3.7	Demultiplexer – 1 line to 2 line demultiplexer – 1 line to 4 line demultiplexer	What is the role of demultiplexer in a computer? Explain the working of a 4 input data / 8 input data demultiplexer Explain the difference between a demultiplexer and a decoder	**K4**
IV	**Sequential Logic System**		
4.1	R-S flip-flop using universal gates – Clocked R-S flip-flop	Define flip flops Explain the working of RS flip flop / clocked RS flip flop	**K2**
4.2	D flip-flop	Construct a D flip-flop and discuss its working Differentiate between D latch and D flip flop	**K4**
4.3	T flip-flop	Explain the working of T flip-flop and give the truth table	**K2**
4.4	J-K flip flop - Master-Slave J-K flip-flop	Explain the working of RS flip flop / clocked RS flip flop	**K5**

		What is racing in JK flip flop? Explain how it is solved in master slave flip flop	
4.5	3 bit register using flip-flop	Construct a 3 bit register using flip flop	**K3**
4.6	Controlled Shift Register	What are shift registers? List down the uses of a shift register Explain the working of a shift register using JK flip flop	**K2**
4.7	Counters – Up Counters – Down Counters – Ring Counters – Mod-10 Counters	Differentiate between asynchronous and synchronous counter Draw the circuit of a Up / Down / Ring counter and explain its working	**K5**
V	**Microprocessor**		
5.1	8085 Microprocessor – architecture – Register – ALU	Explain the architecture of 8085 microprocessor Describe the different types of registers built in 8085 microprocessor Write short notes on Arithmetic and Logic Unit (ALU)	**K2**
5.2	Instruction set – Addressing modes – Type of instruction	What is instruction set? Classify the different types of addressing modes of 8085 microprocessor Explain the types of instructions used in 8085 microprocessor	**K2**
5.3	Assembly language programming – Programs for 8-bit addition, subtraction, multiplication, division, biggest and smallest from a given list – sum of N numbers – ascending and descending order	Develop an assembly language program for 8-bit addition / subtraction, multiplication / division Develop an assembly language program to find the biggest and smallest number from a given list Develop an assembly language program to find	**K6**

		the sum of N numbers Develop an assembly language program to arrange the numbers in ascending and descending order	

4. MAPPING SCHEME (PO, PSO & CO)

U16PH6:1	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	H	M	H	M	-	L	L	L	H	H	M	M
CO2	H	H	M	H	M	L	-	L	L	H	H	M	L
CO3	H	H	H	M	-	L	-	L	L	H	M	-	L
CO4	H	H	M	H	H	L	M	L	L	H	H	H	-
CO5	H	M	H	-	L	-	M	L	L	H	L	M	-
CO6	H	M	M	M	H	-	L	L	L	H	H	M	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams I, II)
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator : Dr. D.Arivukarasan

ELECTIVE - II: CRYSTAL GROWTH AND THIN FILM PHYSICS

SEMESTER: IV **CODE: U16PH6:A**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. No.	Course Outcomes	Level	Unit Covered
CO1	Summarize the theory of nucleation and crystal growth.	**K2**	**I**
CO2	Discuss the significance of single crystals and list their applications	**K4**	**I**
CO3	Classify the different crystal growth techniques outline their principles and infer the advantages and disadvantages.	**K4**	**II,III**
CO4	Contrast different thin film coating techniques.	**K4**	**IV**
CO5	Explain thermodynamics and kinetics of thin film deposition process	**K2**	**V**
CO6	List the various applications of Thin films in different areas of physics.	**K4**	**V**

2. A. SYLLABUS

Unit -I: Basics of Crystal Growth **(15 Hours)**

Types of crystals - Nucleation – Different types of nucleation - Concept of formation of critical nuclei – Significance of single crystals – Oxide materials and its applications – Semiconducting materials and its applications – nonlinear materials and their applications

Unit-II: Crystal Growth Techniques (15 Hours)

Low Temperature solution growth technique

Solution - Solubility and super solubility – Expression of super saturation – Miers T-C diagram - Constant temperature bath and crystallizer - Seed preparation and mounting - Slow cooling and solvent evaporation methods (Basic concept only).

Gel Growth Technique:

Principle – Various types – Structure of gel (SMS: sodium metasilicate) – Importance of Gel – Experimental procedure – Advantages of gel method.

Unit-III: Other Crystal Growth Techniques **(15 Hours)**

Melt technique:

Bridgman technique - Basic process – Various crucibles design - Czochralski technique – Experimental arrangement – Growth process.

Vapour technique:

Physical Vapour Deposition – Chemical Vapour Deposition (CVD) – Chemical Vapour Transport (Basic concept only).

Unit-IV : Thin Film Deposition Techniques **(15 Hours)**

Introduction to Thin Film Deposition Techniques – Classification – Physical Methods – Electron Beam Evaporation - Reactive Sputtering – pulsed laser deposition - Chemical Methods – Chemical bath deposition - Spray Pyrolysis – Electro Deposition.

Unit-V: Applications **(15 Hours)**

Thin film – Thermodynamics and nucleation - Growth Kinetics of Thin Films – Crystal Growth process in thin films – Epitaxial growth of thin films (Basic concepts only) – Applications – Discrete resistive components – Resistors – Carbon thin films – Oxide and Nitride films – metal films – thermistor – strain gauge element – capacitor – Hall probe element – Active devices – micro electronics – Integrated circuits and other applications.

B. TOPICS FOR SELF STUDY

1. **Types of nucleation in thin films**
   https://nptel.ac.in/courses/113/104/113104075/

2. **Molecular beam epitaxy**
   https://nptel.ac.in/content/storage2/courses/115103039/module16/lec38/5.html

3. **Applications of crystals and thin films**
   https://nptel.ac.in/courses/104/106/104106093/
   https://nptel.ac.in/courses/118/102/118102003/

C. TEXT BOOKS

1. P. Santhana Raghavan and P. Ramasamy, Crystal Growth Processes and Methods, KRV Publication, Kumbakonam, 2001.
2. A. Goswami, Thin Film Fundamentals, New Age international (P) Ltd., New Delhi, 2013

D. REFERENCE BOOKS

1. G. Dhanraj, K. Byrappa, V. Prasad, Michael Dudley (Eds.), Handbook of Crystal Growth, Springer Heidelberg Dordrecht London New York, 2010.
2. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986)
3. M. Ohring, Materials Science of Thin Films: Deposition and Structure, 2e, Academic Press (An Imprint of Elsevier), 2002.
4. K. L. Chopra, Thin Film Phenomena, McGraw Hill, New York, 1990.

E. WEBLINKS

1. https://nptel.ac.in/content/storage2/courses/112108092/module2/lec08.pdf
2. https://nptel.ac.in/content/storage2/courses/103104045/pdf_version/lecture19.pdf
3. https://nptel.ac.in/courses/118/102/118102003/
4. https://nptel.ac.in/content/storage2/courses/118102003/downloads/module1.pdf

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of Transaction
I	**Basics of Crystal Growth**		
1.1	Nucleation	Recall the process of nucleation	**K1**
1.2	Different kinds of nucleation	Classify nucleation	**K2**
1.3	Formation of crystal nucleus	Examine the formation of nucleus	**K4**
1.4	Significance of single crystals	Infer the properties of single crystals	**K2**
1.5	Oxide materials and its applications	Discuss the properties of oxide materials and its applications	**K2**
1.6	Semiconducting materials and its applications	List the applications of semiconducting materials	**K3**

1.7	Nonlinear materials and their applications	Distinguish between linear and nonlinear materials and discuss their applications	**K4**
II	**Crystal Growth Techniques**		
Low Temperature solution growth technique			
2.1	Classification of crystal growth methods -	classify crystal growth methods	**K2**
2.2	Growth from low temperature solutions	List low temperature solution growth methods	**K4**
2.3	Solution - Solubility and super solubility –	Define solution, solubility and super solubility and differentiate between them	**K2**
2.4	Expression of super saturation	Derive the expression for super saturation	**K3**
2.5	Meir's T-C diagram	Analyze Meir's solubility diagram	**K4**
2.6	Constant temperature bath and crystallizer - Seed preparation and mounting -	Explain the constructional details and the working of Constant temperature bath	**K4**
2.7	Slow cooling and solvent evaporation methods.	Discuss slow cooling and solvent evaporation methods of crystal growth	**K2**
Gel Growth Technique:			
2.8	Principle, Various types	Explain the principle and various types of gel growth technique	**K1**
2.9	Structure of gel (SMS: sodium metasilicate) –	Discuss the structure of gel	**K2**
2.10	Importance of Gel – Experimental procedure – Advantages of gel method.	Explain the experimental procedure to grow crystals by gel growth technique List the importance and advantages of gel method	**K4**
III	**Other Crystal Growth Techniques**		
3.1	**Melt technique:** Bridgman technique - Basic process, Various crucibles design.	Explain the constructional details of Bridgman technique along with the various crucible design	**K4**

3.2	Czochralski technique - Experimental arrangement, Growth process.	Explain the experimental arrangement and growth process of Czochralski method	**K5**
	Vapour technique:		
3.3	Physical Vapour Deposition Chemical Vapour Deposition (CVD)	Compare the experimental design, growth process, advantages and limitations of physical and chemical vapour deposition methods	**K5**
3.4	Chemical Vapour Transport	Outline the process of chemical vapour transport	**K2**
IV	**Thin Film Deposition Techniques**		
4.1	Thin films	Define and classify thin films	**K1**
4.2	Introduction to vacuum technology method.	Illustrate the method of vacuum technology	**K2**
4.3	Deposition techniques	Categorize various deposition techniques under physical and chemical methods	**K4**
4.4	Physical methods: Electron Beam Evaporation, Reactive Sputtering and pulsed laser deposition.	Interpret the experimental design, coating process, advantages and limitations of various physical deposition methods	**K5**
4.5	Chemical Methods: Chemical bath deposition, Spray Pyrolysis and Electro Deposition.	Compare the experimental design, coating process, advantages and limitations of various physical deposition methods	**K5**
V	**Applications**		
5.1	Thin films	Define Thin Films	**K1**
5.2	Thermodynamics of nucleation	Identify the steps involved in nucleation	**K3**
5.3	Growth kinetics of Thin film	Interpret the film growth process in thin films	**K5**
5.4	Crystal growth process in thin films	Explain the crystal growth of thin films	**K5**

5.5	Applications : Discrete resistive components, Resistors, Carbon thin films, Oxide and Nitride films, metal films, thermistor, strain gauge element, capacitor, Hall probe element, Active devices, microelectronics, Integrated circuits and other applications.	List the various applications of Thin films in different areas of physics.	**K4**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH6: A	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO1	M	-	-	L	-	L	-	M	-	H	M	L	-
CO2	M	L	M	M	M	M	-	L	M	M	H	L	M
CO3	H	H	M	H	M	H	M	M	L	H	M	M	M
CO4	H	H	M	H	M	H	M	L	-	H	M	M	M
CO5	M	-	-	L	-	L	-	M	L	M	M	L	-
CO6	H	H	H	H	M	H	L	M	H	H	H	M	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Project report, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator : Mrs. H. Sirajunisha

ELECTIVE II: ENERGY PHYSICS

SEMESTER: IV **CODE: U20PH6: B**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course, the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Discuss the importance of solar energy	**K2**	**I**
CO2	Explain the importance of solar energy applications	**K2**	**II**
CO3	Apply the principles of electricity in design of solar photovoltaic system	**K3**	**III**
CO4	Outline the different types of wind energy conversion systems	**K2**	**IV**
CO5	Design a biogas energy conversion system	**K5**	**V**
CO6	Analyse the installation and applications of a OTEC system	**K4**	**V**

2. A. SYLLABUS

Unit – I: Fundamentals of Solar Energy **(15 Hours)**

The characteristics of sun – Solar constant – Electromagnetic energy spectrum – spectral distribution – Solar radiation on Earth's surface – solar radiation geometry – Types of Pyroheliometers – Angstrom's Pyroheliometres – Estimation of average solar radiation – Solar radiation on titled surfaces.

Unit – II: Solar Energy Applications **(15 Hours)**

Introduction – Physical principles of the conversion of solar radiation into Heat – Flat-Plate collectors – Collector Energy losses – Solar air heaters – concentrating collectors – focusing and non – focusing concentrators – Advantages and disadvantages of concentrating collectors over flat-plate collectors – Selective coating – Solar water heating – Space heating – Solar distillation – Solar furnace – Solar cooker – Solar Hydrogen.

Unit – III: Solar Energy Storage **(15 Hours)**

Solar pond – convecting and non-convecting solar ponds – Solar electric power conversion –Solar Photovoltaic – Solar cell Principles conversion efficiency and power output – A basic PV system for power generation – Applications –Advantages & disadvantages.

Unit – IV: Wind Energy **(15 Hours)**

Introduction – Basic principles of wind energy conversion – Basic components of WECS – Classification of WEC system – Types of windmills – horizontal and vertical models – Applications – Environmental aspects.

Unit – V: Biomass and Indirect form of Solar Energy **(15 Hours)**

Introduction – Biomass conversion technology – Biogas generation – Classification and types of biogas plants – constructions and design considerations – Tidal power – Wave Energy – Ocean Thermal Energy Conversion (OTEC) – open and closed cycles.

B. TOPICS FOR SELF STUDY

1.Solar radiation

http://ecgllp.com/files/3514/0200/1304/2-Solar-Radiation.pdf

2. Solar Photovoltaics

https://www.uprm.edu/aret/docs/Ch_5_PV_systems.pdf

3. Wind energy

https://www.witpress.com/Secure/elibrary/papers/9781845642051/9781845642051001FU1.pdf

C. TEXT BOOKS:

1. Non – Conventional Energy, G. D. Rai, 4th Ed., Khanna Publishers, New Delhi.

2. Solar EnergyUtilisation, G. D. Rai, Khanna Publications, New Delhi.

D. REFERENCE BOOKS:

1. Solar Energy – S. P. Sukhatme, Second Edition, Tata McGraw Hill, Publishing Company, Limited, New Delhi.

2. Solar Energy Engineering – Jui Sheng Hsieh, New Jersey, Prentice Hall, 1986.

.E. WEBLINKS

1. https://nptel.ac.in/courses/112/105/112105050/#
2. https://nptel.ac.in/courses/112/105/112105051/#

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Fundamentals of Solar Energy**		

1.1	The characteristics of sun – Solar constant	Explain solar constant	**K1**
1.2	Electromagnetic energy spectrum – spectral distribution	Discuss electromagnetic spectrum	**K2**
1.3	Solar radiation on Earth's surface – solar radiation geometry	Explain the importance of solar radiation	**K2**
1.4	Types of Pyroheliometers – Angstrom's Pyroheliometers	Describe the types of Pyroheliometers	**K1**
1.5	Estimation of average solar radiation – Solar radiation on titled surfaces	Define the basic concepts in solar radiation	**K1**
II	**Solar Energy Applications**		
2.1	Introduction – Physical principles of the conversion of solar radiation into Heat	Define the basic concepts in solar energy conversion	**K1**
2.2	Flat-Plate collectors – Collector Energy losses	Explain flat plate collectors	**K2**
2.3	Solar air heaters – concentrating collectors – focusing and non – focusing concentrators –	Explain the different solar concentrators and collectors	**K2**
2.4	Advantages and disadvantages of concentrating collectors over flat-plate collectors	Describe the advantages of concentrating collectors	**K2**
2.5	Selective coating	Summarize selective coating	**K2**
2.6	Solar water heating – Space heating – Solar distillation – Solar furnace – Solar cooker – Solar Hydrogen	Discuss the applications of solar energy	**K2**
III	**Solar Energy Storage**		
3.1	Solar pond – convecting and non-convecting solar ponds	Explain the classification of solar ponds	**K2**

3.2	Solar electric power conversion	Describe a solar PV power system	**K2**
3.3	Solar cell Principles conversion efficiency and power out put	Identify the different components of solar PV system	**K2**
3.4	A basic PV system for power generation – Applications – Advantages & disadvantages	Explain the advantages and disadvantages of a PV system	**K2**
IV	**Wind Energy**		
4.1	Introduction – Basic principles of wind energy conversion	Summarize a wind energy conversion system	**K2**
4.2	Basic components of WECS	Describe the basic components of WECS	**K2**
4.3	Classification of WEC system	Identify the type of WECS	**K2**
4.4	Types of windmills – horizontal and vertical models – Applications – Environmental aspects	Estimate the different parameters in a windmill system	**K2**
V	**Biomass and Indirect form of Solar Energy**		
5.1	Introduction – Biomass conversion technology	Explain a biomass conversion system	**K2**
5.2	Biogas generation	Analyze the installation of a biogas generation system	**K4**
5.3	Classification and types of biogas plants	Explain the different types of biogas plants	**K2**
5.4	Construction and design considerations	Describe the maintenance needed for a biogas plant	**K2**

5.5	Tidal power – Wave Energy – Ocean Thermal Energy Conversion (OTEC) – open and closed cycles	Summarize an OTEC system	**K2**

4. MAPPING SCHEME (PO, PSO & CO)

P21PH204	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	M	M	M	M	M	L	L	H	H	H	H
CO2	H	M	M	M	M	M	M	L	L	H	H	H	H
CO3	H	M	M	M	M	M	M	L	L	H	H	H	H
CO4	H	M	M	M	M	M	M	L	L	H	H	H	H
CO5	H	M	M	M	M	M	M	L	L	H	H	H	H
CO6	H	M	M	M	M	M	M	L	L	H	H	H	H

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Assignment, Seminar, Problem solving, Field visits
3. End Semester Examination

Indirect

1. Course - end survey

Course Co-ordinator : Dr. D. Goplakrishna

ELECTIVE – II: MATHEMATICAL METHODS FOR PHYSICISTS

SEMESTER : VI **CODE: U20PH6:C**

CREDITS: 5 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course, the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Evaluate the integral of complex numbers using de Moivre's theorem, integration of vectors, first order ordinary differential equations and definite integrals using gamma, beta functions	**K5**	**I, II, IV, V**
CO2	Apply Cauchy-Riemann conditions to test analyticity of complex function, row reduction to find rank of a matrix	**K3**	**I, III**
CO3	Outline the complex numbers, types and role of matrices in physics, Gamma and beta functions.	**K2**	**I, III,V**
CO4	Extend the separable method for the solution of first order ordinary differential equations and Gauss divergence theorem for volume integrals	**K2**	**II, IV**
CO5	Analyze initial value problem of ordinary differential equations with boundary conditions in physical problems	**K4**	**IV**
CO6	Construct characteristic equation from system of linear equations and Recursion relation of gamma function	**K3**	**III, V**

2. A. SYLLABUS

Unit-I: Complex analysis (15 hours)

Complex numbers, complex plane and their graphical representation –complex conjugate of a complex expression- Absolute value – de Moivre's theorem -Elementary functions of complex numbers: powers and roots, exponential and trigonometric functions – Functions of complex variables – Analyticity – Cauchy-Reimann conditions.

Unit-II: Vector analysis **(15 hours)**

Scalar and Vector fields – Directional derivatives – Level Surfaces – gradient of a scalar field – divergence of vector point function – curl or rotation of a vector point function – physical interpretation - Integration of a vector - The line integral – surface integral – volume integral – Gauss divergence theorem – physical interpretation.

Unit- III: Matrix theory **(15 hours)**

Real, symmetric and Hermitian matrices – Normal matrix – Triangular matrix– Orthogonal matrix –Unitary matrix –transpose -trace of a matrix- row reduction – rank of a matrix – determinant – linear dependence and independence - System of linear equations – cramer's rule – characteristic equation - Eigenvalue problems.

Unit- IV: Linear ordinary differential equations **(15 hours)**

Linear Ordinary differential equations – First order – solution by separable equations – Initial value problem – Theorem for initial value problem – Boundary conditions – Applications of differential equations –General solution of wave equation in one dimension – Newton's law of cooling – Rate of decay of radioactive materials.

Unit-V: Special functions **(18 hours)**

Gamma functions – Properties– Recursion relation– Gamma Functions for negative integers - Beta functions – properties - Relation between Beta and Gamma functions - Evaluation of definite integrals – Error function – Asymptotic series- Stirling's formula.

B. TOPICS FOR SELF STUDY

1. Complex Analysis – Problems with solutions

https://www.researchgate.net/publication/280722238_Complex_Analysis_Problems_with_solutions

2. Foundations of Mathematical Physics: Vectors, Tensors and Fields

https://www.roe.ac.uk/japwww/teaching/vtf_0910/vtf_0910.pdf

C. TEXT BOOKS:

1. Mary L Boas, Mathematical methods in physical sciences,John Wiley & Sons, New Delhi, 2015.
2. Sathya Prakash, Mathematical Physics 6e, Sultan Chand and Sons, New Delhi, 2014.
3. H.K. Dass, Mathematical Physics, S. Chand and Co. Ltd, New Delhi, 2003.

D. REFERENCE BOOKS:

1. L.A. Pipes and L.R. Harvill, Applied Mathematics for Engineers and Physicists, Mcgraw Hill, Singapore, 1985.
2. A.K. Ghatak, I.C. Goyal and A.J. Ghua, Mathematical Physics, Macmillan, New Delhi, 1995.
3. E. Kreyszig, Advanced Engineering Mathematics, John Wiley, New York, 1999.
4. A.W. Joshi, Matrices and Tensors in Physics, Wiley Eastern Ltd., New Delhi, 1975.

E. WEBLINKS

1. https://nptel.ac.in/courses/115/106/115106086/#
2. https://nptel.ac.in/courses/115/103/115103036/#

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of Transaction
I	**Complex analysis**		
1.1	Complex numbers, complex plane and their graphical representation	Recall Complex numbers, complex plane and their graphical representation	**K1**
1.2	complex conjugate of a complex expression and Absolute value	Evaluate complex conjugate of a complex expression, absolute value	**K3**
1.3	de Moivre's theorem- Elementary functions of complex numbers: powers and roots, exponential and trigonometric functions	Apply de Moivre's theorem to find powers and roots, exponential and trigonometric functions	**K4**
1.4	Functions of complex variables , Analyticity	Explain functions of complex variables, analyticity	**K2**
1.5	Cauchy-Reimann conditions	Verify analyticity using Cauchy-Reimann conditions	**K5**
II	**Vector calculus**		
2.1	Scalar, Vector fields and Directional derivatives	Explain Scalar, Vector fields and directional derivatives complex numbers	**K2**
2.2	Level Surfaces and the gradient of a scalar field	Apply gradient of a scalar field to test Level Surfaces	**K3**
2.3	Divergence, curl or rotation of a vector point function and their physical interpretation	Evaluate divergence, curl or rotation of a vector point function	**K5**
2.4	Integration of a vector: line, surface and volume integral	solve line, surface and volume integral	**K3**

2.5	Gauss divergence theorem, physical interpretation.	Solve integrals using Gauss divergence theorem	**K3**
III	**Matrix theory**		
3.1	Introduction to Matrix	Relate physical observables in matrix form	**K1**
3.2	Real, symmetric and Hermitian matrices, Normal matrix, Triangular matrix, Orthogonal matrix, Unitary matrix	Recall and Relate the types of matrices and their properties	**K2**
3.3	Transpose, trace, rank of a matrix	Find transpose and trace of a matrix the rank of matrix by row reduction method	**K3**
3.4	linear dependence and independence	Identify linear dependence and independence by finding determinant	**K5**
3.5	Cramer's rule	Apply Cramer's rule to find solution of equations	**K6**
3.6	Characteristic equation - Eigen values	Apply the concept of characteristic equation to find Eigen values	**K4**
IV	**Linear ordinary differential equations**		
4.1	Linear ordinary differential equations	Recall the form of differential equation	**K1**
4.2	Linear first order differential equations	Solve linear first order differential equations by separable method	**K3**
4.3	Theorem for initial value problem	Discuss theorem for initial value problem	**K2**
4.4	Boundary conditions, Applications of differential equations	Solve differential equations with boundary conditions	**K3**
4.5	General solution of wave equation in one dimension, Newton's law of cooling, Rate of decay of radioactive materials.	Apply boundary conditions to find the solution of wave equation in one dimension, Newton's law of cooling, Rate of decay of radioactive materials.	**K5**

V	Special functions		
5.1	Gamma functions – Properties– Recursion relation– Gamma Functions for negative integers	Describe Gamma functions, its Properties and Recursion relation Gamma Functions for negative integers	**K4**
5.2	Gamma Functions for negative integers	Solve Gamma Functions for negative integers	**K3**
5.3	Beta functions – properties	Explain Beta functions and its properties	**K2**
5.4	Relation between Beta and Gamma functions	Relate Beta and Gamma functions	**K3**
5.5	Evaluation of definite integral	solve integrals using Beta and Gamma functions	**K5**
5.6	Error function – Asymptotic series- Stirling's formula.	Discuss Error function, Asymptotic series, Stirling's formula.	**K4**

4. MAPPING SCHEME (PO, PSO & CO)

U20PH6: C	PO									PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	M	M	M	M	M	M	L	L	H	H	H	H
CO2	H	M	M	M	M	M	M	L	L	H	H	H	H
CO3	H	M	M	M	M	M	M	L	L	H	H	H	H
CO4	H	M	M	M	M	M	M	L	L	H	H	H	H
CO5	H	M	M	M	M	M	M	L	L	H	H	H	H
CO6	H	M	M	M	M	M	M	L	L	H	H	H	H

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Assignment, Seminar, Problem solving
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Dr. M. B. Jessie Raj

ELECTIVE - III : PROGRAMMING IN C

SEMESTER: VI **CODE: U16PH6:3**

CREDITS: 5 **NO OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the completion of this course the student will be able to:

CO.NO.	Course outcomes	Level	Unit Covered
CO1	Recall the basic structure of C program using constants, variables, datatypes and operators	**K1**	**I**
CO2	Demonstrate the conditional and looping statements to understand the concept of programming language	**K2**	**II**
CO3	Apply the concept of arrays, structures and union in solving problems	**K3**	**III**
CO4	Analyze and classify the different categories of user defined function in C	**K4**	**IV**
CO5	Explain the importance of pointer variables and various file operations	**K5**	**V**
CO6	Design and develop programs by applying all learned concepts to solve real time problems	**K6**	**V**

2. A. SYLLABUS

Unit-I: Introduction to C (15 hours)

Importance of C – Basic structure of C Program – Character set, Keywords and Identifiers – Constants – Variables – Data Types – Declarations of Variables – Assigning values to variables.

Operators and Expressions: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Comma Operators – Arithmetic expressions – Precedence and Associativity.

Unit-II: Control Structures (15 hours)

Input Output Operator: getchar, putchar, formatted output (printf) and formatted input (scanf).

Control Structure: Simple if statement – if else – Nesting of if else – if else ladder– switch - the break and continue statements – goto – while statement – do-while statement – for statement – Nesting of for statement – Jump in loops.

Unit-III: Arrays and Structures (15 hours)

Introduction – one dimensional array – two dimensional arrays – declaring arrays, storing arrays in memory – initializing arrays.

Structure definition – structure initialization – arrays within structure – structure within structure – structures and functions – unions.

Unit-IV: Functions (15 hours)

Introduction– need for function–form of function– return values and their types – calling a function– category of functions– No argument no return values – arguments but no return values – arguments with return values - Nesting of functions– recursion – function with arrays.

Unit-V: Files and Programs (15 hours)

Introduction to pointers – declaring pointer variables – initialization of pointer variables.

Files – definition, opening and closing of files -input/ output operations on files.

To write C programs for the following:

1. Arranging words in Alphabetical order
2. Percentage of marks for five subjects.
3. Conversion of Fahrenheit to Celsius.
4. Solving quadratic equation.
5. Finding factorial using recursion.
6. Addition / Multiplication / Subtraction of two matrices.
7. Smallest and largest element in an array.
8. Sorting a set of numbers in ascending/descending order.

B. TOPICS FOR SELF STUDY

Symbolic constants – Multidimensional arrays – String handling functions – Pointer to functions and array of pointers

C. TEXT BOOK

1. E. Balagurusamy, Programming in ANSI C, Tata McGraw Hill, New Delhi, 2016.

D. REFERENCES BOOKS

1. Byron S. Gottifried, Schaum's Outline of Theory and Problems of Programming with C, McGraw Hill, New Delhi, 2010.
2. Kr. Venugopal nd Sudeep R. Prasath, Programming with C, Tata McGraw Hill Publishing, New Delhi, 2016.

E. WEBLINKS

1. https://www.tutorialspoint.com/cprogramming/c_operators.htm
2. https://www.tutorialspoint.com/cprogramming/index.htm
3. https://www3.ntu.edu.sg/home/ehchua/programming/cpp/c1_Basics.html
4. https://beginnersbook.com/2014/01/c-tutorial-for-beginners-with-examples/
5. https://www.unf.edu/~wkloster/2220/ppts/cprogramming_tutorial.pdf

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Levels of transaction

I	**Introduction to C**		
1.1	Importance of C – Basic structure of C Program	Construct the structure of C program	**K3**
1.2	Character set, Keywords and Identifiers	Recall Character set, Keywords and Identifier	**K2**
1.3	Constants	Analyze the different types of Constants	**K4**
1.4	Declarations of Variables - Assigning values to variables	Define variable Explain the declaration / assigning values to variables	**K1** **K2**
1.5	Data Types	Categorize the types of datatypes.	**K4**
1.6	Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Comma Operators.	Discuss the types of C Operators with illustration.	**K6**
1.7	Arithmetic expressions – Precedence and Associativity.	Apply the rules of precedence and associativity in arithmetic expression.	**K3**
II	**Control Structures**		
2.1	Input Output Operator: getchar, putchar,	Illustrate getchar and putchar function	**K2**
2.2	Formatted output (printf)	Construct the printf statement in C program.	**K3**
2.3	Formatted input (scanf)	Analyze the importance of scanf statement with illustration	**K4**
2.4	Control Structure: Simple if statement – if else – Nesting of if else – if else ladder	Discuss the syntax and flowchart for all conditional if-statements with example.	**K6**
2.5	Switch statement	Defend the importance of break statement in switch statement with program	**K5**
2.6	break and continue statements - goto statement	Outline break and continue statement Explain goto statement	**K2** **K2**
2.7	while statement – do-while statement	Distinguish the while and do-while loop in its syntax, flowchart and program	**K4**

2.8	for statement	Analyze the importance of for-loop statement with a program	**K4**
2.9	nesting of for statement	Explain the nesting-of-for statement	**K2**
III	**Arrays and Structures**		
3.1	Arrays: Introduction - one dimensional array	Define array Construct one dimensional array with declaration, storing arrays in memory and initialization.	**K1** **K6**
3.2	Two dimensional array	Explain the storing of arrays and initialization in two dimensional array with example.	**K5**
3.3	Structure - Introduction	Define structure Compare array and structure	**K1** **K2**
3.4	Structure definition - Structure initialization	Outline the structure definition and structure initialization	**K2**
3.5	arrays within structure	Apply arrays within structure	**K3**
3.6	Structure within structure	Examine the different forms of structure within structure	**K4**
3.7	Structures and functions	Describe structure and functions	**K2**
3.8	Union	Define union Analyse the need of union in C programming	**K1** **K4**
IV	**Functions**		
4.1	Introduction – need for function	Recall function Discuss the need for function	**K1** **K2**
4.2	form of function	Outline the form of function	**K2**
4.3	Return values and their types	Categorize the types of return values	**K4**
4.4	Calling a function	Summarize function call	**K2**
4.5	Category of functions– No argument no return values – arguments but no return values – arguments with return values	Explain the categories of function depending on arguments	**K5**
4.6	Nesting of functions	Describe the nesting of function	**K3**

4.7	Recursion	Analyse the recursion function	**K4**
4.8	Function with arrays	Explain passing of arrays to function	**K2**
V	**Files and Programs**		
5.1	Introduction to pointers – declaring pointer variables – initialization of pointer variables.	Define pointer Explain the declaration and initialization of pointer variables.	**K1** **K2**
5.2	Files – definition, opening and closing of files - input/output operations on files	Define file Explain the input and output operations along with opening and closing of files	**K1** **K5**
5.3	Programs Arranging words in Alphabetical order	Create a program to arrange words in Alphabetical order	**K6**
5.4	Percentage of marks for five subjects. Conversion of Fahrenheit to Celsius. Solving quadratic equation. Finding factorial using recursion	Develop a C program to find the percentage of marks for five subjects Construct a program to convert Fahrenheit to Celsius Develop a C program to solve quadratic equation Construct a program to find factorial using recursion	**K3** **K3** **K3** **K3**
5.5	Addition / Multiplication / Subtraction of two matrices.	Create a program to find Addition / Multiplication / Subtraction of two matrices	**K6**
5.6	Smallest and largest element in an array.	Develop a C program to find the smallest and largest element in an array	**K6**
5.7	Sorting a set of numbers in ascending/descending order.	Design a C program to sort a set of numbers in ascending/descending order	**K6**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH6:3	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	H	M	H	H	H	M	M	L	M	H	H	H
CO2	M	H	M	H	H	H	M	M	L	M	H	H	H
CO3	M	H	H	H	H	H	M	M	M	L	H	H	H

CO4	M	H	M	H	H	H	M	M	L	L	H	H	H
CO5	M	M	H	H	H	H	M	M	L	L	H	H	H
CO6	M	H	M	H	H	H	H	H	H	M	H	H	H

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test(Model Exams I , II)
2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Dr. C. Indumathi

ELECTIVE-III: SPECTROSCOPY AND LASERS

SEMESTER: VI **CODE: U16PH6:D**

CREDITS: 5 **NO. OF HOURS / WEEK: 6**

1. COURSE OUTCOMES (CO)

After the completion of this course the student will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Explain the basic concept of spectroscopy and its types which includes Microwave, IR and Raman.	**K2**	**I - III**
CO2	Explain the fundamentals of lasers and its types.	**K2**	**IV & V**
CO3	Identify the characteristics of EM radiation and its application in the spectroscopic studies	**K3**	**I, II & III**
CO4	Identify the applications and levels of laser	**K3**	**IV & V**
CO5	Analyze the models of SHM and Rigid Rotor to study the rotation and vibration of molecules using IR and Raman spectroscopy and the energy levels for laser action in some selected types	**K4**	**II, III, IV & V**
CO6	Evaluate the energy of the vibrating and rotating molecules using IR and Raman spectroscopy and Einstein Coefficients for laser action and wavelength of the laser emitted in some selected types	**K5**	**I to V**

2. A. SYLLABUS

Unit-I: Introduction to Spectroscopy & MW Spectroscopy (13 Hours)

Electromagnetic spectrum – Characteristics of electromagnetic radiation – Basic elements of practical spectroscopy – Width of spectral lines – Intensity of spectral lines – Rotation of molecules – Rotational Spectra – The rigid diatomic molecule – The intensities of spectral lines – Techniques and Instrumentation (outline) – Chemical analysis by microwave spectroscopy.

Unit-II: Infrared spectroscopy (13 Hours)

The energy of a diatomic molecule – The simple harmonic oscillator – The diatomic vibrating rotator – The vibration – rotation spectrum of CO and CO_2 – The interaction of rotations and vibrations – Techniques and instrumentation (outline) – Double and single beam operation.

Unit-III: Raman Spectroscopy (13 Hours)

Raman effect – molecular polarizability – Pure rotational Raman spectra of linear molecules – Vibrational Raman spectra – Structure determination from Raman and IR spectroscopy – Techniques and instrumentation (outline).

Unit-IV: Fundamentals of Laser (13 Hours)

Basics of laser – Importance of Energy levels – Absorption and emission of light – Einstein's coefficients – Population inversion – Pumping methods – Active medium – Metastable states – Two and three level lasers – optical amplifier and resonator.

Unit-V: Types of lasers and applications (13 Hours)

He-Ne Laser – Carbon-di-oxide Laser – Excimer lasers – ND: YAG laser – Semiconductor lasers – Holography (construction and deconstruction) – Fibre optics.

B. TOPICS FOR SELF STUDY

1. Spectroscopy in everyday life
https://www.chemedx.org/activity/spectroscopy-everyday-life
2. IR Spectroscopy – A level home learning
https://www.tes.com/teaching-resource/infrared-ir-spectroscopy-a-level-home-learning-self-study-12315096
3. IR Spectroscopy of Biological Applications: An Overview
https://onlinelibrary.wiley.com/doi/abs/10.1002/9780470027318.a0208.pub2
4. Spectroscopy applications
https://www.news-medical.net/life-sciences/Spectroscopy-Applications.aspx
5. Practical applications of spectroscopy
https://reality-movement.org/some-practical-applications-of-spectroscopy-you-might-want-to-know/

C. TEXT BOOKS

1. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, New Delhi, 1993. **(Unit-1 to Unit-3)**
2. A. K. Ghatak and K. Thyagarajan, Lasers Theory and Applications, Macmillan, Chennai, 1981. **(Unit-4 & Unit-5)**

D. REFERENCE BOOKS

1. William T. Silfvast, Laser Fundamentals 2e, Cambridge University Press, London, 2004.
2. Donald LP, Gary ML, George SK, & James AV, Introduction to Spectroscopy, 5th Edition, Cengage Learning India Private Limited, 2015.
3. Banwell CN, & Mc Cash EM, Fundamentals of Molecular Spectroscopy, 4th Edition, Mc Graw Hill Education, 2017.
4. Thiyagarajan K, & Ajoy Ghatak, Lasers: Fundamentals and Applications (Graduate Text in Physics), 2nd Edition, Springer, 2011.
5. Sawhney GS, Laser systems and applications, 1st Edition, JBC Press, 2015.

E. WEBLINKS

1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview
2. https://nptel.ac.in/courses/104/106/104106075/
3. https://nptel.ac.in/courses/104/104/104104085/
4. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cy13/

3. **SPECIFIC LEARNING OUTCOMES (SLO)**

Unit/ Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level Of Transactio
I	**Introduction to Spectroscopy and Microwave Spectroscopy**		
1.1	Electromagnetic spectrum	Explain the various components of EM spectrum	**K2**
1.2	Characteristics of electromagnetic radiation	Identify the characteristics of EM radiation	**K3**
1.3	Basic elements of practical spectroscopy	Outline the elements of practical spectroscopy	**K2**
1.4	Width of spectral lines	Explain the width of spectral lines	**K2**
1.5	Intensity of spectral lines	Explain the intensity of spectral lines	**K2**
1.6	Rotation of molecules	Explain the rotation of molecules	**K2**
1.7	Rotational Spectra	Explain the rotational spectra	**K5**
1.8	The rigid diatomic molecule	Explain the rotation in a diatomic molecule bound together	**K5**
1.9	The intensities of spectral lines	Identify the intensities of spectral lines	**K3**
2.0	Techniques and Instrumentation (outline)	Outline the instrumentation techniques related to spectroscopy	**K2**
2.1	Chemical analysis by microwave spectroscopy	Explain the chemical analysis	**K2**
II	**Infrared spectroscopy**		
2.1	The energy of a diatomic molecule	Deduce the energy of diatomic molecule	**K5**
2.2	The simple harmonic oscillator	Analyze the SHM as the model for molecular vibration	**K4**
2.3	The diatomic vibrating rotator	Explain the rigid rotor model	**K5**

2.4	The vibration-rotation spectrum of CO and CO_2	Analyze the diatomic and simple polyatomic molecule	**K4**
2.5	The interaction of rotations and vibrations	Explain the rotation and vibration	**K2**
2.6	Techniques and instrumentation (outline)	Outline the instrumentation techniques related to IR spectroscopy	**K2**
2.7	Double and single beam operation	Identify the double and single beam operation	**K3**
III	**Raman Spectroscopy**		
3.1	Raman effect	Explain Raman effect	**K2**
3.2	Molecular polarizability	Explain the response of electron distribution to an externally applied field	**K5**
3.3	Pure rotational Raman spectra of linear molecules	Identify the scattering involving a change in the rotational quantum state	**K3**
3.4	Vibrational Raman spectra	Analyze the vibrational Raman spectra	**K4**
3.5	Structure determination from Raman and IR spectroscopy	Deduce the structure using Raman and IR Spectra	**K5**
3.6	Techniques and instrumentation (outline)	Outline the instrumentation techniques related to Raman spectroscopy	**K2**
IV	**Fundamentals of Laser**		
4.1	Basics of laser	Explain laser	**K2**
4.2	Importance of Energy levels	Analyse the energy levels	**K4**
4.3	Absorption and emission of light	Examine the absorption and emission of light	**K4**
4.4	Einstein's coefficients	Deduce the Einstein's coefficients	**K5**
4.5	Population inversion	Explain population inversion	**K2**
4.6	Pumping methods	Identify the methods to achieve population inversion	**K2**
4.7	Active medium	Explain the various mediums used in which population inversion is achieved	**K2**

4.8	Metastable states	Explain metastable state	**K2**
4.9	Two and three level lasers	Identify two and three level lasers	**K3**
4.10	Optical amplifier	Explain optical amplifier	**K2**
4.11	Optical resonator	Explain optical resonator	**K2**
V	**Types of lasers and applications**		
5.1	He-Ne Laser	Explain Helium-Neon laser	**K5**
5.2	Carbon-di-oxide Laser	Explain carbon di oxide laser	**K5**
5.3	Excimer lasers	Analyze excimer laser	**K4**
5.4	ND: YAG laser	Explain ND:YAG laser	**K5**
5.5	Semiconductor lasers	Analyze semiconductor laser	**K4**
5.4	Holography (construction and deconstruction)	Identify the application of laser in holography	**K3**
5.6	Fibre optics	Identify the application of laser in fiber optic	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH6:4	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	L	M	-	-	L	L	-	L	H	M	L	M
CO2	M	H	M	M	M	L	L	L	L	H	M	L	M
CO3	M	-	M	H	M	M	L	-	-	M	M	L	-
CO4	M	M	M	H	H	M	M	L	M	H	-	-	M
CO5	M	M	M	M	M	L	L	-	L	M	L	-	L
CO6	M	L	M	L	-	L	L	L	L	M	-	L	-

L- Low M-Moderate H-High

5. COURSE ASSESMENT METHODS

Direct

1. Surprise Class tests and Quizzes
2. Continuous Assessments (Two Internal Tests)
3. Group Discussions and Seminar Presentations
4. End Semester Examinations

In-Direct

1. Assignments and Industry/Field visits
2. Course end survey/Feedbacks

Course Co-ordinator: Dr. S.Franklin

ELECTIVE – III: NON-DESTRUCTIVE TESTING AND EVALUATION

SEMESTER: VI **CODE: U20PH6:E**

CREDITS: 5 **NO. OF HOURS / WEEK: 6**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO 1	Discuss Non-destructive testing methods for the detection of manufacturing defects of materials.	**K6**	**I**
CO 2	Infer Liquid penetrant Testing, Magnetic particle testing, testing procedures and results.	**K2**	**II**
CO 3	Explain Thermography, Eddy current -Principles, Techniques of liquid crystals, Eddy current testing, sensing elements and instrumentation.	**K5**	**III**
CO 4	Discuss Ultrasound testing's, Acoustic emission techniques principle and applications.	**K6**	**IV**
CO 5	Explain interaction of X-ray with matter and imaging.	**K2**	**V**
CO6	Explain Fluoroscopy, Xero-Radiography, Computed Radiography, Computed Tomography characteristics curves, penetrameters, Exposure charts.	**K2**	

2. A. SYLLABUS

Unit – I: General Idea of NDT **(13 Hours)**

Mechanical testing versus NDT- Overview of the Non-Destructive Testing- Methods for the detection of manufacturing defects as well as material characterization- merits and limitations-physical properties of materials and their applications in NDT- Visual inspection.

Unit - II: Surface NDE Methods **(13 Hours)**

Liquid Penetrant Testing – Principles- types and properties of liquid penetrants- developers- advantages and limitations of various methods- Testing Procedure- Interpretation of results- Magnetic Particle Testing-Theory of magnetism- inspection materials Magnetisation methods- Interpretation and evaluation of test indications- Principles and methods of demagnetization- Residual magnetism.

Unit – III: Thermography and Eddy Current Testing (ET) (13 Hours)

Thermography- Principles, Contact and non-contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications. Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations.

Unit – IV: Ultrasonic Testing (UT) and Acoustic Emission (AE) (13 Hours)

Ultrasonic Testing - Principle, Transducers, transmission and pulse-echo method- straight beam and angle beam, instrumentation- data representation, A/Scan, B-scan, C-scan- Phased Array Ultrasound, Time of Flight Diffraction- Acoustic Emission Technique – Principle- AE parameters- Applications

Unit -V Radiography (RT) (13 Hours)

Principle- interaction of X-Ray with matter- imaging- film and film less techniques- types and use of filters and screens- geometric factors- Inverse square- law- characteristics of films - graininess, density, speed- contrast- characteristic curves- Penetrameters- Exposure charts- Radiographic equivalence- Fluoroscopy- Xero-Radiography- Computed Radiography- Computed Tomography

B. TOPICS FOR SELF STUDY

1. **Non-destructive testing (NDT) at TWI**
   https://www.youtube.com/watch?v=tlE3eK0g6vU
2. **Thermography and Eddy Current Testing**
   https://www.youtube.com/watch?v=_gTkNS8WuQ4
3. **Acoustic Emission Testing**
   https://www.youtube.com/watch?v=FWO6-L0nePA
4. **Introduction to Radiology: Conventional Radiography**
   https://www.youtube.com/watch?v=tW2SjlMGj0Q

C. TEXT BOOKS

1.Basic of Non-Destructive Testing, Ari and Kumar.

2.Non-Destructive Testing Techniques, Ravi Prakash, New age International Publishers.

3.Non-Destructive Test and Evaluation of Materials, J. Prasad, C.G.K. Nair, Mc Graw Hill Publication.

D. REFERENCES BOOKS

1. Raj Baldev, Practical Non-Destructive Testing, Narosa Book Distributors (2009)

2. Magdalena Rucka, Non-Destructive Testing of Structures Hardcover, Mdpi AG Publication (2021).

E. WEBLINKS

1. https://archive.nptel.ac.in/courses/113/106/113106070/
2. https://onlinecourses.nptel.ac.in/noc20_mm07/preview

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
I	**Overview of NDT**		
1.1	NDT Versus Mechanical testing.	Compare NDT Versus Mechanical testing.	**K2**
1.2	The detection of manufacturing defects.	Evaluate manufacturing defects.	**K6**
1.3	Relative merits and limitation.	Explain the merits and limitation.	**K2**
1.4	Application of NDT	Identify the applications of NDT	**K3**
1.5	Visual inspection	Explain Visual inspection.	**K1**
1.6	physical properties of materials	Select various physical characteristics of materials.	**K5**
1.7	Inspection of material magnetization methods	Explain the Inspection of material in magnetization methods.	**K3**
1.8	Magnetization methods	Explain Magnetization methods.	**K2**
II	**Surface Non-Destructive Evaluation Methods (NDE)**		
2.1	Liquid penetrant Testing-Principles.	Evaluate Liquid penetrant Testing.	**K5**
2.2	Types and properties of liquid penetrants testing.	Explain the types and properties of liquid penetrants testing.	**K5**

2.3	Advantages and limitation of various methods	Discuss the Advantages and limitation of various methods.	**K3**
2.4	Liquid penetrant Testing. Testing procedures, Interpretation of results	Summarize Liquid penetrant Testing. Testing procedures and Interpret the results.	**K2**
2.5	Theory of magnetism	Explain theory of magnetism	**K4**
2.6	Inspection of material magnetization methods Interpretation and evaluation of test indication.	Describe the Inspection of material magnetization methods and explain the Interpretation and evaluation of test indication.	**K2**
2.7	Principle and method of demagnetization	Explain the Principle and method of demagnetization.	**K5**
2.8	Residual magnetism	Explain residual magnetism.	**K2**
III	**Thermography and Eddy Current Testing(ET)**		
3.1	Thermography-Principles	Explain the principle of thermography.	**K2**
3.2	Thermography-contact and non-contact inspection methods	Discuss Thermography-contact and non-contact inspection methods.	**K6**
3.3	Techniques of applying liquid crystals.	Choose techniques of applying liquid crystals.	**K5**
3.4	Infrared radiation and Infrared detector.	Explain Infrared radiation and Infrared detector.	**K5**
3.5	Eddy current testing and generation of Eddy current	Evaluate eddy current testing and explain generation of eddy current.	**K2**
3.6	Properties of Eddy current.	Summarize the Properties of Eddy current.	**K2**
3.7	Sensing element and probe.	Describe the Sensing element and probe	**K3**
IV	**Ultrasonic Testing (UT) and Acoustic Emission(AE)**		
4.1	Ultrasonic testing principle.	Explain Ultrasonic testing principle.	**K5**
4.2	Transducers	Design transducers and explain its working functions.	**K6**
4.3	Transmission and pulse - echo method	Discuss Transmission and pulse - echo method	**K6**
4.4	Data representation	Explain Data representation.	**K2**
4.5	Ultrasonic: A-Scan, B-Scan, C-Scan.	Interpret Ultrasonic: A-Scan, B-Scan, C-Scan.	**K5**

4.6	Phased array Ultrasound.	Explain Phased array Ultrasound	**K5**
4.7	Time of flight diffraction.	Estimate the Time of flight diffraction.	**K6**
4.8	Acoustic emission technique and parameters	Evaluate Acoustic emission technique and parameters.	**K5**
4.9	Ultrasound Applications.	List out the Ultrasound Applications.	**K4**
V	**Radiography**		
5.1	Principle of Radiography	Explain the Principle of Radiography.	**K2**
5.2	Radiography geometric factor characteristics of film-graininess, density, speed, contrast, penetrameters.	Distinguish Radiography geometric factor characteristics of film-graininess, density, speed, contrast, penetrameters.	**K4**
5.3	Interaction X-ray with matter.	Relate Interaction X-ray with matter.	**K1**
5.4	Radiography: imaging, film and filmless technique.	Inspect Radiography - imaging, film and filmless technique.	**K4**
5.5	Radiography: types and use of filters and screen.	Explain the use of filters and screen in Radiography.	**K2**
5.6	Radiography: characteristics curves.	Analyze the characteristics curve of Radiography.	**K4**
5.7	Radiography: Exposure charts.	Evaluate the Exposure charts in Radiography.	**K6**
5.8	Radiographic equivalence.	Explain Radiographic equivalence.	**K2**
5.9	Fluoroscopy.	Explain Fluoroscopy.	**K2**
5.10	Xero-Radiography.	Discuss Xero-Radiography.	**K6**
5.11	Computed Radiography.	Explain Computed Radiography.	**K5**
5.12	Computed Tomography.	Construct Computed Tomography.	**K6**

4. MAPPING SCHEME (PO, PSO & CO)

U20PH6: E	PO									PSO			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
CO1	H	H	H	L	H	M	M	L	M	H	H	H	H
CO2	H	M	M	H	H	M	H	M	L	H	H	H	H
CO3	M	L	H	M	M	H	M	M	M	H	M	H	H
CO4	H	M	M	H	H	H	H	M	M	H	H	M	H
CO5	H	M	L	H	H	L	M	L	M	M	H	H	H
CO6	H	M	H	H	H	M	L	M	L	H	H	H	H

L-Low M-Moderate H-High

5.COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test, Quizzes, Assignment, Seminar, Problem Solving, Slip test, Surprise test etc.
3. End Semester Examination

Indirect

1. Course-end survey/Feedback

Course co-ordinator: Dr. K. Vijayalakshmi

ELECTIVE - III: STATISTICAL METHODS

SEMESTER: VI **CODE: U20PH6:F**

CREDIT:5 **NO OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit covered
CO1	Analyse a representative subset of data points to identify patterns and trends in the larger data set being examined	**K4**	**I**
CO2	Utilize charts and graphs to display and interpret numerical data, functions, and other qualitative structures.	**K3**	**II**
CO3	Estimate the central tendency of the statistical data and how it is distributed.	**K5**	**II**
CO4	Facilitate comparative study of two or more frequency distribution regarding their shape and pattern.	**K5**	**III**
CO5	Examine the strength and direction of the linear relationship between a pair of observations.	**K4**	**IV**
CO6	Construct a curve or a mathematical function that has the best fit to a series of data points. Make predictions of underlying mechanisms which produced the data.	**K3**	**V**

2. A. SYLLABUS

Unit – I: Sampling **(15 hours)**

Sampling –methods of sampling – simple random sampling – stratified random sampling, systematic sampling and non-sampling error.

Unit – II: Fundamental concepts **(15 hours)**

Types of data-histogram and frequency polygon – rules for forming frequency distribution – relative and cumulative frequency distribution – class interval-size or width of class interval – means of an ungrouped data, grouped data with equal class interval, median, mode, standard deviation – individual observation, discrete series, continuous series – variance, Skewness – symmetrical distribution – asymmetrical distribution – positively skewed distribution – negatively skewed distribution – measures of skeweness – Karl Pearson measure of skewness, measures of kurtosis.

Unit – III: Physical Application of Probability **(15 hours)**

Probability – definition – axiomatic approach of probability – mathematical expectation – binomial distribution – properties of binomial distribution – constants of binomial distribution - importance of binomial distribution – fitting binomial distribution. Poisson distribution – constants-role of Poisson distribution – fitting Poisson distribution -Poisson distribution as an approximation to the binomial

distribution- normal distribution – definition-graph of normal distribution – relation between binomial, Poisson and normal distribution-properties of normal distribution – constants of normal distribution – area under the normal curve.

Unit – IV: Correlation Theory (15 hours)

Definition – linear correlation –methods – Karl Pearson coefficient of correlation – direct method of finding correlation coefficient. Spearman's rank correlation – ranks given, not given, equal ranks.

Unit – V: Linear and Non-linear functions (15 hours)

Curve fitting – methods of least squares – fitting a straight line, parabola, exponential and polynomial curves. Regression – Regression lines – Regression equation – Regression equation of Y on X – regression equation of X on Y.

B. TOPICS FOR SELF-STUDY

1.Poisson Distribution

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

2.Regression

https://www.youtube.com/watch?v=aq8VU5KLmkY

https://www.youtube.com/watch?v=ZkjP5RJLQF4

3.Skewness

https://www.youtube.com/watch?v=Gp6dqDLchbk

4.Correlation

https://www.youtube.com/watch?v=dsyTQNUvqH0

https://www.youtube.com/watch?v=4EXNedimDMs

C. TEXT BOOKS

1. Statistics Theory and Practice–R.S.N.Pillai, Bhagavathi and S. Chand and Co. Ltd. Seventh Revised Edition 2008

2. Elements of Mathematical Statistics – S. C. Gupta and V. K. Kapoor, Sultan Chand & Co., 2003.

3. Comprehensive Statistical Methods – P. N. Arora, S. Chand Co. Ltd., 2007.

D. REFERENCE BOOKS

1.Bansilal and Arora (1989). New Mathematical Statistics, Satya Prakashan, New Delhi.

2. Gupta. S.C. &Kapoor, V.K. (2002). Fundamentals of Mathematical Statistics, Sultan Chand & Sons Pvt. Ltd. New Delhi.

3. Goon A.M. Gupta. A.K. & Das Gupta, B. (1987). Fundamentals of Statistics, Vol.2, World Press Pvt. Ltd., Calcutta.

4. Kapoor, J.N. & Saxena, H.C. (1976). Mathematical Statistics, Sultan Chand and Sons Pvt. Ltd,

New Delhi.

5. Gupta S.P. (2014). Statistical Methods, Sultan Chand & Sons Pvt. Ltd. New Delhi.

E. WEBLINKS

1.https://onlinecourses.nptel.ac.in/noc20_ma22/preview

2.https://onlinecourses.swayam2.ac.in/cec21_ma01/preview

3.https://www.coursera.org/learn/stanford-statistics

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	**Course Content**	**Learning Outcomes**	**Highest Bloom's Taxonomic Levels Of Transaction**
I	**Sampling**		
1.1	Sampling	Define Population, Sample, size of the sample	**K1**
1.2	Methods of sampling	List all the Methods of sampling	**K2**
1.3	Simple random sampling	Elaborate Simple random sampling, merits and demerits	**K3**
1.4	Stratified random sampling	Explain Stratified random sampling, merits and demerits	**K2**
1.5	Systematic sampling	Explain Systematic sampling, merits and demerits	**K2**
1.6	Non-sampling error.	Discuss Non-sampling error.	**K2**
II	**Fundamental concepts**		
2.1	Types of data	Classify Types of data with examples.	**K1**
2.2	Histogram	Construct Histograms with equal and unequal class intervals for any given data.	**K4**
2.3	Frequency polygon	Draw a frequency polygon for the given data.	**K4**
2.4	Rules for forming frequency distribution	Recall the rules for forming frequency distribution	**K1**
2.5	Relative frequency distribution	Explain Relative frequency distribution	**K2**
2.6	Cumulative frequency distribution	Define Cumulative frequency distribution	**K2**
2.7	Class interval	Define Class interval	**K2**
2.8	Size or width of class interval	Describe Size or width of class interval	**K2**
2.9	Mean	Outline the properties, uses and limitations of Arithmetic mean	**K3**
2.10	Mean of grouped & ungrouped data with equal class interval	Calculate Mean of grouped & ungrouped data with equal class interval	**K4**

2.11	Median, Mode, Standard deviation	Find Median, Mode, Standard deviation for the given data	**K4**
2.12	Individual observation	State Individual observation	**K2**
2.13	Discrete series, Continuous series	Compare Discrete data and Continuous data with examples.	**K2**
2.14	Variance	Explain Variance with formula and examples.	**K2**
2.15	Skewness	Explain Skewness and its importance.	**K2**
2.16	Symmetrical distribution, Asymmetrical distribution	Distinguish Symmetrical and Asymmetrical distribution	**K3**
2.17	Positively skewed distribution, Negatively skewed distribution	Distinguish Positively skewed and Negatively skewed distribution	**K3**
2.18	Measures of skeweness	Find out the extent of skewness	**K3**
2.19	Karl Pearson measure of skewness	Calculate Karl Pearson coefficient of Skewness for the given data.	**K3**
2.20	Measures of kurtosis.	Measure the degree of peakedness of the hemp of the distribution.	**K4**
III	**Physical Application of Probability**		
3.1	Probability – definition	Define Probability	**K2**
3.2	Axiomatic approach of probability	Postulate the properties of Probability function	**K3**
3.3	Mathematical expectation	Explain Mathematical expectation	**K2**
3.4	Binomial distribution	Explain Binomial distribution	**K2**
3.5	Properties of binomial distribution	List the properties of binomial distribution	**K2**
3.6	Constants of binomial distribution	Recall the role of Constants of binomial distribution	**K2**
3.7	Importance of binomial distribution	List Importance of binomial distribution	**K2**
3.8	Fitting binomial distribution.	Fit a binomial distribution to the given data.	**K4**
3.9	Poisson distribution – constants	Explain Poisson distribution &constants	**K2**
3.10	Role of Poisson distribution	Recall the role of Poisson distribution	**K2**
3.11	Fitting Poisson distribution	Fit a Poisson distribution to the given data.	**K4**
3.12	Poisson distribution as an approximation to the binomial distribution		**K5**
3.13	Normal distribution	Define Normal distribution	**K2**
3.14	Graph of normal distribution	Explain the purpose of standardization of normal distribution	**K2**
3.15	Relation between binomial, Poisson and normal distribution	Relate binomial, Poisson and normal distribution	**K3**

3.16	Properties of normal distribution	Apply Poisson distribution as an approximation to the binomial distribution	**K2**
3.17	Constants of normal distribution	List Properties of normal distribution Recall the role of Constants of binomial distribution	**K2**
3.18	Area under the normal curve.	Elaborate the properties of Normal curve.	**K4**
IV	**Correlation Theory**		
4.1	Correlation	Define Correlation and its types	**K2**
4.2	Linear correlation	Explain &list the methods of Linear correlation	**K2**
4.3	Karl Pearson coefficient of correlation	Calculate coefficient of correlation using Karl Pearson method.	**K4**
4.4	Direct method of finding correlation coefficient.	Find coefficient of correlation using Direct method	**K3**
4.4	Spearman's rank correlation	Explain Spearman's rank correlation	**K2**
4.5	Ranks given and not given& equal ranks	Calculate the rank correlation coefficient between the pairs of observations when ranks given and not given & equal ranks.	**K4**
V	**Linear and Non-linear functions**		
5.1	Linear and Non-linear functions	Explain Linear and Non-linear functions	**K2**
5.2	Curve fitting	Examine the relationship between independent variables and dependent variable to define a best fit of the relationship.	**K5**
5.3	Methods of least squares	Outline the significance of Methods of least squares	**K3**
5.4	Fitting a straight line	Fit a straight line by the Methods of least squares	**K4**
5.5	Fitting a Parabola	Fit a Parabola by the Methods of least squares	**K4**
5.6	Exponential and Polynomial curves.	Fit exponential and polynomial curves by the Methods of least squares	**K4**
5.7	Regression	Define Regression	**K2**
5.8	Regression lines and equations	Explain briefly about regression lines and equations	**K2**
5.9	Regression equation of Y on X	Obtain linear regression of Y on X	**K3**
5.10	Regression equation of X on Y	Obtain linear regression of X on Y	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U20PH6:F	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	H	L	L	L	L	L	L	L	M	M	H
CO2	H	M	M	L	M	M	H	L	L	L	M	M	M
CO3	M	L	H	L	M	M	M	L	L	H	M	M	M
CO4	H	M	M	L	M	H	M	L	L	M	M	M	L
CO5	H	M	L	M	M	L	M	L	L	M	M	M	L
CO6	L	M	M	M	M	M	L	L	L	M	L	M	H

L- Low M-Moderate H-High

5.COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test, Quizzes, Assignment, Seminar, Problem Solving, Slip test, Surprise test etc.
3. End Semester Examination

Indirect

1. Course-end survey/Feedback

Course co-ordinator: Mrs. E. Shama Pearlin

SBEC - I: BIOPHYSICS AND BIOMEDICAL INSTRUMENTATION

SEMESTER: II **CODE: U16PH2S1**

CREDITS: 2 **NO. OF HOURS/WEEK: 2**

1. **COURSE OUTCOME**

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Infer the structure of amino acids, proteins, DNA and their types.	K4	I
CO2	Apply the concepts of electrical and electronics to design electrodes and transducers.	K3	II
CO3	Categorize various pre-amplifiers and different types of electrodes to analyze bio-signals.	K4	III

CO4	Analyze the working of various Bio-potential recorders.	**K4**	**IV**
CO5	Analyze the origin and acquisition of bio potentials and bioelectric signals such as ECG, EEG etc.,	**K4**	**IV**
CO6	Discuss the operation principles of pacemaker, defibrillator, nerve stimulators, kidney machines.	**K4**	**V**

2. **A. SYLLABUS**

Unit-I: Introduction to Biophysics (5 Hours)

Macromolecules: Introduction – Nucleic acid and chemical structure – Conformational possibilities of monomers and polymers – The double helical structure of DNA – Polymorphism of DNA – Amino acids and primary structures of proteins – The peptide bond and secondary structure of proteins

Unit-II: Bio-potential Sensors (Electrodes and Transducers) (5 Hours)

Basic design of medical instruments - Components of biomedical instrument system - Electrodes – Transducers

Unit-III: Biosignal Acquisition (5 Hours)

Introduction – Physiological signal amplifier – Isolation amplifier – Medical amplifier– Bridge amplifier – Current amplifier – Chopper amplifier – Biosignal analysis – Signal analysis and data acquisition

Unit-IV: Bio-potential Recorders (5 Hours)

Introduction - Characteristic of recording system - ECG, EEG, EMG, ERG, and EOG - block diagram, construction, working, application and limitations - Accuracy and analysis of medical instruments

Unit-V: Physiological assist devices (5 Hours)

Introduction – Pacemaker - Artificial heart valves – Defibrillators – Nerves and muscular stimulators – Heart- lung machine - Kidney machines

B. TOPICS FOR SELF STUDY

1. Double Helical Structure of DNA
(https://www.youtube.com/watch?v=4gFF1-VHHmk&t=15s)

2. Characteristics of transducers

(https://www.youtube.com/watch?v=3c_uDCnnBXc)

3. Electrooculography
(https://www.youtube.com/watch?v=AKz5ADkqONY)

4. Types of dialysis
https://www.youtube.com/watch?v=LAS9dC-E6mM)

C. TEXT BOOKS

1. Vasantha Pattabhi and N. Gautham, Biophysics, Kluwer Academic Publishers, New York, 2002. **(UNIT-I)**

2. M. Arumugam, Biomedical Instrumentation, Anuradha Publications, 2006. **(UNIT-II, III, IV, V)**

D. REFERENCE BOOKS

1. Joseph J. Carr and John M. Brown, Introduction to Biomedical Equipment Technology, Pearson Education, 2001.
2. Thomas E. Creighton, Proteins: Structures and Molecular properties, W.H. Freeman Publisher, 1993.
3. D. Kipke, Biomedical Instrumentation and Design Winter (Revised from M.O'Donnell), 2002.
4. Leonard Banaszak, Foundations of Structural Biology, Academic Press, 2000.

E. WEBLINKS

1. https://nptel.ac.in/courses/108/105/108105101/

2. https://onlinecourses.nptel.ac.in/noc21_ee17/preview

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic Level of transaction
I	**Introduction to Biophysics**		
1.1	Macromolecules: Nucleic acid structure the chemical structure of nucleic acids.	Classify the type of nucleic acids on the basis of chemical structures	**K4**

1.2	Conformational possibilities of monomers and polymers	Analyze the different structures of monomers and polymers in DNA	**K4**
1.3	The double helical structure of DNA	Analyze the double helical structure of DNA	**K4**
1.4	Polymorphism of DNA	Illustrate the properties of DNA based on the its different polymorphs	**K2**
1.5	DNA supercoiling and unusual DNA structures, the structure of transfer RNA	Outline the unusual and supercoiling structure of DNA Explain the structure of transfer RNA	**K2**
1.6	Protein structure - Amino acids and the primary structure of proteins.	Interpret the primary structure of proteins	**K2**
1.7	The peptide bond and secondary structure of proteins.	Explain the peptide and secondary structure of proteins	**K2**
II	**Bio-potential Sensors**		
2.1	Basic design of medical instruments - components of the bio medical instrument system.	Illustrate the components of bio medical instrument system	**K2**
2.2	Electrodes - Half cell potential, purpose of electrode paste.	Define the concept of half-cell potential Explain the purpose of electrode paste	**K2**
2.3	Characteristics of electrode material	Categorize the characteristics of electrode material	**K4**
2.4	Types of electrodes: microelectrodes, depth and needle electrodes, surface electrodes.	Classify the different types of electrodes on the basis of operation	**K4**
2.5	Transducers -Active and Passive transducers	Distinguish active and passive transducers	**K4**
2.6	Characteristics of transducers	Explain the characteristics of transducers	**K2**
2.7	Types of transducers	Compare the types of transducers based on their working principle	**K4**
III	**Biosignal Acquisition**		
3.1	Bio-signal acquisition.	Outline the parameters involved in bio-signal acquisition	**K2**

3.2	Physiological signal amplifiers	Explain the importance of Physiological signal amplifiers	**K2**
3.3	Types of amplifier-Isolation amplifier, Medical amplifier.	Compare and contrast the merits and limitations in various types of bio-signal amplifiers	**K4**
3.4	Bridge amplifier, Current amplifier.	Illustrate the working of bridge and current amplifiers	**K2**
3.5	Chopper amplifier.	Explain the functions of the chopper amplifiers	**K2**
3.6	Bio-signal analysis- Analog and digital methods, signal analysis.	Classify analog and digital method analysis	**K4**
3.7	Fourier methods on frequency analysis	Make use of Fourier methods on frequency analysis of biosignals	**K3**
3.8	Analysis of random signals, signal recovery and data acquisition.	Explain signal recovery and data acquisition	**K2**
IV	**Biopotential Recorders**		
4.1	Bio-potential recorders	Explain biopotential recorder	**K1**
4.2	Characteristics of the recording system,	Summarize the characteristics of the recording system	**K2**
4.3	Writer and pen damping systems.	Illustrate writer and pen damping systems	**K2**
4.4	Types of Bio-potential recorders: Block diagram, construction, working and applications.	Elaborate the construction and working of bio-potential recorders List the applications of bio- potential recorders	**K4**
4.5	Accuracy and analysis of medical instruments	Identify the limitations and accuracy of biopotential recorders	**K3**
V	**Physiological assist devices**		
5.1	Physiological assist devices-Pacemaker: energy requirements, methods of simulation	Analyze the energy requirements of pacemakers	**K4**
5.2	Different modes of operation.	Discuss the different modes of operation in pacemakers	**K4**

5.3	Artificial heart valves: Types, requirements, problems.	Interpret artificial heart valves and their types and requirements	**K2**
5.4	Defibrillators: Types	Classify the types of Defibrillators	**K2**
5.5	Defibrillators: construction and working.	Explain the construction and working of Defibrillators.	**K2**
5.6	Nerve and Muscle Stimulators-Different types of waveforms.	Analyze the different types of waveforms in nerve and muscular stimulators	**K4**
5.7	Heart lung machine: Structure and Function of heart.	Explain the working of Heart and Lung Machine	**K2**
5.8	Components of Extracorporeal circulation in modern cardiac surgery.	Analyze the components of modern cardiac surgery.	**K4**
5.9	Oxygenator and Gas exchange function in Artificial lungs.	Explain gas exchange function in artificial lungs.	**K2**
5.10	Kidney machine: Causes of Renal failure.	List the causes of renal failure. Discuss the principle and working of a dialysis machine Classify the types of dialysis	**K4**

4. MAPPING SCHEME (PO,PSO & CO)

U16PH2S1	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	L	L	M	L	M	L	L	L	L	L	L	L
CO2	H	M	M	H	L	M	L	L	L	H	L	M	L
CO3	M	L	M	M	L	M	L	L	L	H	H	L	L
CO4	M	M	L	H	L	M	L	L	L	M	H	M	L
CO5	M	L	L	M	L	M	L	M	L	L	L	L	H
CO6	H	H	M	L	M	M	L	M	L	L	L	M	H

L- Low M- Moderate H- High

5.COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Exams) I, II
2.Open book test; Assignment, Seminar, etc.,
3.End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Dr. R. Venkatesh

SBEC-II: CONCEPTS THROUGH ANIMATIONS

(THEORY AND PRACTICAL)

SEMESTER: V **CODE: U16PHP**

CREDITS: 2 **NO. OF HOURS/WEEK: 2**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Apply the basic tools of Flash, Photoshop and Adobe Premier software.	**K3**	**I, III, V**
CO2	Develop action scripts and record audio for the E-content	**K5**	**II, V**
CO3	Organize a new Photoshop and video files with multiple layer adjustments such as exploring, deleting and merging etc.	**K3**	**III, V**
CO4	Synchronize audio and video files as per the desired timeline.	**K5**	**I, II, V**
CO5	Edit audio and video files using appropriate tools	**K5**	**I, II, III, IV, V**
CO6	Create scientific content with essential animations using appropriate tools	**K6**	**I, II, V**

2. A. SYLLABUS

Unit-I: Animations with Flash (5 Hours)

Creating a new animation file – insertion of content in frames – add and delete frames and key frames – creating frame by frame animation – preview and testing of animation – create motion and path animations – usage of layers.

Unit-II: Enhancing animations (5 Hours)

Recording a sound file – editing a sound file – importing sound into an animation program – adding sound and text to animation – animating text - adding buttons to animation – action scripts to control an animation.

Unit-III: Introducing Photoshop 7.0 (5 Hours)

Introduction – opening and finding images – creating a new file – the tool box – options bar - Layers - Exploring layers - creating layers - deleting layers - renaming layers - linking layers – adjustment and merging layers – creating a type layer

Unit-IV: Creating images for web page with Photoshop (4 Hours)

Image dimensions – converting images – rotating and flipping the canvas – cropping using marquee - Drawing and Painting – Fore and background colour – lifting – using shape and line tools – using brush tool – using pencil tool – using paint bucket tool – using eraser tool.

Unit-V: Working with video using premier (4 Hours)

Capturing video from a camera – importing video from other digital sources – editing a video – adding effects – adding transitions – adding titles – adding audio tracks.

Unit-VI: Animation in Photoshop (2 Hours)

Recent advancement in the course - only for discussion – Unit 6 will not be included for examination

B. TOPICS FOR SELF-STUDY

1. Animation
   https://www.youtube.com/watch?v=HpiVYB-T7j4
2. Exploring 3D Photoshop
   https://www.youtube.com/watch?v=u5crxEaZHkY
3. Motion Capture
   https://www.youtube.com/watch?v=H6NaNydNAEc
4. Printing in Photoshop
   https://www.youtube.com/watch?v=2GaLODO7cGA

C. TEXT BOOKS

1. Daven Brown and et.al., Adobe – Web Development for the Designer, Macmillan, 1997.

2. S. Weixel, J. Fulton, K. Barkslade, C. B. Morse and B. Morse, Multimedia Basics, Eswar Press, Chennai, 2004.

3. Brigitta Hosea, Macromedia Flash 8, Focal press Elsevier, USA

D. WEBLINKS

1. https://www.education.ne.gov/wp-content/uploads/2017/07/basicanimationwithfash.pdf
2. https://helpx.adobe.com/in/animate/how-to/import-video.html
3. https://www.youtube.com/watch?v=wujHrMtCnp8
4. https://www.youtube.com/watch?v=Q3Wa09eZW3w
5. https://www.youtube.com/watch?v=EJjmxxJrMxI
6. https://www.youtube.com/watch?v=n9fwiNyDHLI
7. https://www.youtube.com/watch?v=epkIPcVGxFo

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomy Levels of Transaction
I	**Animations with Flash**		
1.1	Creating a new animation file, insertion of content in frames, add and delete frames and key frames, creating frame by frame animation	Outline the procedure for animation	**K2**
		Organize contents in the frames	**K3**
		Create frame by frame animations	**K6**
1.2	Preview and testing of animation, create motion and path animations, usage of layers.	Outline the procedue for testing	**K1**
		Make use of multiple layers of images to obtain animated GIF files	**K3**
		Create motion and path animations	**K6**
II	**Enhancing Animations**		
2.1	Recording a sound file, editing a sound file, importing sound into an animation program, adding sound and text to	Outline the procedure to edit a sound track	**K2**

	animation	Outline the method of mixing an audio track with a video	**K2**
		Compile an animated audio and video files	**K6**
2.2	Adding buttons to animation, action scripts to control an animation.	Explain the procedue to label buttons on an animated video	**K2**
		Develop an action script for animation control	**K6**
III	**Introducing Photoshop**		
3.1	Photoshop Introduction, Opening and finding images, creating a new file, tool box, option bar,	Explain the procedure for finding and importing image files in Photoshop software	**K2**
3.2	Exporting layers, creating layers, deleting layers, renaming layers, linking layers, adjustment and merging layers, creating A type layer.	Classify exporting, creating, deleting, renaming, linking, merging and A type layers	**K6**
IV	**Creating images for web page with Photoshop**		
4.1	Image dimensions, converting images, rotating and flipping the canvas, cropping using marquee, drawing and painting, fore and background colour, lifting – using shaping and line tools – using brush tool, using pencil tool, using paint bucket tool, using eraser tool	Create designs using image editing tools like rotate, flip, canvas, cropping etc	**K6**
		Design a web page for a project	**K2**
V	**Working with video using premier**		
5.1	Capturing, importing and editing video. Adding effects, transitions, titles and audio tracking.	Summarize the steps to capture a quality video	**K4**
		Create E-content using video editing tools and adding effects and transitions	**K6**

4. MAPPING SCHEME (PO, PSO& CO)

U16PHPS2	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO 2	PSO 3	PSO 4
CO1	H	H	-	L	L	-	L	L	-	L	M	H	L
CO2	L	L	L	M	L	M	M	L	L	L	L	L	L
CO3	M	L	L	M	-	L	L	L	-	M	L	L	L
CO4	L	L	L	L	L	L	M	-	L	L	M	L	L
CO5	M	L	L	M	-	L	M	L	-	L	L	M	L
CO6	M	L	L	L	L	L	L	L	L	L	L	L	L

L – Low M – Moderate H – High

5. **COURSE ASSESSMENT METHODS**

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Presentation, Project report, Poster preparation etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator: Dr. Ranjith Dev Inbaseelan

SBEC-III: WEB DESIGNING (THEORY AND PRACTICAL)

SEMESTER: VI **CODE: U16PHPS3**

CREDITS: 2 **NO. OF HOURS/WEEK: 2**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO 1	Develop HTML coding for webpage	K2	I
CO 2	Demonstrate and display HTML web site folders.	K3	II
CO 3	Design graphics and hyperlinks in web pages	K3	III
CO 4	Implement other software within the webpage using various methods.	K6	IV
CO 5	Create HTML functions to link different web pages	K6	V

CO 6	Create, edit, delete and manage different forms and fields in a website	**K6**	**V**

2. A. SYLLABUS

Unit-I: Creating a Webpage **(5 hours)**

Web organization – finding websites and webpages – display HTML source code – create HTML web site folders – view a webpage – modify a webpage – format text with HTML tags 2.8

Unit-II: Formatting and Linking Website Pages **(5 hours)**

Structure of website – centre text – add horizontal line to a webpage - changing font face – create hyperlinks on webpages – create a bulleted list – create a numbered list – create multi pages for a website

Unit-III: Animating Webpages **(5 hours)**

Change text colour – change background colour – experiment with website colours – change hyperlink colours – acquire and insert graphics – allign graphics relative to text – format a graphic as a hyperlink – change graphic border.

Unit-IV: Working in a Website Programme **(5 hours)**

Exploring the interface of website design and management software – design a new website – view a website – add pages to website – format web pages – link pages in a linear structure.

Unit-V: Publishing the Website **(5 hours)**

Presentation, interaction and information design – change background graphics and other properties of pages in a website – create a random axes navigation system – test hyperlinks and page properties – prepare and publish website.

Practical: Physics based experiments will be given on which the practical have to be done.

1. HTML program to print the detail of solar system using tables.
2. Webpage for form filling
3. Webpage to explain concepts using hyperlinks.
4. Webpage to explain concepts using animated picture, movie and sound.

B. TOPICS FOR SELF STUDY

1. Structure text and image content for the web using HTML5.
   https://www.youtube.com/watch?v=u7aE3WAoIcg
2. Create hyperlinks to link to other pages
   https://www.youtube.com/watch?v=GmzUr4Tdeb0
3. Preparation of conference event web page
   https://www.youtube.com/watch?v=IYIj9MM5EHc

C. TEXT BOOKS

1. C. Xavier, World Wide Web Design with HTML, McGraw Hill, 2001.
2. C. Xavier, Web Technology and Design, New Age International, 2007

D. REFERENCE BOOKS

1. Terry A. Morris, Basics of Web Design: HTML5 & CSS, 3 Addison-Wesley, 2012.
2. Jennifer T. Campbell, Web Design: Introductory, Cengage Learning, 2017.

E. WEBLINKS

1. https://nptel.ac.in/courses/106/105/106105084/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomy Level of Transaction
I	**Creating a Webpage**		
1.1	Web organization - Finding websites and webpages	Define and illustrate the organization of Website and web page.	**K2**
1.2	Display HTML source code	Recall and Relate the HTML source code for given web page.	**K2**
1.3	Creating HTML website folders,	Develop and Construct HTML folders	**K6**
1.4	View a webpage	Experiment with Web pages using HTML	**K4**
1.5	Modify a webpage	Experiment with Web pages using HTML	**K4**
1.6	Format text with different HTML tags	Build HTML code to Format text in a web page	**K6**
II	**Formatting and Linking Website Pages**		
2.1	Structure of a website	Summarize the contents of a website	**K2**
2.2	Centre text – add horizontal line to a webpage	Construct and Inspect the text using HTML Tags.	**K4**
2.3	Changing font face	Make use of HTML Tags to change font face of a text in a web page	**K4**

2.4	Create hyperlinks on webpages	Build hyperlinks on web pages using HTML	**K6**
2.5	Create a bulleted list - Create a numbered list - Create multi pages for a website	Design and Develop HTML codes for creating bullet, numbered and multi pages for a websites.	**K6**
III	**Animating Webpages**		
3.1	Change text colour- Change background colour- Change hyperlink colours	Modify the text, background and hyperlink colors in a web page.	**K6**
3.2	Acquire and insert graphics- Align graphics relative to text	Utilize the HTML tags to insert and align graphics in a web page.	**K6**
3.3	Format a graphic as a hyperlink- Change graphic border	Outline the de Broglie's theory of matter waves.	**K6**
IV	**Working in a Website Programme**		
4.1	Exploring the interface of website Design and management of software	Classify and explain website interface and management software's	**K2**
4.2	Designing a new website	Construct a website	**K6**
4.3	View a website and add pages to website	Choose suitable HTML codes to add pages to a website	**K6**
4.4	Format web pages - Link pages in a linear structure	Identify suitable commands to modify and link web pages	**K6**
V	**Publishing the Website**		
5.1	Presentation, interaction and information design	Explain the way to express information and interaction in a website	**K2**
5.2	Change background graphics and other properties of pages in a website	Compile HTML codes to change background graphics in a website	**K6**
5.3	Create a random access navigation system	Make up suitable codes to create tabs for random access in a website	**K6**
5.4	Test hyperlinks and page	Formulate HTML codes to test hyperlinks and webpage	**K6**

	properties	properties	
5.5	Prepare and publish website.	Design a website for: • HTML program to print the detail of solar system using tables. • Webpage for form filling • Webpage to explain concepts using hyperlinks. • Webpage to explain concepts using animated picture, movie and sound.	**K6**

4. MAPPING SCHEME (PO, PSO & CO)

U16PHPS3	**PO**									**PSO**			
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	H	H	M	M	L	H	M	L	L	M	H	L	M
CO 2	M	H	L	H	L	M	M	L	L	L	L	M	H
CO 3	M	L	L	H	L	M	L	L	L	M	L	H	H
CO 4	H	H	M	M	L	H	M	L	L	M	H	M	H
CO 5	M	L	M	H	L	H	L	L	L	M	M	H	H
CO 6	H	M	L	H	L	H	L	L	L	M	M	H	H

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I,II

2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Project report, Poster preparation, Problem solving etc.

3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co- ordinator: Dr. Sasikumar

NMEC-I: SIMPLE APPLIANCES

SEMESTER: III **CODE: U16PH3E1**

CREDITS: 2 **NO.OF HOURS/WEEK: 2**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Recall the basics of electricity	**K1**	**I**
CO2	Outline the risk factors and precautionary steps to avoid electric shock.	**K2**	**I**
CO3	Explain the types of electrical wiring & various heating appliances	**K2**	**II**
CO4	Outline the principles & working of moving coil instruments	**K2**	**III**
CO5	Explain the functioning of several home appliances	**K4**	**IV**
CO6	Apply electromagnetic theory to day to day electrical appliances.	**K3**	**V**

2. A. SYLLABUS

Unit-I: Safety Precaution **(5 Hours)**

Electricity – Basic principles - Practical unit of electricity - International system (S.I) of units – Electric shock – Precautions to avoid electric shock – Rescue steps in electric Shock – methods of resuscitation - Electric Line Circuit Breaker (ELCB).

Unit-II: Wiring **(5 Hours)**

Wiring system – Electric supply to house and factories – Types of wiring – ISI Rules – Megger testing – Earthing.

Electricity in house: Design for heating element – Electric iron, Table heater, Hot plate and Room heater.

Unit-III: Electrical Measuring Instruments **(5 Hours)**

Moving coil instruments – Voltmeter – Ammeter – Wattmeter – Kilowatt meter – Frequency meter – Multimeter.

Unit-IV: Electrical Appliances **(5 Hours)**

Cooling appliances – Electric fan – Refrigerator – Air Conditioner – Air cooler.

Other electrical appliances: Electric bell – Buzzer – Incandescent lamp – Fluorescent lamp – LED lamp – Halogen lamp – Reverse osmosis purifier – Washing machine – Solar powered street lights.

Unit-V: Electromagnetic application **(5 Hours)**

Basics of Electromagnetic theory – Solenoid – Electric motor (AC& DC) – Electric generator – transformer – Backup power suppliers (UPS, Invertors) - Induction stove.

B. TOPICS FOR SELF STUDY

1. Electricity and basic principle
   https://www.anixter.com/en_us/resources/literature/technical-references/the-basic-principles-of-electricity.html
2. Types of wiring
   https://www.dfliq.net/blog/electrical-house-wiring/
3. Reverse osmosis purifier
   https://www.freshwatersystems.com/blogs/blog/what-is-reverseosmosis
4. Transformer
   https://circuitglobe.com/what-is-a-transformer.html

C. TEXT BOOKS

1. M.L. Anwani, Basic Electrical Engineering, DhanpatRaiCo. Ltd., Delhi, 2014. (Unit 1-2)
2. William D. Cooper, Electrical Instruments and Measurement Techniques, Prentice Hall India, New Delhi, 1997. (Unit 3-5)

D. REFERENCE BOOKS

1. S.P. Bali, Consumer Electronics, Pearson Education, New Delhi, 2008.
2. B. L. Theraja and A. K. Theraja, A Textbook of Electrical Technology, S. Chand & Co., 2014.

E. **WEBLINKS**

https://www.esabna.com/euweb/mig_handbook/592mig6_2.htm

https://www.constellation.com/energy-101/electrical-safety-tips.html

https://nptel.ac.in/courses/112/105/112105129/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course content	Learning outcomes	Highest Bloom's Taxonomic level of transaction
I	**Safety Precaution**		
1.1	Electricity – Basic principles	Explain basic principles of electricity	**K2**

1.2	Practical unit of electricity - International system (S.I) of units	List the practical unit of electricity and International system (S.I) units	**K1**
1.3	Electric shock -Precautions to avoid electric shock	Analyze the causes for electric shock & precaution to avoid electric shock	**K4**
1.4	Rescue steps in electric Shock	Explain the rescue steps in electric shock & the measure to avoid it	**K2**
1.5	Methods of resuscitation	Explain the methods of resuscitations	**K2**
1.6	Electric Line Circuit Breaker (ELCB)	Summarize the working of Electric Line Circuit Breaker (ELCB) as a rescue measure from electric shock	**K2**
II	**Wiring**		
2.1	Wiring system – Electric supply to house and factories	Illustrate the wiring system and electric supply to house and factories	**K2**
2.2	Types of wiring	List the types of wiring	**K1**
	ISI Rules	Explain ISI rules for wiring	**K2**
2.3	Megger testing – Earthing	Make use of Megger testing to verify Earthing	**K3**
2.4	Electricity in house: Design for heating element	Illustrate the design of heating element	**K2**
2.5	Electric iron, Table heater, Hot plate and Room heater.	Explain the Electric iron, table heater and hot plate and room heater.	**K2**
III	**Electrical Measuring Instruments**		
3.1	Moving coil instruments – Voltmeter – Ammeter	Outline the construction of moving coil instruments (K2) Examine how a moving coil instrument serves as voltmeter & ammeter (K4)	**K4**
3.2	Wattmeter – Kilowatt meter – Frequency meter – Multimeter	Explain the principle & working of wattmeter/ kilowatt meter/ frequency meter / multimeter	**K2**
IV	**Electrical Appliances**		
4.1	Cooling appliances – Electric fan – Refrigerator – Air Conditioner – Air cooler.	Elaborate on the construction & functioning of cooling appliances/ electric fan/ Refrigerator/ Air Conditioner / Air cooler.	**K2**
4.2	Other electrical appliances: Electric bell – Buzzer – Incandescent lamp	Describe the functioning of electric bell/ Buzzer/ Incandescent lamp.	**K6**

4.3	Fluorescent lamp – LED lamp – Halogen lamp – Reverse osmosis purifier – Washing machine – Solar powered street lights	Analyze the role of choke in Fluorescent lamp/ LED lamp / Halogen lamp (K4) Outline the working of Reverse osmosis purifier / Washing machine / Solar powered street lights (K2)	**K4**
V	**Electromagnetic Application**		
5.1	Basics of Electromagnetic theory	Define electromotive force Explain electromagnetic induction	**K2**
5.2	Solenoid	Outline the theory of solenoid	**K2**
5.3	Electric motor (AC& DC) – Electric generator	Distinguish between ac & dc current (K4) Outline the principle of generator (K2) Examine the working of AC & DC motor and AC & DC generator (K4)	**K4**
5.4	Transformer	Explain principle of transformer (K2) Distinguish between step up & step down transformer (K4)	**K4**
5.5	Backup power suppliers (UPS, Invertors) - Induction stove.	Outline the principle of heating in induction stove	**K2**

4. MAPPING SCHEME (PO, PSO& CO)

U16PH3E1	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO 2**	**PSO3**	**PSO4**
CO1	M	L	L	L	-	-	L	-	-	M	-	M	L
CO2	L	-	-	L	-	L	L	-	-	H	L	M	H
CO3	L	L	L	M	L	L	L	M	M	M	-	L	L
CO4	M	-	-	L	-	L	L	L	L	M	L	M	L
CO5	L	L	-	L	-	-	L	-	L	L	-	L	L
CO6	M	L	L	M	L	L	-	L	-	L	-	L	L

L – Low M – Moderate H - High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test; Cooperative learning report, Assignment, Seminar, etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co – ordinator: Dr. Judith Jayarani.A

NMEC II: AUDIO AND VIDEO SYSTEMS

SEMESTER: IV **CODE: U16PH4E2**

CREDITS: 2 **NO.OF HOURS/WEEK: 2**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Outline the nature and production of sound waves	**K2**	**I**
CO2	Classify the different types of microphones and loudspeakers	**K2**	**II**
CO3	Compare the functioning of monochrome and colour television	**K4**	**III**
CO4	Explain the transmission and reception of digital signals in the communication system	**K3**	**IV**
CO5	Explain the operating principles of electronic display devices (LCD & LED)	**K2**	**V**
CO6	Outline the principle, instrumentation, working of audio and video system	**K4**	**II - V**

2. A. SYLLABUS

Unit-I: Characteristics of Sound **(5 hours)**

Nature of sound – Pressure and intensities of sound waves – Sensitivity of human ear for sound – Loudness and Phon – Frequency of sound waves – Pitch – Production of audio waveforms.

Unit- II :Audio System **(5 hours)**

Microphones: Characteristics of microphones – Requisites of a good microphone – Types of microphones – Moving coil microphone – Crystal microphone – Carbon microphone – Special microphone.

Loudspeakers: Characteristics of loudspeakers – Types of loudspeakers – Moving coil cone loudspeaker – Electrodynamic loudspeaker – Horn type loudspeaker – Multi-Way speaker system (Woofers and Tweeters).

Unit – III: Television (5 hours)

Monochrome Television: Introduction to television – Basic monochrome television system – Transmitter – Receiver – Television systems and standards – Television camera tubes – Videocon camera tube.

Colour Television:Colour Transmission and Reception – Colour combination – Three colour theory – Colour TV transmitter and receiver – Colour picture tube – CCTV.

Unit – IV: Digital Communication (5 hours)

Digital Television-Transmission and Reception: Digital system hardware, Signal quantizing and encoding, digital satellite television, Direct –To – Home (DTH) satellite television, Digital TV receiver, Merits of digital TV receivers, Digital Terrestrial Television (DTT).

Unit – V: Liquid Crystal Screen Television (5 hours)

LCD technology - LCD matrix types and operation - LCD screens for television - LED TV - Edge LEDs, Differences between LED and LCD displays.

B. TOPICS FOR SELF STUDY

1. Using audio and video for educational purposes

https://www.deakin.edu.au__data/assets/pdf_file/0003/179013/Modules_1-4_Using_audio_and_video_for_educational_purposes-2014-02-28.pdf

2. Audio System Engineering

https://www.youtube.com/watch?v=Qim3K57Th20&t=91s

3. The Setup: Building a Great Home Entertainment System

https://www.popularmechanics.com/technology/audio/a21987781/how-to-build-a-home-entertainment-system/

C. TEXT BOOKS

1. R. G. Gupta, Audio and Video Systems (Principles, Maintenance and Troubleshooting), Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002 (UNIT-I, II, III).
2. George Kennedy, Bernard Davis and S.R.M. Prasanna, Electronic Communication Systems, Tata McGraw Hill Publishing Company Limited, New Delhi, 2012 (UNIT-IV).
3. R.R. Gulati, Colour Television: Principles & Practice, New Age International Publisher, 2007 (UNIT-V).

D. REFERENCES BOOKS

1. R.R. Gulati, Modern Television Practice, New Age International Publishers, 2007.
2. A.M. Dhake, Television and Video Engineering 2e, McGraw Hill education Limited, 1999.
3. S.P. Bali and R. Bali, Audio Video Systems Principles, Practices and Troubleshooting, Khanna Publishing Company, 2014.
4. S.P. Bali, Consumer Electronics, Pearson Education, 2007.

E. WEBLINKS

1.https://www.udemy.com/course/acoustics-101-speaker-design-basics-and-enclosure-design/

2.https://ww.udemy.com/course/portable-speaker-design-make-you-own-bluetooth-speaker/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	**Course content**	**Learning Outcomes**	**Highest Bloom's Taxonomic Level of Transaction**
I	**Characteristics of Sound**		
1.1	Nature of sound – Pressure and intensities of sound waves	Explain the parameters related to sound	**K2**
1.2	Sensitivity of human ear for sound	Explain the sensitivity of human ear for sound (K2) Classify pleasant and unpleasant sounds (K2)	**K2**
1.3	Loudness and Phon – Frequency of sound waves – Pitch	Define loudness and Phon (K1) Explain the role of pitch in sound waves (K2)	**K2**

1.4	Production of audio waveforms.	Explain the production of audio waveforms	**K2**
II	**Audio System**		
2.1	Microphones: Characteristics of microphones	Explain the characteristics of microphone	**K2**
2.2	Requisites of a good microphone –	Outline the requisites of a good microphone	**K2**
2.3	Types of microphones – Moving coil microphone – Crystal microphone – Carbon microphone – Special microphone.	Classify the different types of microphones (K2) Explain the construction and working of Crystal / Carbon /Special Microphones (K2)	**K2**
2.4	Loudspeakers: Characteristics of loudspeakers	Explain the characteristics of loudspeakers	**K2**
2.5	Types of loudspeakers – Moving coil cone loudspeaker – Electrodynamic loudspeaker – Horn type loudspeaker – Multi-Way speaker system (Woofers and Tweeters)	Explain the construction and working of moving coil /Electrodynamic / Horn type / Multi-way loudspeakers (K2) Categorize the different types of loudspeakers (K4)	**K4**
III	**Television**		
3.1	Monochrome Television: Introduction to television	Outline the fundamentals of television	**K2**

3.2	Basic monochrome television system – Transmitter – Receiver – Television systems and standards –	Explain the basic monochrome television system (K2) Summarize the operating principles of monochrome transmitter and receiver (K2)	**K2**
3.3	Television camera tubes – Videocon camera tube.	Describe the construction and working of Videocon camera tubes	**K2**
3.4	Colour Television:Colour Transmission and Reception	Outline the fundamentals of colour television reception and transmission	**K2**
3.5	Colour combination – Three colour theory –	Explain the three colour theory (K2) Examine the additive and subtractive mixing of colours (K4)	**K4**
3.6	Colour TV transmitter and receiver –	Explain the working of colour television receiver and transmitter	**K2**
3.7	Colour picture tube –	Construct a colour picture tube based on three colour theory	**K3**
3.8	CCTV.	Explain the functioning of CCTV (K2) Utilize CCTV for varied applications (k3)	**K3**
IV	**Digital Communication**		
4.1	Digital Television-Transmission and Reception	Outline the fundamentals of transmission and reception in digital television	**K1**
4.2	Digital system hardware, Signal quantizing and	Explain the working of Digital system hardware, Signal quantizing and	**K2**

	encoding, digital satellite television,	encoding, digital satellite television	
4.3	Direct –To – Home (DTH) satellite television,	Demonstrate the functioning of Direct –To – Home (DTH) satellite television,	**K2**
4.4	Digital TV receiver, Merits of digital TV receivers,	Illustrate the advantages of digital TV receiver	**K2**
4.5	Digital Terrestrial Television (DTT).	Explain transmission and reception in Digital Terrestrial television	**K3**
V	**Liquid Crystal Screen Television**		
5.1	LCD technology - LCD matrix types and operation - LCD screens for television	Explain the LCD technology (K2) Describe the construction and working of LCD (K2)	**K2**
5.2	LED TV -Edge LEDs,	Describe the construction and working of LED	**K2**
5.3	Differences between LED and LCD displays.	Distinguish between LED and LCD displays	**K4**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH4E2	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO 1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	L	L	L	H	H	L	L	H	H	H	M
CO2	H	H	M	L	L	L	L	L	H	H	M	H	L
CO3	H	M	L	L	L	L	L	L	L	H	H	M	L
CO4	H	H	L	L	L	L	L	L	L	H	H	M	M
CO5	H	H	L	L	L	L	L	L	L	H	H	M	M
CO6	H	H	L	L	L	L	M	L	L	H	H	L	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test, Assignment, Quiz, Seminar, Group Presentation, Poster preparation, Problem solving etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co –ordinator: Dr. S. David Jereil

ALLIED PHYSICS I (FOR I B.Sc. MATHS)

MECHANICS, SOUND, THERMAL PHYSICS AND OPTICS

SEMESTER: I **CODE: U18PHY01**

CREDITS: 4 **NO. OF HOURS/WEEK: 4**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the student will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Deduce Centre of Gravity for different geometrical structures	**K4**	**I**
CO2	Measure the metacentric height of a ship with the knowledge of stability of floating bodies	**K5**	**I**
CO3	Investigate the acoustics of buildings and Simple Harmonic Motion (SHM)	**K4**	**II**
CO4	Determine the various elastic modulii of materials	**K5**	**III**
CO5	Estimate the thermal properties of solids and fluids.	**K5**	**IV**
CO6	Explain the principles of spectroscopy and the importance of fibre optic communication systems.	**K5**	**V**

2. A. SYLLABUS

Unit-I: Mechanics (12 Hours)

Centre of gravity – General formula- centre of gravity of a solid hemisphere – hollow hemisphere– solid cone – tetrahedron - stability of floating bodies – Meta centre – metacentric height – determination of metacentric height of a ship.

Unit-II: Sound, Ultrasonic and Acoustics (12 Hours)

Simple harmonic motion – composition of two simple harmonic motions along a straight line and at right angles to each other – Lissajou's figures and their applications.

Ultrasonic – production – Magnetostriction oscillator- properties– applications– Acoustics of buildings – Reverberation and Reverberation time - Sabine's formula – Factors affecting the acoustics of buildings.

Unit-III: Properties of Matter (12 Hours)

Stress – Strain – Hooke's law – Different moduli of elasticity – Young's modulus (E) – Rigidity modulus(G) – Bulk modulus(K) – Poisson's ratio – work done in linear, shearing and volume strain – Relation connecting elastic constants and Poisson's ratio – Bending of beams-bending Moment-Measurement of Young's modulus by non-uniform bending and Rigidity modulus by static torsion (Searle's apparatus) scale and telescope method.

Unit-IV: Thermal Physics (12 Hours)

Newton's law of cooling – verification of Newton's law of cooling – specific heat capacity of a liquid by cooling – Bomb calorimeter – Conduction – coefficient of thermal conductivity – good and bad conductors – Lee's disc method for bad conductors – Stefan's law of radiation – Solar constant – Angstrom's Pyrheliometer – Temperature of the Sun.

Unit-V: Optics and Spectroscopy (12 Hours)

Electromagnetic spectrum – spectral response to human eye – UV and IR Spectroscopy – Raman Effect – Explanation on the basis of quantum theory – Experimental arrangement – application of Raman Effect – Fibre Optic Communication– Introduction– optical fibre – numerical aperture – coherent bundle – fibre optic communication systems and their advantages.

B. TOPICS FOR SELF-STUDY

1. Moments of inertia of plane and circular disc area.:
   https://www.youtube.com/watch?v=nahs3iDvboY
2. Moment of force about a point and about an axis.
   https://nptel.ac.in/courses/105/104/105104160/

3. Fiber bend losses

   https://onlinecourses-archive.nptel.ac.in/noc17_ph01/preview

4. Thermodynamic laws.

   https://nptel.ac.in/courses/112/105/112105220/

C. TEXT BOOKS

1. R. Murugeshan, Properties of Matter, S. Chand and Co., New Delhi, 2004.
2. A. Sundaravelusamy, Allied Physics Paper – I, Priya Publications, 2012.

D. REFERENCES BOOKS

1. R. Murugeshan, Mechanics and Mathematical Methods, S. Chand & Co., 2014.

E. WEBLINKS

1. http://www.brainkart.com/article/Types-of-Moduli-of-Elasticity_6850/
2. https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_lissajous_figures.htm
3. https://ncert.nic.in/ncerts/l/kelm107.pdf
4. https://nptel.ac.in/courses/115/107/115107095/

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of Transaction
I	**Mechanics**		
1.1	Centre of Gravity	Define Centre of Gravity	**K1**
1.2	General formula for Solid hemisphere, Hollow hemisphere, Solid Cone and Tetrahedron	Identify the Centre of Gravity for different geometrical shapes.(K3)	**K3**
		Explain the Centre of gravity of solid hemisphere and hollow hemisphere. (K2)	
		Derive the expression for Centre of gravity of a solid cone and tetrahedron (K3)	
1.3	Stability of floating bodies	Explain Stability of floating bodies	**K2**
1.4	Meta Centre and metacentric height	Outline meta Centre and metacentric height.	**K2**
1.5	Determination of metacentric height of a ship	Measure the metacentric height of a ship	**K5**

II	**Sound, Ultrasonics and Acoustics**		
2.1	Simple Harmonic Motion (SHM)	Define Simple Harmonic Motion (K1)	**K2**
		Explain Simple Harmonic Motion (K2)	
2.2	Composition of two simple harmonic motions along a straight line and at right angles to each other	Evaluate the composition of two SHM along a straight line and at right angles to each other	**K5**
2.3	Lissajiou's figures and their applications	Outline Lissajiou's figure (K2)	**K2**
		List the application of Lissajou's figures (K1)	
2.4	Ultrasonics, Production	Define Ultrasonics (K1)	**K2**
		Summarize the methods of ultrasonic waves production (K2)	
2.5	Magnetostriction oscillator	Explain Magnetostriction oscillator	**K2**
2.6	Ultrasonic Properties, Applications	List the properties of Ultrasonic waves (K1)	**K2**
		Discuss the applications of Ultrasonic waves (K2)	
2.7	Acoustics of buildings, Reverberation and Reverberation time	Outline the reverberation and reverberation time	**K2**
2.8	Sabine's formula	Derive the Sabine's formula	**K3**
2.9	Factors affecting the acoustics of buildings	Inspect the parameters affecting the acoustics of buildings	**K4**
III	**Properties of Matter**		
3.1	Stress – Strain	Interpret Stress and Strain variation	**K2**
3.2	Hooke's law	Explain Hooke's Law	**K2**
3.3	Different moduli of elasticity Young's modulus, Rigidity modulus, Bulk modulus	Classify different types of moduli of elasticity	**K4**
		Deduce the relation between different types of elastic modulii	
3.4	Poisson's ratio	Define Poisson's ratio	**K1**
3.5	Work done in linear, shearing and volume strain	Estimate the work done in linear, shear and volume strain	**K5**

3.6	Relation connecting elastic constants and Poisson's ratio	Derive the relation between elastic constants and Poisson's ratio	**K4**
3.7	Bending of beams	Explain neutral axis and bending moment (K2)	
		Estimate the bending moment of a beam (K5)	**K5**
3.8	Measurement of Young's modulus by non-uniform bending	Determine the Young's modulus of a material by non-uniform bending	**K5**
3.9	Rigidity modulus by static torsion (Searle's apparatus) scale and telescope method	Determine the Rigidity modulus by static torsion setup	**K5**
IV	**Thermal Physics**		
4.1	Newton's law of cooling	Outline Newton's law of cooling	**K2**
4.2	Verification of Newton's law of cooling	Justify Experimentally the verification of Newton's law of cooling	**K5**
4.3	Specific heat capacity	Explain specific heat capacity at constant volume and constant pressure	**K2**
4.4	Specific heat capacity of a liquid by cooling -Bomb calorimeter	Determine the specific heat capacity of a liquid using Bomb calorimeter	**K5**
4.5	Conductors, Good and bad conductors	Distinguish between Good & bad conductors	**K4**
4.6	Lee's disc method for bad	Estimate the co-efficient of thermal conductivity of bad conductors by Lee's disc method	**K5**
4.7	Radiation, Stefan's law of radiation	Summarize Stefan's law of radiation	**K2**
4.8	Solar constant	Calculate the value of solar constant	**K3**
4.9	Angstrom's Pyrheliometer, Temperature of the Sun	Estimate the temperature of the Sun using Angstrom's Pyrheliometer	**K5**
V	**Optics and Spectroscopy**		

5.1	Electromagnetic spectrum	Describe electromagnetic spectrum	**K2**
5.2	Spectral response to human eye	Discuss the Spectral response to human eye	**K2**
5.3	UV and IR Spectroscopy	Distinguish between UV and IR Spectroscopy	**K4**
5.4	Raman effect explanation on the basis of quantum theory	Explain Raman effect on the basis of quantum theory	**K2**
5.5	Experimental arrangement	Sketch out the experimental arrangement to Raman effect study	**K2**
5.6	Application of Raman Effect	Utilize Raman effect to characterize different samples	**K3**
5.7	Fibre Optic communication-Introduction	Outline the principle of fibre optic communication	**K2**
5.8	Optical fibre, numerical aperture, coherent bundle	Explain the construction of optical fibre	**K4**
		Deduce an expression for numerical aperture	
5.9	Fibre optic communication systems and their advantages	Summarize fibre optic communication systems and their advantages	**K2**

4. MAPPING SCHEME (PO, PSO & CO)

U18PHY01	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	M	L	L	L	M	L	L	H	H	H	H
CO2	H	M	M	M	M	L	L	L	L	H	H	M	M
CO3	M	M	H	H	M	L	M	L	L	H	H	H	M
CO4	H	H	H	M	M	L	M	L	L	H	H	H	M
CO5	H	H	H	H	M	M	H	M	M	H	H	M	M
CO6	H	M	H	H	M	L	H	M	M	H	H	M	H

L-Low M-Moderate H- High

5 . COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II

2. Open booktest; Cooperative learning report, Assignment, Seminar, Group Presentation, Problem solving etc.

3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator: Mr. A. Krishnamoorthy

ALLIED PHYSICS I (FOR II B.Sc. CHEMISTRY)

MECHANICS, SOUND, THERMAL PHYSICS AND OPTICS

SEMESTER: III **CODE: U18PHY33**

CREDITS : 3 **NO. OFHOURS/WEEK: 4**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the student will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Deduce Centre of Gravity for different geometrical structures	**K4**	**I**
CO2	Measure the metacentric height of a ship with the knowledge of stability of floating bodies	**K5**	**I**
CO3	Investigate the acoustics of buildings and Simple Harmonic Motion (SHM)	**K4**	**II**
CO4	Determine the various elastic modulii of materials	**K5**	**III**
CO5	Estimate the thermal properties of solids and fluids.	**K5**	**IV**
CO6	Explain the principles of spectroscopy and the importance of fibre optic communication systems.	**K5**	**5V**

2. A. SYLLABUS

Unit-I: Mechanics **(12 Hours)**

Centre of gravity – General formula- centre of gravity of a solid hemisphere – hollow hemisphere– solid cone – tetrahedron - stability of floating bodies – Meta centre – metacentric height – determination of metacentric height of a ship.

Unit-II: Sound, Ultrasonic and Acoustics **(12 Hours)**

Simple harmonic motion – composition of two simple harmonic motions along a straight line and at right angles to each other – Lissajou's figures and their applications.

Ultrasonic – production – Magnetostriction oscillator- properties– applications– Acoustics of buildings – Reverberation and Reverberation time - Sabine's formula – Factors affecting the acoustics of buildings.

Unit-III: Properties of Matter **(12 Hours)**

Stress – Strain – Hooke's law – Different moduli of elasticity – Young's modulus (E) – Rigidity modulus(G) – Bulk modulus(K) – Poisson's ratio – work done in linear, shearing and volume strain – Relation connecting elastic constants and Poisson's ratio – Bending of beams-bending Moment-Measurement of Young's modulus by non-uniform bending and Rigidity modulus by static torsion (Searle's apparatus) scale and telescope method.

Unit-IV: Thermal Physics **(12 Hours)**

Newton's law of cooling – verification of Newton's law of cooling – specific heat capacity of a liquid by cooling – Bomb calorimeter – Conduction – coefficient of thermal conductivity – good and bad conductors – Lee's disc method for bad conductors – Stefan's law of radiation – Solar constant – Angstrom's Pyrheliometer – Temperature of the Sun.

Unit-V: Optics and Spectroscopy **(12 Hours)**

Electromagnetic spectrum – spectral response to human eye – UV and IR Spectroscopy – Raman Effect – Explanation on the basis of quantum theory – Experimental arrangement – application of Raman Effect – Fibre Optic Communication– Introduction– optical fibre – numerical aperture – coherent bundle – fibre optic communication systems and their advantages.

B. TOPICS FOR SELF-STUDY

1. Moments of inertia of plane and circular disc area.:
   https://www.youtube.com/watch?v=nahs3iDvboY
2. Moment of force about a point and about an axis.
   https://nptel.ac.in/courses/105/104/105104160/

3. Fiber bend losses

https://onlinecourses-archive.nptel.ac.in/noc17_ph01/preview

4. Thermodynamic laws.

https://nptel.ac.in/courses/112/105/112105220/

C. TEXT BOOKS

1. R. Murugeshan, Properties of Matter, S. Chand and Co., New Delhi, 2004.
2. A. Sundaravelusamy, Allied Physics Paper – I, Priya Publications, 2012.

D. REFERENCES BOOKS

1. R. Murugeshan, Mechanics and Mathematical Methods, S. Chand & Co., 2014.

E. WEBLINKS

1. http://www.brainkart.com/article/Types-of-Moduli-of-Elasticity_6850/
2. https://nptel.ac.in/courses/115/107/115107095/
3. https://www.tutorialspoint.com/electronic_measuring_instruments/electronic_measuring_instruments_lissajous_figures.htm
4. https://ncert.nic.in/ncerts/l/kelm107.pdf

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomic level of Transaction
I	**Mechanics**		
1.1	Centre of Gravity	Define Centre of Gravity	**K1**
1.2	General formula for Solid hemisphere, Hollow hemisphere,Solid Cone and Tetrahedron	Identify the Centre of Gravity for different geometrical shapes.(K3)	**K3**
		Explain the Centre of gravity of solid hemisphere and hollow hemisphere. (K2)	
		Derive the expression for Centre of gravity of a solid cone and tetrahedron (K3)	
1.3	Stability of floating bodies	Explain Stability of floating bodies	**K2**
1.4	Meta Centre and metacentric height	Outline meta Centre and metacentric height.	**K2**
1.5	Determination of metacentric height of a ship	Measure the metacentric height of a ship	**K5**

II	**Sound, Ultrasonics and Acoustics**		
2.1	Simple Harmonic Motion (SHM)	Define Simple Harmonic Motion (K1)	**K2**
		Explain Simple Harmonic Motion (K2)	
2.2	Composition of two simple harmonic motions along a straight line and at right angles to each other	Evaluate the composition of two SHM along a straight line and at right angles to each other	**K5**
2.3	Lissajiou's figures and their applications	Outline Lissajiou's figure (K2)	**K2**
		List the application of Lissajou's figures (K1)	
2.4	Ultrasonics, Production	Define Ultrasonics (K1)	**K2**
		Summarize the methods of ultrasonic waves production (K2)	
2.5	Magnetostriction oscillator	Explain Magnetostriction oscillator	**K2**
2.6	Ultrasonic Properties,Applications	List the properties of Ultrasonic waves (K1)	**K2**
		Discuss the applications of Ultrasonic waves (K2)	
2.7	Acoustics of buildings, Reverberation and Reverberation time	Outline the reverberation and reverberation time	**K2**
2.8	Sabine's formula	Derive the Sabine's formula	**K3**
2.9	Factors affecting the acoustics of buildings	Inspect the parameters affecting the acoustics of buildings	**K4**
III	**Properties of Matter**		
3.1	Stress – Strain	Interpret Stress and Strain variation	**K2**
3.2	Hooke's law	Explain Hooke's Law	**K2**
3.3	Different moduli of elasticity Young's modulus, Rigidity modulus, Bulk modulus	Classify different types of moduli of elasticity	**K4**
		Deduce the relation between different types of elastic modulii	
3.4	Poisson's ratio	Define Poisson's ratio	**K1**
3.5	Work done in linear, shearing and volume strain	Estimate the work done in linear, shear and volume strain	**K5**

3.6	Relation connecting elastic constants and Poisson's ratio	Derive the relation between elastic constants and Poisson's ratio	**K4**
3.7	Bending of beams	Explain neutral axis and bending moment (K2)	**K5**
		Estimate the bending moment of a beam (K5)	
3.8	Measurement of Young's modulus by non-uniform bending	Determine the Young's modulus of a material by non-uniform bending	**K5**
3.9	Rigidity modulus by static torsion (Searle's apparatus) scale and telescope method	Determine the Rigidity modulus by static torsion setup	**K5**
IV	**Thermal Physics**		
4.1	Newton's law of cooling	Outline Newton's law of cooling	**K2**
4.2	Verification of Newton's law of cooling	Justify Experimentally the verification of Newton's law of cooling	**K5**
4.3	Specific heat capacity	Explain specific heat capacity at constant volume and constant pressure	**K2**
4.4	Specific heat capacity of a liquid by cooling -Bomb calorimeter	Determine the specific heat capacity of a liquid using Bomb calorimeter	**K5**
4.5	Conductors, Good and bad conductors	Distinguish between Good & bad conductors	**K4**
4.6	Lee's disc method for bad	Estimate the co-efficient of thermal conductivity of bad conductors by Lee's disc method	**K5**
4.7	Radiation, Stefan's law of radiation	Summarize Stefan's law of radiation	**K2**
4.8	Solar constant	Calculate the value of solar constant	**K3**
4.9	Angstrom's Pyrheliometer, Temperature of the Sun	Estimate the temperature of the Sun using Angstrom's Pyrheliometer	**K5**
V	**Optics and Spectroscopy**		
5.1	Electromagnetic spectrum	Describe electromagnetic spectrum	**K2**
5.2	Spectral response to human eye	Discuss the Spectral response to human eye	**K2**

5.3	UV and IR Spectroscopy	Distinguish between UV and IR Spectroscopy	**K4**
5.4	Raman effect explanation on the basis of quantum theory	Explain Raman effect on the basis of quantum theory	**K2**
5.5	Experimental arrangement	Sketch out the experimental arrangement to Raman effect study	**K2**
5.6	Application of Raman Effect	Utilize Raman effect to characterize different samples	**K3**
5.7	Fibre Optic communication Introduction	Outline the principle of fibre optic communication	**K2**
5.8	Optical fibre, numerical aperture, coherent bundle	Explain the construction of optical fibre (K2)	**K4**
		Deduce an expression for numerical aperture (K4)	
5.9	Fibre optic communication systems and their advantages	Summarize fibre optic communication systems and their advantages	**K2**

4. MAPPING SCHEME (PO, PSO & CO)

U18PHY33	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	M	L	L	L	M	L	L	H	H	H	H
CO2	H	M	M	M	M	L	L	L	L	H	H	M	M
CO3	M	M	H	H	M	L	M	L	L	H	H	H	M
CO4	H	H	H	M	M	L	M	L	L	H	H	H	M
CO5	H	H	H	H	M	M	H	M	M	H	H	M	M
CO6	H	M	H	H	M	L	H	M	M	H	H	M	H

L-Low M-Moderate H- High

5.COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II

2. Open book test; Cooperative learning report, Assignment, Seminar, Group Presentation, Problem solving etc.

3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator: Mr. A. Krishnamoorthy

ALLIED PHYSICS II (FOR I B.Sc. MATHS)

ELECTRICITY, ATOMIC, NUCLEAR PHYSICS AND ELECTRONICS

SEMESTER: IV **CODE: U18PHY02**

CREDITS: 4 **NO. OF HOURS /WEEK: 4**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Explain Coloumb's theorem and the principle of capacitors.	**K2**	**I**
CO2	Assess effective current and voltage in electrical circuits using kirchoff's law and self and mutual inductance of the coils using principle of electromagnetic induction.	**K5**	**II**
CO3	Utilize X-ray diffraction technique to characterize the samples and identify the Quantum numbers based on vector atom model.	**K3**	**III**
CO4	Explain various nuclear models and the principle of particle detectors.	**K2**	**IV**
CO5	Classify solids based on band theory and categorize the semiconductors.	**K4**	**V**
CO6	Evaluate numerical equivalence between different number systems and simplified Boolean expression.	**K5**	**V**

2. A. SYLLABUS

Unit-I: Electrostatics (12 Hours)

Coloumb's theorem– Mechanical force on the surface of a charged conductor– Capacitors– Expression for capacitance of a capacitor–Principle of a capacitor– Energy of a charged capacitor– Loss of energy due to sharing of charges-Cylindrical capacitor-Spherical capacitor.

Unit-II: Electricity (12 Hours)

Kirchoff's Laws - Wheatstone bridge - Carey Foster's bridge – Determination of specific resistance – Laws of electromagnetic induction – expression for induced emf – self and mutual induction – Rayleigh's method of finding self-inductance of a coil – Determination of mutual inductance using BG - Coefficient of coupling – Eddy currents and its applications.

Unit-III: Atomic Physics (12 Hours)

Vector atom model – Pauli's exclusion principle– various quantum numbers – quantization of orbits - X–rays – continuous and characteristic X–rays–Moseley's law and its importance - Bragg's Law - Miller indices – Estimation of cell dimension using Laue method.

Unit-IV: Nuclear Physics (12 Hours)

Basic concepts - Binding energy-nucleus size, charge, mass, spin – nuclear models– liquid drop model– shell model - Particle detectors – cloud chamber – Bubble chamber – Photographic emulsion technique.

Unit-V: Electronics and Digital Electronics (12 Hours)

Band theory of solids-Types of Semiconductor-Intrinsic and Extrinsic-P-N junction diode-Biasing-Zener diode

Basic logic gates– AND, OR, NOT, NOR and NAND gates– Boolean algebra – Laws of Boolean algebra– De–Morgan's theorems– Verification using truth tables-Decimal, Binary, Octal, Hexadecimal number systems and their mutual conversion.

B.TOPICS FOR SELF STUDY

1. Applications of Capacitors
   https://www.elprocus.com/capacitors-types-applications

2. Principle of Transformer
   https://byjus.com/jee/transformer

3. Production of X-Ray
   https://www.radiologycafe.com/radiology-trainees/frcr-physics-notes/production-of-x-rays
4. Magic Numbers
   https://www.science.gov/topicpages/m/magic+numbers

5. Characteristics of P-N Junction diode
   https://byjus.com/physics/p-n-junction

C. TEXT BOOKS

1. Brij Lal and N. Subrahmanyam, Electricity and Magnetism, Palaniyappa, Chennai, 1974.

2. R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics 18e, S. Chand and Co., 2014.

3. V.K. Mehta and Rohit Mehta,Principles of Electronics 7e, S. Chand, New Delhi, 2005.

D. REFERENCE BOOKS

1. S.L. Gupta and V. Kumar, Hand Book of Electronics, Pragati Prakashan, Meerut, 1970.

2. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill, New Delhi, 1984.

E. WEBLINKS

1. https://en.wikipedia.org/wiki/Nuclear_physics
2. https://www.eia.gov/energyexplained/electricity/the-science-of-electricity.php
3. https://www.osti.gov/biblio/4379156-introduction-atomic-nuclear-physics-fifth-edition

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomy Level of Transaction
I	**Electro Statics**		
1.1	Coloumb's theorem	Explain Coloumb's theorem	**K2**
1.2	Mechanical force on the surface of a charged conductor	Derive the mechanical force on the surface of a charged conductor	**K3**
1.3	Capacitors	Recall Capacitors	**K1**
1.4	Expression for capacitance of a capacitor.	Derive the capacitance of a capacitor	**K3**
1.5	Principle of a capacitor	Explain the principle of a capacitor	**K2**
1.6	Energy of a charged capacitor	Determine the energy of a charged capacitor	**K5**
1.7	Loss of energy due to sharing of charges.	Determine the loss of energy due to sharing of charges.	**K5**
1.8	Cylindrical capacitors, Spherical capacitors	Determine the capacitance of cylindrical & Spherical capacitors	**K5**
II	**Electricity**		
2.1	Kirchoff's laws	State Kirchoff's laws	**K1**
2.2	Wheat stone bridge	Explain Wheat stones bridge	**K2**
2.3	Carey Foster's bridge	Explain Carey Foster's bridge	**K5**
2.4	Determination of specific resistance	Evaluate determination of specific resistance	**K5**
2.5	Laws of electromagnetic induction	State the laws of electromagnetic induction	**K1**
2.6	Expression for induced emf	Derive the expression for induced emf	**K1**
2.7	Self and mutual induction	Derive the expression for self-induction and mutual induction	**K4**
2.8	Rayleigh's method of finding self-inductance of a coil	Explain Rayleigh's method of finding self-inductance of a coil	**K2**
2.9	Determination of mutual inductance using BG	Determine the mutual inductance using BG	**K5**
2.9.1	Coefficient of coupling	Derive the expression for coefficient of coupling	**K2**
2.9.2	Eddy currents and its	Explain Eddy currents and its	**K5**

	applications	applications	
III	**Atomic Physics**		
3.1	Vector atom model	Explain Vector atom model	**K2**
3.2	Pauli's exclusion principle	State Pauli's exclusion principle	**K1**
3.3	Various quantum numbers	Classify Various quantum numbers	**K2**
3.4	Quantization of orbits	Outline the Quantization of orbits	**K5**
3.5	X-rays	Recall X-rays	**K1**
3.6	Continuous and characteristic x-rays	Explain Continuous and characteristic x-rays	**K5**
3.7	Moseley's law and its importance	Explain Moseley's law and its importance	**K2**
3.8	Bragg's law	State Bragg's law	**K1**
	Miller indices	Explain Miller indices	**K2**
3.9	Estimation of cell dimension using Laue method	Estimate the cell dimension using Laue method	**K5**
IV	**Nuclear Physics**		
4.1	Nucleus basic concepts	Explain the basic concepts of nucleus	**K2**
4.2	Binding energy	Define Binding energy	**K1**
4.3	Nucleus size, charge, mass, spin	Recall Nucleus size, charge, mass, spin	**K1**
4.4	Nuclear models - Liquid drop model, shell model	Explain - Liquid drop model/ shell model	**K2**
4.5	Particle detectors	Compare Particle detectors	**K2**
4.6	Cloud chamber	Explain Cloud chamber	**K5**
4.7	Bubble chamber	Explain Bubble chamber	**K5**
4.8	Photographic emulsion technique	Analyze Photographic emulsion technique	**K4**
V	**Electronics and Digital Electronics**		
5.1	Band theory of solids	Explain Band theory of solids	**K2**
5.2	Types of semiconductor - intrinsic and extrinsic	Classify the types of semi-conductor	**K2**
5.3	P-N junction diode - Biasing	Explain the biasing of P-N junction diode	**K2**
5.4	Zener diode	Discuss the Zener diode	**K3**
5.5	Basic logic gates	Classify Basic logic gates	**K2**
5.6	AND, OR, NOT, NOR, and NAND gates	Compare AND, OR, NOT, NOR, and NAND gates	**K4**
5.7	Boolean algebra	Apply Boolean algebra to solve logic problems	**K3**
5.8	Laws of Boolean algebra	Illustrate the laws of Boolean algebra	**K2**
5.9	De-Morgon's theorems - verification using truth tables	Make use of De-Morgon's theorems to verify truth tables	**K3**
5.9.1	Decimal, binary, octal, Hexadecimal numbers	Analyze the mutual conversion of Decimal, binary, octal and	**K4**

	systems and their mutual conversion	hexa decimal number systems and their mutual conversion	

4. MAPPING SCHEME (PO, PSO& CO)

U18PHY02	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	L	M	L	H	M	L	-	-	H	L	L	M
CO2	H	H	H	L	H	M	M	-	-	H	L	L	M
CO3	H	M	M	L	M	L	L	-	-	M	L	L	L
CO4	H	M	M	L	L	L	L	-	-	H	L	L	M
CO5	H	L	L	L	L	L	L	-	-	M	L	L	L
CO6	H	M	H	H	H	M	M	-	-	H	H	H	H

L-Low M-Moderate H-High

5. COURSE ASSESMENT METHODS

Direct

1. Continuous Assessment Test (Model exams) I,II
2. Open book test; Cooperative learning report, assignment, seminar, group presentation, Project report, poster preparation, Problem solving etc.

Indirect

1. Course-end survey

Course Co-ordinator: Mr. T. Yesudoss

ALLIED PHYSICS II (FOR II B.Sc. CHEMISTRY)

ELECTRICITY, ATOMIC, NUCLEAR PHYSICS AND ELECTRONICS

SEMESTER: IV **CODE: U18PHY44**

CREDITS: 4 **NO. OF HOURS/WEEK: 4**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Unit Covered
CO1	Explain Coloumb's theorem and the principle of capacitors.	**K2**	**1**
CO2	Assess effective current and voltage in electrical circuits using kirchoff's law and self and mutual inductance of the coils using principle of electromagnetic induction.	**K5**	**II**
CO3	Utilize X-ray diffraction technique to characterize the samples and identify the Quantum numbers based on vector atom model.	**K3**	**III**
CO4	Explain various nuclear models and the principle of particle detectors.	**K2**	**IV**
CO5	Classify solids based on band theory and categorize the semiconductors.	**K4**	**V**
CO6	Evaluate numerical equivalence between different number systems and simplified Boolean expression.	**K5**	**V**

2. A. SYLLABUS

Unit-1: Electrostatics (12 Hours)

Coloumb's theorem– Mechanical force on the surface of a charged conductor– Capacitors– Expression for capacitance of a capacitor–Principle of a capacitor– Energy of a charged capacitor– Loss of energy due to sharing of charges-Cylindrical capacitor-Spherical capacitor.

Unit-2: Electricity (12 Hours)

Kirchoff's Laws - Wheatstone bridge - Carey Foster's bridge – Determination of specific resistance – Laws of electromagnetic induction – expression for induced emf – self and mutual induction – Rayleigh's method of finding self-inductance of a coil – Determination of mutual inductance using BG - Coefficient of coupling – Eddy currents and its applications.

Unit-3: Atomic Physics (12 Hours)

Vector atom model – Pauli's exclusion principle– various quantum numbers – quantization of orbits - X–rays – continuous and characteristic X–rays–Moseley's law and its importance - Bragg's Law - Miller indices – Estimation of cell dimension using Laue method.

Unit-4: Nuclear Physics (12 Hours)

Basic concepts - Binding energy-nucleus size, charge, mass, spin – nuclear models– liquid drop model– shell model - Particle detectors – cloud chamber – Bubble chamber – Photographic emulsion technique.

Unit 5: Electronics and Digital Electronics (12 Hours)

Band theory of solids-Types of Semiconductor-Intrinsic and Extrinsic-P-N junction diode-Biasing-Zener diode

Basic logic gates– AND, OR, NOT, NOR and NAND gates– Boolean algebra – Laws of Boolean algebra– De–Morgan's theorems– Verification using truth tables-Decimal, Binary, Octal, Hexadecimal number systems and their mutual conversion.

B.TOPICS FOR SELF STUDY

1. Applications of Capacitors
   https://www.elprocus.com/capacitors-types-applications

2. Principle of Transformer
   https://byjus.com/jee/transformer

3. Production of X-Ray
   https://www.radiologycafe.com/radiology-trainees/frcr-physics-notes/production-of-x-rays
4. Magic Numbers
   https://www.science.gov/topicpages/m/magic+numbers

5. Characteristics of P-N Junction diode
   https://byjus.com/physics/p-n-junction

C. TEXT BOOKS

1. Brij Lal and N. Subrahmanyam, Electricity and Magnetism, Palaniyappa, Chennai, 1974.

2. R. Murugeshan and Kiruthiga Sivaprasath, Modern Physics 18e, S. Chand and Co., 2014.

3.V.K. Mehta and Rohit Mehta,Principles of Electronics 7e, S. Chand, New Delhi, 2005.

D. REFERENCE BOOKS

1. S.L. Gupta and V. Kumar, Hand Book of Electronics, Pragati Prakashan, Meerut, 1970.

2. R.P. Jain, Modern Digital Electronics, Tata McGraw Hill, New Delhi, 1984.

E. WEBLINKS

1. https://en.wikipedia.org/wiki/Nuclear_physics
2. https://www.eia.gov/energyexplained/electricity/the-science-of-electricity.php
3. https://www.osti.gov/biblio/4379156-introduction-atomic-nuclear-physics-fifth-edition

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit	Course content	Learning Outcomes	Highest Bloom's Taxonomy Level of Transaction
I	**Electro Statics**		
1.1	Coloumb's theorem	Explain Coloumb's theorem	**K2**
1.2	Mechanical force on the surface of a charged conductor	Derive the mechanical force on the surface of a charged conductor	**K3**
1.3	Capacitors	Recall Capacitors	**K1**
1.4	Expression for capacitance of a capacitor.	Derive the capacitance of a capacitor	**K3**
1.5	Principle of a capacitor	Explain the principle of a capacitor	**K2**
1.6	Energy of a charged capacitor	Determine the energy of a charged capacitor	**K5**
1.7	Loss of energy due to sharing of charges.	Determine the loss of energy due to sharing of charges.	**K5**
1.8	Cylindrical capacitors, Spherical capacitors	Determine the capacitance of cylindrical & Spherical capacitors	**K5**
II	**Electricity**		
2.1	Kirchoff's laws	State Kirchoff's laws	**K1**
2.2	Wheat stone bridge	Explain Wheat stones bridge	**K2**
2.3	Carey Foster's bridge	Explain Carey Foster's bridge	**K5**
2.4	Determination of specific resistance	Evaluate determination of specific resistance	**K5**
2.5	Laws of electromagnetic induction	State the laws of electromagnetic induction	**K1**
2.6	Expression for induced emf	Derive the expression for induced emf	**K1**
2.7	Self and mutual induction	Derive the expression for self-induction and mutual induction	**K4**
2.8	Rayleigh's method of finding self-inductance of a coil	Explain Rayleigh's method of finding self-inductance of a coil	**K2**
2.9	Determination of mutual inductance using BG	Determine the mutual inductance using BG	**K5**
2.9.1	Coefficient of coupling	Derive the expression for coefficient of coupling	**K2**
2.9.2	Eddy currents and its applications	Explain Eddy currents and its applications	**K5**

III	**Atomic Physics**		
3.1	Vector atom model	Explain Vector atom model	**K2**
3.2	Pauli's exclusion principle	State Pauli's exclusion principle	**K1**
3.3	Various quantum numbers	Classify Various quantum numbers	**K2**
3.4	Quantization of orbits	Outline the Quantization of orbits	**K5**
3.5	X-rays	Recall X-rays	**K1**
3.6	Continuous and characteristic x-rays	Explain Continuous and characteristic x-rays	**K5**
3.7	Moseley's law and its importance	Explain Moseley's law and its importance	**K2**
3.8	Bragg's law	State Bragg's law	**K1**
	Miller indices	Explain Miller indices	**K2**
3.9	Estimation of cell dimension using Laue method	Estimate the cell dimension using Laue method	**K5**
IV	**Nuclear Physics**		
4.1	Nucleus basic concepts	Explain the basic concepts of nucleus	**K2**
4.2	Binding energy	Define Binding energy	**K1**
4.3	Nucleus size, charge, mass, spin	Recall Nucleus size, charge, mass, spin	**K1**
4.4	Nuclear models - Liquid drop model, shell model	Explain - Liquid drop model/ shell model	**K2**
4.5	Particle detectors	Compare Particle detectors	**K2**
4.6	Cloud chamber	Explain Cloud chamber	**K5**
4.7	Bubble chamber	Explain Bubble chamber	**K5**
4.8	Photographic emulsion technique	Analyze Photographic emulsion technique	**K4**
V	**Electronics and Digital Electronics**		
5.1	Band theory of solids	Explain Band theory of solids	**K2**
5.2	Types of semiconductor - intrinsic and extrinsic	Classify the types of semi-conductor	**K2**
5.3	P-N junction diode - Biasing	Explain the biasing of P-N junction diode	**K2**
5.4	Zener diode	Discuss the Zener diode	**K3**
5.5	Basic logic gates	Classify Basic logic gates	**K2**
5.6	AND, OR, NOT, NOR, and NAND gates	Compare AND, OR, NOT, NOR, and NAND gates	**K4**
5.7	Boolean algebra	Apply Boolean algebra to solve logic problems	**K3**
5.8	Laws of Boolean algebra	Illustrate the laws of Boolean algebra	**K2**
5.9	De-Morgon's theorems - verification using truth tables	Make use of De-Morgon's theorems to verify truth tables	**K3**
5.9.1	Decimal, binary, octal, Hexadecimal numbers systems and their mutual conversion	Analyze the mutual conversion of Decimal, binary, octal and hexa decimal number systems and their mutual conversion	**K4**

4. MAPPING SCHEME (PO, PSO& CO)

U18PHY44	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	L	M	L	H	M	L	-	-	H	L	L	M
CO2	H	H	H	L	H	M	M	-	-	H	L	L	M
CO3	H	M	M	L	M	L	L	-	-	M	L	L	L
CO4	H	M	M	L	L	L	L	-	-	H	L	L	M
CO5	H	L	L	L	L	L	L	-	-	M	L	L	L
CO6	H	M	H	H	H	M	M	-	-	H	H	H	H

L-Low **M-Moderate** **H-High**

5. COURSE ASSESMENT METHODS

Direct

1. Continuous Assessment Test (Model exams) I,II

2. Open book test; Cooperative learning report, assignment, seminar, group presentation, Project report, poster

preparation, Problem solving etc.

Indirect

1. Course-end survey

Course Co-Ordinator: Mr. T. Yesudoss

APPLIED PHYSICS I (FOR II B.Sc. COMPUTER SCIENCE)

ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

SEMESTER: III **CODE: U13PHZ34**

CREDITS: 3 **NO. OF HOURS/ WEEK: 4**

1. COURSE OUTCOMES (CO)

After the Completion of the Course the students will be able to:

CO. NO.	Course Outcomes	Level	Unit Covered
CO1	Explain the principle of Electrostatics	**K2**	**I**
CO2	Estimate the capacity of Spherical and cylindrical capacitors	**K5**	**I**
CO3	Classify materials based on its magnetic properties	**K3**	**II**
CO4	Measure current and resistance in electrical circuits using Kirchhoff's laws and Wheatstone's principle	**K5**	**III**
CO5	Analyze self-inductance and Mutual inductance using Faraday's laws of Electromagnetic induction	**K4**	**IV**
CO6	Examine current and impedance in Single, double and tri component	**K4**	**V**

2. A. SYLLABUS

Unit-I: Electrostatics **(12 hours)**

Fundamentals of electrostatics – Gauss theorem - Applications – Intensity at a point between two charged parallel plane conductors – Intensity at a point due to uniformly charged cylinder – Action of points – Capacitance – Principle of a capacitor – Spherical and cylindrical capacitors – Energy of a charged capacitor – Energy loss due to sharing of charges – Types of capacitors.

Unit-II: Magnetostatics **(12 hours)**

Magnetic field – Magnetic flux density – Magnetization – Intensity of magnetization – Permeability – Susceptibility – Relation – Magnetic materials – Properties of dia, para and ferro magnetic materials – Hysteresis – Magnetometer method – Finding coercivity, retentivity and energy loss from hysteresis loop (BH Curve).

Unit-III: Current Electricity **(12 hours)**

Current – Definition of Ampere – Units of voltage and resistance – Ohm's law – Kirchoff's law – Wheatstone's bridge – Carey Foster's bridge – Potentiometer – Measurement of current and resistance –

Force between two parallel conductors carrying current – Fleming's left hand rule – Theory of ballistic galvanometer – conversion of galvanometer into an ammeter and voltmeter.

Unit-IV: Electromagnetic Induction (12 hours)

Laws of electromagnetic induction – Self-induction - Determination of self-inductance by Anderson's method – Mutual induction – Determination of mutual inductance by absolute method - Relation between induced emf and mutual inductance –Coefficient of coupling - Eddy current and its applications.

Unit-V: Alternating Current (12 hours)

AC Circuits with single components – Double components – Measurement of current and voltage – Power in AC Circuit – Power factor derivation – Wattless current – Choke-series and parallel resonance circuits – Impedance – Q factor – Selectivity and Sharpness of resonance – Oscillatory discharge of a condenser.

B. TOPICS FOR SELF STUDY

1. Basic laws of Electricity and Magnetism

https://www.amherst.edu › system › files › media

2. Electric field due to system of charges

https://www.brainkart.com/article/Electric-field-due-to-the-system-of-point-charges_38361/

3. Basics of AC circuits

C. TEXT BOOKS:

1. Brij Lal and N. Subrahmanyam, Electricity and Magnetism, Ratan Prakashan Mandir, New Delhi, 1995(unit 1 to 5)
2. R. Murugeshan, Electricity and Magnetism 10e, S.Chand and Company Ltd, 2017

D. REFERENCE BOOKS:

1. D.N .Vasudeva , Fundamentals of Magnetism and Electricity, S.Chand & co, 2007
2. N.K.Sehgal , K.L Chopra and D.L. Sehgal , Electricity and magnetism 6e, Sultan chand and sons , 2004

E. WEBLINKS

1. https://byjus.com/physics/electricity-and-magnetism/
2. https://www.thoughtco.com/introduction-electricity-and-magnetism-4172372

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/ Section	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Levels

			of Transaction
I	**Electrostatics**		
1.1	Electrostatics	Explain the fundamental of electrostatics	**K2**
1.2	Gauss theorem	Explain Gauss theorem	**K2**
1.3	Intensity at a point between two plane parallel conductor	Apply Gauss theorem to calculate intensity at a point between two plane parallel conductor	**K3**
1.4	Intensity at a point due to uniformly charged cylinder	Apply Gauss theorem to calculate intensity at a point due to uniformly charged cylinder	**K3**
1.5	Action of Points	Explain Action of points	**K2**
1.6	Capacitance	Explain capacitance of a capacitor	**K2**
1.7	Principle of a capacitor,	Explain the Principle of a capacitor	**K2**
1.8	Spherical Capacitor	Estimate the capacitance of a spherical capacitor	**K5**
1.9	cylindrical capacitor	Determine the capacitance of a cylindrical capacitor	**K5**
1.10	Energy of a charged capacitor,	Relate energy equation of a charged capacitor	**K2**
1.11	Energy loss due to sharing of charges	Estimate the loss of energy due to sharing of charges	**K3**
1.12	Types of Capacitors	Classify the various types of capacitor	**K4**
II	**Magnetostatics**		
2.1	Magnetic field ,Magnetic flux density	Recall Magnetic field and Magnetic flux density	**K1**
2.2	Magnetization, Intensity of magnetization	Explain Magnetization and Intensity of magnetization	**K2**
2.3	Permeability-Susceptibility Relation	Relate Permeability and Susceptibility	**K2**
2.4	Magnetic materials	Classify magnetic materials	**K2**
2.5	Properties of dia, para	Compare the three types of	**K4**

	and a ferromagnetic materials	magnetic materials	
2.6	Hysteresis	Define hysteresis	**K1**
2.7	Hysteresis – Magnetometer method	Determine susceptibity of a given liquid using magnetometer method	**K5**
2.8	Finding Coercivity, retentivity	Interpret Coercivity and retentivity from hysteresis loop	**K2**
2.9	Energy loss from Hysteresis loop(BH curve)	Estimate Energy loss from Hysteresis loop	**K5**
III	**Current electricity**		
3.1	Current	Explain current	**K2**
3.2	Definition of Ampere	Define unit of current	**K1**
3.3	Units of Voltage and resistance, Ohm's law	Define Ohm's law Relate voltage , current and resistance	**K2**
3.4	Kirchhoff's law	Explain Kirchhoff's law	**K2**
3.5	Wheatstone's bridge	Apply Kirchhoff's law and deduce the condition of Wheatstone's bridge	**K3**
3.6	Carey Foster's bridge law	Estimate the specific resistance of a given coil using carey Foster's bridge	**K5**
3.7	Potentiometer	Explain the principle of Potentiometer	**K2**
3.8	Measurement of Current and Resistance	Measure current and resistance of a wire using Potentiometer	**K5**
3.9	Force between two parallel conductors carrying current	Explain the force between two parallel conductors carrying current	**K2**
3.10	Fleming's left hand rule	Define Fleming's left hand rule	**K1**
3.11	Theory of Ballistic galvanometer	Explain the theory of Ballistic galvanometer	**K4**
3.12	Conversion of Galvanometer into an ammeter	Construct a circuit to convert Galvanometer into an ammeter	**K3**
3.13	Conversion of Galvanometer into a voltmeter	Construct a circuit to convert Galvanometer into a voltmeter	**K3**
IV	**Electromagnetic induction**		
4.1	Laws of electromagnetic induction	Explain the laws of Electromagnetic induction	**K2**
4.2	Self-induction	Explain self-induction of a coil	**K2**
4.3	Determination of self-induction by Anderson's method	Determine Self-induction of a coil by Anderson's method	**K5**

4.4	Mutual induction	Explain Mutual induction of a pair of coils	**K2**
4.5	Determination of Mutual induction by Absolute method	Determine mutual induction of a pair of coil by Absolute method	**K5**
4.6	Relation between induced emf and mutual inductance	Relate induced emf and mutual inductance	**K2**
4.7	Coefficient of coupling	Explain Coefficient of coupling	**K2**
4.8	Eddy current	Explain Eddy current	**K2**
4.9	Application of Eddy current	Summarize the application of Eddy current	**K4**
V	**Alternating currents**		
5.1	AC circuits with single components	Measure mean current and impedance in Ac circuit with single components	**K3**
5.2	Ac circuits with double components	Measure mean current and impedance in with double components	**K3**
5.3	Measurement of current and voltage	Measure current and voltage in Ac circuits	**K3**
5.4	Power in Ac circuits	Explain power in Ac circuits	**K2**
5.5	Power factor derivation	Derive an expression for Power factor in Ac circuit	**K2**
5.6	Wattles current –choke	Explain wattles current and choke	**K2**
5.7	Series resonance circuit	Examine the resonance frequency in Series resonance circuit	**K4**
5.8	Parallel resonance circuits,	Examine Q factor of a coil in Parallel Resonance circuit	**K4**
5.9	Impedance	Define Impedance	**K1**
5.10	Q factor	Explain Q-factor	**K2**
5.11	Selectivity and sharpness of resonance	Explain Selectivity and sharpness of resonance	**K2**
5.12	Oscillatory discharge of a condenser	Analyze the oscillatory discharge of a condenser	**K4**

4. MAPPING SCHEME (PO, PSO &CO)

U13PHZ34	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	L	L	L	L	-	-	-	H	L	L	M
CO2	M	M	M	L	H	M	-	-	L	M	M	H	L
CO3	M	L	L	-	M	L	L	-	L	M	H	L	L
CO4	H	M	M	H	M	L	L	-	L	M	M	H	L

CO5	M	M	L	M	H	L	L	L	M	M	M	M	M
CO6	M	L	M	M	H	M	L	L	L	M	L	H	L

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHOD

Direct

1. Continuous Assessment Test (Model Exams) I,II
2. Open book test, Quizzes, Assignment, Seminar, Problem Solving, Slip test, Surprise test etc.
3. End Semester Examination

Indirect

1. Course-end survey/Feedback

Course Co-ordinator: Mrs. S. Pauline Sheeba

APPLIED PHYSICS II (FOR II B.SC. COMPUTER SCIENCE)

SOLID STATE DEVICES AND MICROPROCESSOR

SEMESTER: IV **CODE: U13PHZ45**

CREDITS: 4 **NO. OF HOURS/WEEK: 4**

1. COURSE OUTCOMES (CO)

After the completion of this course the students will be able to:

CO. No	Course Outcomes	Level	Unit Covered
CO1	Explain semiconductors, characteristics of diodes & their applications	**K2**	**I**
CO2	Analyse the Characteristics of Transistors & FET	**K4**	**I**
CO3	Utilize Operational Amplifier to perform several mathematical operations	**K3**	**II**
CO4	Outline the evolution and Architecture of Microprocessor Intel 8085.	**K2**	**III**
CO5	Explain the addressing modes and functioning of various Instruction set of Intel 8085.	**K2**	**IV**
CO6	Develop simple assembly language programs.	**K3**	**V**

2. A. SYLLABUS

Unit-1: Diodes and Transistors **(12 Hours)**

Semiconductors – Types – diode characteristics – Zener Diode – characteristics – regulated power supply – Transistor – types – DC characteristics of CE configuration (PNP) – Transistor as an amplifier – FET – n-Channel FET characteristics – FET parameters – FET amplifiers.

Unit-2: Operational Amplifier **(12 Hours)**

Introduction – differential amplifier – CMRR – Offset Balance – Inverting and Non inverting amplifier – Sign changer – Unit gain follower – Adder – Subtractor – Differentiator – Integrator – D/A conversion – Binary weighted method.

Unit-3: Architecture of Microprocessor 8085 **(12 Hours)**

Evolution of Microprocessors – Introduction to Intel 8085 – Architecture – Pin configuration – Registers – Data and Address Bus – Status flags.

Unit-4: Instruction Set of Intel 8085 (12 Hours)

Introduction – Op code – Operand - Addressing Modes - Data Formats - Instruction Set of Intel 8085 instructions - Data transfer group, Arithmetic group, Logical group, Branch group - Stack-I/O and Machine control group.

Unit-5: Examples of Assembly language programs (12 Hours)

Block transfer – 8-bit addition, subtraction, multiplication and division – Sum of a series of numbers – Ascending and descending order – Largest and smallest number in a series of numbers – Multibyte addition and subtraction.

B. TOPICS FOR SELF-STUDY

1. **Transistors**
   https://byjus.com/physics/uses-of-transistor
2. **Architecture of Microprocessor 8085**
   https://nptel.ac.in/courses/108/107/108107029/
3. **Microprocessor Programming**
   https://www.geeksforgeeks.org/assembly-language-program-8085-microprocessor-add-two-8-bit-numbers/
4. **Program for Multibyte addition**
   https://www.tutorialspoint.com/8085-program-to-subtract-two-multi-byte-numbers
5. **Program for Multibyte addition**
   https://www.coursehero.com/file/73901401/expt1-1doc/

C. TEXT BOOKS

1. V.K.Mehta and Rohit Mehta, Principles of Electronics 11thedition, S.Chand& company Ltd, Delhi, 2008.

2. B.Ram, Fundamentals of Microprocessor and Micro Computers, DhanapatRai and sons, Delhi, 1995.

D. REFERENCE BOOKS

1. Malvino, Electronic principles, 5thedition, Tata McGraw Hill Ltd., New Delhi, 1995.

2. T.L.Floyd, Electronic Devices, Pearson Education, New York, 2004.

E.WEBLINKS

1. https://nptel.ac.in/courses/117/107/117107095/
2. https://nptel.ac.in/courses/117/107/117107094/
3. https://www.youtube.com/watch?v=IWCAQf2-HMg

3. SPECIFIC LEARNING OUTCOMES (SLO)

Unit/Section	Course content	Learning Outcomes	Highest Bloom's Taxonomy level of Transaction
I	**Solid State Devices and Microprocessor**		
1.1	Semiconductors-Types of Semiconductors	Outline the basics of Semiconductors Classify the types of Semiconductors	**K4**
1.2	Diode Characteristics	Explain the characteristics of diodes	**K5**
1.3	Zener diode-Characteristics	Explain the mechanism of Avalanche breakdown.	**K4**
1.4	Regulated Power Supply	Analyze the Characteristics of Zener diode	**K4**
		Utilize the effect of biasing on Zener diode as regulated power supply	**K4**
1.5	Transistor	Classify the type of transistors.	**K4**
		Discuss the working of PNP transistor.	**K2**
1.6	Characteristics of a transistor	Illustrate the characteristics CE configuration of PNP transistor.	**K2**
1.7	Transistor amplifier	Explain the working of a transistor as an amplifier.	**K2**
1.8	Field effect transistor	Define FET amplifier	**K1**
		List the characteristics of FET	**K1**
		Explain the parameters of FET	**K2**
II	**Operational Amplifier**		
2.1	Introduction	Evolution of Operation amplifier Outline the role of different stages in operational amplifier	**K2**
2.2	Differential amplifiers	Explain the working of differential amplifier Interpret the process of applying negative feedback in operational amplifiers	**K2**

2.3	CMRR	Illustrate common mode and differential mode gain in operational amplifier Explain common mode and differential mode signals in operational amplifiers Define CMRR	**K2**
2.4	Offset balance	Illustrate the pin configuration of IC 741 operational amplifier Discuss the construction of offset balance circuit in Operational Amplifier	**K5**
2.5	Inverting	Explain the working of an Op-amp in inverting configuration	**K2**
2.6	Non inverting amplifier	Interpret the functioning of an Op-amp in non-inverting configuration. (K2) Determine the voltage gain of a non-inverting amplifier. (K4)	**K4**
2.7	Sign changer	Apply non inverting configuration in op-amp to construct sign changer	**K3**
2.8	Unit gain follower	Construct a unit gain amplifier using an operational amplifier	**K3**
2.9	Adder	Explain the operation of summing amplifiers	**K3**
2.10	Subtractor	Discuss the working of Op-Amp as a subtractor	**K4**
2.11	Differentiator	Obtain an expression for output voltage in differentiator circuit.	**K4**
2.12	Integrator	Discuss the operation of an integrator circuit to produce different waveforms.	**K3**
2.13	D/A Conversion: Binary Weighted Method	Distinguish digital and analog signals. (K4) Explain the terms resolution, step size in improving the quality of D/A conversion (K5) Illustrate the method of Binary weighted for D/A conversion (K2)	**K5**
III	**Architecture of Microprocessor 8085**		

3.1	Architecture of microprocessor 8085	Explain about the architecture of Intel 8085 with a proper block diagram	**K5**
		Analyze the working status flags of Intel 8085	**K4**
3.2	Status flags	Describe the process of data and address bus in Intel 8085	**K2**
3.3	Data and address bus	Discuss the working of each pins in pin configuration in Intel 8085	**K2**
3.4	Pin configuration	Discuss the working of each pins in pin configuration in Intel 8085	**K2**
IV	**Instruction Set of INTEL 8085**		
4.1	Introduction to instruction set	Define opcode and operand	**K1**
		List the different types of addressing modes in Intel 8085	**K1**
4.2	Addressing modes	List the different types of instruction set in Intel 8085	**K4**
4.3	Instruction set	Explain the data transfer group/ arithmetic group/ logical group/ branch control group/ I/p control group with suitable example.	**K5**
V	**Examples of Assembly Language Programs**		
5.1	Assembly language program	Apply the instructions of Intel 8085, to Write a program for Block transfer/ Addition and subtraction /Ascending order/ Maxima of series of number/ Sum of series/ Multiplication and division/ Multibyte addition.	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U13PHZ45	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	H	M	L	H	L	L	M	L	L	H	H	M	H
CO2	H	M	L	H	M	L	M	L	L	H	H	M	M
CO3	H	H	M	H	H	L	M	L	L	H	M	H	M
CO4	H	M	M	H	L	M	L	L	L	H	M	M	M
CO5	H	M	M	M	M	M	L	M	M	H	M	H	M
CO6	H	M	M	M	H	M	M	L	L	H	M	H	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1. Continuous Assessment Test (Model Exams) I, II
2. Open book test; Cooperative learning report, Assignment, Seminar, etc.
3. End Semester Examination

Indirect

1.Course-endsurvey

Course Co-ordinator: Dr. Judith Jayarani. A

MAJOR PRACTICALS - I

SEMESTER: I **CODE: U16PH1P1**

CREDITS: 3 **NO. OF HOURS/WEEK: 3**

1. COURSE OUTCOMES (CO)

After the completion of this course the student will be able to:

CO.NO.	Course outcomes	Level	Experiment Covered
CO1	Determine surface tension and interfacial tension by weight drop method	K5	3
CO2	Analyze the basic operations and the characteristics of Zener diode in various configuration	K6	6
CO3	Demonstrate and apply the concept of optical theory of lenses to find the focal Length, radius of curvature of long focus convex lens	K2	5
CO4	Determine the frequency of AC mains using Sonometer and find	K5	4,13

	wavelength, period, amplitude using Meldes method		
CO5	Estimate the moduli of elasticity, rigidity modulus for different materials using non uniform bending pin and microscope and torsion method.	**K6**	**1,14**
CO6	Determine refractive index of given prism by spectrometer and measure g and K using compound pendulum.	**K5**	**2,8,14**

2. SYLLABUS

List of experiments

1. Non-uniform bending – microscope method.
2. Compound pendulum – g and K.
3. Surface tension and interfacial tension – drop weight method.
4. Sonometer-verification of laws.
5. Long focus convex lens-f, R,μ.
6. Characteristics of junction diodes.
7. Static torsion - determination of n.
8. Spectrometer-refractive index of the prism.
9. Digital Screw Gauge - Basic measurements
10. Digital Vernier Calipers – Dimensions of materials
11. Mega Ohm meter – Measurement of High Resistance
12. Cantilever depression – scale and telescope.
13. Melde's string arrangement-Transverse and longitudinal mode.
14. Spectrometer-refractive index of liquid.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Course Content	Learning Outcomes	Highest Bloom's Taxonomy level of transaction
1.	Young's modulus –non-Uniform bending.	Measure the Young's modulus of the bar material by uniform bending optic lever method	**K5**
2.	Rigidity modulus – Static Torsion	Determine the rigidity modulus using Static Torsion Apparatus.	**K5**
3.	Spectrometer – Refractive index of Glass	Determine angle of the Prism, minimum	**K5**

	Prism.	deviation and refractive index of prism material using Spectrometer.	
4.	Sonometer – Verification of laws	Verify the laws of transverse vibration of strings using Sonometer,	**K5**
5.	Compound Pendulum	Test for Acceleration due to gravity, radius of gyration of the bar using Compound Pendulum.	**K4**
6.	Focal Length, Radius of curvature - long focus convex lens	Determine the Focal Length, Radius of curvature - Refractive index using long focus convex lens	**K5**
7.	Characteristics of Junction diode	Analyze the basic operations and the characteristics of Junction diode in various configuration.	**K6**
8.	Viscosity of a Highly Viscous Liquid – Poiseuille's Flow Method.	Determine the co efficient of viscosity of a liquid by Poiseuille's capillary flow method.	**K5**
9.	Digital Screw Gauge	Examine the thickness (d) of the material at various places along its portion.	**K4**
10.	Digital Vernier Caliper	Examine the Breath(b) of the material at various places along its portion.	**K4**
11.	Mega Ohm meter	Measure of High Resistance of given discrete components.	**K6**
12.	Cantilever depression – scale and telescope.	Measure the depression of the beam using scale and telescope.	**K5**
13.	Melde's string arrangement-Transverse and longitudinal mode.	Determine the frequency of an electrically maintained tuning fork in two modes (Transverse and Longitudinal).	**K5**
14.	Spectrometer-refractive index of liquid	Determine the refractive index of given liquid using spectrometer.	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH1P1	PO									PSO			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	-	L	H	-	-	-	-	L	H	H	H	M
CO2	H	L	H	H	-	M	-	H	M	H	H	H	M
CO3	H	-	-	H	L	L	-	-	-	H	L	L	H
CO4	H	-	-	H	L	L	-	-	-	H	L	L	H
CO5	H	-	L	H	-	-	-	-	L	H	H	H	M
CO6	H	L	H	H	-	M	-	H	M	H	H	H	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Mr. A. Veerapandian

MAJOR PRACTICALS - II

SEMESTER: II **CODE: U16PH2P2**

CREDITS: 3 **NO. OF HOURS/WEEK: 3**

1.COURSE OUTCOMES

After the completion of this course the students will be able to:

CO. NO.	Course outcomes	Level	Experiment Covered
CO1	Measure the coefficient of viscosity of low and highly viscous liquids using graduated burette, Ostwald's viscometer and Stoke's method	**K5**	**2,5,14**
CO2	Analyze the basic operations and the characteristics of Zener diode in various configuration	**K4**	**7**
CO3	Apply the concept of optical theory of lenses to find the focal Length, radius of curvature and the refractive index of long focus concave lens	**K3**	**6**
CO4	Determine the frequency of AC mains using Sonometer.	**K5**	**3**
CO5	Estimate the moduli of elasticity for different materials using optic lever and torsional pendulum.	**K5**	**1,4**
CO6	Make use of CRO, AFO and multimeter to study the frequency resonant circuit, Lissajous figures, different waveforms and basic electrical measurements	**K3**	**10,12,13**

2.SYLLABUS

List of Experiments

1. Rigidity modulus - Torsional pendulum.
2. Co-efficient of viscosity – Graduated burette.
3. Determination of A.C. frequency - Sonometer.
4. Young's modulus - Uniform bending – optic lever.
5. Viscosity of highly viscous liquid – Stokes method
6. Focal Length, Radius of curvature - Refractive Index - Long focus concave lens.
7. Characteristics of Zener diode.
8. Energy gap of a thermistor - P.O.box.
9. Surface tension-capillary rise method.
10. Study of frequency resonant circuit/ Lissajous figures - CRO/DSO.
11. Acoustics studies of fluids - Ultrasonic Interferometer.
12. Source of Sinusoidal, Square, Saw tooth and Triangular waves – AFO.

13. Basic electric measurements – Multimeter.
14. Viscosity of a liquid – Ostwald viscometer

3.SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Course Content	Learning Outcomes	Highest Bloom's Taxonomic level of transaction
1.	Rigidity modulus - Torsional pendulum	Determine the rigidity modulus of the torsional pendulum	**K5**
2.	Co-efficient of viscosity – Graduated burette	Estimate the Co-efficient of viscosity of liquid by Graduated burette method	**K5**
3.	Determination of A.C. frequency - Sonometer	Determine A.C. frequency mains using sonometer	**K5**
4.	Young's modulus - Uniform bending – optic lever	Measure the Young's modulus of the bar material by uniform bending optic lever method	**K5**
5.	Viscosity of highly viscous liquid – Stokes method	Evaluate the Viscosity of highly viscous liquid by Stokes method	**K5**
6.	Focal Length, Radius of curvature - Refractive Index - Long focus concave lens	Determine the Focal Length, Radius of curvature - Refractive Index using long focus concave lens	**K5**
7.	Characteristics of Zener diode	Analyze the basic operations and the characteristics of Zener diode in various configuration	**K4**
8.	Energy gap of a thermistor - P.O.box	Determine the energy gap of a thermistor using post office box	**K5**
9.	Surface tension-capillary rise method	Measure the surface tension of liquid by capillary rise method	**K5**

10.	Study of frequency resonant circuit/ Lissajous figures - CRO/DSO	Infer the Lissajous figures patterns using CRO	**K4**
11.	Acoustics studies of fluids - Ultrasonic Interferometer	Determine the various acoustics properties of fluids using Ultrasonic Interferometer	**K5**
12.	Source of Sinusoidal, Square, Saw tooth and Triangular waves – AFO	Analyze the various types of wave forms using AFO	**K4**
13.	Basic electric measurements – Multimeter.	Measure V, I, R, C, L using multimeter in different electronic circuits.	**K5**
14.	Viscosity of a liquid – Ostwald viscometer	Measure the viscosity of a liquid by Ostwald viscometer.	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH2P2	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	H	M	H	H	M	M	L	H	H	H	M
CO2	H	H	H	M	H	H	M	M	M	H	H	H	M
CO3	H	M	H	M	H	H	M	M	-	H	L	L	H
CO4	H	M	L	L	H	H	M	M	-	H	L	L	H
CO5	H	M	H	M	H	H	M	M	L	H	H	H	M
CO6	H	H	M	H	H	H	M	M	M	H	H	H	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Mr. A. Veerapandian

MAJOR PRACTICALS - III

SEMESTER: III **CODE: U16PH3P3**

CREDITS: 3 **NO. OF HOURS.WEEK: 3**

1. COURSE OUTCOMES (CO)

After successful completion of the course, the students will be able to:

CO. NO.	Course Outcomes	Level	Experiment covered
CO1	Determine thermal constants (specific heat, thermal conductivity) of substances.	**K1**	**1,2,3**
CO2	Analyze the properties of light (interference, refraction and polarization).	**K5**	**4,5**
CO3	Design rectifier circuits using diodes.	**K6**	**6**
CO4	Analyze transistor characteristics in CE mode	**K4**	**11**
CO5	Analyze the solar spectrum	**K2**	**9**
CO6	Estimate the sensitivity of a galvanometer (B.G).	**K3**	**8**

2.SYLLABUS

List of Experiments

1. Specific heat of a liquid- Newton's law of cooling.
2. Specific heat capacity of a liquid - Joule's calorimeter.
3. Thermal capacity of a bad conductor Lee's disc method.
4. Determination of R and of the lens - Newton's ring.
5. Spectrometer-i-d curve
6. Full wave rectifier-Percentage of regulation.
7. Ammeter calibration – Potentiometer.
8. Figure of merit-B.G.
9. Spectrometer – Spectral distribution of solar radiation
10. Dispersive characteristics of biomaterials
11. Polarimeter – Optical activities of liquids
12. Bomb Calorimeter – Calorific values of different bio masses
13. Transistor Characteristics-CE configuration.
14. Telescope (High Range) – Determination of Focal length of long focus lens

3.SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Experiment	Learning Outcomes	Highest Bloom's Taxonomic Levels of Transaction
1	Specific heat of a liquid-Newton's law of cooling.	Determine specific heat capacity of given liquid by Newton's law of cooling.	**K5**
2	Specific heat capacity of a liquid - Joule's calorimeter.	Determine specific heat capacity of given liquid using Joule's calorimeter.	**K5**
3	Thermal conductivity of a bad conductor Lee's disc method.	Measure the thermal conductivity of a poorly conducting material using Lee's disc method.	**K3**
4	Determination of R and focal length of the lens - Newton's ring.	Determine thickness of the air gap between lens and the base by Newton's ring.	**K5**
5	Spectrometer-I-d curve	Observe the deviation angle of a ray passing through a prism will be minimal, when the entrance and exit angles are equal. Analyze the relationship between angle of incidence and angle of refraction graphically using the observations and hence to determine the refractive index of the material of the prism.	**K5**
6	Full wave rectifier-Percentage of regulation.	Construct and convert both polarities of the input waveform to pulsating DC.	**K3**
7	Ammeter calibration – Potentiometer.	Calibrate the device and verify Ammeter calibration.	**K2**
8	Figure of merit-B.G.	Characterize the performance of a B.G.	**K4**
9	Spectrometer – Spectral distribution of solar radiation	Express analytically and graphically the relation between luminous flux per wavelength and wavelength of solar radiation.	**K3**

10	Polarimeter – Optical activities of liquids	Experiment the ability of a substance to rotate the plane of polarization of a beam of light that is passed through it.	**K4**
11	Bomb Calorimeter – Calorific values of different bio masses	Measure the amount of heat released or absorbed in chemical or physical reactions.	**K5**
12	Transistor Characteristics-CE configuration.	Analyze the Transistor Characteristics in CE configuration.	**K4**
13	Telescope (High Range) – Determination of Focal length of long focus lens	Determine the focal length **of** the long focus lens.	**K6**

4. MAPPING SCHEME (PO, PSO& CO)

U16PH3P3	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	-	L	-	-	-	M	H	L	M	-	-	M
CO2	H	M	M	H	M	H	-	L	M	H	H	M	-
CO3	-	H	M	L	H	H	H	M	-	M	L	L	L
CO4	M	L	-	H	H	L	-	M	M	H	H	-	M
CO5	H	H	M	M	-	H	M	L	H	-	M	L	L
CO6	-	H	M	L	H	L	H	M	-	M	L	M	L

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Mr. A. Veerapandian

MAJOR PRACTICALS - IV

SEMESTER: IV **CODE: U16PH4P4**

CREDITS: 3 **NO. OF HOURS/WEEK: 3**

1. COURSE OUTCOMES (CO)

After successful completion of this course, the students will be able to:

CO.NO.	Course Outcomes	Level	Experiment Covered
CO1	Measure the temperature co- efficient of materials using potentiometer and P.O. Box.	**K5**	**3,6,12,13**
CO2	Determine emissivity of blackened surface of the Spherical calorimeter.	**K5**	**1**
CO3	Construct circuit diagram to find specific resistance and calibrate low range voltmeter.	**K3**	**4,5**
CO4	Determine thickness of wire, films and wave length of visible light (direct and oblique method) by using spectrometer- Grating.	**K5**	**2,7,10,11**
CO5	Make use of optical microscope to identify the microstructure of samples.	**K3**	**9**
CO6	Verify the function of logic gates using discrete components.	**K2**	**8**

2.SYLLABUS

List of experiments

1. Emissive power of the surface –spherical calorimeter.
2. Thickness of wire and insulation - Air wedge.
3. E.M.F. of a Thermocouple direct deflection method.
4. Specific resistance - Carey Foster's bridge.
5. Calibration of low range voltmeter - Potentiometer.
6. Temperature Coefficient of resistance – Potentiometer.
7. Grating- Oblique incidence - Spectrometer.
8. Study of logic gates – discrete components.
9. Microstructural analysis of samples - Optical Microscope.
10. Thickness of films forming air wedge and edge cutting - Travelling Microscope with micrometer screw.
11. Wave length of Hg Spectrum - Grating- Normal incidence – Spectrometer.

12. Temperature Co-efficient of thermistor - P.O. Box.
13. Temperature Co-efficient of resistance - P.O. Box.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Course Content	Learning Outcomes	Highest Bloom's Taxonomic Level of transaction
1.	Emissive power of the surface –spherical calorimeter	Determine Emissive power of the surface using spherical calorimeter	**K5**
2.	Thickness of wire and insulation - Air wedge	Find the thickness of the wire and insulation by forming interference pattern	**K3**
3.	E.M.F. of a Thermocouple direct deflection method	Estimate the EMF of the thermocouple by direct deflection method	**K4**
4.	Specific resistance - Carey Foster's bridge	Apply the principle of Wheatstone's Bridge to observe the resistance of the given coil and hence calculate the specific resistance	**K3**
5.	Calibration of low range voltmeter - Potentiometer	Illustrate the calibration of voltmeter using potentiometer and to draw its responses graphically	**K3**
6.	Temperature Coefficient of resistance – Potentiometer	Apply the principle of Wheatstone's Bridge to observe the variation in resistance with temperature of the coil and hence calculate the temperature coefficient	**K3**
7.	Grating- Oblique incidence - Spectrometer	Determine the wavelength of spectral lines with a diffracting grating and spectrometer by minimum deviation method	**K3**
8.	Study of logic gates – discrete components	Design logic circuits using discrete components such as diodes and transistors and verify their truth tables	**K5**
9.	Microstructural analysis of samples - Optical Microscope	Analyzes the microstructural characteristics of biomaterials	**K4**

10.	Thickness of films forming air wedge and edge cutting - Travelling Microscope with micrometer screw.	Find the thickness of the wire and edge cutting by forming interference pattern	**K3**
11.	Wave length of Hg Spectrum - Grating- Normal incidence – Spectrometer.	Determine the Calorific values of different bio masses using Bomb Calorimeter	**K5**
12.	Temperature Co-efficient of thermistor - P.O. Box.	Measure the temperature coefficient of thermistor using P.O Box	**K5**
13.	Temperature Co-efficient of resistance - P.O. Box.	Measure the temperature coefficient of resistor using P.O Box	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH4P4	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	H	H	H	H	M	M	M	H	H	H	M
CO2	H	M	H	M	H	H	M	H	H	H	H	H	M
CO3	H	M	H	M	H	H	M	M	M	H	L	L	H
CO4	H	M	L	H	H	H	M	H	L	H	L	L	H
CO5	H	H	H	M	H	H	H	M	L	H	H	H	M
CO6	H	H	M	H	H	H	M	M	H	H	H	H	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Mr. A. Veerapandian

MAJOR PRACTICALS - V

SEMESTER: V **CODE: U16PH5P5**

CREDITS:3 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After successful completion of the course the students will be able to:

CO. NO.	Course outcomes	Level	Experiment covered
CO 1	Recall the laws in specific area and apply it to estimate the physical properties of materials	**K1**	**1,3,4,14**
CO2	Illustrate the functions of important circuits that are used to measure electrical properties of components.	**K2**	**12**
CO3	Conduct experiments to measure the physical observables.	**K3**	**7,8,9,13,16,17,18,19,20**
CO4	Analyze the quality of equipment's based on the observations	**K4**	**2,5,610,11,15**
CO5	Conduct experiments to demonstrate the relation between different properties of materials	**K5**	**21**
CO6	They have acquiring computational skills in C language	**K6**	**22,23,24,25,26**

2.SYLLABUS

List of Experiments

1.i-i' curve – Spectrometer

2.Cauchy's constants - Spectrometer.

3.Dispersive power of grating - Spectrometer.

4.Temperature coefficient of thermistor - Potentiometer.

5.Calibration of high range voltmeter - Potentiometer.

6. Charge Sensitivity - Ballistic galvanometer.

7.Absolute capacity of a condenser - Ballistic galvanometer.

8.Mutual inductance - Ballistic galvanometer.

9. High resistance by leakage - Ballistic galvanometer.

10.onversion of galvanometer into ammeter.

11. Conversion of galvanometer into voltmeter.

12. AC self-inductance of the coil - Anderson's bridge.

13.Field along the axis of a Coil-Determination of H & M

14. Small angle prism - Spectrometer.

15. Temperature coefficient of resistance - P.O Box.

16. Absolute value of M & H - Deflection and vibration magnetometer.

17. Measurement of EMF – Potentiometer.

18. Calculation of Radiation in atmosphere, Characteristics of GM tube, Gamma Radiation and study of isotopes - GM Counter.

19. Resistivity of materials - Four Probe Set Up.

20. Mobility and Carrier Concentration of Materials - Hall Effect measurement Set Up.

21. Study on the effect of sterilization using IR radiation on Micro-organism - IR Source

22. Conversion of Celsius into Fahrenheit and Fahrenheit into Celsius.

23. Biggest and smallest of a set of numbers.

24. Solving quadratic equation

25. Arranging the numbers in ascending and descending order

26. Arranging the words in alphabetical order.

3.SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Course content	Learning outcomes	Highest Bloom's Taxonomic Level of transaction
1	i-i' curve – Spectrometer	Analyze the relationship between angle of incidence and angle of refraction graphically using the observations and hence to determine the refractive index of the material of the prism.	**K3**
2	Cauchy's constants - Spectrometer.	Evaluate the wavelength λ of the lines of mercury spectrum and refractive index μ offered by the material of a prism experimentally and to establish a relation between μ and λ graphically and statistically.	**K5**
3	Dispersive power of grating - Spectrometer.	Evaluate the wavelength λ of the lines of mercury spectrum experimentally and to estimate the dispersive power of the grating using the observations.	**K5**
4	Temperature coefficient of thermistor - Potentiometer.	Apply the principle of Wheatstone's bridge to record the variation in resistance with temperature of the thermistor and hence to estimate the temperature coefficient of resistance of it.	**K3**
5	Calibration of high range voltmeter - Potentiometer.	Validate the calibration on a high range voltmeter by analyzing its response for various values of voltages.	**K6**

6	Charge Sensitivity - Ballistic galvanometer.	Estimate the figure of merit of the ballistic galvanometer by analyzing its response experimentally.	**K4**
7	Absolute capacity of a condenser - Ballistic galvanometer.	Measure the absolute capacity of a condenser experimentally using a ballistic galvanometer	**K5**
8	Mutual inductance - Ballistic galvanometer.	Measure the mutual inductance of a pair of coils experimentally using a ballistic galvanometer	**K5**
9	High resistance by leakage - Ballistic galvanometer.	Measure the high resistance of a resistor experimentally using a ballistic galvanometer	**K5**
10	Conversion of galvanometer into ammeter.	Estimate the resistance to be connected in parallel with given galvanometer, to construct the circuit to convert the galvanometer into ammeter of desired range and analyze its function.	**K6**
11	Conversion of galvanometer into voltmeter.	Estimate the resistance to be connected in series with given galvanometer, to construct the circuit to convert the galvanometer into voltmeter of desired range and analyze its function.	**K6**
12	AC self-inductance of the coil - Anderson's bridge.	Apply the principle of Anderson bridge to determine the self-inductance of a coil experimentally	**K3**
13	Field along the axis of a coil-Determination of H & M	Measure the magnetic field at a point along the axis of the coil and to determine the moment of the given magnet experimentally.	**K5**
14	Small angle prism - Spectrometer.	Conduct an experiment to measure the refractive index of the material of a small angle prism.	**K5**
15	Temperature coefficient of resistance - P.O Box.	Apply the principle of Wheatstone bridge to detect the minute variation in resistance of a coil with varying temperature and to estimate the temperature coefficient resistance of material of the coil.	**K3**
16	Absolute value of M & H - Deflection and vibration magnetometer.	Measure the absolute value of moment of the given magnet and horizontal intensity of earth's magnetic field.	**K5**
17	Measurement of EMF	Measure the emf of a cell	**K5**

	– Potentiometer.	experimentally using a potentiometer.	
18	Calculation of Radiation in atmosphere, Characteristics of GM tube, Gamma Radiation and study of isotopes - GM Counter.	Appraise the Plateau characteristics of GM tube and to determine reasonable operating point for the tube experimentally	**K4**
19	Resistivity of materials - Four Probe Set Up.	Measure the energy band gap and hence the resistivity of the given semiconductor experimentally using four probes set up	**K5**
20	Mobility and Carrier Concentration of Materials - Hall Effect measurement Set Up.	Measure the mobility, charge concentration and hence the Hall coefficient of the given semiconductor.	**K5**
21	Study on the effect of sterilization using IR radiation on Micro-organism - IR Source	Analyze of the effect of IR radiation over micro-organisms.	**K4**
22	Conversion of Celsius into Fahrenheit and Fahrenheit into Celsius.	Develop a C program to convert the given temperature in Fahrenheit and vice versa and to tabulate the results.	**K6**
23	Biggest and smallest of a set of numbers.	Develop a C program to find the biggest / smallest numbers among a set of numbers and tabulate the results.	**K6**
24	Solving quadratic equation	Develop a C program to solve the quadratic equation and to tabulate the results.	**K6**
25	Arranging the numbers in ascending and descending order	Develop a C program to arrange a set of numbers in descending order.	**K6**
26	Arranging the words in alphabetical order	Develop a C program to arrange the given set of words in alphabetical order.	**K6**

4. MAPPING SCHEME (PO, PSO & CO)

U16PH6P6	PO									PSO			
	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PSO 1	PSO 2	PSO 3	PSO 4
CO 1	-	-	-	-	-	-	-	-	-	H	-	-	-
CO 2	H	-	-	-	-	-	-	L	-	-	H	M	-
CO 3	-	-	-	H	-	-	M	-	-	-	-	-	-
CO 4	-	H	-	-	-	-	-	-	-	-	-	-	M
CO 5	-	-	H	-	-	M	-	-	-	-	-	-	H
CO 6	-	-	-	-	H	-	-	-	-	-	H	-	-

Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course Co-ordinator: Mr. A. Veerapandian

MAJOR PRACTICALS - VI

SEMESTER:VI **CODE: U16PH6P6**

CREDITS: 3 **NO. OF HOURS/WEEK: 6**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. NO.	Course Outcomes	Level	Experiment Covered
CO1	Explain the characteristics of FET and its working as an amplifier.	**K4**	**1,2**
CO2	Recall basic logic gates, Boolean algebra and modify digital circuits using K-map.	**K6**	**3,4,5,6**
CO3	Design amplifier and oscillator circuits using bipolar transistors.	**K6**	**7,8,9,10**
CO4	Analyze low pass and high pass filter circuits using operational amplifier.	**K6**	**11,12,13**
CO5	Develop assembly language program to perform various operations using 8085 microprocessors	**K6**	**14,15**
CO6	Explain voltage regulation using Zener diode.	**K4**	**16**

2. A. SYLLABUS

List of Experiments

1. FET characteristics.
2. FET amplifier.
3. Determination of frequency by beats - Hartley oscillator.
4. Determination of frequency by Lissajous's figures - Colpitts's oscillator.
5. Determination of frequency by CRO - Tuned collector oscillator.
6. Astable multivibrator.
7. Half Adder and Full Adder.
8. Half Subtractor and Full Subtractor
9. Universal Gates – Basic gates using universal gates.
10. Series resonance circuit
11. Parallel resonance circuit.
12. OP-AMP – Inverting amplifier – Non-inverting amplifier – Differential amplifier
13. OP-AMP adder and subtractor.
14. OP-AMP-High pass filter.
15. OP-AMP-Low pass filter.
16. OP-AMP- integrator.
17. OP-AMP-differentiator.

18. Single stage R-C coupled amplifier.
19. μP:8-bit multiplication and division.
20. Regulated Power supply using Zener diode – percentage of regulation.
21. Dielectric properties of liquids (Hydrated biomolecules, amino acids and proteins) - Dielectric study
22. Impedance analysis of materials - LCZ Meter.
23. Electromagnets with power supply and Gauss Meter – Study of Zeeman Shift
24. Measurement of EMF – Potentiometer.
25. Reduction of Boolean expression using K-map.
26. μP:8-bit addition and subtraction.
27. Impedance analysis of materials - LCZ Meter.
28. Electromagnets with power supply and Gauss Meter – Study of Zeeman Shift
29. Measurement of EMF – Potentiometer.
30. Reduction of Boolean expression using K-map.
31. μP:8-bit addition and subtraction.

Experiment No	Course content	Learning Outcomes	Highest Bloom's Taxonomy level of transaction
1	FET characteristics.	Analyze the characteristics of field effect transistor	**K4**
2	FET amplifier.	Analyze the gain of FET amplifiers	**K4**
3	Universal Gates – Basic gates using universal gates	Analyze and modify logic circuits using Karnaugh map reduction techniques	**K6**
4	Half Subtractor and Full Subtractor		
5	Half Adder and Full Adder.		
6	Reduction of Boolean expression using K-map.		
7	Single stage R-C coupled amplifier.	Design various amplifier, oscillator and multivibrator circuits using bipolar transistor	**K6**
8	Hartley Oscillator		
9	Colpitt's Oscillator		
10	Astable multivibrator		
11	Tuned Collector Oscillator		
12	OP-AMP Inverting amplifier, non-inverting amplifier and Differential amplifier	Design operational amplifier circuits to perform various mathematical operations	**K6**

13	OP-AMP adder and subtractor		
14	OP-AMP-High pass filter		
15	OP-AMP-Differentiator		
16	OP-AMP-Integrator		
17	OP-AMP-Low pass filter		
18	µP:8-bit addition and subtraction	Develop assembly language programs for 8085 Microprocessor	**K6**
19	µP:8-bit multiplication and division		
20	Regulated Power supply using Zener diode – percentage of regulation	Analyze voltage regulation using Zener diode	**K4**
21	Dielectric properties of liquids (Hydrated biomolecules, amino acids and proteins) - Dielectric study kit	Study the properties of liquids	**K2**
22	Impedance analysis of materials – LCZ meter	Analyze impedance of given materials.	**K6**
23	Study of Zeeman shift	Measure Zeeman shift given sample by magnetic field.	**K4**

24	Measurement of EMF - Potentiometer	Determine unknown EMF by potentiometer.	**K4**
25	Series resonance circuit	Design LCR circuits of desired resonant frequency	**K6**
26	Parallel resonance circuit		

4. MAPPING SCHEME (PO, PSO & CO)

U16PH6P6	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
CO 1	H	H	-	H	M	H	-	-	-	H	H	H	H
CO 2	H	H	-	H	M	H	-	-	-	H	H	H	H
CO 3	H	H	-	H	M	H	-	-	-	H	H	H	H
CO 4	H	H	-	H	M	H	-	-	-	H	H	H	H
CO 5	H	H	-	H	M	H	-	-	-	H	H	H	H
CO 6	H	H	-	H	M	H	-	-	-	H	H	H	H

Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course co-ordinator: Mr. A. Veerapandian

ALLIED PHYSICS PRACTICALS (FOR I B.Sc. MATHS AND II B.Sc. CHEMISTRY)

SEMESTER: I & II / III & IV **CODE: U16PHYP1/U20PHYP1**

CREDITS: 4 **NO. OF HOURS/WEEK:3**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO. No	Course Outcomes	Level	Experiment Covered
CO 1	Measure the coefficient of viscosity of liquids using graduated burette method and find surface tension using drop weight method	**K5**	**2,15**
CO2	Determine the Horizontal intensity of earth magnetic field and magnetic moment using Tangent galvanometer.	**K5**	**5,6**
CO 3	Measure series and parallel resistance, specific resistance, using potentiometer, Carey fosters bridge.	**K3**	**11,12**
CO4	Examine specific heat capacity of two different liquids using Newton's law of cooling method and thermal conductivity of a bad conductor using Lee's disc method.	**K4**	**3,4**
CO5	Apply optical theory find the radius of curvature of a given convex lens using Newton rings method and the refractive index of prism using spectrometer.	**K3**	**7,9**
CO6	Test Laws of transverse vibrations and find AC frequency of a given string and young's modulus of a non-uniform bending of a bar using pin and Microscope method.	**K4**	**1,8,10**

2. SYLLABUS

List of Experiments

1. Young's modulus of a non-uniform bending of a bar using pin and Microscope method
2. Coefficient of viscosity of a given liquid in the graduated burette using capillary tube method
3. The specific heat capacity of two different liquids using Newton's law of cooling method.
4. Thermal conductivity of a bad conductor using Lee's disc method.
5. Magnetic moment of a field along the axis of a coil using deflection magnetometer method
6. Magnetic field intensity of a field along the axis of a coil using deflection magnetometer method.
7. Radius of curvature of a given convex lens using Newton rings method
8. Laws of transverse vibrations of a wire using sonometer

9. Refractive index of a prism using spectrometer.
10. Sonometer-AC frequency of a given string using Sonometer.
11. (i) Series and (ii) Parallel resistance of a given coils using Meter bridge.
12. Specific resistance of a given coil using Carey Foster's Bridge.
13. Forward bias resistance and Reverse bias resistance of a given diode using its V-I characteristics circuit method.
14. Algebraic operations of AND, OR and NOT gates using discrete component.
15. Surface tension and Interfacial tension of given liquid drop using drop weight method.
16. Construct the full wave rectifier and verify its percentage of regulation.

3.SPECIFIC LEARNING OUTCOMES(SLO)

Experiment No	Course Content	Learning outcomes	Highest Bloom's Taxonomic Levels Of Transaction
1	Young's Modulus	Determine the Young's modulus of a non-uniform bending of a bar by constructing pin and Microscope method	**K3**
2	Co efficient of viscosity of a liquid	Calculate the coefficient of viscosity of a given liquid in the graduated burette by constructing capillary tube method	**K3**
3	Newton's law of cooling	Evaluate the measurement of the specific heat capacity of two different liquids using Newton's law of cooling method by (i) experimental and (ii) Graphical techniques	**K5**
4	Thermal conductivity - Lee's disc method	Determine thermal conductivity of a bad conductor using Lee's disc method.	**K5**
5	Magnetic moment of a field along the axis of a coil	Calculate the magnetic moment of a field along the axis of a coil using deflection magnetometer method	**K3**
6	Magnetic field intensity of a field along the axis of a coil	Calculate the Magnetic field intensity of a field along the axis of a coil using deflection magnetometer method	**K3**
7	Newton rings	Measure the radius of curvature of a given convex lens using Newton rings method	**K5**
8	Laws of transverse vibrations	Test the laws of transverse vibrations of a wire using Sonometer.	**K4**
9	Refractive index	Estimate the refractive index of a prism	**K5**

	of a prism	using spectrometer	
10	Specific resistance of a given coil-Meter Bridge	Measure the specific resistance of a given coil using meter bridge.	**K5**
11	(i) series and (ii) parallel resistance of a given coils	Calculate the (i) series and (ii) parallel resistance of a given coils using meter bridge.	**K3**
12	Specific resistance of a given coil-Carey Foster Bridge	Measure the specific resistance of a given coil using Carey Foster's Bridge	**K5**
13	V-I characteristics of junction diode	Measure the forward bias resistance and reverse bias resistance of a given diode using its V-I characteristics circuit method	**K5**
14	AND, OR and NOT gates	Demonstrate the algebraic operations of AND, OR and NOT gates using discrete components	**K2**
15	Surface tension and Interfacial tension of given liquid	Measure the surface tension and interfacial tension of given liquid drop using drop weight method	**K5**
16	Full wave rectifier	Construct the full wave rectifier for verifying its percentage of regulation.	**K3**

4. MAPPING SCHEME (PO, PSO & CO)

U16PHYP1/ U20PHYP1	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	H	M	H	M	H	H	M	M	L	H	H	H	M
CO2	H	H	H	M	H	H	M	M	M	H	H	H	M
CO3	H	M	H	M	H	H	M	M	-	H	L	L	H
CO4	H	M	L	L	H	H	M	M	-	H	L	L	H
CO5	H	M	H	M	H	H	M	M	L	H	H	H	M
CO6	H	H	M	H	H	H	M	M	M	H	H	H	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct
1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect
1. Course-end survey

Course co-ordinator: Mr. A. Veerapandian

APPLIED PHYSICS PRACTICAL (FOR II B.SC. COMPUTER SCIENCE)

SEMESTER: III & IV **CODE: U13PHZP1**

CREDITS: 3 **NO. OF HOURS/WEEK: 3**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Experiments Covered
CO1	Analyze the basic operation and the characteristics of Junction and Zener diode in various configuration and construct regulated power supply using Zener diode.	**K4**	**6,12**
CO2	Explain the characteristics features of FET and CE - Transistor.	**K4**	**5,13**
CO3	Estimate the Q-factor from frequency response of series and parallel resonance circuits.	**K5**	**4,14**
CO4	Construct and study the adder, Subtractor circuits using OPAMP IC 741, and verify the function of logic gates using discrete components.	**K3**	**7,8,15**
CO5	Determine the horizontal component of intensity of earth magnetic field and magnetic moment using Tangent galvanometer.	**K5**	**2,10**
CO6	Measure resistance, specific resistance, current, using potentiometer, Carey fosters bridge and PO box.	**K4**	**1,3,11,16**

2.SYLLABUS

List of Experiments

1.Measurement of resistance –Potentiometer

2.Field along the axis of a Coil carrying current

3.Thermister and energy gap

4.Series resonance circuit

5.FET Characteristics

6.Semiconductor Diode characteristics

7.OP AMP adder.

8.Logic gates AND, OR, NOT (Discrete Components)

9.Zener diode regulated power supply

10.Field along the axis of a coil magnetic moment

11.Measurement of Current-Potentiometer calibration of ammeter

12.Characteristics of Zener diode

13.Transistor CE characteristics mode

14.Parallel resonance circuit

15.OPAMP Subtractor

16.Carey Foster bridge

3.SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Course Content	Learning Outcomes	Highest Bloom's Taxonomic level of transaction
1.	Semiconductor Diode Characteristics.	Measure the forward bias resistance and reverse bias resistance of a given Junction diode using its V-I characteristics circuit method	**K5**
2.	Zener diode characteristics.	Measure the forward bias resistance and	**K5**

		reverse bias resistance of a given Zener diode using its V-I characteristics circuit method	
3.	Transistor Characteristics - CE configuration.	Construct and measure Transistor Characteristics - CE configuration.	**K3**
4.	FET characteristics	Analyze the characteristics of FET.	**K4**
5.	Parallel resonance circuit.	Construct and verify the parallel resonance circuit.	
6.	Series resonance circuit.	Construct and verify the resonance condition in LCR connected in series.	**K5**
7.	Regulated Power supply using Zener diode.	Construct a regulated power supply using Zener diode and measure percentage of regulations.	**K4**
8.	OP-AMP adder.	Construct and verify OPAMP adder circuit.	**K3**
9.	OP-AMP subtractor	Construct and verify OPAMP subtractor circuit.	**K3**
10.	Logic gates AND, OR, NOT using discrete components.	Construct logic circuits using discrete components such as diodes and transistors and verify their truth tables	**K3**

11.	Field along the axis of a coil-determination of M.	Determine M using the Field along the axis of coil.	**K5**
12.	Carey-Foster's bridge.	Determine Specific resistance of the unknown coil.	**K4**
13.	Field along the axis of a coil-determination of H	Determine magnetic moment of magnet using the Field along the axis of coil.	**K5**
14.	Potentiometer.	Determination the Specific resistance of given wire using Potentiometer.	**K5**
15	Thermistor - determination of energy gap - Thermistor.	Measure band gap of thermistor using PO box.	**K5**
16	Ammeter calibration - Potentiometer.	Calibration of ammeter using potentiometer.	**K3**

4.MAPPING SCHEME (CO, PO & PSO)

U13PHZP1	**PO**									**PSO**			
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	M	L	M	L	L	L	M	L	L	M	H	H	M
CO2	M	M	M	H	M	H	M	M	L	L	L	H	M
CO3	M	M	M	M	M	L	M	L	L	L	L	L	M
CO4	M	M	L	L	L	L	M	H	L	H	L	L	H
CO5	M	M	M	L	M	L	M	L	L	M	M	M	M
CO6	M	M	L	M	M	M	M	M	M	M	M	M	M

L-Low M-Moderate H- High

5. COURSE ASSESSMENT METHODS

Direct

1.Continuous Assessment Test (Model Practical Exams)
2. Record, Assignment, Problem solving, Design new circuits and set up, Skill Assessment etc.,
3. End Semester Examination

Indirect

1. Course-end survey

Course co-ordinator: Mr. A. Veerapandian

DIGITAL ELECTRONICS AND MICROPROCESSOR LAB

(FOR III B.Sc. COMPUTER SCIENCE)

SEMESTER : V & VI **CODE: U18CS6P6**

CREDITS: 3 **NO. OF HOURS/WEEK: 2**

1. COURSE OUTCOMES (CO)

After the successful completion of this course the students will be able to:

CO.NO.	Course Outcomes	Level	Experiments Covered
CO1	Recall basics of logic gates by a universal NAND and NOR gates.	**K4**	**3,11**
CO2	Construct and study the Half Adder and Full Adder. Half Subtractor and Full Subtractor circuits.	**K4**	**4,12**
CO3	Verify the Conversion of Decimal to Hexadecimal and Hexa decimal to decimal and Block Transfer by8085 microprocessors.	**K5**	**8,10**
CO4	Develop assembly language program to perform various operations using 8085 microprocessors. μP: Multibyte μP:8-bit: addition and subtractor.	**K3**	**7,15,16**
CO5	Construct the circuit and verify the Karnaugh map reduction technique, Shift register, Up and down counter.	**K5**	**5,6,13**
CO6	Verify the Analog to Digital converter Binary weight method.	**K4**	**1,2,9,14**

2.SYLLABUS

List of Experiments

1. Microprocessor -Sum of series
2. Microprocessor Maxima and Minima of set of data
3. NAND as Universal gates
4. Half adder and Full adder circuits
5. Shift Register
6. Karnaughs reduction techniques
7. Microprocessor addition and Multiplication
8. Microprocessor Block transfer
9. Microprocessor ascending and descending order.
10. Microprocessor- Decimal to Hexadecimal and Hexadecimal to decimal conversion.
11. NOR as Universal gates
12. Half subtractor and Full subtractor circuits
13. Up Counter and Down Counter
14. Analog to Digital: binary weight method
15. Microprocessor subtraction and division
16. Microprocessor multibyte addition and Subtraction.

3. SPECIFIC LEARNING OUTCOMES (SLO)

Experiment No	Course Content	Learning Outcomes	Highest Bloom's Taxonomic level of transaction
1.	Basic gates by using NAND as universal gates	Construct NAND gates and verify their truth tables as basic gates.	**K3**
2.	Basic gates by using NOR as universal gates	Construct NOR gates and verify their truth tables as basic gates.	**K3**
3.	Half Adder and Full Adder.	Design and verify the truth table of Half Adder and Full Adder.	**K3**
4.	Half Subtractor and Full Subtractor.	Demonstrate the Half Subtractor and Full Subtractor for their truth tables.	**K2**
5.	Conversion of	Make use of 8085	**K3**

	Decimal to Hexadecimal and Hexa decimal to decimal.	microprocessors to verify Conversion of Decimal to Hexadecimal and Hexa decimal to decimal.	
6.	Block Transfer	Make use of 8085 microprocessors to Transferring the Data one location to another location.	**K3**
7.	μP: Sum of series.	Test Sum of series 8085 microprocessors.	**K6**
8.	μP: Maximum and Minimum of a set of numbers.	Choose set of numbers and verify the Maximum and Minimum of set of numbers by 8085 microprocessors.	**K6**
9.	μP:8-bit multiplication and division.	Verify the multiplication and division using 8085 microprocessors.	**K5**
10.	μP: Multibyte addition and subtractor.	Verify the multibyte addition and subtractor using 8085 microprocessors.	**K5**
11.	μP:8-bitAscending and descending order.	Choose set of numbers and verify Ascending and descending order of set of numbers by 8085 microprocessors.	**K6**
12.	Karnaugh's map reduction technique	Simplify Boolean algebra by Karnaugh's map technique.	**K4**
13.	Up and Down counter.	Construct circuit and verify performances of counters.	**K6**
14.	Shift register	Construct and test the performance of register.	**K6**
15	Analog to Digital converter Binary weight method.	Construct the given circuit and to test the equivalent responses analog to digital.	**K6**
16	μP: Addition and subtractor.	Verify the addition and subtractor using 8085 microprocessors.	**K5**

4. MAPPING SCHEME (PO, PSO & CO)

U18CS6P6	PO									PSO			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
CO1	M	L	M	L	L	L	M	L	L	M	H	H	M
CO2	M	M	M	H	M	H	M	M	L	L	L	H	M
CO3	M	M	M	M	M	L	M	L	L	L	L	L	M
CO4	M	M	L	L	L	L	L	H	L	H	L	L	M
CO5	M	M	L	L	M	L	M	L	L	M	M	M	M
CO6	M	M	L	M	M	M	M	M	M	M	M	M	M

L-Low M-Moderate H- High

5. COURSE ASSESMENT METHODS

Direct

1. Record and Observation Evaluation
2. Continuous Assessments (Minimum Two)
3. End Semester Practical Examinations

In-Direct

1. Assignments
2. Laboratory / Field visits
3. Course end survey/Feedbacks

Course Co-ordinator: Mr. A. Veerapandian

PROGRAMME ARTICULATION MATRIX (UG-2020-2021)

S.No.	COURSE NAME	COURSE CODE	CORRELATION WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES												
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO1	PSO2	PSO3	PSO4
1	Properties of matter and Acoustics	U16PH101	H	H	M	H	H	M	M	M	M	H	M	M	M
2	Mechanics	U16PH202	H	H	H	M	M	M	L	L	L	H	H	H	M
3	Thermal Physics	U16PH303	H	M	M	L	M	L	L	L	M	M	L	M	L
4	Optics	U16PH404	H	M	M	M	M	M	L	L	L	H	M	L	L
5	Electricity, Magnetism and Electromagnetism	U16PH505	H	H	M	H	H	M	M	M	M	H	H	H	M
6	Electronic Devices	U16PH506	H	M	M	H	L	L	L	M	M	H	L	H	L
7	Nuclear Physics, Wave Mechanics and Relativity	U16PH607	H	H	M	M	H	L	L	L	M	H	L	M	M
8	Solid State Physics	U16PH608	M	M	H	M	M	M	M	-	-	H	M	M	M
9	Atomic Physics	U16PH5:1	M	M	M	H	H	M	M	L	M	H	M	L	M
	Communication System	U16PH5:A	M	H	H	H	M	M	M	M	L	M	M	H	M
	Astronomy and Astrophysics	U20PH5:B	H	H	H	M	M	M	L	L	L	H	H	H	M
	Python	U20PH5:C	M	H	H	H	H	H	M	M	L	M	H	H	H
10	Digital Electronics	U16PH6:1	H	H	M	H	H	L	M	L	L	H	H	M	M
	Crystal Growth and Thin Film Physics	U16PH6:A	H	M	M	M	M	M	L	M	L	H	M	M	M
	Energy Physics	U20PH6:B	H	M	M	M	M	M	M	L	L	H	H	H	H
	Mathematical Methods for Physicists	U20PH6:C	H	M	M	M	M	M	M	L	L	H	H	H	H
11	Programming in C	U16PH6:3	M	H	H	H	H	H	M	M	L	M	H	H	H
12	SBEC - I :Bio-Physics And Bio-Medical Instrumentation	U16PH2S1	H	M	L	M	L	M	L	L	L	M	M	L	M
13	SBEC – II: Concepts through Animations	U16PHPS2	M	L	L	M	L	L	M	-	-	L	L	M	L
14	SBEC - III :Web Designing (Theory And Practical)	U16PHPS3	H	H	M	H	L	H	M	L	L	M	M	H	H
15	NMEC- I: Electrical Appliances	U16PH3E1	M	L	L	M	L	L	L	L	L	M	L	M	L
16	NMEC – II: Audio And Video Systems	U16PH4E2	H	H	L	L	L	L	L	L	L	H	H	M	M
17	Allied Physics-1 (I B.Sc. Mathematics) Mechanics, sound, thermal physics and	U18PHY01	H	H	H	H	M	M	M	M	M	H	H	M	M

	optics														
18	Allied Physics-1 (II B.Sc. Chemistry) Mechanics, sound, thermal physics and optics	U18PHY33	H	H	H	H	M	M	M	M	M	H	H	M	M
19	Allied Physics- II (I B.Sc. Mathematics) Electricity, Atomic and Nuclear Physics and Electronics	U18PHY02	H	H	H	M	H	M	M	-	-	H	M	M	M
20	Allied Physics-II (II B.Sc. Chemistry) Electricity Atomic and Nuclear Physics and Electronics	U18PHY44	H	H	H	M	H	M	M	-	-	H	M	M	M
21	Applied Physics- II (II B.Sc. Computer Science) Electricity, Magnetism and Electromagnetism	U13PHZ34	H	M	M	M	H	M	L	L	L	H	M	M	L
22	Applied Physics II(II B.Sc. Computer Science) Solid state Devices and Microprocessor	U13PHZ45	H	M	M	H	M	L	L	L	L	H	H	M	H
23	Major Practicals - I	U16PH1P1	H	L	M	H	L	M	-	-	H	M	H	H	M
24	Major Practical-II	U16PH2P2	-	H	H	-	H	M	H	-	-	-	H	H	H
25	Major Practicals - III	U16PH3P3	H	L	M	H	L	M	-	-	H	M	H	H	M
26	Major Practical-IV	U16PH4P4	-	H	H	-	H	M	H	-	-	-	H	H	H
27	Major Practicals - V	U16PH5P5	H	H	H	H	H	M	M	L	L	H	H	H	M
28	Major Practicals - VI	U16PH6P6	H	H	-	H	M	H	-	-	-	H	H	H	H
29	Allied Physics Practicals (I B.Sc. Mathematics/ II B.Sc. Chemistry)	U16PHYP1/ U20PHYP1	H	H	H	H	H	H	M	M	L	H	H	H	H
30	Applied Physics Practicals (II B.Sc. Computer Science)	U13PHZP1	M	M	M	M	L	M	M	M	L	M	M	M	M
31	Digital Electronics and Microprocessor Lab (III B.Sc. Computer Science)	U18CS6P6	M	M	M	M	L	M	M	M	L	M	M	M	M