B.Sc PHYSICS
Programme Code – UPH
(Aided & SF)

Programme outcome (PO) Bachelor of Science (B.Sc.)

PO1 **Scientific Knowledge and Critical Thinking:**

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the arrangement of solutions to the problems that come across in our day-to-day life/activities

PO2 **Problem Solving:**

Identify and analyse the problem and formulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.

PO3 **Communication and Computer Literacy:**

Communicate the fundamental and advanced concepts of their discipline in written and oral form. Able to make appropriate and effective use of information and information technology relevant to their technique.

PO4 **Life-Ling Learning:**

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO5 **Ethical, Social and Professional Understanding:**

Commitment to principles, codes of conduct and social responsibility in order to behave consistently with personal respect. Acquire the responsibility to contribute for the personal development and for the development of the community. Respect the ethical values, social responsibilities and diversity.

PO6 **Innovative, Leadership and Entrepreneur Skill Development:**

Function as an individual and as a member or leader in diverse teams and in multidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving and intellectual skills.

VISION

To provide an ambient environment for teaching and research in physics with focus on achieving academic excellence

MISSION

- To contribute to develop and sustain teaching and evaluation methods in physics learning in tune with emerging trends in science
- To constantly explore and enhance research potential among faculty and students to promote innovation
- To bridge the gap between curriculum-based learning and career readiness/employability of physics graduates
- To create a conscientious awareness among students about issues pertaining to welfare of society and environment

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- The objectives of this programme is to equip/prepare students to

PEO1	A successful career in academia, government, industry, corporates or as an self-employed entrepreneur
PEO2	Continue to learn and advance in academia to undertake higher education with focus on research and development
PEO3	Communicate physics related topics effectively by way of oral presentations and write-ups in the form of scientific reports, projects, dissertations, etc.
PEO4	Acknowledge the importance of participation in co-curricular and etra-curricular activities to nurture and grow leadership skills
PEO5	Be socially sensitive to contemporary issues and play a constructive role towards the welfare of the society and environment

-

PROGRAMME SPECIFIC OUTCOMES – B.Sc. PHYSICS

- On successful completion of B.Sc. Physics, the students will be able to

PSO1	Identify key concepts, principles and fundamental laws that are central to the study of various areas of physics, define and describe them with clarity
PSO2	Demonstrate the application of physics principles, concepts and laws with necessary experimental background and assess their consequences
PSO3	Explain the mathematical foundation of the underlying physics principles, concepts and laws
PSO4	Formulate, discuss and analyse problems in physics by identifying key concepts and principles to solve them
PSO5	Plan and execute an experiment through careful observations, precise measurements, analysis, interpretation and effectively communicate the results

Semester –V

Course	Code	Subject	Contact hours per week	Credits	Total No. of hoursallotted	Maximum Marks		Total
						CA	SE	
Core–9	UPH20C51	Elementary SolidStatePhysics	6	6	90	25	75	100
Core–10	UPH20C52	Analog Electronics	6	6	90	25	75	100
Core–11	UPH20C53	Modern Physics	6	6	90	25	75	100
Core Elective–I	UPH20CE51A/B/C	Numerical Methods with Programming in C/ Mathematical Physics/ Introduction to Microprocessor	6	5	90	25	75	100
SEC–I	UPH20SE51 A/B/C	Data Analysis and Interpretation/Physics of optoelectronic devices/Nanophysics	2	2	30	15	35	50
CoreLab 3	UPH20CL61	Major Practical – III General Experiments	2	–	30	–	–	–
CoreLab 4	UPH20CL62	Major Practical – IV Electronic Experiments	2	–	30	–	–	–
			30	**25**	**450**	**115**	**335**	**450**
	UPH20IN	**Internship**		**2**		**15**	**35**	**50**

Semester –VI

Course	Code	Subject	Contact hours per week	Credits	Total No. of Hrs Allotted	Maximum Marks		Total
						CA	SE	
Core–12	UPH20C61	Atomic and Molecular spectra	6	6	90	25	75	100
Core–13	UPH20C62	Nuclear and particle physics	6	6	90	25	75	100
Core–14	UPH20C63	Digital Electronics	6	6	90	25	75	100
Core Elective-II	UPH20CE 61A/B/C	Introduction to Quantum mechanics/ Optical fiber communication/ Foundation of Astronomy	6	5	90	25	75	100
SEC-II	UPH20SE61 A/B/C	Physics of Home Appliances/Instrumentation/ Medical Physics	2	2	30	15	35	50
CoreLab 3	UPH20CL 61	Major Practical – III General Experiments	2	2	30	40	60	100
CoreLab 4	UPH20CL 62	Major Practical – IV Electronic Experiments	2	2	30	40	60	100
			30	**29**	**450**	**195**	**455**	**650**
		NCC/NSS/PET		1		50	50	100
Total Credits for Semesters I to VI				**140**				

Thiagarajar College (Autonomous), Madurai – 625 009
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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20C51	ELEMENTARY SOLID STATE PHYSICS	Core	6	–	–	6

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	25	75	100

Preamble

Solid State Physics deals with macroscopic and microscopic physical properties of matter in its condensed state. This paper deals with the essential principles of solids in the crystalline state and properties of condensed matter such as superconductivity, dielectric and ferroelectric behaviour. Also, some new materials which possess novel properties that find application in all walks of human life have also been included.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Explain fundamental principles of crystalline objects and their symmetry in detail.
CO2	Understand the principles of X-ray diffraction and its application to study the internal structure of solids.
CO3	Comprehend thebasic experimental principles and theoretical foundations superconductivity and its applications.
CO4	Interpret the physical foundations of dielectric and ferroelectric materials.
CO5	Understand the properties of new materials which exhibit novel properties for application in all walks of life.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	M	M
CO2	M	S	M	S	M	M
CO3	S	S	-	M	S	M
CO4	M	S	S	M	M	M
CO5	S	S	-	M	M	S

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	S	S
CO2	M	S	S	L	S
CO3	M	S	S	S	X
CO4	S	S	M	S	S
CO5	S	S	S	M	S

Syllabus : ELEMENTARY SOLID STATE PHYSICS

Unit I Crystal physics I: Lattice points and space lattice – The basis and crystal structure – Unit cells and lattice parameters – Unit cells versus primitive cells – Crystal systems – Crystal symmetry – Twenty three symmetry elements in a cubic crystal – Five-fold rotation axis is not compatible with a Lattice – Combination of symmetry elements – Rotation-Inversion axis – Translation symmetry elements – Space groups – The Bravais space lattices – Metallic crystal structures – Relation between the density of crystal material and lattice constant in a cubic lattice.

Unit II Crystal physics II : Other cubic structures – Directions, planes and Miller indices – Important features of Miller indices of crystal planes – Important planes and directions in a cubic crystal – Distribution of atoms in the atomic planes of a simple cubic crystal – Separation between lattice planes in a cubic crystal – Allotropy and polymorphism – Imperfections in crystals – Reciprocal lattice–X-ray diffraction– Bragg's law – Bragg's X-ray spectrometer – Powder crystal method – Rotating crystal method – Correction for Bragg's equation.

Unit III Superconductivity : A survey of superconductivity – Mechanism of super conductors – Effects of magnetic field A.C. resistivity – Critical currents – Flux exclusion – The Meissner effect – Thermal properties – The energy gap – Isotope effect – Mechanical effects – The penetration depth – Type I and Type II superconductors – London equations – Electrodynamics – superconductors in A.C. Fields – B.C.S. Theory – Josephson's Tunneling – Theory of D.C. Josephson effect

Unit IV Dielectric materials: Introduction– Fundamental definitions in dielectrics–Different types of electric polarization– Frequency and temperature effects on polarization–Dielectric loss–Local field or internal field –Clausius-Mossotti relation – Determination of dielectric constant–Dielectric breakdown– Properties and different types of insulating materials–Ferroelectric materials

Unit V New materials : Introduction – Metallic glasses –Fiber reinforced plastics and Fiber reinforced metals–Metal matrix composites –Surface Acoustic Wave materials–Biomaterials –Ceramics –Cermets– High temperature materials–Thermoelectric materials– Electrets.

Text Books

1. PILLAI, S.O.(1997).*Solid State Physics* (4th ed.), New Age International Publisher, New Delhi. ISBN:81-224-1048-0.
   (Unit I :p.87-109; Unit II : p.110-145, 157-170;Unit III: p.359,361-381, 387-389,392-394)
2. ARUMUGAM, M. (2002). *Materials Science*,(3rd ed.), AnuradhaPublications, Chennai. ISBN:81-87721-05-7
   (Unit IV: p.6.1-6.42; Unit V: p.11.1-11.23)

References

1. HANNAY, N.B.(1976). *Solid State Chemistry*, Prentice Hall of India Private Limited, ISBN 10: 0138219591 / ISBN 13: 9780138219598
2. RAGHAVAN, V. (2015).*Materials Science and Engineering – A First Course*, (6th ed.), Prentice-Hall of India, Delhi. ISBN:978-81-203-5092-2.
3. Wahab, (2017). M.A. *Structure and Properties of Materials,* (3rd ed.), Alpha Science International Limited,ISBN: 9781842652183, 1842652184.

Web resources

1. https://podcasts.ox.ac.uk/series/oxford-solid-state-basics
2. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
3. https://en.wikipedia.org/wiki/Amorphous_metal

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Department of Physics
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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20C52	ANALOG ELECTRONICS	Core	6	–	–	6

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	25	75	100

Preamble

Analog electronics helps students to acquire knowledge and apply it to various electronics instruments. It also helps the students to apply the knowledge in analog circuits in the development of electronic instruments. It motivates the students to understand the principles of analog electronics used in the electronic gadgets used in their day – to – day life

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Study the characteristics of transistor amplifiers
CO2	Discern the fundamental aspects of Power Amplifiers
CO3	Design the different types of oscillators using transistors
CO4	Recognize the basic concepts of modulation and demodulation
CO5	Understand the basic concepts and applications of OP-AMP

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	L	M	M	-
CO2	L	S	L	M	M	M
CO3	M	S	L	M	M	S
CO4	M	S	M	M	S	S
CO5	S	S	S	S	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	S	M	M
CO2	S	S	S	L	M
CO3	M	L	L	S	S
CO4	M	S	S	L	L
CO5	S	L	L	S	S

Syllabus : ANALOG ELECTRONICS

Unit I Transistor voltage amplifiers: Single stage amplifier – Graphical demonstration – Practical circuit – Phase reversal – DC & AC equivalent circuits – Load line analysis – Voltage gain – Voltage gain of CE amplifier – Voltage gain of unloaded CE amplifier - Voltage gain of CE amplifier without C_E – Input impedance of CE amplifier – Voltage gain stability – Classification of amplifiers – Gain of transistor configurations – Multistage transistor amplifier - Important terms – RC, transformer and direct coupled amplifiers.

Unit II Transistor audio power amplifiers : Transistor audio power amplifier – Small signal and large signal amplifiers – Output power of amplifiers – Difference between voltage and power amplifiers – Performance quantities and classification of power amplifiers – Expression for collector efficiency – Maximum collector efficiency of series-fed class A amplifier - Thermal runaway – Heat sink–push-pull amplifier – Maximum efficiency for class B power amplifier.

Unit III Oscillators: Sinusoidal oscillator – Types of sinusoidal oscillators – Oscillatory circuit – Undamped oscillations from tank circuit – positive feedback-amplifier – essentials of transistor oscillator – explanation of Barkhausen criterion –Colpitt's oscillator – Hartley oscillator – Principle of phase shift oscillator – Phase shift oscillator.

Unit IV Modulation and demodulation: Introduction – radio broadcasting, transmission and reception – Modulation – types of modulation – Amplitude modulation – Modulation factor – Sideband frequencies in AM wave – Transistor AM modulator-limitations of amplitude modulation – Frequency modulation – Theory of frequency modulation – Comparison of FM and AM – Demodulation.

Unit V Applications of Op-amp: Inverting amplifier-non-inverting amplifier – Voltage follower – Summing amplifiers – Applications of summing amplifiers: as averaging amplifier, as Subtractor –Op-amp integrator – Critical frequency of integrators – Op-amp differentiator – comparator circuits: as a square wave generator, zero-crossing detector and a level detector.

Text Books

1. MEHTA, V. K. & MEHTA, R. (2016).*Principles of electronics* (11th ed.), S. Chand & Co., New Delhi. ISBN:978-81-219-2450-4.

Unit I – Chapter 10 (10.1 - 10.5, 10.7 -10.9, 10.12 – 10.16, 10.18, 10.21) Chapter 11 (11.1, 11.3, 11.5, 11.7);

Unit II – Chapter 12 (12.1 – 12.5, 12.7, 12.8, 12.11 – 12.12, 12.17 – 12.18);

Unit III – Chapter 14 (14.1 -14.7, 14.10-14.13);

Unit IV – Chapter 16 (16.1 -16.5, 16.7 – 16.14)

Unit V – Chapter 25 (25.23 -25.27, 25.32 – 25.39)

References

1. BELL, D. A. (2008). *Electronic Devices and Circuits* (5th ed.), Prentice-Hall of India, New Delhi.
2. MALVINO, A. BATES, D. J. (2017). *Electronic Principles* (7th ed.), Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3. CHATTOPADHYAY, D. RAKSHIT, P. C. (2020). *Electronics Fundamentals and Applications*(16th ed.), New Age International (P) Limited, New Delhi.

Web resources

1. https://www.electronics-tutorials.ws/amplifier/amp_2.html
2. *https://en.wikipedia.org/wiki/Audio_power_amplifier*
3. *https://en.wikipedia.org/wiki/Electronic_oscillator*

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Department of Physics
(For those joined B.Sc. Physics on or after June 2020)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20C53	MODERN PHYSICS	Core-11	6			6

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	25	75	100

Preamble

The beginning of 20th century witnessed revolutionary ideas in Physicswhichgave immense impetus to our understanding of matter at atomic scale and universe, in general. These ideas paved way for several new fields such as Atomic, Nuclear, Quantum, Solid State Physics. This course deals with the physical principles underlying some of the important topics of ModernPhysicssuch asrelativity, elements of light quanta, statistical physics and molecular structure.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Comprehend the postulates of special relativity and their consequences.
CO2	Understand the changes that are required to describe the fundamental physical quantities such as momentum and energy of relativistic objects.
CO3	Explain the origin and evolution of the idea of quantization of light.
CO4	Illustrate the application of statistical principles in describing constituent of matter.
CO5	Explain the quantum origins of chemical bonds and why not all atoms bond together to form molecules.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	L	L	M	M
CO2	S	S	M	M	M	L
CO3	M	S	S	M	M	L
CO4	M	S	S	M	L	M
CO5	M	S	S	M	L	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	L	S	S	M
CO2	S	S	S	L	M
CO3	S	M	S	M	S
CO4	M	S	S	L	L
CO5	S	L	L	S	S

Syllabus: MODERN PHYSICS

Unit I Relativity I: Special relativity – The principle of relativity– The Michelson-Morley experiment – Postulates of special relativity – Consequences of special relativity –The Lorentz transformation–Space, time and causality

Unit II Relativity II: Relativistic momentum and the relativistic form of Newton's laws – Relativistic energy – Mass as a measure of energy – Conservation of relativistic momentum and energy – General relativity.

Unit III The quantum theory of light: Hertz experiments – Light as an electromagnetic wave – Blackbody radiation – The Rayleigh-Jeans law and Planck's law – Light quantization and the photoelectric effect – The Compton effect and X-rays – Particle-wave complementarity – Does gravity affect light?

Unit IV Statistical physics: The Maxwell-Boltzmann distribution – Under what physical conditions are Maxwell-Boltzmann statistics are applicable? – Quantum statistics – Applications of Bose-Einstein statistics – An application of Fermi-Dirac statistics.

Unit V Molecular structure: Bonding mechanisms - A survey – Molecular rotation and vibration – Molecular spectra – Electron sharing and the covalent bond – Bonding in complex molecules

Text Books

1. SERWAY, R.A., MOSES, C.J. & MOYER, C.A. (2005).*Modern Physics* (3rd ed.), Thomson Learning, Singapore.ISBN 0-534-40624-6

   Unit I – Chapter 1; Unit II – Chapter 2; Unit III – Chapter 3; Unit IV – Chapter 10

   Unit V – Chapter 11

References

1. TIPLER, P.A. &LEWELLYN, R.A. (2012). *Modern Physics* (6th ed.), W.H Freeman & Co., New York. ISBN-13: 978-1-4292-5078-8

2. ARULDHAS, G. &RAJAGOPAL, P. (2016). *Modern Physics* (7th print), PHI Learning Private Limited, Delhi. ISBN 978-81-203-2597-5
3. THORNTON, S.T. & REX, A. (2006). *Modern Physics for Scientists and Engineers* (4th ed.), Cengage Learning, Boston. ISBN: 978-1-133-10372-1
4. KRANE, K.S. (2011). *Modern Physics* (3rd ed.), John Wiley & Sons, New Jersey. ISBN: 978-1-119-49555-0
5. BEISER, A. (2003). *Concepts of Modern Physics* (6th ed.), McGraw Hill, New York. ISBN 0–07–115096–X.

Web resources

1. https://javalab.org/en/special_relativity_en/
2. https://faraday.physics.utoronto.ca/GeneralInterest/Harrison/Flash/
3. https://www.refsmmat.com/jsphys/relativity/relativity.html

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CE51A	NUMERICAL METHODS WITH PROGRAMMING IN C	Core Elective	5	1	–	5

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	25	75	100

Preamble

Numerical solutions to mathematical problems are often a necessity for students of Physics. Thus, exposure to principles of numerical methods and a computer language is expected to enable students to solve larger mathematical problems on computers with enormous speed and accuracy and save lot of time compared to those attempted by desk calculators. This paper deals with the essential principles of numerical methods and C programming.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Comprehend the principles of numerical methods by applying them to solve simple mathematical equations
CO2	Apply numerical methods to solve differential and integral equations.
CO3	Understand the basic elements of C language
CO4	Explain the structure of C programming
CO5	Employ C programming for computational and graphical applications.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

.	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	S	S	M
CO2	M	S	S	S	M	L
CO3	L	S	S	S	M	L
CO4	L	S	S	S	M	L
CO5	L	S	S	S	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	M	L
CO2	S	S	L	M	L
CO3	M	M	L	M	L
CO4	S	S	S	M	S
CO5	M	M	S	S	M

Syllabus : NUMERICAL METHODS WITH PROGRMMING IN C

Unit I Algebraic and Transcendental Equations: Introduction – Iteration method – Bisection method – Regula-Falsi method – Newton-Raphson method.

Unit II Numerical Integration and Numerical solution of Differential Equation: Numerical Integration – Trapezoidal rule – Simpson's one third rule – Taylor series method – Euler's method- Modified Euler's method

Unit III C Fundamentals: Identifiers and keywords – Data types – Constants – Variables – Declarations – Expressions – Symbolic constants – Library functions, operators and expressions: Arithmetic operators – Unary operators – Relational and logical operator – Assignment operator – Conditional operator and bitwise operator data input and output: The get char functions – The put char function – Scanf function – Printf function – Gets and puts function.

Unit IV Control Statements: Branching statement: The if and if-else statement – The while statement and the do-while statement Looping statement: The for statement – Nested control statement – The switch statement – The break statement – The continue statement – The goto statement.

Unit V Arrays, Functions and Structures: Arrays – One dimensional, two dimensional & multidimensional arrays – Defining a function – Accessing a function – Function prototypes – passing Arguments to a function – Recursion – Structures – Initialization – Comparison – Arrays of structures – Arrays within structures – Structures within structures.

Text Books

1. ISSAC, A. (2015). *Numerical Analysis with Programming in C*(9th ed.), New Gamma House.(Unit I: Chapter 1.2,1.4,1.5,1.6, Unit II: Chapter 6.1,6.3,6.4, 7.1, 7.3)
2. RAMASAMY, S. &RADHAGANESAN, P. (2015). *Programming in C*, (2nded.) Scitech Publications. ISBN: 978-8183716383.

References

1. KERNIGHAN, B.W. & RITCHIE, D.M.(1988).*The C programming language* (2nd ed.), Prentice-Hall of India Pvt. Ltd.New Delhi, ISBN:0-13-110362-8
2. MULLISH, H. & COOPER, H.L., (1996).*The spirit of C* (15th ed.), Jaico Publishing house,

   ISBN: 81-7224-040-6
3. KUO (1966).*Numerical methods and Computers*,(1sted.), Addison Wesley, London.
4. RAJARAMAN, V.(2013).*Computer Oriented Numerical Methods* (3rd ed.), Prentice Hall, New Delhi. ISBN: 97-8812-0307865

Web resources

1. https://en.wikipedia.org/wiki/Numerical method
2. https://en.wikipedia.org/wiki/Numerical_methods_for_ordinary_differential_equations
3. www.kciti.edu/wp-content/uploads/2017/07/cprogramming_tutorial.pdf

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CE51B	MATHEMATICAL PHYSICS	Major Elective	5	1		5

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	25	75	100

Preamble

Mathematics is indispensable to the study of physics as every physical situation has a mathematical basis. This course deals with application of mathematical methods to solve problems in physics. Though mathematical physics is a broad subject, this course covers some of the essential areas such as vector algebra, matrices, vector calculus, complex variables and Fourier series necessary at under graduate level.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Describe the mathematical basis of vectors and their application in physics problems.
CO2	Explain the concept of eigenvectors and eigenvalues and their physical meaning.
CO3	Demonstrate the concept of Gradient, Curl, Divergence in physics
CO4	Comprehend the theorems of complex analysis.
CO5	Describe the usefulness of Fourier series in solving problems associated with periodicity.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	M	M	L
CO2	L	S	S	M	M	M
CO3	S	M	S	M	M	L
CO4	M	S	S	M	M	L
CO5	M	S	S	L	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	L	M	L
CO2	M	M	L	M	L
CO3	M	M	M	M	L
CO4	S	S	M	M	M
CO5	S	S	M	M	M

Syllabus: MATHEMATICAL PHYSICS

Unit I Vector Algebra : Introduction – Simple applications of vectors to mechanics – The scalar and vector fields – Directional derivatives – Level surfaces – The gradient of a scalar field – The divergence of a vector point function –The curl or rotation of a vector point function – The line integral – Gauss divergence theorem – Gauss` theorem – Stoke`s theorem in space.

Unit II Matrices : Vector spaces, Inner product spaces, linear transformations – The matrix eigenvalue problem – Determining eigenvalues and eigenvectors – Some Applications of Eigen value problems - stretching of an elastic membrane – Vibrating system of two masses on two springs – Symmetric, Skew symmetric and orthogonal matrices – Diagonalization of matrices

Unit III Vector calculus: Position, displacement and separation vectors – Vector transformation – Derivatives – Gradient – Del operator – Divergence – Curl – Product rule – Second derivatives – Line, surface and volume integrals - Fundamental theorems of calculus – Fundamental theorems of gradient, divergence and curl - Integration by parts – Curvilinear coordinates – Spherical polar and cylindrical coordinates – One-dimension Dirac delta function.

Unit IV Complex variables : Introduction – Definitions – Operation of fundamental laws of algebra on complex numbers – Regular functions – Cauchy's theorem – Cauchy's integral formula – Cauchy's residue theorem

Unit V Fourier series : Fourier series – Arbitrary period – Even and Odd functions : periodic Rectangular wave – Periodic rectangular wave – Change of scale – Half wave rectifier

Text Books

1. GUPTA, B.D. (1993). *Mathematical Physics* (2nd ed.), Vikas Publishing House. ISBN:0-7069-76-4.
   Unit I – Chapter 1: Sections 1.16, 1.21–1.24, 1.28, 1.31, 1.48, 1.51, 1.54, 1.61
   Unit IV – Chapter 5: Sections 5.1–5.3, 5.6, 5.9, 5.10, 5.15.

2. KREYSZIG, E. (2011). *Advanced Engineering Mathematics* (10th ed.), Wiley. ISBN 978-0-470-45836-5.
   Unit II – Chapters 7& 8: Sections 7.9, 8.1–8.4.
   Unit V– Chapter 11 : Sections 11.1,1 1.2, p.474–480, 483–486.
3. GRIFFITHS, D.J. (2013). *Introduction to Electrodynamics* (4th ed.), Pearson. ISBN:978-0-321-85656-2.
   Unit III –Chapter 1 :Sections : 1.14, 1.15,1.2.1–1.2.7,1.3.1–1.3.6, 1.4.1, 1.4.2, 1.5.2

References

1. SATYAPRAKASH (2014). Mathematical physics with classical mechanics, (6th ed.),SultanChand &Sons, New Delhi. ISBN 81-7014-925-8.
2. DASS, H.K. (2014). *Mathematical Physics*, (7th ed.,)S. Chand & Co., New Delhi.ISBN-81-219-1469-8.
3. MUKHOPADHYAY, A.K. (2010).*Mathematical Methods for Engineers and Physicists*, (2nd ed.), Wheeler Pub, New Delhi.

Web resources

1. https://video.ias.edu/taxonomy/term/75
2. https://nptel.ac.in/courses/115/103/115103036/
3. https://www.coursera.org/learn/vector-calculus-engineers
4. http://ncbgudi.com/wp-content/uploads/2018/01/vector-differential-calculus.pdf

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Department of Physics
(For those joined B.Sc. Physics on or after June 2020)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CE51C	INTRODUCTION TO MICROPROCESSOR-8085	Core Elective	5	1	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	25	75	100

Preamble

Microprocessors are present not just in computers but everywhere around us, in mobile phones, automobiles, household appliances, etc. and their ability to carry out high speed computing have enormously increased in recent years. Though several high end 32/64-bit processors are available, the present paper deals with the essential programming concepts of first generation 8085 processor since its architecture is simple and has sufficient instruction set that is necessary for learning microprocessor programming.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Explain the design of the architecture of µP 8085
CO2	Understand address bus, data bus, opcodes and operands
CO3	Learn Stack and Subroutine of µP 8085
CO4	Understand Code conversion
CO5	Apply µP 8085 concepts in implementing interrupts

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	L	L	S	M
CO2	M	S	L	L	M	M
CO3	M	M	M	S	S	M
CO4	M	M	S	S	S	S
CO5	S	L	S	S	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	X	M	M	M
CO2	M	L	M	L	L
CO3	S	L	L	X	L
CO4	L	X	L	L	X
CO5	S	M	L	L	L

Syllabus :INTRODUCTION TO MICROPROCESSOR- 8085

Unit I Microprocessors architecture: Microprocessor instructions set and computerlanguages – Microprocessor architecture and its operations – Memory – I/O devices– Examples.

Unit II Introduction to 8085 instructions, programming techniques: Data transfer operations – Arithmetic operations – Logic operations – Branch operations – Writing assembly language programs – Programming techniques; Looping counting and indexing – Additional data transfer and 16-bit arithmetic instructions –Arithmetic operations related to memory – Rotate – Compare.

Unit III Stack and subroutine: Stack – Subroutine – Restart, conditional CALL and RETURN instructions.

Unit IV Code conversion and BCD arithmetic: BCD to binary conversion – Binary to BCD conversion – BCD addition – BCD subtraction – Multiplication - Subtraction with carry.

Unit V Interrupts: The 8085 interrupt -–RST instruction – Illustration of 8085 interrupt – Issues in implementing interrupts – Multiple interrupts and priorities – 8085 vector interrupts– TRAP – RST 7.5, 6.5 and 5.5.

Text Books

1. GAONKAR, R.S.(2008). *Microprocessor Architecture, Programming and applications with the 8085*.(5th ed.), Penram International Publishing (India) Private Ltd., ISBN:81-8797209-2.

   Unit I – Chapter 1 &3 : Sections 1.1, 1.2, 3.1, 3.2, 3.3, 3.4
   Unit II – Chapter 6 & 7: Sections 6.1–6.5, 7.1–7.5
   Unit III – Chapter 9 : Sections 9.1–9.3
   Unit IV – Chapter 10 : Sections 10.1, 10.2, 10.5, 10.6, 10.8, 10.9
   Unit V – Chapter 12: Sections 12.1–12.2

References

1. HALL, D.V. (2006). *Microprocessor Interfacing, Programming and Hardware*(2nd ed.), Tata McGraw Hill.
2. LEVENTHAL, L. A. (2000). *8080A/8085-Assembly Language Programming*(2nd ed.), Osborne McGraw-Hill, 2000.
3. UDAYA KUMAR, K. &UMASANKAR, B.S. (2008). *The 8085 Microprocessor Architecture*(1st ed.), Pearson Education.
4. VIJAYENDRAN, V. &VISWANATHAN, S.(2009). Fundamentals of Microprocessor 8085(2nd ed.),Printers & Publishers Pvt Ltd.*ISBN:* 9788187156130
5. MATHUR, S. (2010). *Microprocessor 8085 and its Interfacing*(2nded), Prentice-Hall India

Web resources

1. https://www.javatpoint.com/microprocessor-architecture
2. https://www.eeeguide.com/programming-techniques-in-microprocessor-8085
3. https://www.tutorialspoint.com/stack-and-the-stack-pointer-in-8085-microprocessor#:~:text=The%20stack%20is%20a%20LIFO,use%20the%20stack%20as%20well.

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20SE51A	Data Analysis and Interpretation	SEC	2	–	–	2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	15	35	50

Preamble

Any quantity that can be measured and expressed in numbers with respective units is a physical quantity. Even when measurements are done with utmost care and precise instruments, the measured quantities are subject to some uncertainties. This paper deals with the study of such uncertainties**.** As students of physics carry out measurements during laboratory sessions as part of their study, this paper would be a useful addition in the curriculum.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Understand the significance of error and methods of analysing it to correlate it with accuracy.
CO2	Explain the importance of graphical representation for data analysis and interpretation

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	L	S	S	L	-
CO2	L	S	M	-	-	-

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	L	M	S

CO2	M	S	M	S	M

Syllabus : DATA ANALYSIS AND INTERPRETATION

Unit I Error analysis of data: Significant figures– Discrepancy comparison oftwomeasurednumbers– Checkingproportionalitywithagraph–Fractionaluncertainties– Uncertainty in sums and differences: products and quotients: power– Random and systematicerrors–The meanand standard deviation

UnitII Representation of data: Graphsofbasictypeoffunctions(linear,quadratic, power, polynomial, rational, exponential, logarithmic, sinusoidal) and their physicalinterpretation-Examples

Text Books

1. TAYLOR, J.R.(1997). *An Introduction to Error Analysis : The Study of Uncertainties In Physical Measurements* (2nd ed.), University Science Books, California. ISBN 0-935702-75-X

References

1. *BARFORD, N.C. (1969). Experimental Measurements: Precision, Error and Truth(2nded),Addison Wesley Publishing Company, London.*

Web resources

1. https://www.vicphysics.org/analysis.html
2. https://www.edx.org/course/subject/data-analysis-statistics
3. https://www.learner.org/resources/series158.html

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20SE51B	PHYSICS OF OPTOELECTRONIC DEVICES	SEC II	2			2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	15	35	50

Preamble

Optoelectronics is a novel area of physics which deals with semiconductor materials that can detect and control. Breakthroughs in the design and fabrication of optoelectronics has immense scope from the point of view of energy conservation and environment. This paper deals with some fundamental aspects of optoelectronic devices at the under graduate level.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Explain the basic principles of construction and working of optoelectronic devices.
CO2	Understand the applications of optoelectronics in practical devices.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	S	S	L	L	L	L

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

COs \ PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	M	L	L	M

Syllabus :PHYSICS OF OPTOELECTRONIC DEVICES

Unit I **Types:** Optical sources, detectors and receivers a – Modulators and amplifiers- - Semiconductor lasers – Organic Light Emitting Diodes (OLED) –Microstructured optical fibres

Unit II **Applications:** Communication – Imaging and displays – Sensing and data processing –Industrial, biomedical and commercial applications.

Text Books

1. DAKIN, J.P. & BROWN, R.G.W. (2006). *Handbook of Optoelectronics* (Vol.I)(1st ed), Taylor & Francis.

References

1. CHUANG, S.L. (1995). *Physics of Optoelectronic Devices*(1st ed), John Wiley & Sons.
2. KASAP, S.O. (2013). Optoelectronics and Photonics, Principles and practices(2nd ed), Pearson Education Limited.
3. MAINI, A.K. (2013). Lasers and Optoelectronics (1st ed), John Wiley & Sons.

Web resources

1. https://www.elprocus.com/optoelectronics-devices-with-their-applications
2. https://www.youtube.com/watch?v=ROV9xtKkMsw
3. https://www.youtube.com/watch?v=mtAcrB9JrhA
4. https://www.youtube.com/watch?v=lxwcTbfWAEQ

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20SE51C	NANOPHYSICS	SEC II	2			2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth	15	35	50

Preamble

This course provides understanding of the postulates and concepts of nanophysics with clarity. The learners are expected to understand the principles, and gain knowledge on fabrication and design of Carbon Nano-Tubes and their applications.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Comprehend the theoretical and experimental aspects of quantum wells,wires and dots
CO2	Grasp the principles, fabrication and design of Carbon Nano-Tubes

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	S	M	M	L
CO2	L	S	S	M	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

PSOs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	L	M	L
CO2	M	M	L	M	L

Syllabus :PHYSICS OF OPTOELECTRONIC DEVICES

Unit I General methods of preparations: Introduction – Emergence ofNanotechnology – Bottom-Up and Top-Down Approaches- Challenges in Nanotechnology-Self Assembled Minelayers: Introduction – monolayer on gold – growth process- phasetransitions - patterning monolayer - mixed monolayer - SAMS and applications.

Unit II Carbon nanotubes: Introduction - synthesis and purification – filling of nanotubes – mechanism of growth - electronic structure – transport properties – mechanicalproperties – physical properties – applications – nano tubes of other materials.

Text Books

1. HUOZHONGGAO (2004). *Nanostructures & Nanomaterials*, (1st ed), Imperial College Press.
2. PRADEEP, T.(2007). *NANO: The essentials – Understanding Nanoscience and nanotechnology*, (1st ed), Tata McGraw-Hill Publishing Company Ltd. New Delhi.

References

1. MANASIKARKARE, (2008). *Nanotechnology: Fundamentals and applications*, (1st ed),I.K. International Pvt.Ltd.

Web resources

1. https://www.elprocus.com/optoelectronics-devices-with-their-applications
2. https://www.youtube.com/watch?v=ROV9xtKkMsw
3. https://www.youtube.com/watch?v=mtAcrB9JrhA
4. https://www.youtube.com/watch?v=lxwcTbfWAEQ

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20C61	ATOMIC AND MOLECULAR SPECTRA	Core	6			6

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	25	75	100

Preamble

Spectroscopy is the study of interaction of matter with electromagnetic radiation and constitutes an important branch of physics. This paper deals with results of interaction of light with matter that paved way for precise understanding of atomic and molecular structure. The underlying principles of spectroscopic methods such as electronic, vibrational, rotational, nuclear magnetic resonance, Raman and X-ray spectroscopy and their applications are dealt with in this paper.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Describe the evolution of atom models and relativistic effects in explaining the fine structure of spectral lines of hydrogen atom.
CO2	Apply Pauli's exclusion principle to interpret the electronic configuration of atoms
CO3	Illustrate the splitting of spectral lines under the influence of magnetic and electric fields.
CO4	Explain the classification of molecular spectra.
CO5	Summarize the underlying principles of Raman scattering, NMR, ESR and Mossbauer spectroscopy.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	L	S	S
CO2	S	S	M	M	M	S
CO3	M	M	S	S	S	M
CO4	L	S	M	M	M	L

CO5	L	M	S	M	S	L

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	L	S
CO2	S	S	M	M	M
CO3	M	M	S	S	S
CO4	L	S	M	M	M
CO5	L	M	S	M	S

Course title: ATOMIC AND MOLECULAR SPECTRA

Unit I Atomic models: Early atomic spectra – Thomson model – Alpha particle scattering – Rutherford's nuclear model – Bohr's model of the Hydrogen atom – The Hydrogen spectrum – Bohr's model-correction for nuclear motion – Hydrogen-like atom – General quantization rule – Sommerfeld's model – The correspondence principle – Deficiencies of the quantum theory

Unit II Atomic spectra I: Hydrogen atom spectrum – Orbital magnetic moment of hydrogen atom – Larmor precession – Stern-Gerlach experiment – Electron spin – The vector atom model – Spin-orbit and fine structure – Pauli's exclusion principle and electronic configuration. Total angular momentum in many electron systems: L-S coupling or RusselSaunder's coupling – j-j coupling – Hund's rules.

Unit II Atomic spectra II: Energy levels and transitions of Helium – Alkali spectra : Shielding by core electrons – Spectral terms of equivalent electrons – Normal Zeeman effect : Early experimental arrangement – Theory – Anomalous Zeeman effect – Paschen-Bach effect – Stark effect – Moseley's law – Width of spectral lines.

Unit IV Molecular spectra I: Electromagnetic spectrum – Molecular energies – Classification of molecules – Rotational spectra of diatomic molecules – Diatomic vibrational spectra – Rotation-vibration transitions – Vibrations of polyatomic molecules – Characteristic group frequencies – Infrared spectrometer – Electronic spectra – Frank-Condon principle.

Unit V Molecular spectra II: Raman scattering: Quantum theory of Raman scattering – Classical description of Raman scattering – Vibrational Raman scattering – Rotational Raman spectra – Raman spectrometer – Nuclear Magnetic Resonance : NMR principle – The NMR spectrometer – Chemical shifts – Indirect spin-spin interaction – Applications of NMR –Mossbauer spectroscopy – Isomer shift.

Text Books

1. ARULDHAS, G. &RAJAGOPAL, P. (2016). *Modern Physics* (7th print), PHI Learning Private Limited, Delhi. ISBN 978-81-203-2597-5

Unit I – Chapter 3, Secs.3.1 – 3.12;
Unit II – Chapter 7, Secs.7.1-7.9
Unit III – Chapter 7, Secs.7.10 – 7.19
Unit IV – Chapter 9, Secs.9.1 – 9.11
Unit V – Chapter 9, Secs.9.12 – 9.15

References

1. BANWELL, C.N. (1983). *Fundamentals of Molecular Spectroscopy* (3rd ed.), McGraw-Hill Book Co., London. ISBN 0-07-084139-X.
2. GRAYBEAL, J.D.(1993). *Molecular spectroscopy*(1st ed.), McGraw-Hill, New York.
3. HOLLAS, M. (2004). *Modern spectroscopy*(4th ed.), John Wiley, New York.

Web resources

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20C62	NUCLEAR AND PARTICLE PHYSICS	Core	6	-	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	25	75	100

Preamble

Nuclear and particle physics deals with the characteristic features of atomic nuclei, the properties of nucleons, radioactive decay, the nature of interaction between elementary particles, etc. This course teaches the theoretical foundations and experimental aspects necessary for the understanding of the atomic and nuclear structure.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Explain the characteristic properties of nuclei, nuclear decay, nuclear reactions.
CO2	Summarize the various nuclear models and their successes and failures.
CO3	Assess the magnitude and impact of energy produced in nuclear reactors.
CO4	Classify the various types of particle accelerators and detectors
CO5	Distinguish between the characteristic features of fundamental particles.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	S	S	L	M	S
CO2	L	S	S	L	M	S
CO3	L	S	S	L	M	S
CO4	L	S	S	L	M	S
CO5	S	S	S	L	M	S

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	M	M	M
CO2	S	L	M	L	L
CO3	M	L	L	-	L
CO4	S	-	L	L	-
CO5	S	M	L	L	L

Course title: NUCLEAR AND PARTICLE PHYSICS

Unit I Nuclear properties: Constituent of nuclei–Nuclear size–Mass spectrometer – Binding energy–Angular momentum of the nucleus–Magnetic moment–Nuclear quadrupole moment – Parity – Semi-empirical mass formula – Existence of magic numbers –Nuclear shell model – Predictions of the Shell model – Nuclear forces – Two nuclear system(Deuteron)– General features– Meson theory of nuclear forces.

Unit II Radioactive decay: Discovery of radioactivity – Rate of decay, half-life and mean life–Conservation laws in radioactive decays–Decay series– Radioactive equilibrium – Secular equilibrium – Transient equilibrium – Radioactive dating – Alpha decay – Theory of Alpha decay – Beta decay – Electron emission – Positron emission – Electron capture – Theory of beta decay– Gamma decay– Radioisotopes–Applications.

Unit III Nuclear reactions: Basics – Cross-section – Nuclear reaction kinetics – Q value of a nuclear reaction – Reaction mechanisms – The compound nucleus – Neutron activation – Direct reactions – Nuclear fission – Theory of nuclear fission –Chain reaction – Fission reactor – Breeder reactor – Nuclear fusion – Fusion reaction in stars –Fusion reactor – Transuranium elements.

Unit IV Nulclear radiation detectors and particle accelerators:Ionization chamber and Geiger counter – Geiger – Muller counter – Scintillation counter–Semiconductor junction detector – The cloud chamber – The bubble chamber – Other detectors: Spark chamber – Photographic emulsion – Cerenkov detector – Cyclotron–Synchrocyclotron– Synchrotron– Synchrotron radiation –Linear accelerator.

Unit V Elementary particles: Fundamental interactions in nature –Dawn of elementary particle physics – Mediator of an interaction – □-mesons – Muons, kaons and hyperons – Particles and antiparticles– Classification of elementary particles – Conservation laws – Lepton conservation – Baryon conservation– Strangeness – Isospin–Hypercharge.

Text Books

1. ARULDHAS, G. &RAJAGOPAL, P. (2016). Modern Physics (7th print), PHI Learning Private Limited, Delhi. ISBN 978-81-203-2597-5
   Unit I – Chapter 17: Sec.17.1 –17.13
   Unit II – Chapter 18: Secs.18.1 – 18.10
   Unit III – Chapter 19: Secs.19.1 – 19.7
   Unit IV – Chapter 20: Secs.20.1 – 20.9

Unit V – Chapter 21,Secs.21.1– 21.5

References

1. SERWAY, R.A., MOSES, C.J. & MOYER, C.A. (2005).*Modern Physics* (3rd ed.), Thomson Learning, Singapore.
2. TIPLER, P.A. &LEWELLYN, R.A. (2012). *Modern Physics* (6th ed.), W.H Freeman & Co., New York. ISBN-13: 978-1-4292-5078-8
3. THORNTON, S.T. & REX, A. (2006). *Modern Physics for Scientists and Engineers* (4th ed.), Cengage Learning, Boston. ISBN: 978-1-133-10372-1
4. KRANE, K.S. (2011). *Modern Physics* (3rd ed.), John Wiley & Sons, New Jersey. ISBN: 978-1-119-49555-0
5. BEISER, A. (2003). *Concepts of Modern Physics* (6th ed.), McGraw Hill, New York. ISBN 0–07–115096–X.

Web resources

1. https://www.hep.phy.cam.ac.uk/~chpotter/particleandnuclearphysics/Lectu re_13_BasicNuclearProperties.pdf
2. https://byjus.com/chemistry/nuclear-reaction/#:~:text=Nuclear%20reactions%20are%20processes%20in,to%20as%20the%20parent%20nuclei).

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20C63	DIGITAL ELECTRONICS	Core	6	-	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	25	75	100

Preamble

This course facilitatesan understanding of different number systems, logic gates and Boolean algebra. The course gives knowledge on combinational and sequential logic systems. It also give an insight to the students about fundamental concepts, techniques and applications of Flip-flops and Counters

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Understand the binary number systems
CO2	Apply the basics binary arithmetic and solve the problems
CO3	Devise the flip flops
CO4	Design the registers and counters using digital logic circuits
CO5	Make a distinction between A/D and D/A converters

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	S	S	L	M	M
CO2	L	S	S	S	M	S
CO3	L	S	S	S	M	S
CO4	L	S	S	S	M	S
CO5	S	S	S	S	M	S

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	M	M
CO2	M	L	M	M	L
CO3	L	S	S	M	M
CO4	S	L	M	M	S
CO5	L	M	M	S	S

Syllabus : DIGITAL ELECTRONICS

Unit I Digital principles and digital logic: Definition of digital signals – Digital wave forms – Digital logic – Moving & storing – Digital information – Digital operations – Digital computers – Digital ICs – Digital IC signal levels – The basic gates – Universal logic gates – NOR, NAND

Unit II Combinational logic circuit & data processing circuit: Boolean laws and theorems – Sum of products – Truth table to Karnaugh Map – Pairs, quads and octets – Karnaugh simplification – Don't care conditions – Product Of Sums method – Product Of Sums simplification - Multiplexer – demultiplexers – 1 – of – 16 decoder – BCD to decimal decoders – Encoder – XOR Gates – Parity Generator and checkers ROM – PAL – PLA – Trouble shooting.

Unit III Flip flops, clocks & timers: RS Flip Flops – Gated flip-flops - Edge triggered RS – Edge triggered D flip-flops – Edge triggered JK flip – flops – Flip flop timing – JK Master Slave – Switch Contact Bouncing Circuit – Clock Wave forms – TTL clock – Schmidt trigger – Circuits using 555 timer – Pulse forming circuits.

Unit IV Registers and counters: Types of Registers – SISO – SIPO – PISO – PIPO – Ring counter – Asynchronous counters – Synchronous counters – Changing the counter modulus – Decade counters – Mod-5 and Mod-10 counters – Digital clock.

Unit V Arithmetic circuits, D/A & A/D conversion: Binary addition – Subtraction – Unsigned binary numbers – 2's compliment representation – 2' complement arithmetic - Arithmetic building blocks – Adder – Subtractor – Binary multiplication & division – Variables resistor networks – Binary ladder – D/A converters – D/A accuracy ad resolution – A/D converter – Simultaneous conversion – Counter method – Continuous A/D conversion - AD technique – Dual slope.

Text Books

1. DONALD P. LEACH, D.P. &MALVINO, A.P. (2015).*Digital Principles and Applications* (8th ed.), Tata-McGraw-Hill.
   Unit I – Chapter 1: Sec.1.1 –1.8; Chapter 2: Sec. 2.1–2.2.
   Unit II – Chapter 3: Secs.3.1 – 3.8; Chapter 4: Sec: 4.1 – 4.8 & 4.10 – 4.13.
   Unit III – Chapter 8: Secs.8.1 – 8.6 & 8.8-8.9; Chapter 7: Secs.7.1 – 7.7.
   Unit IV – Chapter 9: Secs.9.1 – 9.5 & 10.1 –10.6 & 10.8.

Unit V – Chapter 6: Secs.6.1 – 6.4; 6.5–6.8; 6.11; Chapte 12: Secs: 12.1–12.9.

References

1. DONALD P. LEACH, D.P. (1986).*Experiments in Digital Principles* (3rd ed.), Tata McGraw Hill.
2. FLYOD, (2015)*Digital Fundamentals*, (11th ed.), Pearson, USA.

Web resources

1. info.iet.unipi.it/~luigi/biomedica/sito/cosc205.pdf
2. https://www.electronics-tutorials.ws/combination/comb_1.html
3. https://www.ssucet.org/~jgallaher/.../Chapter9-LatchesFlip-FlopsAndTimers.pdf
4. https://en.wikibooks.org/wiki/Digital_Circuits/Registers_and_Counters
5. examradar.com/ad-and-da-converters

Course designed by

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Thiagarajar College (Autonomous), Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2020)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CE61A	INTRODUCTION TO QUANTUM MECHANICS	Core Elective	5	1	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	25	75	100

Preamble

Quantum mechanics describes the physics associated with sub-atomic particles by incorporating concepts such as quantization of energy, dual nature of matter, uncertainty principle, correspondence principle, etc. which has drastically altered the way of our understanding of matter. It has paved way for the birth of several new branches of science such as quantum chemistry, quantum electronics, quantum optics, etc. This paper deals with the essential concepts of quantum mechanics, describe its mathematical foundation and discuss a few examples of its applications in Physics.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Understand the need for quantum mechanical approach in Physics.
CO2	Appreciate duality of matter and consequences of de Broglie's hypothesis.
CO3	Comprehend the experimental basis of uncertainty principle and its consequences
CO4	Understand the basic mathematical concepts of quantum mechanics.
CO5	Apply Schrodinger's formulation to solve physical problems.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	-	L	M	M
CO2	S	S	M	M	M	L
CO3	M	S	S	M	M	L
CO4	M	S	S	M	L	M
CO5	M	S	S	M	L	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	X	M	M	M
CO2	S	L	M	L	L
CO3	S	L	L	X	L
CO4	S	X	L	L	X
CO5	S	M	L	L	L

Syllabus : INTRODUCTION TO QUANTUM MECHANICS

Unit I Origin of quantum theory: Black body radiation – Failure of classical physics to explain the spectrum of a black body – Planck`s quantum theory – Planck's radiation law – Consequences of Planck's law – Photoelectric effect – Failure of classical physics to explain the photoelectric effect – Einstein`s explanation of the photoelectric effect – The Ritz combination principle – Stability of an atom – Bohr`s quantization of angular momentum and its application to the hydrogen atom – Origin of spectral lines – Limitations of Bohr's theory.

Unit II Wave properties of matter: Wave particle duality – de Broglie hypothesis for matter waves – concept of wave velocity –Concept of group velocity – Velocity of de Broglie wave –diffraction of particles – Interference of electrons – Consequences of de Broglie`s concepts –wave packet.

Unit III Heisenberg's uncertainty principle: Uncertainty principle – Uncertainty relation for energy and time – Elementary proof of Heisenberg`s uncertainty relation – Physical significance – Elementary proof of uncertainty relation between energy and time – Illustration of Heisenberg`s uncertainty principle by thought experiments – Diffraction of electron at a slit – Gamma ray microscope thought experiment – Consequences of uncertainty relation.

Unit IV Schrodinger's wave equation: Schrodinger`s one dimensional time dependent wave equation- one dimensional time independent Schrodinger`s wave equation – Physical interpretation of the wave function Ψ – Operators in quantum mechanics, Eigen function, Eigenvalue and Eigenvalue equation – Expectation values – Postulates of quantum mechanics – transition probability.

Unit V Applications of quantum mechanics: Particle in a one dimensional box – Particle in a rectangular three dimensional box – Simple harmonic oscillator- 1D simple harmonic oscillator in classical mechanics - 1D simple harmonic oscillator in quantum mechanics – Reflection at a step potential – Transmission across a potential barrier: the tunnel effect.

Text Books

1. Kamal Singh , S.P. & Singh**,** S. (2005). *Elements of Quantum Mechanics*(2nd ed.), S. Chand & Company, New Delhi [ISBN:81 -219-2539-8]
   Unit I – Chapter 1 [Sec. 1.1 – 1.8]
   Unit II – Chapter 2 [Sec. 2.1 – 2.9]
   Unit III – Chapter 3 [Sec. 3.1 – 3.5]
   Unit IV – Chapter 4 [Sec. 4.1 – 4.7]
   Unit V – Chapter 5 [Sec.5.1 – 5.5]**.**

References

1. ARULDHAS, G. (2009). *Quantum Mechanics*, (2nded.,) Prentice – Hall of India, New Delhi. ISBN-81- 203-1962. 667

Web resources

1. http://hyperphysics.phy-astr.gsu.edu/hbase/uncer.html
2. https://opentextbc.ca/universityphysicsv3openstax/chapter/de-broglies-matter-waves/

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CE61B	OPTICAL FIBER COMMUNICATION SYSTEMS	Core Elective	5	1		5

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	25	75	100

Preamble

The advent of fibre optics has revolutionized the field of communications world-wide, particularly transmission of large amounts of data at high speeds. This paper introduces the theoretical and practical knowledge necessary to understand the physics behind fibre optic communications systems and devices.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Define the characteristic parameters associated with optical fibres.
CO2	Classify various types of optical fibres based on their characteristic properties.
CO3	Explain the physical principles behind losses associated with transmission through optical fibres.
CO4	Understand the various modes of dispersion and methods to minimize their causes.
CO5	Explain optical fibre sources, detectors and various types of fibre optic sensors.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	M	S	-	L	M	S
CO2	M	S	-	L	M	M
CO3	M	S	M	L	M	S
CO4	M	S	M	L	M	L
CO5	S	S	-	L	M	S

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	X	S	M	M
CO2	M	L	S	L	L
CO3	M	L	L	X	L
CO4	S	X	L	L	X
CO5	S	M	L	L	L

Course title: OPTICAL FIBRE COMMUNICATION SYSTEMS

Unit I Introduction to opticalfibres: What are optical fibres? –Importance–Generation of telephone system and optical fibre – Propagation of light in different media – Propagation of light waves in an optical fibre-Basic structure and optical path of an optical fibre – Acceptance angle and acceptance cone- Numerical aperture (NA) – Numerical aperture of a graded index fibre – Modes of propagation-Meridional and skew rays – Number of modes and cut-off parameters of fibres – Single mode propagation – Comparison of step and graded index fibres – Application of fibres.

Unit II Classification of optical fibres: Fibres: classification – Stepped index fibre–Stepped index monomodefibre – Disadvantages of monomodefibre – Graded index monomodefibre-Plastic fibres – Other latest developed types of fibres – High purity silica fibre (HPSUV) – High purity silica (HPSIR) – Chalcogenidefibre – Chalcogenidefibre – Halide fibre – Mechanism of refractive index variation – Fibre strength – Mechanical strength measurement of optical fibres.

Unit III Fibre losses: Attenuation in optic fibres – Material or impurity losses – Rayleigh scattering losses – Absorption losses – Leaky modes – Bending losses – Radiation induced losses – Inherent defect losses – Inverse square law losses – Transmission losses – Temperature dependence of fibre losses – Core and cladding losses.

Unit IV Dispersion in optical fibres: Electrical vs optical bandwidth-Bandwidth length product-Dispersion in an optical fibre – Intermodal dispersion – Mixing of modes – Material or chromatic dispersion – Waveguide dispersion – Dispersion power penalty – Total dispersion delay-Maximum transmission rate – Dispersion shifted fibres.

Unit V Optical fibre sources, detectors and types of fibre optic sensors: Introduction – LED – The process involved in LEDs – Structure of LED – LED Materials – Laser-Light emitting transistor – Organic LEDs – Power efficiency – OLED: structure and operation – Quantum efficiency. **PHOTODETECTORS:** Introduction – Characteristic of photodetectors – Photoemissive photo-detectors – Photoconductive devices – Photo voltaic devices – PN junction photo-detector-Pin photodiode – Avalanche photo diode – Photo transistor-bit error rate (BER). **SENSORS:** Introduction – Fibre optic sensors – Intensity modulated sensors – Liquid level type hybrid sensor – Diffraction grating sensors – Sensors using single mode fibre – Interferometric sensor – Polarisation problem in interferometric sensor using SMF – Medical applications of fibre sensors – Fibre optic gyroscopes – Vibrations and displacement measurement sensors – Rotary position sensor

– Linear position measuring sensor – Liquid level sensor – Acceleration measuring sensor – Multiplexing and distributed sensing.

Text Books

1. SARKAR, S.K. (2010). *Optical Fibres and FibreOptic Communication Systems*. S. Chand & Co. Ltd.ISBN: 81-219-1459-0.
   Unit I– Chapter 1 [Sec. 1.1 – 1.4], Chapter 2 [Sec. 2.1 – 2.12]
   Unit II – Chapter 3 [Sec. 3.1 – 3.10]
   Unit III – Chapter 7 [Sec. 7.1 – 7.12]
   Unit IV – Chapter 8 [Sec.8.1 – 8.11].
   Unit V – Chapter 9 [Sec. 9.1, 9.2, 9.2.1 – 9.2.3, 9.3.1, 9.4.1 – 9.4.5],
   Chapter 10 [10.1 – 10.10]
   Chapter 16 [16.1-16.5, 16.9- 16.10, 16.14 -16.15, 16.19, 16.22 – 16.26]

References

1. CRISP, J.(2010). *Introduction to Fibre Optics* (2nd ed.), Publisher, ISBN:07506-50303
2. KEISER, G. (2003). *Optical Fibre Communication* (3rd ed.), McGraw Hill Co., ISBN:07-232101- 6

Web resources

1. *www.jb.man.ac.uk/research/fibre/intro2fibre.htm*
2. *science.jrank.org/pages/2702/Fiber-Optics-Fiber-classifications.html*
3. https://en.wikipedia.org/wiki/Fiber_optic_sensor

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CE61C	FOUNDATIONS OF ASTRONOMY	Core Elective	5	1		5

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	25	75	100

Preamble

Astronomy deals with several important questions about how our Universe originated. New discoveries keep providing new insights about the characteristic life cycle of stars, types of stars and galaxies. This paper deals with essential founding principles of Astronomy which is expected to pave way for students to pursue higher studies in fields related to understanding the origin and evolution of the Universe and its component systems.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Identify bright stars, constellations, asterisms, planets, deep sky objects and the role of telescopes and observatories
CO2	Understand the physical characteristics of Sun and other family of stars
CO3	Explain the characteristic features of interstellar medium and the formation of stars.
CO4	Explain the classification of stars and the physics of the life cycle of stars.
CO5	Explain the physical principles behind the formation of neutron stars, blackholes and the origin and evolution of milky way galaxy.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	S	S	M	-
CO2	M	S	S	M	M	L
CO3	M	M	S	L	M	-
CO4	-	S	S	M	L	-

CO5	-	S	S	M	L	-

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	S
CO2	S	L	M	S	M
CO3	X	S	S	M	X
CO4	S	S	L	M	S
CO5	M	S	S	S	S

Syllabus : FOUNDATIONS OF ASTRONOMY

Unit I Sky, Light and Telescopes: Stars and constellations – The Sky and Celestial Motions – Sun and Planets – Astronomical influences on Earth's Climate – Radiation : Information from Space – Telescopes – Observatories on Earth : Optical and Radio – Airborne and Space Observatories – Astronomical Instruments and Techniques – Non-Electromagnetic Astronomy.

Unit II The Sun and Family of Stars: The Solar Photosphere and Atmosphere – Solar Activity – Nuclear Fusion in the Sun – Star distances – Apparent Brightness, Intrinsic Brightness and Luminosity – Stellar Spectra – Star Sizes – Star Masses – Binary Stars – A Census of the Stars

Unit III The Interstellar Medium, Formation and Structure of Stars: Studying the Interstellar Medium – Components of the Interstellar Medium – The Gas-Stars-Gas Cycle – Making Stars from the Interstellar Medium – The Orion Nebula : Evidence of Star Formation – Young Stellar Objects and Protostellar Disks – Stellar Structure – The Source of Stellar Energy

Unit IV Stellar Evolution & Deaths of Stars: Main Sequence Stars – Post-Main Sequence Evolution – Star Clusters : Evidence of Stellar Eolution – Variable Stars : Evidence of Stellar Evolution – Low-Mass Stars – The Evolution of Binary Stars – High-Mass Stars – Supernova Explosions – The End of Earth.

Unit V Neutron Stars, Black Holes and the Milky Way Galaxy: Neutron Stars – Black Holes – Compact Objects with Disks and Jets – Discovyer of the Galaxy – Structure of the Galaxy – Spiral Arms and Star Formation – The Nucleus of the Galaxy – Origin and Evolution of the Galaxy.

Text Books

1. SEEDS, M.A. &BACKMAN, D.E. (2019). *Foundations of Astronomy* (14th ed.), Cengage, Boston, USA.ISBN: 978-1-337-39992-0
   Unit I - Chapter 2 (14 pages) & Chapter 6 (24 pages)

Unit II - Chapter 8 (19 pages) & Chapter 9 (22 pages)
Unit III - Chapter 10 (14 pages) & Chapter 11 (17 pages)
Unit IV - (16 pages) and Chapter 13 (21 pages)
Unit V - (18 pages) & Chapter 15 (26 pages)

References

1. KARTTUNEN, H., KRÖGER, P., OJA, H., POUTANEN, M. & DONNER, K.J. (eds.) (2017). *Fundamental Astronomy* (6th ed.), Springer. ISBN:978-3-662-53044-3; DOI 10.1007/978-3-662-53045-0.
2. BELY, P.Y, CHRISTIAN, C.& ROY, J. R. (2010). A Question and Answer Guide to Astronomy, Cambridge University Press, New York.

Web resources

1. Software aid: www.stellarium.org
2. www.timeanddate.com
3. https://stardate.org/
4. https://www.space.com/
5. https://hubblesite.org/
6. https://www.heavens-above.com/

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20SE61A	PHYSICS OF HOME APPLIANCES	SEC II	2			2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	15	35	50

Preamble

Electrical appliances have become indispensable in our day-to-day life. Hence, this paper aims to teach students the underlying principles of their function and essential safety measures to be followed while using them. Also, the paper provides opportunities for learning through hands-on sessions with a view to train students to efficiently handle and trouble-shoot commonly used home appliances.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Acquire knowledge about practical household electrical wiring, modern lighting and safety aspects such as grounding and circuit breakers.
CO2	Understand important electrical features of some domestic appliances and acquire skills to troubleshoot simple faults.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	M	S	S	M	M
CO2	M	S	S	M	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

COs \ PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M

Syllabus : PHYSICS OF HOME APPIANCES

Unit I Domestic wiring and devices: Electrical bulb, Choke, Starter, Tube light wiring, CFL Functioning, LED Lighting, Staircase switch, domestic wiring, fuse, ELCB (Earth Leak Circuit Breaker), Circuit breaker (MCB).

Unit II Domesticappliances : Transformers, Electric iron, Fan, Mixer Grinder, Refrigerator, Circuit diagram and working.

Text Books

1. ROBIN, G.J. & RAJ, U.A. (2013). *Maintenance of Electrical Equipment (1st ed.)*, Indira Publication, Marthandam.
   Unit I – Chapter 3 (p.70 – 113)
   Unit II – Chapter 4 (p.114 – 144)

References

1. KIAMEH, P. (2002). *Electrical Equipment Handbook: Troubleshooting and Maintenance (1sted)*, McGraw Hill, New Delhi.

2. RAO, S. (2010). *Testing Commissioning Operation & Maintenance of Electrical Equipment*(3rd ed.), Khanna Publishers, New Delhi.

3. KLEINERT, E. (2013). *Troubleshooting and Repairing Major Appliances* (3rd ed.), McGraw Hill, New York.

Web resources

1. https://www.youtube.com/watch?v=3JaxRPQkGMk
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/hsehld.html
3. https://en.wikipedia.org/wiki/Home_appliance
4. https://www.electricveda.com/book/electric-appliances

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20SE61B	INSTRUMENTATION	SEC II	2			2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	15	35	50

Preamble

To Know and understand the general characterization of recording and storage devices. It also provides an opportunity to learn about different display devices and its applications.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Learn different types of recording devices.
CO2	Learn the different types of working of display devices.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	L	M	M
CO2	S	S	M	L	M	M

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

COs \ PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	M	M	S

CO2	M	L	L	M	S

Syllabus : INSTRUMENTATION

Unit I **Recording devices:** Recorders– Recording requirements – Analog recording – XY recorder – Magnetic tape recorder– Basic components of a tape recorder – Principle – Methods of recording – Direct recording – Digital tape recorders – Return to zero and non-return to zero – Data formatting– Computer storage devices – CD – DVD – Pen drive.

Unit II **Display devices:** Light Emitting Diode (LED) – Liquid Crystal Display(LCD) – Cathode Ray Oscilloscope (CRO)– Action of CRT – Signal display on CRO – Examination of waveforms, voltages and frequencies using CRO – Principle, block diagram and medical applications of ECG.

Text Books

1. SAWHNEY, A.K.(2007). *Electrical and Electronic Measurements*(18th ed), DhanpatRai& Co (P) Ltd.
2. MEHTA, V.K. (1998). *Elements of Electronics and Instrumentation*(1st ed), Chand & Co.

References

1. Cooper, W.D. (1978). *Electronic Instrumentation and Measurement Techniques* (2nd ed.), Prentice Hall.
2. ARUMUGAM, M. (1997). *Biomedical Instrumentation* (2nd ed.), Anuradha Agencies.

Web resources

1. https://www.youtube.com/watch?v=mo4_5vG8bbU
2. https://www.youtube.com/hashtag/croblockdiagram

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20SE61C	MEDICAL PHYSICS	SEC II	2			2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Sixth	15	35	50

Preamble

This paper enables the students to understand the working of various medical instruments and also helps them to gain practical knowledge of it. It also createawareness about the banes and boons of radiation.

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Identify the various eye defects and practical knowledge about medical instruments like ECG, MRI and PET scan.
CO2	Aware of the biological effects of radiation, radiation hazards occurring in man, atmosphere and space.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	S	S	L	L	L	L

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

COs \ PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M

Syllabus : MEDICAL PHYSICS

Unit I Medical instruments: Defects in eye – Intraocular pressure measurement – Glaucoma – Correction of defects using lenses – ECG –Origin of cardiac action potential–ECG Leads –ECG recording setup – Magnetic resonance imaging (MRI) – MRI scanning Instrument –Positron emission tomography (PET).

Unit II Radiation: Effect of UV, visible & IR radiations on human body – IR lamp & IR therapy – Biological effect of radiation – Radiation damage in embryo and foetus during pregnancy – demerits of different diagnostic and therapeutic methods of nuclear medicine during pregnancy – Radiation hazards in man – Radiation hazards in atmosphere and space.

Text Books

1. BRIJLAL&SUBRAMANIAM (2002).*Optics*(10th ed), S. Chand & Co, New Delhi.
2. VENKATRAM, S.K.(2000). *Biomedical Electronics& instrumentation*(1st ed),Galgotia Pub. Instrumentation Pvt. Ltd,

References

1. HARPER COLLINS(2002). *How Things Work* (Vol. 1 & 2) (2nd ed), Harper Collins Pub. India (A joint venture with The India Today Group), New Delhi.
2. ROY, R.N. (2001). *A text book of Biophysics*(2nd ed),New central book agency.
3. ARUMUGAM, M. (2009). *Biomedical Instrumentation*(2nd ed), Anuradha Publications
4. CROMWELL, L., WEIBELL, F.J. & ERICH A.(2017). *Biomedical Instrumentation and Measurements*(2nd ed), Pfeiffer PHI.

Web resources

1. https://www.youtube.com/watch?v=Av1ZiN9P01s
2. http://hyperphysics.phy-astr.gsu.edu/hbase/vision/eyedef.html
3. https://en.wikipedia.org/wiki/Magnetic_resonance_imaging
4. http://hyperphysics.phy-astr.gsu.edu/hbase/mod3.html

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CL61	Major Practical- III	Core Lab	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth & Sixth	40	60	100

Preamble

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Understand the experimental ideas related with matter, optics, electricity and magnetism.
CO2	Identify the link between theory and practical
CO3	Learn to minimize contributing variables and recognize thelimitations of equipment.
CO4	Evaluate the process and outcomes of an experiment quantitatively andqualitatively
CO5	Use previous notes in their lab notebooks to inform design of futureexperiments.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	M	S	L
CO2	-	S	M	S	S	-
CO3	M	-	L	S	S	L
CO4	S	S	-	M	S	M
CO5	L	M	S	M	L	S

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M
CO3	L	M	M	M	M
CO4	S	S	S	M	L
CO5	L	M	S	M	L

Course title: MAJOR PRACTICAL - III

1. i-i' curve
2. Air wedge
3. Polarimeter
4. Cauchy's constant
5. Hartmann's constant
6. Conversion of Galvanometer in to voltmeter
7. Conversion of Galvanometer into ammeter
8. Owen's bridge
9. Maxwell's bridge
10. Grating II order spectrum
11. High resistance by leakage
12. Electrochemical equivalence of copper
13. Determination of Planck's constant
14. Determination of dielectric constant
15. Hall probe method for measurement of magnetic field
16. Abbe's refractometer
17. Find roots of equation by using Newton Raphson method
18. Find roots of equation by using Bisection method
19. Find roots of equation by using False position method
20. Defect detection-Ultrasonic flaw detector
21. Resolving power of prism/grating
22. Michelson interferometer

Text Books

1. ARORA. C. L.,(2005) B.Sc. Practical Physics, (19th ed.), S. Chand Publication, New Delhi. ISBN: 81-219-0909-0.

References

1. GEETHASANON., (2005) B.Sc. Practical Physics, (19th ed.), S. Chand Publication, New Delhi. ISBN: 978-8180-4505-32.

Web resources

1. https://www.vlab.co.in
2. https://praxilabs.com/

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PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH20CL62	Major Practical- IV	Core Lab	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
Third	Fifth & Sixth	40	60	100

Preamble

Course Outcomes (COs)

On the completion of the course the student will be able to

COs	Course Outcome
CO1	Understand the experimental ideas related with Digital and analog electronics.
CO2	Identify the link between theory and practical
CO3	Learn to minimize contributing variables and recognize thelimitations of equipment.
CO4	Evaluate the process and outcomes of an experiment quantitatively andqualitatively
CO5	Use previous notes in their lab notebooks to inform design of futureexperiments.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	M	S	L
CO2	-	S	M	S	S	-
CO3	M	-	L	S	S	L
CO4	S	S	-	M	S	M
CO5	L	M	S	M	L	S

Mapping of Course Outcomes (COs) with Programme Specific Outcomes (PSOs)

POs / COs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M
CO3	L	M	M	M	M
CO4	S	S	S	M	L
CO5	L	M	S	M	L

Course title: ANALOG ELECTRONICS

1. Single stage amplifier
2. Hartley oscillator
3. Colpittsoscillator
4. Phase shift oscillator
5. Voltage doubler
6. Dual power supply
7. Astablemultivibrator (using transistor)
8. Inverting and non-inverting amplifiers using Op-amp.
9. Op-Amp integrator and differentiator.
10. Adder and subtractor using Op-amp.
11. Monostablemultivibrator (using 555)
12. Astablemultivibrator (using 555)
13. Half adder & full adder (Construction using IC's)
14. Zener voltage regulator
15. RS flip-flop.
16. Transistor voltage regulator.
17. FET characteristics.
18. JK flip flop.
19. Simplification of Boolean expression using k map and implementation
20. Verification of de Morgan's theorems
21. Universality of NAND / NOR gates

Text Books

1. ARORA. C. L., (2005) B.Sc. Practical Physics, (19th ed.), S. Chand Publication, New Delhi. ISBN: 81-219-0909-0.

References

2. GEETHASANON., (2005) B.Sc. Practical Physics, (19th ed.), S. Chand Publication, New Delhi. ISBN: 978-8180-4505-32.

Web resources

1. https://www.vlab.co.in
2. https://praxilabs.com/

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