THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE
B.Sc. PHYSICS
DEGREE COURSE

(With effect from 2022 - 2023)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
SEMESTER I							**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Mechanics	25	75	100
	III	Core Practical	Paper-1	3	0		0	0	0
4.	III	Allied -1	Paper-1	4	3	Chemistry I or Biochemistry I	25	75	100
	III	Allied Practical	Practical-1	3	0		0	0	0
5.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
SEMESTER II							**CIA**	**Uni. Exam**	**Total**
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	4	4	**Communicative English II**	25	75	100
9.	**II**	**NMSDC I : Language Proficiency for Employability**	**Paper-1**	**2**	**2**	**Effective English**	**25**	**75**	**100**
10.	III	Core Theory	Paper-2	4	4	Heat and Thermodynamics	25	75	100
11.	III	Core Practical	Practical-1	3	2	Practical - I	25	75	100
12.	III	Allied-1	Paper-2	4	3	Chemistry II or Biochemistry II	25	75	100
13.	III	Allied Practical	Practical-1	3	2	Practical-Allied	25	75	100
14.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15.	IV	Value Education		2	2	Value Education	25	75	100
16.	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		**36**	**27**		**250**	**750**	**1000**
SEMESTER III							**CIA**	**Uni. Exam**	**Total**
17.	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100

18.	II	English	Paper-3	6	4	English	25	75	100
19.	III	Core Theory	Paper-3	5	4	Electricity, Magnetism and Electromagnetism	25	75	100
	III	Core Practical	Paper-2	3	0		0	0	0
20.	III	Allied-2	Paper-3	6	3	Mathematics I	25	75	100
21.	IV	Skill Based Subject	Paper-1	2	2	Basic Electrical Technology	25	75	100
22.	IV	Non-Major Elective	Paper-1	2	2	Environmental Physics	25	75	100
		Sem. Total		**30**	**19**		**150**	**450**	**600**
SEMESTER IV									
23.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
24.	II	English	Paper-4	6	4	English	25	75	100
25.	III	Core Theory	Paper-4	5	5	Waves and Optics	25	75	100
26.	III	Core Practical	Practical-2	3	3	Any 15 Experiments given in the syllabus	25	75	100
27.	III	Allied-2	Paper-4	6	5	Mathematics II	25	75	100
28.	**IV**	**NMSDC II : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	**25**	**75**	**100**
29.	IV	Non-Major Elective	Paper-2	2	2	Everyday Physics	25	75	100
		Sem. Total		**30**	**25**		**175**	**525**	**700**
SEMESTER V									
30.	III	Core Theory	Paper-5	6	6	Atomic and Molecular Physics	25	75	100
31.	III	Core Theory	Paper-6	6	6	Relativity and Quantum mechanics	25	75	100
32.	III	Core Theory	Paper-7	6	6	Basic and Applied Electronics	25	75	100
	III	Core Practical	Practical-3	3	0	General Practical	0	0	0
	III	Core Practical	Practical-4	3	0	Electronics Practical	0	0	0
33.	III	Elective	Paper-1	4	3	Group (A) or (B) or (C)	25	75	100
34.	IV	Skill Based Subject	Paper-2	2	2	Cell Phone Technology	25	75	100
		Sem. Total		**30**	**23**		**125**	**375**	**500**
SEMESTER VI									
35.	III	Core Theory	Paper-8	6	5	Nuclear and Particle Physics	25	75	100
36.	III	Core Theory	Paper-9	5	5	Solid State Physics	25	75	100
37.	III	Core Practical	Practical-3	3	3	General Practical	25	75	100
38.	III	Core Practical	Practical-4	3	3	Electronics Practical	25	75	100
39.	III	Elective	Paper-2	4	3	Group (A) or (B) or (C)	25	75	100
40.	III	Elective	Paper-3	4	3	Group (A) or (B) or (C)	25	75	100
41.	III	Compulsory Project	Paper-10	3	3	Group / Individual Project	25	75	100
42.	**III**	**NMSDC III : Data Analytics with Advanced Tools for Employability**	**Paper-3**	**2**	**2**	**Project Based Learning III**	**25**	**75**	**100**
43.	V	Extension Activities		0	1		100	0	100
		Sem. Total		**30**	**28**		**300**	**600**	**900**
		Grand Total			**142**				**4300**

Note: Compulsory Project

The faculty/Guides are advised to give projects and suggest project titles focusing more on the current field of research/social relevance and ensure the level of innovation. Staff member cannot guide more than five studentsfor a group project.

A student may be permitted to work on projects in an Industrial/Research Organization, on the recommendations of the Head of his/her Department. In such cases, the Project work shall be jointly guided by a guide of the department and an expert from the organization. The student shall be instructed to meet the respective guide periodically for evaluating the progress.

ELECTIVE SUBJECTS

Students can choose any one of the groups (Elective I, II & III)

GROUP A

Elective 1: Digital Electronics

Elective 2: Fundamentals of Microprocessor-8085

Elective 3: Nanophysics

GROUP B

Elective 1: Digital Electronics

Elective 2: Materials Science

Elective 3: Medical Physics

GROUP C

Elective 1: Digital Electronics

Elective 2: Radiation Safety

Elective 3: Astrophysics

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: I **Paper type: Core**

Paper code: **Name of the Paper: Mechanics** **Credit:4**

Total Hours per Week:6 **Lecture Hours: 90** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To know the basics of vectors algebra and the dynamic of a system
2. To understand the dynamics of rigid bodies
3. To learn the concept of work, energyand collisions
4. To study the basics of elasticity
5. To expose the knowledge on gravitation and satellites

UNIT-I **Teaching Hours: 20**

VECTORS AND DYNAMICS

Introduction to Vectors - Vector algebra-Scalar and vector products-Gradient of a scalar field- Divergence of a vector field - Line integral - Curl of a vector field - Surface and volume integrals -Stoke's theorem - Gauss theorem of divergence - Green's theorem - Newton's laws of motion-Principle of conservation of momentum-Impulse-Projectile-Range on an inclined plane- Range and Time of fight down an inclined plane-Two body problem and the reduced mass-Centre of mass-Centre of gravity-Centre of gravity of a solid tetrahedron-Analytical problems solving.

UNIT-II **Teaching Hours: 20**

DYNAMICS OF RIGID BODIES

Rotational kinetic energy and moment of inertia-Angular acceleration and angular momentum-Law of conservation of angular momentum-Torque-Work done by a torque-Theorem of perpendicular and parallel axes-Moment of inertia of a thin uniform rod-rectangular lamina-uniform circular disc (through the centre of gravity for all)-Determination of acceleration due to gravity-Compound pendulum-Centre of suspension and centre of oscillation are interchangeable- Bifilar pendulum (parallel threads)- Analytical problems solving.

UNIT-III **Teaching Hours: 18**

WORK, ENERGY & COLLISIONS

Work-Energy Theorem – Conservative forces - Potential Energy-Force as gradient of potential energy-Principle of conservation of energy of a freely falling body.

Elastic and inelastic collisions-Coefficient of restitution-Oblique impact of a smooth sphere on a fixed smooth plane-Oblique impact of two smooth spheres-Loss of kinetic energy due to oblique impact- Analytical problems solving.

UNIT-IV **Teaching Hours: 18**

ELASTICITY

Elastic moduli-Hooke's law- Relation between elastic constants – Poisson's Ratio - Work done in stretching twisting a wire-Twisting couple on a cylinder-Rigidity modulus of a wire by Torsional pendulum-Rigidity modulus of a rod by Static torsion method-Bending of beams -Expression for bending moment – Cantilever -Expression for depression at the loaded end- Non-uniform bending-Determination of young's modulus pin & microscope and Koenig's method- Uniform bending-Expression for elevation – Experiment to determine young's modulus using optic lever method- Analytical problems solving,

UNIT-V **Teaching Hours: 14**

GRAVITATION

Law of gravitation-Acceleration due to gravity- Inertial mass and gravitational mass-Gravitational field-Gravitational potential-Gravitational potential energy- Potential and field due to spherical shell and solid sphere.

Kepler's Laws-Basic principles of rocket motion-Rocket Equation, thrust and acceleration-Escape velocity-Orbital velocity-Satellite in circular orbit-Geosynchronous orbits-

Weightlessness- Basic idea of global positioning system (GPS)-Physiological effects on astronauts- Analytical problems solving.

Text Books

Unit 1

1. R. Murugeshan, Mechanics and Mathematical methods, S.Chand&Co.Ltd, New Delhi, 2016

Unit 2

1. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002

Unit 3

1. M. Narayanamurti and N.Nagartnam, Dynamics, The National Publishing Company, Chennai, 2005.
2. Prof. D.S. Mathur revised byDr.P.S. Hemne, Mechanics, S. Chand and Company Limited, 2014
3. R. Murugeshan, Mechanics and Mathematical methods, S.Chand&Co.Ltd, New Delhi, 2016

Unit 4

1. R. Murugeshan, Properties of Matter and Acoustics, S.Chand&Co.Ltd, New Delhi, 2016
2. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002
3. K. Ilangovan, Properties of Matter and Sound, Ananda Book Depot, Chennai, 2018.
4. J.Jayachitra and M. Gunasekaran, Properties of Matter and Acoustics, KRU Publications, Kumbakonam, 2007.

Unit 5

1. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002
2. Prof. D.S. Mathur revised byDr.P.S. Hemne, Mechanics, S. Chand and Company Limited, 2014

Reference Books

1. Introduction to Mechanics, Mahendra Verma, Universities Press,Hyderabad, 2016
2. Sathyaprakash, Mathematical Physics, Sultanchand& Sons, New Delhi, Revised Ed.
3. Resnick, Halliday and Walker, Physics, 8/e. 2008, Wiley
4. J.W. Jewett, R.A. Serway ,Physics for scientists and Engineers with Modern Phys., , 2010, Cengage Learning
5. R.P.Feynman, R.B.Leighton, M.Sands ,Feynman Lectures, Vol. I, , 2008, Pearson Education
6. M.R. Spiegel, Theoretical Mechanics, , 2006, Tata McGraw Hill.
7. C.Kittel, W.Knight, et.al, Mechanics, Berkeley Physics, vol.1. 2007, Tata McGraw-Hill.

8. G.R. Fowles and G.L. Cassiday, Analytical Mechanics,. 2005, Cengage Learning.
9. Higher Secondary Plus 1 and Plus 2 Physics Books- TN State Board and NCERT Books.
10. எந்திரவியல் மற்றும் பொருட்பண்பியல் &ஒலி-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)

E-Materials

1. https://sites.google.com/a/euhsd.org/physics/
2. https://en.wikipedia.org/wiki/Euclidean_vector
3. https://www.youtube.com/watch?v=sXKiAKn0WCM
4. https://en.wikipedia.org/wiki/Center_of_mass
5. https://en.wikipedia.org/wiki/Moment_of_inertia
6. https://www.toppr.com/guides/physics/system-of-particles-and-rotational-dynamics/moment-of-inertia/
7. https://byjus.com/physics/work-energy-power/
8. https://www.physicsclassroom.com/class/energy
9. https://en.wikipedia.org/wiki/Bending_moment
10. https://www.youtube.com/watch?v=CQGlgu-8dmA (Tamil video)
11. https://en.wikipedia.org/wiki/Newton%27s_law_of_universal_gravitation
12. https://www.youtube.com/watch?v=kxkFaBG6a-A
13. http://hyperphysics.phy-astr.gsu.edu/hbase/rocket2.html
14. https://en.wikipedia.org/wiki/Global_Positioning_System
15. https://study.com/academy/lesson/the-global-positioning-system-and-its-uses.html
16. https://www.nasa.gov/centers/johnson/pdf/584739main_Wings-ch5d-pgs370-407.pdf

Course Out Comes (five outcomes for each units should be mentioned)

1. After studied unit-1, the student will be able to know fundamentals of vectors and able to formulate the expression for projectiles.
2. After studied unit-2, the student will be able to study the dynamics of rigid bodies in terms of moment inertia and also able to find the moment of inertia of different systems.
3. After studied unit-3, the student will be able to define work, energyand also able to understand the oblique impact between smooth spheres.
4. After studied unit-4, the student will be able to learn the elastic property of the solid materials and also derive the relation between elastic moduli.
5. After studied unit-5, the student will be able to explain the concept of gravitation and able to know the principles of rocket and satellite.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	M	M	L
CO2	S	S	S	M	S	S	S	M	M	L
CO3	S	S	S	M	S	M	S	M	S	M
CO4	S	S	S	M	S	S	S	M	M	L
CO5	S	S	S	M	S	S	S	M	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: II **Paper type: Core**

Paper code: **Name of the Paper: Heat and ThermodynamicsCredit: 4**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Get clear idea about the specific heat capacity and kinetic theory of gases
2. Knowledge about the conduction, radiation and low temperature physicswill be gained

3. To know the thermodynamic system and its laws
4. To learn the concept of entropy and Mawell'sthermodynamical relations
5. To study the basic ideas of statistical mechanics

Unit-I **Teaching Hours : 15**

SPECIFIC HEAT & KINETIC THEORY OF GASES

Specific heat capacity-Principle of method of mixtures-Specific heat capacity of liquid by method of mixtures-Newton's law of cooling-Specific heat capacity of a liquid by the method of cooling- Specific heat capacity of a liquid by Callender and Barne's method-Specific heat capacity of gases- Meyer's relation between C_P and C_v.

Kinetic theory of gases-Expression of pressure of gas-Boyle's law-Charle's law-Perfect gas equation- Mean free path-Expression for mean free path-Maxwell's velocity distribution law-Transport phenomena-Diffusion-Law of equipartition energy- Application to specific heat of gases.

Unit-II **Teaching Hours : 15**

TRANSMISSION OF HEAT & LOW TEMPERATURE PHYSICS

Conduction-Coefficient of thermal conductivity-thermal conductivity of a good conductor--Forbe's method – thermal conductivity of a poor conductor -Lee's disc method-Black body radiation-Stefan -Boltzmann law-determination of Stefan's constant -laboratory method-Solar energy-Solar cooker-solar constant- temperature of the Sun.

Joule-Kelvin effect-Porous plug experiment- liquefaction of hydrogen- liquefaction of helium-Kammerling-Onne's method-Helium I and II -Lambda point-Superconductivity-Type I and II superconductors -Meissner effect-applications of superconductors.

UNIT-III **Teaching Hours : 10**

THERMODYNAMICS

Thermodynamic system- Zeroth law, First and Second law of thermodynamics -Carnot's theorem-Statement and proof-Otto (petrol) engine and Diesel engine –Construction, working and efficiency- Thermodynamic scale of temperature- Thermodynamic and perfect gas scale.

UNIT-IV **Teaching Hours : 10**

ENTROPY & ENTHALPY

Entropy- Change in entropy in a reversible/irreversible process-Temperature entropy diagram -Entropy of perfect gas- Third law of thermodynamics-Maxwell's thermo dynamical relations--Clapeyron latent heat equation-Clausius latent heat equation-Helmholtz and Gibb's free energy-Enthalpy.

UNIT-V **Teaching Hours : 10**

STATISTICAL MECHANICS

Phase space- Macrostate and Microstate- Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity -Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics-Ensembles-Micro,canonical and grand canonical ensembles.

Text Books

Unit 1 to Unit 5

1. D. Jayaraman, K. Ilangovan, Thermal Physics &Stastical Mechanics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2016.
2. BrijLal and N Subrahmanyam,Heat Thermodynamics and Statistical Physics,S Chand & Company Pvt Ltd, New Delhi, 2016.

Reference Books

1. D.S. Mathur, Heat and Thermodynamics**,** S Chand & Company Pvt Ltd, 2008.
2. J.B. Rajam, Heat and thermodynamics,S Chand & Co., New Delhi, 1990.
3. R Murugeshan and KiruthigaSivaprasad, Thermal Physics, S Chand & Co., New Delhi, 2002.
4. Gupta and Kumar, Elements of Statistical Mechanics, PragatiPrakashan, Meerut, 2000.
5. SathyaPrakash and J P Agarwal , Statistical Mechanics , KedarNath& Ram Nath& Co., Meerut, 2002.
6. வெப்ப இயற்பியல்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)

E- Materials

1. https://www.e-booksdirectory.com/details.php?ebook=1778
2. https://www.ugrad.math.ubc.ca/coursedoc/math100/notes/diffeqs/cool.html
3. https://www.youtube.com/watch?v=JLU0phEP7h4
4. https://www.youtube.com/watch?v=Q7qzc7-flMY (Tamil Video)
5. https://www.youtube.com/watch?v=Atnjo7dD_bA
6. https://www.youtube.com/watch?v=iENG9VnBeP0
7. http://www.iiserpune.ac.in/~bhasbapat/phy221_files/Lee's%20Method.pdf
8. https://vikaspedia.in/energy/energy-production/solar-energy/solar-cookers

9. https://www.youtube.com/watch?v=ZWDl1-oZLJQ (Tamil Video)
10. https://www.youtube.com/watch?v=6IRXVZKH6WQ
11. https://www.youtube.com/watch?v=DPjMPeU5OeM
12. https://statisticalphysics.openmetric.org/equilibrium/ensembles.html

Course Out Comes

1. After studied unit-1, the student will be able to know fundamentals specific heat capacity and able to explain the kinetic theory of gases.
2. After studied unit-2, the student will be able to describe the conduction and radiation of heat and also able to study the Joule-Kelvin effect based on the low temperature phenomena and its applications.
3. After studied unit-3, the student will be able to cite the laws of thermodynamics and their applications.
4. After studied unit-4, the student will be able to explore the equations governing second law of thermodynamics and entropy.
5. After studied unit-5, the student will be able to explain Phase-space, micro and macrostates and able to distinguish MB,FD and BE statistics.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	No	Yes	Yes	No
4	Yes	Yes	No	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	M	M	L
CO2	S	S	M	M	S	S	M	M	M	L
CO3	S	S	M	M	S	S	M	M	M	L
CO4	S	S	M	M	S	S	M	M	M	L
CO5	S	S	M	M	S	S	M	M	M	L

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115

(B.Sc Physics) – 2022-2023 onwards

Semester: II **Paper type: Core Practical**

Paper code: **Name of the Paper: Practical –1** **Credit: 2**

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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List of Experiments (Any 15 Experiments only)

1. Compound Pendulum -Determination of ‘g’ and ‘k’.
2. Young’s modulus –non-uniform bending -Pin and microscope.
3. Young’s modulus –non-uniform bending -Optic lever.
4. Young’s modulus cantilever- depression- dynamic method-Mirror, Scale and Telescope.
5. Rigidity modulus -Torsional Pendulum -without masses.
6. Rigidity modulus and moment of inertia -Torsional Pendulum -with identical masses.
7. Rigidity modulus -Static torsion -Mirror, scale and telescope.
8. Surface tension and Interfacial surface tension - drop weight method.
9. Coefficient of viscosity of liquid-Graduated burette -Radius of capillary tube by using microscope.
10. Thermal conductivity of a poor conductor -Lee’s disc method.
11. Specific heat capacity of liquid -Newton’s law of cooling.
12. Sonometer -Frequency of Tuning fork.
13. Sonometer -Relative density of a solid and liquid.
14. Focal length -R and μ of a convex lens [focal length i) u-v and ii) conjugate foci method; Radius of curvature by telescope method].
15. Focal length -R and μ of a concave lens [focal length i) in contact and ii) auxiliary lens method; Radius of curvature by Boy’s method].
16. Spectrometer -Solid prism- Refractive indexof material of a prism.
17. Spectrometer- Hollow prism – Refractive index of a liquid.
18. Potentiometer -Calibration of low range voltmeter.
19. Potentiometer - Internal resistance of a Cell.
20. Post office box -Temperature coefficient of resistance of a coil.

Text Books

1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai,2018.
2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

Reference Books

1. Samir Kumar Ghosh, A Textbook of Advanced Practical Physics, NCBA, Kolkatta, 2000.
2. D. Chattopadyay, P.C.Rakshit, An Advanced Course in Practical Physics,NCBA, Kolkatta, 2011
3. C.L.Arora, B.Sc., Practical Physics,S. Chand and Company., New Delhi.
4. D.P.Khandelwal , A Laboratory Manual of Physics for Undergraduate Classes,VaniPublications.
5. B.Saraf et al, Physics through Experiments,Vikas Publications.
6. Harnaam Singh., B.Sc., Practical Physics,S. Chand and Company., New Delhi.
7. D C Tayal, University Practical Physics, Himalaya Publishing House.
8. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: III **Paper type: Core**

Paper code: **Name of the Paper:** **Electricity, Magnetism & Electromagnetism** **Credit: 4**

Total Hours per Week: 5 **Lecture Hours: 75** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Familiarize with the concept of electric flux, electric potential and capacitors.
2. To know the principles current and thermo electricity.
3. Understand the magnetic effects of electric current.
4. Study the unification of electric and magnetic phenomena.
5. To gain knowledge about Maxwell's equations.

UNIT-I **Teaching Hours: 17**

ELECTROSTATICS

Coulomb's Law- Gauss's Law and its applications (Electric Field due to a uniformly charged sphere, hollow cylinder & solid cylinder)-Electric Potential - Potential at a point due to a uniformly charged conducting sphere-Principle of a capacitor-Capacity of a spherical and cylindrical capacitors- Capacitance of a parallel plate capacitor-Partially filled with dielectric-Energy stored in a charged capacitor-Loss of energy on sharing of charges between two capacitors-Problems solving.

UNIT-II **Teaching Hours: 17**

CURRENT ELECTRICITY AND THERMO ELECTRICITY

Carey Foster's Bridge-Determination of temperature coefficient of resistance of a coil–Potentiometer-Calibration of Ammeter and Voltmeter (Low range and High range) - Comparison of Resistances- Seebeck, Peltier and Thomson effects -Peltier coefficient - Thomson coefficient - application of thermodynamics to a thermocouple and expressions for Peltier and Thomson coefficients - thermo electric power and thermo electric diagrams-Problems solving.

UNIT-III **Teaching Hours: 16**

ELECTROMAGNETIC INDUCTION

Laws of electromagnetic induction- Self and mutual induction- Self-inductance ofa solenoid-Mutual inductance of a pair of solenoids-Coefficient of coupling-Experimental determination of self (Rayleigh's method) and mutual inductance-Growth and decay of current in a circuit containing L and R-Growth and decay ofcharge in a circuit containing C and R-Measurement of High resistance byleakage-Problems solving.

UNIT-IV **Teaching Hours: 17**

MAGNETISM

Intensity of Magnetization-Magnetic Susceptibility- Magnetic Permeability-Types of magnetic materials- Properties of para, dia and ferromagnetic materials-Langevin's theory of dia and para magnetism-Weiss's theory of ferromagnetism - B-H curve-Energy loss due to magnetic hysteresis- Ballistic Galvanometermethod for plotting B-H curve - Magnetic

properties of iron and steel-Problems solving.

UNIT-V **Teaching Hours: 08**

MAXWELL'S EQUATIONS & ELECTROMAGNETIC THEORY

Introduction-Displacement Current-Maxwell's equations in material media-Plane electromagnetic waves in free space-velocity of light-Electromagnetic waves in isotropic non-conducting media-Index or refraction-Poynting vector-Problems solving

Text Books

Unit 1 to Unit 4

1. R Murugeshan- Electricity and magnetism, S Chand & Co., New Delhi, 2006.

Unit 4 and Unit 5

1. R Murugeshan- Electricity and magnetism, S Chand & Co., New Delhi, 2006
2. K KTewari, Electricity & Magnetism by, S Chand & Co.,2001.

Reference Books

1. BrijLal and N Subrahmanyam,Electricity and Magnetism, S Chand & Company Pvt Ltd, New Delhi, 2000.
2. D.C. Tayal, Electricity and Magnetism, Himalaya Publishing House,Bombay, 1992.
3. M Narayanamurthy& N Nagarathnam, Electricity & Magnetism, National Publishing Co., Meerut.
4. David J Griffiths, Introduction to Electrodynamics, Prentice Hall of India, Pvt. Ltd., New Delhi, 1997.
5. மின்னியலும் காந்தவியலும்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)

E-Materials

1. https://en.wikipedia.org/wiki/Coulomb%27s_law
2. https://www.toppr.com/guides/physics/electric-charges-and-fields/coulombs-law/
3. https://www.youtube.com/watch?v=rkntp3_cZl4
4. https://ask.learncbse.in/t/derive-an-expression-for-the-capacitance-of-a-parallel-plate-capacitor/66928
5. http://egyankosh.ac.in/bitstream/123456789/18820/1/Experiment-6.pdf
6. https://www.youtube.com/watch?v=vGpXTq-ITCE
7. https://en.wikipedia.org/wiki/Thermoelectric_effect
8. https://ww.topperlearning.com/answer/derive-the-formula-for-self-inductance-of-a-solenoid/8k8rlhzff
9. https://www.brainkart.com/article/Self-inductance-of-a-long-solenoid_12109/
10. https://byjus.com/physics/diamagnetic-paramagnetic-ferromagnetic/
11. https://www.youtube.com/watch?v=yWa_2P6CDpw
12. https://nptel.ac.in/courses/115/101/115101005/
13. https://www.youtube.com/watch?v=4vEeG-YmCJQ (Tamil video)

Course Outcomes

1. After studied unit-1, the student will be able to know fundamentals coulomb's law and Gauss's law and also able to derive the expression for electric potential, capacitance of a parallel plate capacitor.
2. After studied unit-2, the student will be able to derive the expression for temperature coefficient resistance of a coil using Carey Foster's Bridge and able to know how to calibratethe ammeter and voltmeter. Also students will be able to learn the thermo electricity concepts.
3. After studied unit-3, the student will be able to explain the concepts of self and mutual inductance using electromagnetic induction phenomenon.
4. After studied unit-4, the student will be able to distinguish the dia, para and ferro magnetic materials based on different theories.
5. After studied unit-5, the student will be able formulate the expression for displacement current and Maxwell's equations.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	Yes	Yes	Yes	Yes
3	Yes	Yes	No	Yes	Yes	Yes
4	Yes	Yes	No	Yes	No	Yes
5	Yes	Yes	Yes	No	Yes	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	M	M	L
CO2	S	S	M	M	S	S	M	M	M	L
CO3	S	M	M	M	S	S	S	S	M	L
CO4	S	S	M	M	M	S	M	M	M	M
CO5	S	S	M	M	S	S	M	M	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: III **Paper type: Skill Based Subject (SBS)-1**

Paper code: **Name of the Paper:** **Basic Electrical Technology** **Credit: 2**

Total Hours per Week: 2 Lecture Hours: 30 **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Students can know the basic principles of electricity.
2. To expose the knowledge on different kinds of cells and batteries.
3. To state the different theorems for DC circuits and know the function of DC generator/motor.
4. To know the principle of transformers and motors.
5. To acquire the basic ideas of alternating voltage and current.

UNIT-I **Teaching Hours: 07**

BASIC ELECTRICITY PRINCIPLES

Voltage, Current, Resistance, and Power-Ohm's law- Resistors Series, parallel -combinations - Series-Parallel combinations - Charge-Coulomb's law-Capacitors-Capacitance of capacitor– ACElectricity-LT/HT Line-Concept of neutral and earth-Application of fuse- MCB, ELCB-relays -Electrical Safety- Safety Precautions of Electricity -Electric Shock-Preventive measures of Electrical Shock.

UNIT-II **Teaching Hours: 05**

CELL AND BATTERIES

Dry Cell -Voltaic Cell-Daniel cell-Lechlanche cell-Secondary Cell and its Classification-Lithium Ion Battery- Disparity between Lead Acid Battery and Lithium Ion Battery-Hydrogen battery-UPS Battery -Solar cell-Principle and design.

UNIT-III **Teaching Hours: 05**

DC CIRCUITS

Kirchhoff's Current and Voltage Law-Wheatstone's bridge-Source conversion-Superposition theorem-Thevenin's theorem-Norton's theorem-Joule's law of electric heating-Electric power-D.C generator-Construction and working-D.C motor-Speed of a D.C motor.

UNIT-IV **Teaching Hours: 07**

AC FUNDAMENTALS

Generation of Alternating voltages and alternating currents-Equations of the alternating voltages and currents-Simple waveforms - Cycle-Time Period - Frequency-Amplitude-Different forms of emf equation - Phase-Phase difference-RMS, Average and Peak values-RLC circuit in series-Resonance in RLC circuit-Graphic representation of series resonance-Single phase and three phase connections-Star and delta connection.

UNIT-V **Teaching Hours: 06**

TRANSFORMERS AND MOTORS

Transformer-Step and Step down transformers-Construction and working-Losses in a transformer-Efficiency of a transformer-Types of a transformers-AC generator/alternator-Principle and construction-Single phase and three phase induction motors-Principle and construction.

Text Books

Unit-1 to Unit-5

1. B.L. Theraja, Fundamentals of Electrical Engineering and Electronics, S. Chand & Company Ltd., New Delhi,2008.
2. B.L. Theraja and A.K. Theraja, A Text book of Electrical Technology, Volume I & II, Chand & Company Ltd., New Delhi, 2007.

Reference Books

1. V.K. Mehta and Rohit Mehta, Basic Electrical Engineering,S. Chand & Company Ltd., New Delhi, 2009.
2. Basic Electrical Engineering-Vocational Theory-Plus One Text Book-TN State Board.

E-Materials

1. https://www.electrical4u.com/
2. https://www.youtube.com/watch?v=WtymNvcBdIU
3. https://www.atlantictraining.com/blog/15-safety-precautions-electricity/
4. https://www.explainthatstuff.com/solarcells.html
5. https://www.youtube.com/watch?v=L_q6LRgKpTw
6. https://www.youtube.com/watch?v=3rOvQ3qFZpI
7. https://en.wikipedia.org/wiki/Wheatstone_bridge
8. https://www.electronics-tutorials.ws/accircuits/series-resonance.html
9. https://www.youtube.com/watch?v=smXF1UeN0EI (Tamil video)
10. https://www.youtube.com/watch?v=hXLA5sdT9Cs
11. http://www.circuitstoday.com/transformer

Course Outcomes

1. After studied unit-1, the student will be able to know principle of Voltage, Current, Resistance, Ohm's law and Electrical safety.
2. After studied unit-2, the student will be able to distinguish between cells and batteries and able to explain the different types of batteries.
3. After studied unit-3, the student will be able to understand the Wheastone's bridge, Thevenin and Norton's theorem and also able to describe the function of DC generator and motor.
4. After studied unit-4, the student will be able to know the fundamentals of alternating currents and voltages and able to differentiate the single phase and three phase connections.

5. After studied unit-5, the student will be able to acquire the principle and construction of transformers and its types and also able to demonstrate the function of AC generator.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	Yes	No	Yes	Yes	No
4	Yes	Yes	No	Yes	No	Yes
5	Yes	No	Yes	No	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	M	M	L
CO2	S	S	M	M	S	S	M	M	M	L
CO3	M	M	M	M	S	M	S	S	M	L
CO4	S	S	M	M	M	S	M	M	M	L
CO5	S	S	M	M	S	S	M	M	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
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Semester: III **Paper type: Non-Major Elective (NME)-1**

Paper code: Name of the Paper: Environmental Physics Credit: 2

Total Hours per Week: 2Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

1. Students will have the basic knowledge about atmosphere, weather and cyclones.
2. To understand the reasons for climate change and global warming.
3. To analyse the need and usage of non-conventional energy resources.
4. To learn the concepts of Radiation detection.
5. To realise the importance of Radiation safety measures.

UNIT- I **Teaching Hours: 06**

ATMOSPHERIC PHYSICS

Basics of the structure and composition of atmosphere - Layers of atmosphere - Measurement of atmospheric pressure and temperature - Weather patterns - Weather analysis and forecasting - Characteristics of cyclones and anti-cyclones.

UNIT- II **Teaching Hours: 06**

CLIMATE CHANGE

Climate - Definition and classification - Basic reasons for climate change - Greenhouse effect and gases -Effects of global warming - Ozone depletion - Acid rain.

UNIT- III **Teaching Hours: 06**

ENERGY RESOURCES

Need for non-conventional energy resources- Solar water heater - Solar cell -Merits and Demerits of Solar energy - Wind energy conversion systems - Bio mass energy - Bio gas generation - Industrial applications.

UNIT- IV **Teaching Hours: 06**

RADIATION DETECTION

Nuclear reactions - Nuclear fission and fusion - Interaction between energetic particles and matter - Ionisation Chamber - Proportional counter - Geiger Muller Counter - Wilson cloud chamber - Diffusion cloud chamber - Bubble chamber - Nuclear emulsions - Scintillation counter - Cerenkov counter.

UNIT- V **Teaching Hours: 06**

RADIATION SAFETY

Biological effects of nuclear radiations - Radiation hazards - Radiation protection standards - Radiation protection methods -Nuclear waste disposal management - Nuclear disasters - Chernobyl disaster - Hiroshima and Nagasaki disaster - Nuclear reactors in India - Radiation safety measures in India.

Text Books

Unit 1 and Unit 2

1. Frederick Lutgens K, Edward J Tarbuck, Dennis Tasa,Atmosphere- An Introduction to Meteorology, Prentice Hall of India.
2. S.R.Ghadekar, Meteorology, ,Agromet Publishers, 2001.
3. AnupChatterjee,Global Warming and Climate Change, , Global publications.

Unit 3

1. B.H.Khan, Non-Conventional Energy Resources, , McGraw Hill Publications.
2. Agarwal, Renewable and Sustainable Energy Sources,

Unit 4 and Unit 5

1. R.Murugesan, Modern Physics, , KiruthigaSivaprasath, S.Chand&Co, New Delhi, 2007
2. S.N.Ghoshal, Nuclear Physics,S.Chand& Co, New Delhi, 2006
3. AN.Subrahmaniyam, Brijlal, Atomic and Nuclear Physics, S.Chand&Co, New Delhi, 2006
4. K.Gopalakrishnan, Atomic and Nuclear Physic, Mcmillan Publishers, 2006

Reference Books

1. I.C.Joshi, Aviation Meteorology, , Himalayan Books, 201.4
2. V.Devanathan, Nuclear Physics, Narosa Publishing House, New Delhi, 2013.
3. D.P. Kothari,K.C. Singal&RakeshRanjan, Renewable Energy Sources and Emerging Technologies, Prentice Hall of India pvt. Ltd., New Delhi, 2008.
4. A.Martin and S.A.Harbisor, An Introduction to Radiation Protection, , John Wiley & Sons, 1981.
5. Atmospheric Science - An Introductory Survey , John M.Wallace, Peter V.Hobbs, Elsevier Publishers
6. NCRP, ICRP, ICRU, IAEA, AERB publications.
7. ஆற்றல் இயற்பியல்-A.சுந்தரவேலுசாமி, பிரியா பப்ளிகேஷன்ஸ்,கரூர்.

E-Materials

1. https://easyengineering.net/non-conventional-energy-resources-khan/
2. http://nap.edu/631
3. https://ocw.mit.edu/courses/nuclear-engineering/22-091-nuclear-reactor-safety-spring-2008/
4. https://en.wikipedia.org/wiki/Atmosphere_of_Earth
5. https://www.youtube.com/watch?v=zaQWhEtLxeU (Tamil video)
6. https://www.youtube.com/watch?v=Nf8cuvl62Vc
7. https://en.wikipedia.org/wiki/Acid_rain
8. https://nptel.ac.in/content/storage2/courses/108108078/pdf/chap7/teach_slides07.pdf
9. https://www.youtube.com/watch?v=Rf9whdycpLI
10. https://www.youtube.com/watch?v=WyyIuiV4rKE

11. https://en.wikipedia.org/wiki/Geiger_counter

Course Outcomes

1. After studied unit-1, the student will be able to basic concepts of atmosphere and also able to know how it can be measured and study the characteristics of cyclones.
2. After studied unit-2, the student will be able to explain the details of climate, greenhouse effect and global warming.
3. After studied unit-3, the student will be able to describe the different renewable energy sources and its applications.
4. After studied unit-4, the student will be able to know how to detect the nuclear radiation with different instruments.
5. After studied unit-5, the student will be able to know how to saveourselves from nuclear radiation hazards.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	No	Yes	No	No
5	Yes	No	Yes	No	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	M	L
CO2	S	S	M	S	S	S	M	M	L	M
CO3	M	M	M	S	S	M	S	S	M	M
CO4	S	S	M	S	M	S	M	M	M	L
CO5	S	S	M	S	S	S	M	M	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: IV **Paper type: Core**

Paper code: **Name of the Paper: Waves and Optics** **Credit: 5**

Total Hours per Week: 5 Lecture Hours: 75 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

1. To expose the knowledge of different types of waves motion and oscillations.
2. To study the property of surface tension and viscosity of a liquid.
3. To learn the different types of aberrations and phenomenon of interference.
4. To teach the Fresnel's and Fraunhofer's class of diffraction and its applications.
5. To know the basics of polarization phenomenon.

UNIT- I **Teaching Hours: 17**

WAVES & OSCILLATIONS

Progressive waves-Equation for progressive wave-Simple harmonic motion - Superposition of Two Perpendicular Harmonic Oscillations - Lissajous Figures -Forced oscillations-Differential equation and solution-Laws of transverse vibration of stretched string - Sonometer-Frequency of AC mains - Acoustics-Intensity and Loudness-Reverberation and reverberation time - Absorption coefficient - Sabine's formula -measurement of reverberation time - Acoustic aspects of halls and auditoria -Ultrasonics-Production-Piezoelectric oscillator - Applications-Non Destructive Testing (NDT)-B-Scan-Problems solving

UNIT- II **Teaching Hours: 13**

FLUIDS

Surface Tension-Excess pressure inside a curved liquid surface-Synclastic and anticlastic surface - Surface tension-Jaeger's method-Drop weight method-Interfacial surface tension-Variation of surface tension with temperature - Viscosity-Poiseuille's formula - Determination of coefficient of viscosity of aliquid -Burette method- Variations of viscosity of a liquid with temperature and pressure - Lubrication-Problems solving

UNIT- III **Teaching Hours: 17**

GEOMETRICAL OPTICS & INTERFERENCE

Spherical aberration in lenses -Condition for minimum spherical aberration in the case of two lenses separated by a distance-Chromatic aberration in lenses - Condition for achromatism of two thin lenses(in contact and out of contact) - Astigmatism-Huygen's and Ramsden's

eyepieces - Air wedge- Determination of diameter of a thin wire by air wedge- Fringes of equal thickness-Michelson's Interferometer-Determination of wave length- Thickness of thin transparent material-Refractive index of gases -Jamin's& Rayleigh's Interferometers-Problems solving

UNIT- IV **Teaching Hours: 14**

DIFFRACTION

Fresnel's diffraction-Diffraction at circular aperture and straight edge- Fraunhofer's diffraction -Single slit-Theory of Plane diffraction grating -Experiment to determine wavelength-normal incidence- Determination of wavelengths-Missing orders-Overlapping spectra-Rayleigh's criteria -Resolving power of telescope-Microscope-Prism - Grating-Distinguish between prism and grating spectra-Problems solving

UNIT- V **Teaching Hours: 14**

POLARISATION

Introduction to polarisation-Brewster's law- Double refraction-Huygen's explanation of double refraction in uniaxial crystal-Nicol Prism-Double image polarizing prisms-Dichroism -Polaroids and their uses-Production and detection of Plane, circularly and elliptically and polarized light -Optical Activity -Fresnel's explanation of optical activity -Specific Rotation-Laurent's Half Shade Polarimeter -Faraday effect-Problems solving

Text Books

Unit 1 to Unit 2

1. K. Ilangovan, Properties of Matter and Sound, S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2018.
2. J.Jayachitra and M. Gunasekaran, Properties of Matter and Acoustics, KRU Publications, Kumbakonam, 2007.

Unit 3 to Unit 5

1. N.SubrahmanyamBrijlal and M.N Avadhanulu, A Text Book of Optics, S.Chand& Co.Ltd, New Delhi, 2015.
2. R. Murugeshan, Optics & Spectroscopy, S.Chand&Co.Ltd, New Delhi, 2016.

Reference Books

1. R. Murugeshan, Properties of Matter and Acoustics, S.Chand&Co.Ltd, New Delhi, 2016
2. BrijLal and N. Subrahmanyam, Properties of Matter, S.Chand&Co.Ltd, New Delhi, 2002
3. N.Subrahmanyam and BrijLal, A Text Book of Sound,Vikas Publications, New Delhi,1982.
4. C.L.Arora, Waves, Vibrations & Sound, S.Chand&Co.Ltd, New Delhi, 1984.
5. B.K. Mathur, Principles of Optics, Gopal Printing, 1995

6. H.R. Gulati and D.R. Khanna,Fundamentals of Optics, R. Chand Publication, 2011.
7. பொருட்பண்பியல்&ஒலி,ஒளியியல்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)

E-Materials

1. http://hyperphysics.phy-astr.gsu.edu/hbase/shm.html
2. https://www.youtube.com/watch?v=tudxily5Qu0
3. https://en.wikipedia.org/wiki/Surface_tension
4. https://www.youtube.com/watch?v=CC7Q5cvmuTA (Tamil video)
5. https://www.youtube.com/watch?v=aKY_GnwDyZc
6. https://ta.wikipedia.org/wiki/%E0%AE%AA%E0%AE%9F%E0%AE%BF%E0%AE%AE%E0%AE%AE%E0%AF%8D:Chromatic_aberration_lens_diagram.svg (Tamil)
7. https://www.diffen.com/difference/Fraunhofer_Diffraction_vs_Fresnel_Diffraction
8. https://www.youtube.com/watch?v=Q-oQKSLhLKw
9. https://www.slideshare.net/AnuroopAshok/polarization-birefringence-and-huygens-theory-of-double-refraction
10. https://www.youtube.com/watch?v=lhUUGWA_uFE

Course Outcomes

1. After studied unit-1, the student will be able to formulate the equation for plane progressive wave and able to understand the concept of simple harmonic motion and other types of waves
2. After studied unit-2, the student will be able study the property of surface tension of a liquid and know how the surface tension varies with temperature and also able to explain the property of viscosity of a liquid.
3. After studied unit-3, the student will be able to describe the different optical of a lens system and able to design the eyepieces. Also able to know the phenomenon of interference and its applications.
4. After studied unit-4, the student will be able to distinguish between Fresnel class of diffraction and Fraunhofer class of diffraction. Also formulate the expression for resolving power of telescope, microscope, prism and grating.
5. After studied unit-5, the student will be able to explain the phenomenon of polarization and able to study the double refraction in uniaxial crystals. Also they can define optical activity, specific rotation and know the applications of polaroids.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	No	Yes	No	Yes
5	Yes	Yes	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	M	L

CO2	S	S	M	S	S	S	M	M	L	M
CO3	S	M	S	M	S	M	S	M	M	L
CO4	S	S	M	S	M	S	M	M	M	L
CO5	S	S	M	S	S	S	M	S	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

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Semester: IV **Paper type: Non-Major Elective (NME)-2**

Paper code: Name of the Paper: Everyday Physics Credit: 2

Total Hours per Week: 2Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

1. Students can able to understand the basic measurements and mechanics.
2. To learn the principle applied in Pressure cooker, Refrigerator and Air-conditioner.
3. To know the construction and working of various electrical appliances.
4. To study the fundamentals of laser and its applications.
5. To know the different biomedical instrumentation techniques.

UNIT- I **Teaching Hours: 07**

MEASUREMENTS & MECHANICS

Fundamental quantities-System of Units-CGS,FPS,MKS and SI-Verniercalliper, Screw gauge and their utility-Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet-Newton's law of motion- Lever mechanism - Pulleys-Force -Weight -Work -Energy -Power- Horsepower -Circular motion-Banking of curved tracks.

UNIT-II **Teaching Hours: 05**

THERMO AND HYDRODYNAMICS

Variation of boiling point with pressure - Pressure cooker - First and Second law of thermodynamics-Refrigerator - Air Conditioner - Principle and construction-Bernoulli Theorem-Applications.

UNIT – III **Teaching Hours: 05**

ELECTRICAL APPLIANCES

Electric iron Box-Electric Fan-Construction and Working of Ceiling and Table fans-Water Heater -Types-Function -Wet Grinder-Mixer Grinder-Principle and Design.

UNIT- IV **Teaching Hours: 07**

LASER

Power of a Lens-Human eye- Defects of vision - Laser-Spontaneous emission -Stimulated emission -Meta stable state -Population inversion -Pumping - Laser Characteristics- Ruby Laser - Helium-Neon Laser-Applications of Laser-Laser cutting - Welding- Drilling -Lasers in Surgery - Lasers in ophthalmology.

UNIT- V **Teaching Hours: 06**

BIOMEDICAL INSTRUMENTATION

Digital thermometer-Digital BP apparatus-One touch Glucometer–thermal scanner-pulse oximeter-Lipid profile test-pH meter-BMI calculator - Ventilator-Principle, description, function and recording of ECG, EMG and EEG- artificial pace maker.

Text Books

Unit 1& Unit 2

1. N. Subrahmanyam and BrijLal, Principles of Physics, S.Chand&Co.,Ltd, Chennai.
2. Plus one Physics Book-TN state Board and NCERT Books.
3. D. Jayaraman, K. Ilangovan, Thermal Physics &Stastical Mechanics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2016.
4. BrijLal and N Subrahmanyam, Heat and Thermodynamics, S Chand & Company Pvt Ltd, New Delhi, 2016.

Unit 3

1. S.P. Bali,Consumer Electronics -, Pearson Education, New Delhi, 2005.
2. Basic Electrical Engineering -Vocational Theory- Plus One Text Book-TN State Board.

Unit 4

1. R. Murugeshan, Optics & Spectroscopy, S.Chand&Co.Ltd, New Delhi, 2016.

Unit 5

1. M.Arumugam , Biomedical Instrumentation, Anuradha Publications, Kumbakonam, 2011.
2. V.Yuvaraj, Instrumentation Techniques, Sri Krishna Publications, 2020.

Reference Books

1. Fundamentals of Physics by D. Hallidy, R. Rensick and J. Walker, 6th Edition, Wiley, NY,2001.
2. BrijLal and N Subrahmanyam,Heat and Thermodynamics, S Chand & Company Pvt Ltd, New Delhi, 2016.
3. R. Murugeshan, Optics & Spectroscopy, S.Chand&Co.Ltd, New Delhi, 2016.

E-materials

1. https://www.youtube.com/watch?v=M_kHKSKmT6o
2. https://www.toppr.com/content/concept/fundamental-quantities-and-fundamental-units-208185/
3. https://www.youtube.com/watch?v=T-mRqCjv6ak (Tamil video)
4. https://www.jagranjosh.com/general-knowledge/the-human-eye-and-its-defects-1456386342-1
5. https://www.youtube.com/watch?v=c4_5ftlYTbI
6. https://en.wikipedia.org/wiki/Laser
7. https://www.youtube.com/watch?v=oUEbMjtWc-A
8. https://techblog.livongo.com/how-do-blood-pressure-monitors-work/
9. https://www.youtube.com/watch?v=7oKNewTSF7M

10. https://www.youtube.com/watch?v=-UJf-GHz7x4 (Tamil video)
11. https://www.smartbmicalculator.com/

Course Outcomes

1. After studied unit-1, the student will be able to know the fundamental quantities and units and able to some basic ideas of mechanics.
2. After studied unit-2, the student will be able to demonstrate the construction and working of pressure cooker, refrigerator, air conditioner devices.
3. After studied unit-3, the student will be fundamental principles applied in our day today life electrical appliances.
4. After studied unit-4, the student will be able to know the basic properties of laser and characteristics and able to design solid and gas lasers.
5. After studied unit-5, the student will be able to demonstrate the principle and working of biomedical equipment will be used in our daily life.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	No	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	No	Yes	No	No
5	Yes	No	Yes	No	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	S	L	M	M	S	L
CO2	S	S	S	S	S	M	M	M	S	L
CO3	S	M	S	S	S	M	S	S	S	M
CO4	S	S	S	S	M	L	M	M	S	L
CO5	S	S	S	S	S	M	M	M	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: II **Paper type: Core Practical**
Paper code: **Name of the Paper: Practical –2** **Credit: 3**

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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List of Experiments (Any 15 Experiments only)

1. Young's modulus uniform bending –optic lever.
2. Young's modulus uniform bending-Pin and microscope.
3. Sonometer- Frequency of AC mains - Steel and Brass wires.
4. Spectrometer -i-d curve-μ of a Prism.
5. Spectrometer -Grating -N and λ -Normal incidence method.
6. Spectrometer -Grating -N and λ -Minimum deviation method.
7. Air wedge - Thickness of a thin wire.
8. Carey Foster's bridge - Temperature coefficient of resistance of a coil
9. Potentiometer -Calibration of low range Ammeter.
10. Potentiometer - Resistance and specific resistance of a wire.
11. Figure of merit- Table Galvanometer.
12. Field along the axis of a circular coil carrying current-Determination of B_H.
13. BG- Figure of merit - Charge sensitiveness.
14. BG- Comparison of capacitances of capacitors.
15. BG- Comparison of emf of two cells.
16. Deflection magnetometer and vibration magnetometer-Determination of m and B_H-Tan C position.
17. Low range power pack –Bridge Rectifier.
18. Voltage regulator -Bridge Rectifier-Using a Zener diode.
19. Logic gates-AND, OR (using diodes) and NOT (using transistor).
20. NAND and NOR gates-Universal gates.

Text Books

1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai,2018.
2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

Reference Books

1. Samir Kumar Ghosh, A Textbook of Advanced Practical Physics, NCBA, Kolkatta, 2000.
2. D. Chattopadyay, P.C.Rakshit, An Advanced Course in Practical Physics, NCBA, Kolkatta, 2011
3. C.L.Arora, B.Sc., Practical Physics,S. Chand and Company., New Delhi.
4. D.P.Khandelwal D.P., A Laboratory Manual of Physics for Undergraduate Classes. Vani Publications.
5. B.Saraf et al, Physics through Experiments,Vikas Publications.
6. Harnaam Singh., B.Sc., Practical Physics,S. Chand and Company., New Delhi.

7. D C Tayal, University Practical Physics, Himalaya Publishing House.
8. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut.

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: V **Paper type: Core**

Paper code: **Name of the Paper: Atomic and Molecular Physics** **Credit: 6**

Total Hours per Week: 6 **Lecture Hours: 90** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To study the properties of cathode and positive rays and can formulate the expression for e/m
2. To know the structure of the atom and to understand the spectral lines.
3. To understand effects of magnetic field on atomic spectra
4. To acquire the knowledge about photoelectric effect and can derive the expression for Einstein's photoelectric equation.
5. To teach various energy levels viz., rotational, vibrational etc.and can understand the principle of Infrared spectroscopy, Raman effect and Laser

UNIT- I **Teaching Hours: 15**

CATHODE AND POSITIVE RAYS

Properties of cathode rays-Mass of an electron-Determination of the electronic charge: Milikan's oil drop method-Dunnington's method for determining e/m-Properties of positive rays-Positive ray analysis-Thomson's parabola method-Aston's Mass spectrograph-Bain Bridge Mass spectrograph- Dempster's Mass Spectrograph-Mass defect and packing fraction.

UNIT - II **Teaching Hours: 20**

ATOMIC STRUCTURE

Rutherford's Experiments on scattering of α-particle-Theory of α-particle Scattering-Rutherford formula-Bohr Atom model-Spectral series of hydrogen atom-Bohr Correspondence Principle-Critical potentials-Experimental determination of critical potentials-Drawbacks of Bohr Atom model- Sommerfeld's relativistic atom model-Vector atom model-Quantum numbers associated with the vector atom model-Coupling schemes

UNIT- III **Teaching Hours: 20**

EFFECTS OF MAGNETIC FIELD ON ATOMIC SPECTRA

Pauli's exclusion principle - Periodic table- Magnetic dipole moment due to orbital motion of the electron-Magnetic dipole moment due to spin-Optical spectra-Fine structure of H_α line-Zeeman effect-Larmor's theorem-Quantum mechanical explanation of Zeeman effect-Anomalous Zeeman effect – Paschen-Back effect-Stark effect-Problems solving

UNIT- IV **Teaching Hours: 15**

PHOTOELECTRIC EFFECT

Introduction-Lenard' method to determine e/m-Richardson and Compton experiment-Experimental investigations on the photoelectric effect-Laws of photoelectric emission-Einstein's photoelectric equation-Photo-emissive cell-Photo-voltaic cell-Photoconductive cell-Applications of photoelectric cells-Planck's quantum theory-Wien's displacement law-Derivation of Planck'slaw of radiation-Problems solving.

UNIT- V **Teaching Hours: 20**

MOLECULAR PHYSICS

Introduction -Theory of the origin of pure rotational spectrum of a molecule-Non-Rigid Rotator-The energy of a diatomic molecule- Vibrating diatomic molecule as a harmonic oscillator-Infrared Radiation - Range of IR radiation-IR spectrometer – Instrumentation-Molecular vibrations of water molecule (H_2O)-Raman effect-Characteristics of Raman lines-Quantum theory of Raman effect-Raman spectrum of Nitrous oxide (N_2O) - Laser - Characteristics-Stimulated Emission-Population Inversion-Optical Pumping - He-Ne laser-Applications of Laser-Problems solving.

Text Books

Unit 1 to Unit 4

1. R. Murugeshan and KiruthigaSivaprasath, ModernPhysics, S.Chand&Co.,Ltd, New Delhi,2016
2. B.L. Theraja, Modern Physics, S.Chand&CO.,Ltd, New Delhi,2016

Unit 4 and Unit 5

1. R. Murugeshan and KiruthigaSivaprasath, Modern Physics, S.Chand&Co.,Ltd, New Delhi,2016
2. R. Murugeshan, Optics & Spectroscopy, S.Chand&Co.Ltd, New Delhi, 2016

Reference Books

1. J.B. Rajam, Atomic Physics, S. Chand & Co Ltd., New Delhi, 2009.
2. Sehgal, Chopra and Sehgal, Modern physics, Sultan Chand & Sons, New Delhi.
3. S.N .Ghoshal, Atomic Physics, S. Chand & Co Ltd., New Delhi, 2004.
4. C.L.Arora, Modern Physics and Electronics, S. Chand & Co Ltd., New Delhi, 1992.
5. C.N. Banwell, Fundamentals of Molecular Spectroscopy,McGraw Hill Education; Fourth edition, 2017.
6. G. Aruldhas, Molecular structure and Spectroscopy, Prentice Hall of India, New Delhi, 2005.
7. William T. Silfvast, Laser fundamentals, University Press, Published in South Asia by Foundation books, New Delhi, 1998.
8. K. Thyagarajan and A.K. Ghatak, LASER Theory and Application, McMillan, India

Ltd, 1984.
9. அணு இயற்பியல்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)
10. நிறமாலையியலும் லேசர் இயற்பியலும்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு).

E-Materials

1. https://www.youtube.com/watch?v=wSe3oBZDTUI
2. https://vlab.amrita.edu/?sub=1&brch=195&sim=357&cnt=1
3. https://en.wikipedia.org/wiki/Vector_model_of_the_atom
4. https://www.youtube.com/watch?v=CBUjVHq6Grs
5. https://www.youtube.com/watch?v=Ju-3Eu133KE
6. https://en.wikipedia.org/wiki/Zeeman_effect
7. https://en.wikipedia.org/wiki/Photoelectric_effect
8. https://www.youtube.com/watch?v=O0wchw_Mi30
9. http://www.iiserpune.ac.in/~bhasbapat/phy420_files/Demtroeder_rotovibrazioni.pdf
10. https://www.youtube.com/watch?v=gJc4_6NNIhM
11. https://www.youtube.com/watch?v=djMVjULfRII (Tamil video)

Course Outcomes

1. After studied unit-1, the student will be able to know the properties of cathode rays and positive rays. Also will be able to study the determination of specific charge of an electron.
2. After studied unit-2, the student will be know the different atom models and can get an idea about coupling schemes..
3. After studied unit-3, the student will be able to study the Zeeman effect, Paschen Back effect and Stark effect.
4. After studied unit-4, the student will be able to know the basic idea of photoelectric effect and can able to derive the equation for Einstein's photoelectric equation.
5. After studied unit-5, the student will be able to study the rotational and vibrational energy of a molecule and also learn the Infrared spectra, Raman Effect and Laser.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	Yes	No
5	Yes	Yes	Yes	Yes	No	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	S	M	L
CO2	S	M	M	M	S	S	M	M	M	L
CO3	S	S	M	M	S	S	M	M	M	M

CO4	M	S	S	M	M	S	M	S	M	L
CO5	S	S	M	M	S	L	M	S	M	L

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: V **Paper type: Core**

Paper code: **Name of the Paper:** **Relativity and Quantum Mechanics Credit: 6**

Total Hours per Week: 6 **Lecture Hours: 90** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Outcomes

1. To teach the fundamental aspects of relativity and special theory of relativity.
2. Ability to understand the concepts of matter waves and to study the phase velocity and group velocity.
3. To learn the Heisenberg's Uncertainty Principle and to derive the time dependent and time independent Schrödinger equation.
4. To apply the Schrödinger's equation to various quantum mechanical systems.
5. To expose the ideas of postulates of quantum mechanics and operators.

UNIT- I **Teaching Hours: 20**

RELATIVITY

Introduction - Frame of reference - Newtonian relativity - Galilean Transformation equations - The Ether hypothesis - The Michelson -Morley experiment - Special theory of relativity - The Lorentz Transformation equations - Length contraction - Time Dilation - relativity of simultaneity- addition of velocities - variation of mass with velocity - Mass Energy equivalence -Minkowski's Four dimensional Space-Time continuum-General theory of relativity-Gravitational red shift.

UNIT- II **Teaching Hours: 15**

WAVE MECHANICS

Inadequacy of classical mechanics -Matter waves - de Broglie wavelength - Expression for de Broglie wavelength-Other expressions for de Broglie wavelength- Phase velocity (wave velocity) of de Broglie waves-Group Velocity- Expression for Group velocity-Group velocity of de Broglie waves- Relation between group velocity and phase velocity-Davisson and Germer's experiment-G.P.Thomson's experiment.

UNIT- III **Teaching Hours: 20**

SCHRODINGER EQUATION

Electron microscope-Heisenberg's Uncertainty Principle-Determination of position with γ-ray microscope-Diffraction of a beam of electrons by a slit-Elementary proof between Displacement and Momentum, Energyand Time- Derivation of time dependent form of Schrödinger equation-Time independent form of Schrödinger equation-Eigenvalues and Eigenfunctions-Physical significance of wave function-Orthogonal wave function-Normalized wave function.

UNIT-4 **Teaching Hours: 15**

APPLICATIONS OF SCHRÖDINGER EQUATION

The free particle-Particle in a box: Infinite square well potential-Rectangular Potential well-The Barrier Penetration problem-Tunnel effect-Linear harmonic oscillator-Energy levels-Zero point energy-Rigid rotator-Schrödinger's equation for the hydrogen atom-Separation of variables-Equations only.

UNIT-5 **Teaching Hours: 20**

OPERATOR FORMALISM OF QUANTUM MECHANICS

Postulates of quantum mechanics-Operator for momentum, Kinetic energy,Total energy, Angular momentum-Commuting operators-Commutator algebra-Hermitian operator-Properties of Hermitian operator-Parity operator-Properties of Parity operator-Probability density-Probability current density-Wave packet-Ehrenfest's theorem-Hilbert space-Dirac's Bra and Ket notation-Properties of Bra and Ket notation.

Text Book

Unit 1 to Unit 5

1. R.Murugesan and KiruthigaSivaprasath, Modern Physics, S Chand & Co, New Delhi, 2016.

Reference Books

1. P.M Mathew and K.Venkatesan, A Text Book of Quantum Mechanics,Tata McGraw Hill Publishing Co.Ltd., New Delhi, 2016.
2. Gupta, Kumar and Sharma, Quantum Mechanics, Jai PrakashNath Publications, Meerut,Sathyaprakash, Quantum Mechanics, PragatiPrakashan, Meerut.
3. G. Aruldhas, Quantum Mechanics, Prentice-Hall Of India Pvt. Limited, 2008.
4. G.R.Chatwal and S.K.Anand, Quantum Mechanics, Himalaya Publishing House, Mumbai, 2010.
5. V. Devanathan, Quantum Mechanics, Narosa, Chennai.
6. V.K. Thangappan, Quantum mechanics, New Age International, 1993.
7. AjoyGhatak& S. Loganathan, Quantum Mechanics, Springer, 2004.

E-Materials

1. http://psi.phys.wits.ac.za/teaching/Connell/phys284/2005/lecture-01/lecture_01/node5.html
2. https://www.youtube.com/watch?v=NH3_lIkSB9s
3. https://en.wikipedia.org/wiki/Matter_wave

4. https://www.youtube.com/watch?v=X-m9L0_pKU8 (Tamil video)
5. https://www.youtube.com/watch?v=cH5QexEN0sk
6. https://en.wikipedia.org/wiki/Schr%C3%B6dinger_equation
7. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-007-electromagnetic-energy-from-motors-to-lasers-spring-2011/lecture-notes/MIT6_007S11_lec40.pdf
8. https://www.youtube.com/watch?v=uK60QAKooyM
9. https://www.youtube.com/watch?v=r2NMWEsNcTs
10. https://en.wikipedia.org/wiki/Bra%E2%80%93ket_notation

Course Outcomes

1. After studied unit-1, the student will be able to know the frames of reference and able to formulate the Galilean Transformation equations and Lorentz Transformation equations.
2. After studied unit-2, the student will be understand the matter waves and can derive an equation for de Broglie wavelength. Also able to distinguish between phase velocity and group velocity and demonstrate Davison &Germer experiment.
3. After studied unit-3, the student will be able to state the Heisenberg's Uncertainty Principle and able to derive the time dependent and time independent Schrödinger's equations.
4. After studied unit-4, the student will be able to know the basic idea of photoelectric effect and can able to derive the equation for Einstein's photoelectric equation.
5. After studied unit-5, the student will be able to learn postulates of quantum mechanics, operators and also able to acquire knowledge on Dirac's bra and ket notations.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	No	Yes	Yes	No
4	Yes	Yes	No	No	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	S	S	M	M	M	L
CO2	S	S	M	M	M	S	S	M	M	L
CO3	S	M	M	S	S	S	M	S	M	M
CO4	M	S	M	M	S	M	M	S	S	L
CO5	S	M	M	M	S	S	M	S	M	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: V **Paper type: Core**

Paper code: **Name of the Paper:** **Basic and Applied Electronics** **Credit: 6**

Total Hours per Week: 6 **Lecture Hours: 90** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Students will gain knowledge about semiconducting diodes and transistors.
2. To teach the different types of amplifiers and oscillators.
3. To learn the working multivibrators and wave shaping circuits.
4. To study the basics of fabrication of integrated circuits and fundamentals of operational amplifiers.
5. To expose the various applications of OP-AMP and 555 Timer.

UNIT- I **Teaching Hours: 18**

SEMICONDUCTING DIODES & TRANSISTORS

Classification of solids and energy bands- PN Junction Diode-Full wave Bridge Rectifier-Zener Diode-Voltage Regulated Power supply-Tunnel diode - Characteristics-Tunnel diode as an oscillator-Construction and working of Photo diode -Photo transistor -Solar Cell-LED-FET-Construction and working-FET as an amplifier-Output Characteristics and parameters of FET-MOSFET-Construction and working Principle-SCR-Working of SCR-SCR as a switch and half wave rectifier- UJT-Equivalent circuit and V-I characteristics of UJT - UJT as relaxation oscillator.

UNIT- II **Teaching Hours: 18**

AMPLIFIERS & OSCILLATORS

R-C coupled amplifier (Two stage)-Power amplifiers-Class A,B and C-Push-Pull amplifier-Feedback amplifier-Principles of negative feedback in amplifier-Gain of negative feedback amplifier-Hybrid parameters-Determination of h parameters-h parameter equivalent circuit-Performance of a linear circuit in h parameters-h parameters for a transistor in CE mode - Sinusoidal oscillators -Circuit operation and frequency of oscillation of -Hartley, Colpitt's, Phase shift, Wein bridge and Crystal oscillator.

UNIT- III **Teaching Hours: 18**

MULTIVIBRATORS& WAVE SHAPING CIRCUITS

Multivibrators-Types of multivibrators-Transistor astable, monostable and bistablemultivibrators - Differentiating and Integrating-Circuits-Clipping circuits-Positive clipper-Biased clipper-Combination clipper-Clamping circuits-Positive clamper-Negative clamper.

UNIT- IV **Teaching Hours: 18**

INTEGRATED CIRCUITS &OP-AMP

Integrated circuit-Classification of ICs-Advantages-Limitations-Integrated circuit technology- Fabrication of Transistors, diodes, capacitors and resistors - Symbol and Terminals of an OP-AMP- Parameters - Inverting and Non-inverting amplifier - Gain - Miller effect - Virtual ground - Offset voltage - offset current - PSRR - CMRR.

UNIT- V **Teaching Hours: 18**

OP-AMP APPLICATIONS & TIMER

OPAMP -Sign and Scale changer -Adder, subtractor and average-Integrator and differentiator -OP AMP Logarithmic amplifier -Antilogarthmic amplifier-OP-AMP-Comparator-Schmitt Trigger OP-AMP-Astablemultivibrator-Monostablemultivibrator-Bistablemultivibrator - 555 Timer-Internal structure- Pin configuration of 555 Timer-555 Timer as Schmitt Trigger-555 Timer as Astablemultivibrator.

Text Books

Unit 1 to Unit 5

1. V.K. Mehta and Rohit Mehta, Principles of Electronics, S Chand &Co., New Delhi, 2007.
2. M Arul Thalapathi, Basic and Applied Electronics, Comptek, Publishers, Chennai 2005.

Reference Books

1. B.L. Theraja, Fundamentals of Electrical Engineering and Electronics, S Chand &Co., New Delhi, 2008.
2. R.S.Sedha, A Text Book of Applied Electronics, S Chand &Co., New Delhi, 2010.
3. V. Vijayendran, Introduction to Integrated Electronics (Digital & Analog), S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2007
4. Hand Book of Electronics - Gupta & Kumar, PragatiPrakashan, Meerut, 2014.
5. மின்னணுவியல்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)

E-Materials

1. https://www.electronics-tutorials.ws/diode/diode_6.html?nab=0&utm_referrer=https%3A%2F%2Fwww.google.com%2F
2. https://www.youtube.com/watch?v=EkHch86UXpY
3. https://www.youtube.com/watch?v=jZ-pD8nVD6s&app=desktop
4. https://www.electrical4u.com/hybrid-parameters-or-h-parameters/
5. http://www.circuitstoday.com/category/clipping-and-clamping-circuits
6. https://www.youtube.com/watch?v=XsawrtWmm9M
7. https://www.youtube.com/watch?v=ek_H6efvwxA (Tamil video)
8. https://www.electronicsforu.com/resources/learn-electronics/555-timer-working-specifications
9. https://www.youtube.com/watch?v=yBVGU02rlAg
10. https://www.electronics-tutorials.ws/waveforms/555_timer.html

Course Outcomes

1. After studied unit-1, the student will be able to classification of solids on the basis of band theory and know the construction, working and applications of semiconducting diodes and transistors.
2. After studied unit-2, the student will be able to design the RC-coupled amplifier and to study its frequency response curve. Also students will be able to classify the power amplifiers, to learn the h-parameters and to able to design oscillator circuits.
3. After studied unit-3, the student will be able to understand the multivibrators using transistors and can able to study the different wave shaping circuits.
4. After studied unit-4, the student will be able to know the basic idea of integrating circuits and able to fabricate diode, transistors, resistor and capacitors. Also students will be study the structure of operational amplifier and its parameters.
5. After studied unit-5, the student will be able to analyze the different applications of op-amp circuits like adder, subtractoretc.and also able to demonstrate 555 Timer and its applications.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	No	Yes	Yes	No
2	Yes	No	Yes	Yes	Yes	No
3	Yes	Yes	No	Yes	No	No
4	Yes	Yes	No	Yes	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	L	M	M	M	M
CO2	S	S	M	M	S	M	M	S	M	S
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	S	M	M	S	M	S	S	M	M
CO5	S	S	M	S	M	S	M	S	S	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
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Semester: III **Paper type: Skill Based Subject (SBS)-3**

Paper code: **Name of the Paper:** **Cell Phone Technology** **Credit: 2**

Total Hours per Week: 2 **Lecture Hours: 30** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To learn the back ground information about cellular system.
2. To study the various mobile standards.
3. To teach the chip level information of mobile phones.
4. To expose the idea about trouble shooting of problems in mobile phones.
5. To acquire the knowledge about mobile service tools.

UNIT- I **Teaching Hours: 06**

CELLULAR SYSTEM
Background - The cellular concept - interference Vs capacity, cell splitting, sectorisation.The cellular system-mobile location, in call handover and power control in cell planning.TACS standard. The cellular network - Base stations, MSC, services.

UNIT - II **Teaching Hours: 06**

MOBILE STANDARDS
SmartPhones (Android, IOS, Windows) APPs - Mobile Software (PC suite)-WPAN standards - IrDA, Bluetooth, 1G, 2G standards, 2.5G applications. 3G devices and applications. Network protocols - TDMA(2G), GSM(2G), cdma one(2G), PDC 2(G), GPRS(2.5G), CDMA 2000 1x(2.5G), EDGE(3G), CDMA 2000 1xEV(3G), WCMA(G)-WiMax (4G)

UNIT- III **Teaching Hours: 06**

CHIP LEVEL STUDY
Block Diagrams -Schematic Diagrams - Chip Level Information of Mobile -Phones - BGA - SMD Reworking Station - Soldering lead -Soldering paste -De- Soldering wire - Identification of IC's - Assembling &Disassembling ofSmart Phones.

UNIT- IV **Teaching Hours: 06**

TROUBLE SHOOTING
Causes for various problems & Troubleshooting of Problems in a SmartPhone - Network Problems - Display Problems -Touch Problems - Sim CardProblems -Charging problems - Battery Problems - Software Problems -IMEI information - Problems related tomobile phonehandsets - replacement of Various components ICS.

UNIT- V **Teaching Hours: 06**

MOBILE SERVICE TOOLS

Ultrasonic Cleaner - Computer Connectors - SIM Card Reader – MemoryCard Reader - Mobile Virus - Virus Prevention - Removing Virus – HealthHazards with Mobiles - SAR.

Text Book

Unit 1 to Unit 5

1. ManaharLotia , Modern Mobile phone Introduction & Servicing, BPB Publications, 2017

Reference Books

1. ManaharLotia, Modern Mobile Phone Repair using Computer Software & Service Devices , BPB Publications, 2017.
2. ManaharLotia, Modern Mobile Phone Unlocking & Utility Codes For GSM & CDMA Phones, BPB Publications, 2017
3. Mobile Telephony, Digit Magazine, Jasubhai Digital Media Publications.
4. Raj Pandya, Mobile & Personal Communication Systems & Services, PHI Publications
5. William C.Y.Lee, Mobile Cellular Telecommunications (Analog & Digital Systems), McGraw Hill, New Delhi,1995
6. Andy Dornan, The Essential Guide to Wireless Communications & Applications, Prentice Hall, New Delhi, 2002.

E-Materials

1. https://www.slideshare.net/priyahada/cellular-concepts-41556741
2. https://www.youtube.com/watch?v=whYljse4Abc
3. https://electronics.howstuffworks.com/cell-phone7.htm
4. https://www.youtube.com/watch?v=IvWYk3FAVak
5. https://www.youtube.com/watch?v=eRe_nD2t0Hk
6. https://en.wikipedia.org/wiki/Rework_(electronics)
7. https://www.mobiledic.com/android-tips/sim-card-can-not-be-detected.html
8. https://www.youtube.com/watch?v=MZz5zrNnAec (Tamil video)
9. https://www.youtube.com/watch?v=JmDz0HOzvVU
10. https://www.who.int/news-room/q-a-detail/what-are-the-health-risks-associated-with-mobile-phones-and-their-base-stations

Course Outcomes

1. After studied unit-1, the student will be able understand the cellular communication system.
2. After studied unit-2, the student will be able to study the smart phones and various mobile standards like 1G,2G, etc.
3. After studied unit-3, the student will be able to learn chip level information and soldering and desoldering the various components.
4. After studied unit-3, the student will be able to understand the network problems and SIM card problems and to learn the trouble shooting process.
5. After studied unit-5, the student will be able to know how to use the ultrasonic cleaner, mobile virus and other service tools.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	No	No	Yes
5	Yes	No	No	No	Yes	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	M	M	L
CO2	M	S	M	M	S	S	M	M	S	M
CO3	M	M	M	M	S	M	S	S	S	S
CO4	S	S	S	S	M	S	M	M	M	S
CO5	S	S	M	S	S	S	M	M	S	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: VI **Paper type: Core**

Paper code: **Name of the Paper:** **Nuclear and Particle Physics** **Credit: 5**

Total Hours per Week: 6 **Lecture Hours: 90** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To have a clear idea about the fundamentals of nucleus and its structure.
2. To understand the concept of radioactivity.
3. To have a clear understanding of the design and working of particle accelerators and detectors.
4. To understand the nuclear reactions and the nuclear reactors.
5. To gain knowledge about the elementary particles

UNIT- I **Teaching Hours: 20**

GENERAL PROPERTIES OF NUCLEI AND NUCLEAR MODELS

Constituents of nuclei - Classification of nuclei - Nuclear mass and binding energy - Stability of nucleus, Mass defect and Packing fraction, Binding fraction Vs Mass number curve - Nuclear size - Nuclear spin - Nuclear energy levels - Nuclear magnetic moment --Parity of nuclei - Nuclear forces - Yukawa's model of nuclear forces.

Nuclear models - Liquid drop model, Semi-empirical mass formula - Shell model - Salient features of shell model-Problems solving.

UNIT- II **Teaching Hours: 20**

RADIOACTIVITY

Radioactive decay law - Half life and Average life - Activity or strength of a radioactive sample- Successive transformation - Radioactive chain- Radioactive equilibrium - Radioactive dating - α-decay - Geiger-Nuttall law - Tunnel effect - Gamow's theory of α-decay - β-decay - energetics of β-decay - Continuous β-spectrum - Inverse β-decay -Parity violation in β-decay - Neutrino hypothesis - Properties of neutrino - Gamma rays - Origin of the gamma rays - Internal conversion-Problems solving.

UNIT- III **Teaching Hours: 15**

PARTICLE ACCELERATORS AND DETECTORS

Linear accelerator - Cyclotron -Betatron - Electron synchrotron - Accelerators in India

Radiation detectors - Ionisation chamber - Proportional counter - G.M. Counter - Cloud chamber - Scintillation counter - Solid state track detector - Semiconductor detector- Problems solving.

UNIT- IV **Teaching Hours: 20**

NUCLEAR REACTIONS AND NUCLEAR REACTORS

Nuclear reactions - Types of nuclear reactions - Conservation laws in nuclear reactions - Energetics of nuclear reactions - Kinematics of nuclear reactions -Threshold energy of nuclear reactions - Solution of the Q-value equation - Cross-section of nuclear reactions.
Nuclear fission - Fission of light nuclei - Prompt and delayed neutrons - Neutron speed, Classifications - Nuclear chain reaction - Neutron cycle - Nuclear reactor - Types of reactor - Fission bomb - Nuclear power in India- Fusion -Thermonuclear reaction - Hydrogen bomb - Possibility of fusion reactor-Problems solving.

UNIT- V **Teaching Hours: 15**

ELEMENTARY PARTICLES

Classification of elementary particles -Pions and Muons - K-mesons -Hyperons - Conservation laws - Exact laws - Approximate conservative laws- Fundamental interactions - Antiparticles - Resonance particles -Hypernucleus - Symmetry classification of elementary particles - Quark model.

Text Books

Unit 1 to Unit 5

1. R. Murugeshan and KiruthigaSivaprasath, Modern Physics,S Chand &Co.New Delhi,2006.
2. Gupta and Roy., Physics of the Nucleus, Books and Allied (P) Ltd. Kolkatta, 2011
3. J. B. Rajam, Nuclear Physics, S Chand Publishing Co.
4. D.C.Tayal, Nuclear Physics, Himalaya Publishing House, 2009

Reference Books

1. SatyaPrakash, Nuclear Physics, APragatiPrakasan Publication, 2011.
2. S. N. Ghoshal, Nuclear Physics, S. Chand & Co., Edition, 2003
3. M. L. Pandya& R.P.S. Yadav, Elements of Nuclear Physics, KedarNath& Ram Nath, 2000
4. Jahan Singh, Fundamentals of Nuclear Physics, APragati Publication, 2012.
5. V.Devanathan, Nuclear Physics, Narosa Publications, New Delhi, 2016.
6. அணுக்கரு இயற்பியல்-A சுந்தரவேலுசாமி ,பிரியா பப்ளிகேஷன்ஸ், கரூர் (தமிழ் வழியில் பயிலும் மாணவர்களுக்கு)

E-Materials

1. https://courses.lumenlearning.com/introchem/chapter/nuclear-binding-energy-and-mass-defect/
2. https://www.khanacademy.org/science/physics/quantum-physics/in-in-nuclei/v/mass-defect-and-binding-energy
3. https://www.youtube.com/watch?v=ZqdxGZOipD4

4. http://hyperphysics.phy-astr.gsu.edu/hbase/Nuclear/halfli2.html
5. https://www.slideshare.net/sailakshmipullookkar/linac-ppt
6. https://www.youtube.com/watch?v=jSgnWfbEx1A
7. https://en.wikipedia.org/wiki/Nuclear_fission
8. https://www.youtube.com/watch?v=vurL9UVa95A (Tamil video)
9. https://www.youtube.com/watch?v=2zZ1kv6vlq0
10. https://en.wikipedia.org/wiki/Elementary_particle

Course Outcomes

1. After studying Unit 1, the student will have a clear idea about the fundamentals of nucleus and its structure.
2. After studying Unit 2, the student would have understood the concept of radioactivity.
3. After studying Unit 3, the student will be having a clear understanding of the design and working of particle accelerators and detectors.
4. After studying Unit 4, the student will be having a thorough understanding about the nuclear reactions and nuclear reactors.
5. After studying Unit 5, the student would have gained adequate knowledge about the elementary particles like pions, muons, hyperons etc.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	Yes	Yes	Yes	No
4	Yes	Yes	Yes	No	Yes	No
5	Yes	Yes	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	S	M	M	M	L
CO2	S	S	M	M	S	M	S	M	M	L
CO3	S	M	M	S	M	S	M	M	M	M
CO4	S	S	M	M	S	M	M	S	S	L
CO5	S	M	M	M	S	S	M	S	M	S

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
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Semester: VI **Paper type: Core**

Paper code: **Name of the Paper:** **Solid State Physics** **Credit: 5**

Total Hours per Week: 5 **Lecture Hours: 75** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To gain the knowledge of the crystal system and to know the different crystal structure.
2. To know the different types of bonding in crystals and to know the basics of superconductors and their applications.
3. To learn how the X-ray diffraction helps to know the crystal structure and to know the defects present in the crystals
4. To know the different types of magnetism and their theories.
5. To understand the electric polarization in a dielectric material.

UNIT- I **Teaching Hours: 15**

CRYSTALLOGRAPHY

Crystalline and amorphous solids -Crystal lattice -Basis -Unit cell -Primitive and non-primitive unit cell -Elements of Symmetry - Seven Classes of Crystals - Bravais lattices - Miller indices -Calculation of atomic radius, coordination number and atomic packing factor for SC, FCC, BCC and HCP structures- simple numerical problems- Structure of KCl, NaCl and diamond crystals **.**

UNIT- II **Teaching Hours: 15**

DIFFRACTION IN CRYSTALS & CRYSTAL DEFECTS

Bragg's law- conditions for X-ray diffraction - Experimental Method- Laue Method, Rotating Crystal Method - Powder Photograph Method - Crystal defects - point, line, surface and volume defects - effects of crystal imperfections.

UNIT- III **Teaching Hours: 15**

CHEMICAL BONDS & SPECIFIC HEAT CAPACITY

Types of bonding in crystals - ionic, valence, metallic, Vanderwaal's and hydrogen bonding-optical properties -Specific heat capacity -Dulong and Pettit's law -Einstein's and Debye's theory of specific heat capacity

UNIT- IV **Teaching Hours: 15**

MAGNETISM IN SOLIDS& SUPER CONDUCTIVITY

Basic terms in magnetism -Classification of magnetic materials -Weiss theory of Paramagnetism- Domain theory of ferromagnetism- Hysteresis- Soft and hard magnetic materials - Superconductivity - Properties of Superconductors - Types of Superconductors - Meissner effect-BCS theory of superconductivity- Cooper Pair- First and Second London equation-Josephson effect-Application of Superconductors.

UNIT- V **Teaching Hours: 15**

DIELECTRIC IN SOLIDS

Introduction to dielectrics- Basic definitions- - Different types of Electric polarization - dependency on frequency and temperature - Dielectric Loss -Local or Internal Field-Clausius-Mosotti Relation -Determination of dielectric constant- Dielectric Breakdown-Uses of dielectric materials.

Text Books

Unit 1 to Unit 5

1. K. Elangovan, Solid State Physics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2007.
2. S.O.Pillari, Solid State Phsics, New Age International Publishers,New Delhi,2015

Reference Books

1. Gupta and Kumar, Solid State Physics,
2. R. Murugeshan and KiruthigaSivaprasath, Modern Physics,S Chand & Co.,2006
3. M. Arumguarn, Material Science,Anuradha Publishers.
4. Kittel, Introduction to Solid State Physics, Wiley and Sons,

E- Materials

1. https://www3.nd.edu/~amoukasi/CBE30361/Lecture__crystallography_A.pdf
2. https://ocw.mit.edu/courses/chemistry/5-069-crystal-structure-analysis-spring-2010/lecture-notes/
3. http://www.issp.ac.ru/ebooks/books/open/Superconductivity_-Theory_and_Applications.pdf
4. https://www.iitk.ac.in/che/pdf/resources/XRD-reading-material.pdf
5. https://nptel.ac.in/content/storage2/courses/112108150/pdf/Lecture_Notes/MLN_03.pdf
6. http://tiiciiitm.com/profanurag/Physics-Class/Unit-2-DM.pdf
7. https://www.youtube.com/watch?v=D81zc-LK6fc
8. https://en.wikipedia.org/wiki/Crystallographic_defect
9. https://www.youtube.com/watch?v=D-9M3GWoBrw
10. https://www.youtube.com/watch?v=ByViA0H--5c (Tamil video)

Course Out Comes

1. After studied unit-1, the student will be able to Distinguish between crystalline and amorphous solids, Classify the crystal systems and able to understand the crystal structure
2. After studied unit-2, the student will be able to Relate the X-ray diffraction with crystal structure and explain the various differences in properties of solids due to crystal imperfections
3. After studied unit-3, the student will be able tounderstand the different types of bonding in crystals, apply this to understand the optical , specific heat capacity of solids
4. After studied unit-4, the student will be able togain the knowledge of magnetism in

materialsand able to distinguish different magnetic materials. Also able to understand the phenomena of superconductivity and their applications

5. After studied unit-5, the student will be able to explain the electric polarization in dielectric materials and also gain the knowledge in dielectric breakdown mechanisms in a dielectric material.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	No	No	Yes	Yes	No
4	Yes	Yes	No	No	Yes	No
5	Yes	No	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	S	M	M	M	S
CO2	M	S	M	M	M	S	S	M	S	L
CO3	M	M	S	S	S	S	M	S	M	M
CO4	M	S	M	M	S	S	M	S	S	L
CO5	S	M	S	S	S	S	M	M	M	S

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium L – Low (may be avoided)

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
(B.Sc Physics) – 2022-2023 onwards

Semester: VI **Paper type: Core Elective 1 – Group (A)**

Paper code: **Name of the Paper: Digital Electronics** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Understanding the different number systems and conversion between them and also to study the basic logic gates.
2. To teach the laws of Boolean Algebra, De Morgan's theorems and other logic circuits.
3. To Study combination of logiccircuits and understanding concepts of various flip- flops.
4. To expose the knowledge on various registers and counters.
5. To learn the digital to analog and analog to digital converters.

UNIT – I **Teaching Hours: 14**

NUMBER SYSTEMS AND BASIC LOGIC GATES
Number systems -Decimal, Binary, Octal and Hexadecimal system - Conversion from one number system to another- Binary Arithmetic -Addition -Subtraction-Multiplication-Division- 1's and 2's complement - Subtraction using Complements-Signed Binary Numbers-Binary codes- BCD code - Excess 3 code, Gray code - ASCII code - Basic logic gates-NOT,OR,AND-Design of AND, OR gates using diodes and NOT gate using transistor-Logic circuits and logic expressions-Sum of Products-Product of Sum- NAND, NOR and EX-OR - functions and truth tables.

UNIT- II **Teaching Hours: 14**

BOOLEAN ALGEBRA AND LOGIC CIRCUITS
Laws of Boolean algebra - De Morgan's theorems-NAND & NOR as Universal gates (AND,OR and NOT only)-Karnaugh map - Minterms-Relationship between K-Map and truth table- 2,3 and 4 variable K Map using minterms- Simplification of Boolean function using K Map - Arithmetic Circuits-Half adder and Full adder- Four Bit Adder-BCD Adder- Half subtractor and Full subtractor-Four Bit Adder/subtractor.

UNIT- III **Teaching Hours: 12**

COMBINATION OF CIRCUITS & FLIP-FLOPS
Multiplexer-Demultiplexer- Decoder- 2 to 4 and 3 to 8 Decoder-BCD to seven segment decoder- BCD to decimal decoder-Encoder-Programmable Logic Array (PLA)-Binary to Gray and Gray to Binary Conversion using EX-OR gates-Parity Generator and Checker -
Flip Flops -SR Flip Flop -Clocked SR-Edge triggered Flip – Flops- D Flip-Flop - JK Flip-Flop -JK Master-Slave Flip - Flop-T Flip-Flop.

UNIT- IV **Teaching Hours: 10**

REGISTERS & COUNTERS

Registers-Shift Registers- Shift Right and Shift Left Shift Registers-Ring Counter-Johnson'sCounter-Asynchronous/Ripple Counter-Mod-2, Mod-4, Mod-8 and Mod-16 Counter-4-Bit Binary Up/Down Counter-Synchronous Counters-Design of Synchronous Counters-Mod-3, Mod-5 Counter- Synchronous BCD counter.

UNIT- V **Teaching Hours: 10**

D/A AND A/D CONVERTERS

Binary weighted resistors D/A converter-R-2R Resistive Ladder - Analog to Digital Converter (ADC)-Counter Type A/D Converter-Successive Approximation A/D Converter-Dual Slope A/D Converter-Parallel Comparator A/D Converter.

Text Book

Unit 1 to Unit 5

1. V.Vijayendran, Introduction to Integrated Electronics (Digital & Analog), S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2007.

Reference Books

1. Malvino and Leech, Digital Principles and Application, 4th Edition, Tata McGraw Hill, New Delhi, 2000.
2. V.Vijayendran, Digital Fundamentals, S.Viswanathan, Printers & Publishers PrivateLtd, Chennai,2004.
3. R.P. Jain, Modern Digital Electronics, 2/e, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. H. Taub and D. Schilling , Digital Integrated Electronics -, McGraw-Hill Book Company.
5. T.L. Floyd , Digital Fundamentals -, Pearson Education, 8/e.
6. W.H. Gothmann , Digital Electronics -, Prentice Hall of India Private Limited, 2/e.

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1. https://www.youtube.com/watch?v=4ae9sJBBkvw
2. https://learnabout-electronics.org/Digital/dig11.php
3. https://www.youtube.com/watch?v=RrynEQ7sG5A
4. https://www.sciencedirect.com/topics/computer-science/de-morgans-theorem
5. https://en.wikipedia.org/wiki/Flip-flop_(electronics)
6. https://www.youtube.com/watch?v=tSti91b6qec
7. https://www.youtube.com/watch?v=vRBnZMJA0LY
8. https://en.wikipedia.org/wiki/Shift_register
9. https://www.tutorialspoint.com/linear_integrated_circuits_applications/linear_integrated_circuits_applications_digital_to_analog_converters.htm
10. https://www.youtube.com/watch?v=Y2OPnrgb0pY
11. https://www.youtube.com/watch?v=_xxQZEVbPwU (Tamil video)

Course Outcomes

1. After studied unit-1, the student will be able to gain knowledge between different types of number systems, and their conversions. Also able to study the various Binary codes and to design basic logic gates.
2. After studied unit-2, the student will be able to describe laws of Boolean Algebra, De Morgan's theorems. Also able to demonstrate K-Map and simplification of logic expressions and to design universal gates using NAND and NOR gates.
3. After studied unit-3, the student will be able to explain the Multiplexer, Demultiplexer and Decoder. Students can know the functions of various Flip-Flop circuits.
4. After studied unit-4, the student will be able to conceptualize the classification of registers and counters.
5. After studied unit-5, the student will be able to know how to convert digital to analog and analog to digital using different methods.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	L	M	M	M	M
CO2	S	S	M	M	S	M	M	S	M	S
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	S	M	M	S	M	S	S	M	M
CO5	S	S	M	S	M	S	M	S	S	M

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Semester: VI **Paper type: Core Elective 2 – Group (A)**

Paper code: **Name of the Paper: Fundamentals of Microprocessor-8085** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Couse Objectives

1. To know the complete basic details and architecture of microprocessor 8085
2. To study the different types of instructions and addressing modes
3. To write the simple assembly language programs for arithmetic operations and to learn about the instruction cycles
4. To understand the functions of ROM/RAM memory devices and peripheral devices
5. To expose the idea of pin function, working and interacting of peripheral devices with microprocessor

UNIT- I **Teaching Hours: 12**

MICROPROCESSOR ARCHITECTURE

Evolution of Microprocessor-Applications of Microprocessors of Different Generations-The system bus and bus structure-Execution of an instruction-Pin functions of 8085- Architecture of 8085-Block diagram-Register array-ALU and associated circuitry -Instruction Register and Decoder-Timing and Control Unit- Interrupt and Serial I/O units-Types of Interrupts-Programmer's model of 8085.

UNIT- II **Teaching Hours: 12**

INSTRUCTIONS & ADDRESSING MODES

Data transfer/ copy Instructions-Arithmetic, Logical- Two examples each instructions-Branch instructions-Unconditional and conditional jump- Call and Return instructions-Stack and Stack related instructions- I/O and Machine control instructions- Addressing modes.

UNIT- III **Teaching Hours: 12**

ALP & INSTRUCTION TIMINGS

Assembly language programs-Addition, Subtraction, Multiplication and Division (8-bit only)-Largest/smallest in an array-Sum of series of a set- T-State-Machine cycle-Instruction cycle-Memory read cycle-Memory write cycle-Wait state-Halt state-Hold state- Delay calculations-Time delay using a single register.

UNIT- IV **Teaching Hours: 12**

MEMORY AND I/O INTERFACE

Memory interface basics-Demultiplexing address/data bus-Generation control signals-2K × 8 ROM/RAM Interface - Direct I/O Interface-IN FE_H instruction and its timing diagram-Design of Output Port using octal latch only-Memory mapped I/O- Difference between

Direct I/O and Memory mapped interface.

UNIT- V **Teaching Hours: 12**

PERIPHERAL DEVICES & APPLICATIONS

Hand shake signals-Single Handshake I/O and Double Handshake I/O- Pin function and Block diagram and working of 8255-Pin function and Block diagram and working of 8279-LED Interface-Temperature Controller.

Text Books

Unit 1 to Unit 5

1. Fundamental of Microprocessor - 8085 - Architecture, Programming and interfacing – V. Vijyendran, S. Viswanathan, Pvt. Ltd., 2003.
2. A. NagoorKani, 8085 Microprocessor and its Applications, Tata McGraw Hill, New Delhi, 2013.

Reference Books

1. R.S. Goankar , Microprocessor Architecture, Programming and Applications with the 8085, 3rdEdn. Prentice Hall,
2. B.Ram, Fundamentals of Microprocessors and Microcomputers,DhanpatRai Publications, New Delhi.
3. Aditya P Mathur, Introduction to Microprocessors, Tata McGraw Hill Publishing Company Ltd., New Delhi,

E-Materials

1. https://www.youtube.com/watch?v=ii7PCV2zvms
2. https://www.tutorialspoint.com/microprocessor/microprocessor_8085_pin_configuration.htm
3. https://www.youtube.com/watch?v=7nWt5dixiX0 (Tamil video)
4. https://www.tutorialspoint.com/microprocessor/microprocessor_8085_instruction_set
5. https://www.youtube.com/watch?v=G3iUO96XhC4
6. https://www.youtube.com/watch?v=MIx6khOFFoU (Tamil video)
7. https://www.geeksforgeeks.org/8085-program-to-divide-two-8-bit-numbers/
8. http://www.psnacet.edu.in/courses/ECE/Microcontroller%20and%20Microprocessor/lecture4.pdf
9. https://www.youtube.com/watch?v=-FGw_MPlfbk&vl=en
10. https://www.youtube.com/watch?v=_M8hDkRAL6M&vl=en
11. https://www.geeksforgeeks.org/programmable-peripheral-interface-8255/

Course Outcomes

1. After studied unit-1, the student will be able to know the evolution of microprocessor, pin and architecture of 8085 microprocessor in detail.
2. After studied unit-2, the student will be able to describe different types of instructions like data transfer, arithmetic, logical and branching instructions with examples and it will be used for writing the assembly language programs.
3. After studied unit-3, the student will be able to write assembly language programs for simple arithmetic operations and hence they can apply it for interfacing applications.
4. After studied unit-4, the student will be able to learn the memory interface and

peripheral interface devices.

5. After studied unit-5, the student will be able to know how to interface the peripheral device with microprocessor 8085 and they are able to write the programs for LED and Temperature control interface system.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	No	Yes	Yes	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	No	Yes	No	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	M	M	M	M	M	M
CO2	S	S	M	S	S	M	M	S	M	L
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	S	M	S	S	S	S	S	M	L
CO5	S	S	M	S	M	M	M	S	S	L

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Semester: VI **Paper type: Core Elective 3 – Group (A)**

Paper code: **Name of the Paper: Nanophysics** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To know the fundamentals of nanotechnology.
2. To learn about carbon nanostructures and its properties.
3. To study the preparation of nanomaterial by different methods.
4. To analyse the synthesized nanomaterial by various characterization techniques.
5. To understand the various applications of nanotechnology.

UNIT- I **Teaching Hours: 12**

INTRODUCTION TO NANO AND TYPES OF NANOMATERIAL

Need and origin of nano - Emergence of nanotechnology with special reference to Feynman.Size & Scales: definition of nanostructures;Top-down and bottom-up approaches-Introductory ideas of 1D, 2D and 3D nanostructured material– Quantumdots - Quantum wire - Quantum well - Exciton confinement in quantum dots-surface to volume ratio-semiconducting and magnetic nanoparticles.

UNIT- II **Teaching Hours: 12**

CARBON NANOTUBES

Carbon materials – Allotropes of carbon – Structure of carbon nanotubes – Types of CNTs – Electronic properties of CNTs – Band structure of Graphene – Band structure of SWNT from graphene – Electron transport properties of SWNTs – Scattering in SWNTs – Carrier mobility in SWNTs.

UNIT- III **Teaching Hours: 12**

FABRICATION OF NANOMATERIAL

Synthesis of nanoparticles- Co-precipitation method-sol-gel method –Hydrothermal method-Ball milling method–Physical vapor deposition-thin film deposition method-spray pyrolysis–Molecular beam epitaxy –Pulsed laser deposition-Chemical vapor deposition-Plasma

enhanced CVD- Laser induced CVD-Chemical beam epitaxy.

UNIT- IV **Teaching Hours: 12**

CHARACTERIZATION OF NANOMATERIAL

Principle, Design and utility-XRD (X-ray diffraction)-particle size analysis using Scherer formula-UV-Visible spectroscopy-Band gap energy-Tau plot-FTIR spectroscopy-structural analysis-EDAX-elemental analysis-Scanning electron microscopy (SEM)- Transmission electron microscopy (TEM)-morphology.

UNIT – V **Teaching Hours: 12**

APPLICATIONS

Nanoelectronics–OLEDs-OTFTs-SWNTFETs-Nanorobots–Nanomedicine-bio sensors-targeted drug delivery-Energy storage applications-nanosilicon for solar cells-MEMS and NEMS-Photonic crystals.

Text Books

Unit 1 to Unit 5

1. T.Pradeep et al., A Textbook ofNanoscience and Nanotechnology,Tata McGraw Hill, New Delhi, 2012.
2. T.Pradeep , Nano: The Essentials,Tata McGraw Hill, New Delhi, 2012.
3. R.W. Kelsall, I.W. Hamley and M. Geoghegan, Nanoscale Science and Nanotechnology (John-Wiley & Sons, Chichester, 2005.
4. G. Cao, Nanostructures and Nanomaterials,Imperial College Press, London, 2004.
5. C.P. Poole and F.J. Owens, Introduction to Nanotechnology,Wiley, New Delhi, 2003.

Reference Books

1. H.S. Nalwa, Nanostructured Materials and Nanotechnology,Academic Press, San Diego, 2002.
2. M. Wilson, K. Kannangara, G. Smith, M. Simmons, B. Raguse, Nanotechnology:
3. Basic Science and Emerging Technologies,Overseas Press, New Delhi, 2005.

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1. https://en.wikipedia.org/wiki/Nanotechnology
2. https://en.wikipedia.org/wiki/Carbon_nanotube
3. https://www.nanowerk.com/nanotechnology/introduction/introduction_to_nanotechnology_22.php
4. https://www.youtube.com/watch?v=sbuIluJhT4A (Tamil video)
5. https://www.youtube.com/watch?v=14DqBIG96W0
6. https://www.sciencedirect.com/topics/chemistry/sol-gel-process (Journal)
7. https://www.slideshare.net/RamalingamGopal/sol-gel-synthesis-of-nanoparticles
8. https://en.wikipedia.org/wiki/Scanning_electron_microscope
9. https://www.youtube.com/watch?v=kdb6dHEHCA0

10. https://interestingengineering.com/15-medical-robots-that-are-changing-the-world
11. https://en.wikipedia.org/wiki/Nanorobotics

Course Outcomes

1. After studied unit-1, the student will be able to know the origin and emergence of nanotechnology and also able to define different nanostructures.
2. After studied unit-2, the student will be able to describe carbon nanostructures and its fabrication. Also they can know the electrical, vibrational and mechanical properties of carbon nanostructure and its applications.
3. After studied unit-3, the student will be able to know how to fabricate the Nanomaterials by different methods.
4. After studied unit-4, the student will be able to learn the characterization techniques likeXRD, UV-Vis, FTIR, EDAX,SEM,TEM etc for the synthesized nanostructures.
5. After studied unit-5, the student will be able to know the applications of nanotechnology in different field.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	No	No	Yes	Yes	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	No	No	No	No	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	M	M	M	M	M
CO2	S	M	S	S	S	M	M	S	M	L
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	S	S	S	S	S	S	S	M	L
CO5	S	M	S	S	M	M	M	S	S	L

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Semester: VI **Paper type: Core Elective 1 – Group (B)**

Paper code: **Name of the Paper: Digital Electronics** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Understanding the different number systems and conversion between them and also to study the basic logic gates.
2. To teach the laws of Boolean Algebra, De Morgan's theorems and other logic circuits.
3. To Study combination of logic circuits and understanding concepts of various flip- flops.
4. To expose the knowledge on various registers and counters.
5. To learn the digital to analog and analog to digital converters.

UNIT – I **Teaching Hours: 14**

NUMBER SYSTEMS AND BASIC LOGIC GATES
Number systems -Decimal, Binary, Octal and Hexadecimal system - Conversion from one number system to another- Binary Arithmetic -Addition -Subtraction-Multiplication-Division- 1's and 2's complement - Subtraction using Complements-Signed Binary Numbers-Binary codes- BCD code - Excess 3 code, Gray code - ASCII code - Basic logic gates-NOT,OR,AND-Design of AND, OR gates using diodes and NOT gate using transistor-Logic circuits and logic expressions-Sum of Products-Product of Sum- NAND, NOR and EX-OR - functions and truth tables.

UNIT- II **Teaching Hours: 14**

BOOLEAN ALGEBRA AND LOGIC CIRCUITS
Laws of Boolean algebra - De Morgan's theorems-NAND & NOR as Universal gates (AND,OR and NOT only)-Karnaugh map - Minterms-Relationship between K-Map and truth table- 2,3 and 4 variable K Map using minterms- Simplification of Boolean function using K Map - Arithmetic Circuits-Half adder and Full adder- Four Bit Adder-BCD Adder- Half subtractor and Full subtractor-Four Bit Adder/subtractor.

UNIT- III **Teaching Hours: 12**

COMBINATION OF CIRCUITS & FLIP-FLOPS
Multiplexer-Demultiplexer- Decoder- 2 to 4 and 3 to 8 Decoder-BCD to seven segment decoder- BCD to decimal decoder-Encoder-Programmable Logic Array (PLA)-Binary to Gray and Gray to Binary Conversion using EX-OR gates-Parity Generator and Checker -
Flip Flops -SR Flip Flop -Clocked SR-Edge triggered Flip – Flops- D Flip-Flop - JK Flip-Flop -JK Master-Slave Flip - Flop-T Flip-Flop.

UNIT- IV **Teaching Hours: 10**

REGISTERS & COUNTERS

Registers-Shift Registers- Shift Right and Shift Left Shift Registers-Ring Counter-Johnson'sCounter-Asynchronous/Ripple Counter-Mod-2, Mod-4, Mod-8 and Mod-16 Counter-4-Bit BinaryUp/Down Counter-Synchronous Counters-Design of Synchronous Counters-Mod-3, Mod-5 Counter- Synchronous BCD counter.

UNIT- V **Teaching Hours: 10**

D/A AND A/D CONVERTERS

Binary weighted resistors D/A converter-R-2R Resistive Ladder - Analog to Digital Converter (ADC)-Counter Type A/D Converter-Successive Approximation A/D Converter-Dual Slope A/D Converter-Parallel Comparator A/D Converter.

Text Book

Unit 1 to Unit 5

1. V.Vijayendran, Introduction to Integrated Electronics (Digital & Analog), S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2007.

Reference Books

1. Malvino and Leech, Digital Principles and Application, 4th Edition, Tata McGraw Hill, New Delhi, 2000.
2. V.Vijayendran, Digital Fundamentals, S.Viswanathan, Printers & Publishers PrivateLtd, Chennai,2004.
3. R.P. Jain, Modern Digital Electronics, 2/e, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. H. Taub and D. Schilling , Digital Integrated Electronics -, McGraw-Hill Book Company.
5. T.L. Floyd , Digital Fundamentals -, Pearson Education, 8/e.
6. W.H. Gothmann , Digital Electronics -, Prentice Hall of India Private Limited, 2/e.

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1. https://www.youtube.com/watch?v=4ae9sJBBkvw
2. https://learnabout-electronics.org/Digital/dig11.php
3. https://www.youtube.com/watch?v=RrynEQ7sG5A
4. https://www.sciencedirect.com/topics/computer-science/de-morgans-theorem
5. https://en.wikipedia.org/wiki/Flip-flop_(electronics)
6. https://www.youtube.com/watch?v=tSti91b6qec
7. https://www.youtube.com/watch?v=vRBnZMJA0LY
8. https://en.wikipedia.org/wiki/Shift_register
9. https://www.tutorialspoint.com/linear_integrated_circuits_applications/linear_integrated_circuits_applications_digital_to_analog_converters.htm
10. https://www.youtube.com/watch?v=Y2OPnrgb0pY
11. https://www.youtube.com/watch?v=_xxQZEVbPwU (Tamil video)

Course Outcomes

1. After studied unit-1, the student will be able to gain knowledge between different types of number systems, and their conversions. Also able to study the various binary codes and to design basic logic gates.
2. After studied unit-2, the student will be able to describe laws of Boolean Algebra, De Morgan's theorems. Also able to demonstrate K-Map and simplification of logic expressions and to design universal gates using NAND and NOR gates.
3. After studied unit-3, the student will be able to explain the Multiplexer, Demultiplexer and Decoder. Students can know the functions of various Flip-Flop circuits.
4. After studied unit-4, the student will be able to conceptualize the classification of registers and counters.
5. After studied unit-5, the student will be able to know how to convert digital to analog and analog to digital using different methods.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	L	M	M	M	M
CO2	S	S	M	M	S	M	M	S	M	S
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	S	M	M	S	M	S	S	M	M
CO5	S	S	M	S	M	S	M	S	S	M

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Semester: VI **Paper type: Core Elective 2 – Group (B)**

Paper code: **Name of the Paper:** **Materials Science** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Contents

1. To teach the classification of engineering materials and properties.
2. To discuss the mechanical and thermal behavior of materials.
3. To expose the knowledge on polymers, ceramics and nanomaterial.
4. To study the basics of smart materials.
5. To learn the idea of energy storage materials.

UNIT – I **Teaching Hours: 12**

ENGINEERING MATERIALS AND CHEMICALBONDING
Classification of engineering materials- levels of structure - structure-property relationship in materials-stability and metastability- bond energy- bond type and bond length- ionic and covalent bonding -Metallic bonding-secondary bonding-lattice energy-Born Haber cycle - cohesive energy -variation in bonding character and properties.

UNIT- II **Teaching Hours: 12**

MECHANICAL AND THERMAL BEHAVIOUR OFMATERIALS
Elastic behaviour -atomic model of elastic behaviour -Young's modulus -Poisson's ratio - shear modulus- bulk modulus-composite materials - the modulus as a parameter of design-rubber like elasticity -plastic deformation -tensile -yield strength -toughness -elongation - hardness- impact strength -stress - strain curve -Heat capacity, thermalconductivity, thermal expansion of materials.

UNIT- III **Teaching Hours: 12**

POLYMERS, CERAMICS AND NANOMATERIAL
Polymers - Polymerization mechanism - Polymer structures - Deformation of polymers - Behaviour of polymers-Ceramics-Ceramic phases - Structure - classes - Effect of structureon the behaviour of ceramic phases - composites - Nanomaterial-Need and origin of nano-Introductory ideas of 1D, 2D and 3D nanostructured material-Synthesis of oxide

nanoparticles by sol-gel method -fullurences-Carbon nanotubes- Fabrication and structure of carbon nanotubes

UNIT- IV **Teaching Hours: 12**

SMART MATERIALS

Definition of smart materials- Types -Piezoelectric materials-Materials for MEMS and NEMS- Ferro fluid- Magnetic shapememoryalloys (MSMAs)- Shape memory alloy (SMA)- Oneway and Two way memory effect- Dielectric elastomers (DEs).

UNIT- V **Teaching Hours: 12**

ENERGY STORAGE MATERIALS

Solar cells: Organic solar cells - Polymer composites for solar cells-Polymer membranes for fuel cells - Acid/ alkaline fuel cells -design of fuel cells-Carbon Nanotubes for energy storage - Hydrogen Storage in Carbon Nanotubes.

Text Books

Unit 1 to Unit 5

1. V. RaghavanV,Materials science and engineering - A FirstCourse, 5th Ed, Prentice Hall India, New Delhi, 2012.
2. M. Arumugam, Materials Science - Anuradha Agencies, 1990.

Reference Books

1. V. Rajendran, Material Science, Tata McGraw Hill Ltd, New Delhi,2001.
2. Dr. M.N. Avadhanulu, Material science, S.Chand& Company, New Delhi, 2014.
3. G.K.Narula, K.S. Narula, V.K. Gupta Materials Science, Tata McGraw Hill Publishing, New Delhi, 1994.
4. M V Gandhi and B S Thompson B S, Smart Materials andStructures. Chapman & Hall 1992.

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1. https://www.learnpick.in/prime/documents/ppts/details/729/classification-of-engineering-materials-part-1
2. https://www.youtube.com/watch?v=5hJhRFCUilo
3. https://www.youtube.com/watch?v=iegJ76DS3lc
4. https://nptel.ac.in/content/storage2/courses/112108150/pdf/Web_Pages/WEBP_M15.pdf
5. https://plastics.americanchemistry.com/plastics/The-Basics/
6. https://study.com/academy/lesson/what-are-polymers-properties-applications-examples.html
7. https://internetofthingsagenda.techtarget.com/definition/micro-electromechanical-systems-MEMS

8. https://en.wikipedia.org/wiki/Microelectromechanical_systems
9. https://www.iitk.ac.in/reach/2008/Energy/REACH2008-SolarCells-SundarIyer.pdf
10. https://www.youtube.com/watch?v=zMLrhgSAPHc
11. https://www.youtube.com/watch?v=4Homfj_ne0Q (Tamil video)

Course Objectives

1. After studied unit-1, the student will be able to know the origin engineering materials and its classification. Also students will be able to learn the bonding character and its Properties
2. After studied unit-2, the student will be able to describe mechanical properties like elastic behavior and thermal properties like heat capacity, thermal conductivity etc.
3. After studied unit-3, the student will be able to know the basics of polymers, ceramics and nanomaterial.
4. After studied unit-4, the student will be able to explain definition and types of smart materials.
5. After studied unit-5, the student will be able to conceptualize the energy storage materials.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	Yes
2	Yes	Yes	No	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	No	No
5	Yes	No	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	S	L	M	M	M	M
CO2	S	M	M	M	M	M	M	S	M	L
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	M	M	M	S	M	S	S	M	M
CO5	S	S	M	S	M	S	M	S	S	M

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Semester: VI **Paper type: Core Elective 3 – Group (B)**

Paper code: **Name of the Paper:** **Medical Physics** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To have a fundamental knowledge about the characteristics and production of X-rays.
2. To understand the concept of radiation physics.
3. To have a clear understanding of the design and working of Medical imaging techniques.
4. To understand the concepts and ideas behind radiation therapy.
5. To gain knowledge about the protective measures in radiation therapy.

UNIT- I **Teaching Hours: 12**

X - RAYS

Electromagnetic spectrum, production of x-rays, x-ray spectra-Brehmsstrahlung, Characteristic x-ray- Coolidge tube, x-ray tubedesign, tube cooling stationary mode, Rotating anode x-ray tube, Tube rating, qualityand intensity of x-ray. X-ray generator circuits, half wave and full wave rectification,filament circuit, kilo voltage circuit, types of X-Ray Generator, high frequencygenerator, exposure timers and switches, HT cables, HT generation.

UNIT- II **Teaching Hours: 12**

RADIATION PHYSICS

Radiation units exposure, absorbed dose, units: rad, gray,relative biological effectiveness, effective dose, inverse square law- Interaction ofradiation with matter Compton & photoelectric effect, Rem & Sievert, linear attenuationcoefficient - Radiation Detectors: Thimble chamber, condenser chambers, GeigerMuller counter, Scintillation counters and Solid State detectors, ionization chamber, Dosimeters, survey methods, area monitors, TLD, Semiconductor detectors.

UNIT- III **Teaching Hours: 12**

MEDICAL IMAGING PHYSICS

Evolution of Medical Imaging, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging, Ultrasound imaging, Physics of Doppler with applications and modes, Vascular Doppler. Radiography: Filters, grids, cassette, X-ray film, film processing, fluoroscopy- Computed tomography scanner- principle & function,display, generations, mammography. Thyroid uptake system and Gamma camera (onlyPrinciple, function and display)

UNIT- IV **Teaching Hours: 12**

RADIATION THERAPHY PHYSICS

Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, -Radioisotope imaging equipment, Single photon and positron emission tomography- Therapeutic nuclear medicine: Interaction between radiation and matter -Dose and isodose in radiation treatment - Medical Instrumentation: Basic Ideas of Endoscope and Cautery, Sleep Apnea and Cpap Machines, Ventilator and its modes

UNIT- V **Teaching Hours: 12**

RADIATION PROTECTION

Principles of radiation protection,protective materials-radiation effects, somatic, genetic stochastic and deterministiceffect. Personal monitoring devices: TLD film badge -pocket dosimeter, OSL dosimeter- Radiation dosimeter- Natural radioactivity, Biological effects of radiation, Radiationmonitors-Steps to reduce radiation to Patient, Staff and Public- Dose Limits forOccupational workers and Public-AERB: Existence and Purpose.

Text Books

Unit 1 to Unit 5

1. Dr. K. Thayalan, Basic Radiological Physics, Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi, 2003.
2. Curry, Dowdey and Murrey, Christensen's Physics of Diagnostic Radiology, Lippincot Williams and Wilkins,1990.
3. FM Khan-Williams and Wilkins,Physics of Radiation Theraphy, Third edition,2003.

Reference Books

1. Chandra-LippincotWillams and Wilkins, Nuclear Medicine Physics,1998.
2. William R Hendee-Mosby Medical Imaging Physics, 3rd edition,1992.
3. K.N. Govindarajan,Advanced Medical Radiation Dosimetry, Prentice Hall of India Pvt. Ltd. New Delhi ,1992.
4. Muhammad Maqbool, Introduction to Medical Physics ,Springer International Publishing, 2017.

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1. https://www.youtube.com/watch?v=T1WwHh4b__M
2. https://en.wikipedia.org/wiki/X-ray
3. https://www.studyandscore.com/studymaterial-detail/geiger-muller-counter-construction-principle-working-plateau-graph-and-applications
4. https://www.youtube.com/watch?v=Sr1BdM89RnA
5. https://en.wikipedia.org/wiki/Magnetic_resonance_imaging
6. https://www.youtube.com/watch?v=Q9-X4uV8ymk
7. https://www.adacap.com/nuclear-medicine/
8. http://jnm.snmjournals.org/content/57/1/163.full

9. https://www.youtube.com/watch?v=gXR5Wdmeu_s (Tamil video)
10. https://www.healthline.com/health/endoscopy

Course Outcomes

1. After studying Unit 1, the student will have a clear idea about the fundamentals of the production and characteristics of X-rays.
2. After studying Unit 2, the student would have understood the concept of radiation units and radiation detectors.
3. After studying Unit 3, the student will have a clear understanding of the design and working of Medical imaging techniques and computer tomography scanner.
4. After studying Unit 4, the student will be having a thorough understanding about the diagnostic nuclear medicine and some medical instrumentation.
5. After studying Unit 5, the student would have gained adequate knowledge about the protective measures to be undertaken in radiation therapy.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	L	S	S	M	M
CO2	S	S	M	M	S	M	S	S	M	S
CO3	S	M	S	S	S	M	S	S	S	S
CO4	S	S	M	M	S	M	S	S	M	L
CO5	S	S	M	S	M	S	M	S	S	M

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Semester: VI **Paper type: Core Elective 1 – Group (C)**

Paper code: **Name of the Paper:** **Digital Electronics** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. Understanding the different number systems and conversion between them and also to study the basic logic gates.
2. To teach the laws of Boolean Algebra, De Morgan's theorems and other logic circuits.
3. To Study combination of logiccircuits and understanding concepts of various flip- flops.
4. To expose the knowledge on various registers and counters.
5. To learn the digital to analog and analog to digital converters.

UNIT – I **Teaching Hours: 14**

NUMBER SYSTEMS AND BASIC LOGIC GATES

Number systems -Decimal, Binary, Octal and Hexadecimal system - Conversion from one number system to another- Binary Arithmetic -Addition -Subtraction-Multiplication-Division- 1's and 2's complement - Subtraction using Complements-Signed Binary Numbers-Binary codes- BCD code - Excess 3 code, Gray code - ASCII code - Basic logic gates-NOT,OR,AND-Design of AND, OR gates using diodes and NOT gate using transistor-Logic circuits and logic expressions-Sum of Products-Product of Sum- NAND, NOR and EX-OR - functions and truth tables.

UNIT- II **Teaching Hours: 14**

BOOLEAN ALGEBRA AND LOGIC CIRCUITS

Laws of Boolean algebra - De Morgan's theorems-NAND & NOR as Universal gates (AND,OR and NOT only)-Karnaugh map - Minterms-Relationship between K-Map and truth table- 2,3 and 4 variable K Map using minterms- Simplification of Boolean function using K Map - Arithmetic Circuits-Half adder and Full adder- Four Bit Adder-BCD Adder- Half subtractor and Full subtractor-Four Bit Adder/subtractor.

UNIT- III **Teaching Hours: 12**

COMBINATION OF CIRCUITS & FLIP-FLOPS

Multiplexer-Demultiplexer- Decoder- 2 to 4 and 3 to 8 Decoder-BCD to seven segment decoder- BCD to decimal decoder-Encoder-Programmable Logic Array (PLA)-Binary to Gray and Gray to Binary Conversion using EX-OR gates-Parity Generator and Checker -
Flip Flops -SR Flip Flop -Clocked SR-Edge triggered Flip – Flops- D Flip-Flop - JK Flip-Flop -JK Master-Slave Flip - Flop-T Flip-Flop.

UNIT- IV **Teaching Hours: 10**

REGISTERS & COUNTERS

Registers-Shift Registers- Shift Right and Shift Left Shift Registers-Ring Counter - Johnson'sCounter-Asynchronous/Ripple Counter-Mod-2, Mod-4, Mod-8 and Mod-16 Counter-4-Bit BinaryUp/Down Counter-Synchronous Counters-Design of Synchronous Counters-Mod-3, Mod-5 Counter- Synchronous BCD counter.

UNIT- V **Teaching Hours: 10**

D/A AND A/D CONVERTERS

Binary weighted resistors D/A converter-R-2R Resistive Ladder - Analog to Digital Converter (ADC)-Counter Type A/D Converter-Successive Approximation A/D Converter-Dual Slope A/D Converter-Parallel Comparator A/D Converter.

Text Book

Unit 1 to Unit 5

1. V.Vijayendran, Introduction to Integrated Electronics (Digital & Analog), S. Viswanathan, Printers & Publishers Private Ltd, Chennai, 2007.

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1. Malvino and Leech, Digital Principles and Application, 4th Edition, Tata McGraw Hill, New Delhi, 2000.
2. V.Vijayendran, Digital Fundamentals, S.Viswanathan, Printers & Publishers PrivateLtd, Chennai,2004.
3. R.P. Jain, Modern Digital Electronics, 2/e, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. H. Taub and D. Schilling , Digital Integrated Electronics -, McGraw-Hill Book Company.
5. T.L. Floyd , Digital Fundamentals -, Pearson Education, 8/e.
6. W.H. Gothmann , Digital Electronics -, Prentice Hall of India Private Limited, 2/e.

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1. https://www.youtube.com/watch?v=4ae9sJBBkvw
2. https://learnabout-electronics.org/Digital/dig11.php
3. https://www.youtube.com/watch?v=RrynEQ7sG5A
4. https://www.sciencedirect.com/topics/computer-science/de-morgans-theorem
5. https://en.wikipedia.org/wiki/Flip-flop_(electronics)
6. https://www.youtube.com/watch?v=tSti91b6qec

7. https://www.youtube.com/watch?v=vRBnZMJA0LY
8. https://en.wikipedia.org/wiki/Shift_register
9. https://www.tutorialspoint.com/linear_integrated_circuits_applications/linear_integrated_circuits_applications_digital_to_analog_converters.htm
10. https://www.youtube.com/watch?v=Y2OPnrgb0pY
11. https://www.youtube.com/watch?v=_xxQZEVbPwU (Tamil video)

Course Outcomes

1. After studied unit-1, the student will be able to gain knowledge between different types of number systems, and their conversions. Also able to study the various binary codes and to design basic logic gates.
2. After studied unit-2, the student will be able to describe laws of Boolean Algebra, De Morgan's theorems. Also able to demonstrate K-Map and simplification of logic expressions and to design universal gates using NAND and NOR gates.
3. After studied unit-3, the student will be able to explain the Multiplexer, Demultiplexer and Decoder. Students can know the functions of various Flip-Flop circuits.
4. After studied unit-4, the student will be able to conceptualize the classification of registers and counters.
5. After studied unit-5, the student will be able to know how to convert digital to analog and analog to digital using different methods.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	Yes	No
3	Yes	Yes	Yes	Yes	Yes	Yes
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	L	M	M	M	M
CO2	S	S	M	M	S	M	M	S	M	S
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	S	M	M	S	M	S	S	M	M
CO5	S	S	M	S	M	S	M	S	S	M

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Semester: VI **Paper type: Core Elective 2 – Group (C)**

Paper code: **Name of the Paper: Radiation Safety** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. The students can learn the basic concepts of atomic and nuclear physics
2. To teach the different types of radiation and interaction of charged particles
3. To study the basic idea of different units of activity and working principle of radiation detectors
4. To understand the concept of radiation safety management
5. To give the application of nuclear techniques

UNIT- I **Teaching Hours: 12**

BASICS OF ATOMIC AND NUCLEAR PHYSICS

Basic concept of atomic structure; X rayscharacteristic and production; concept of bremsstrahlung and auger electron-Thecomposition of nucleus and its properties, mass number, isotopes of element, spin,binding energy, stable and unstable isotopes, law of radioactive decay- Mean life and half-life, -Basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions- Types of nuclear reaction, fusion, fission.

UNIT- II **Teaching Hours: 12**

INTERACTION OF RADIATION WITH MATTER

Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons - Photoelectric effect, Compton Scattering, Pair Production- Linear and Mass Attenuation Coefficients- Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channeling and Cherenkov radiation- Beta Particles- Collision and Radiation loss (Bremsstrahlung)-Interaction of Neutrons- Collision, slowing down and Moderation.

UNIT- III **Teaching Hours: 12**

RADIATION DETECTION AND MONITORING DEVICES

Radiation Quantities and Units: Basicidea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose,effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived AirConcentration (DAC) - Radiation detection: Basic concept and working principle ofgas detectors (Ionization Chambers, Proportional Counter, Multi-Wire ProportionalCounters (MWPC) and Gieger Muller Counter), Scintillation Detectors (Inorganic andOrganic Scintillators), Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetr.

UNIT- IV **Teaching Hours: 12**

RADIATION SAFETY MANAGEMENT

Biological effects of ionizing radiations-Operationallimits and basics of radiation hazards evaluation and control: radiation protectionstandards-International Commission on Radiological Protection (ICRP) principles,justification, optimization, limitation, introduction of safety and risk management ofradiation. Nuclear waste and disposal management.Brief idea about Accelerator drivenSub-critical system (ADS) for waste management.

UNIT-V **Teaching Hours: 12**

APPLICATION OF NUCLEAR TECHNIQUES

Application in medical science (e.g., MRI, PET,Projection Imaging Gamma Camera, radiation therapy), Archaeology, Art, Crime detection, Mining and oil-Industrial Uses: Tracing, Gauging, Material Modification,Sterization, Food preservation.

Text Books

Unit 1 to Unit 5

1. R. Murugeshan and KiruthigaSivaprasath, Modern Physics,S Chand &Co.New Delhi,2006.
2. H. Cember and T. E. Johnson, Introduction to Health Physics, 4th Ed.,McGraw Hill, 2008.
3. K. Thayalan, Handbook of Radiological Safety ,JaypeeBrothers,Medical ,Publishers, 2009.

Reference Books

1. Dr. K. Thayalan, Basic Radiological Physics ,Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi, 2003.
2. R. F. Mould Radiation Protection in Hospital (Adam Hilger Ltd., Bristol, 1985.
3. Martin, S. Harbison, K. Beach and P. Cole, An Introduction to Radiation Protection, 6th Ed. CRC Press, 2013.
4. AERB Radiation Protection Rules, 2004.
5. IAEA Safety Series 41

E-Materials

1. https://en.wikipedia.org/wiki/Radioactive_decay
2. https://www.toppr.com/guides/physics/nuclei/radioactivity-law-of-radioactive-decay/
3. https://www.youtube.com/watch?v=9UhmFr2WctU (Tamil video)
4. https://ta.wikipedia.org/wiki/%E0%AE%92%E0%AE%B3%E0%AE%BF%E0%AE%AE%E0%AE%BF%E0%AE%A9%E0%AF%8D_%E0%AE%B5%E0%AE%BF%E0%AE%B3%E0%AF%88%E0%AE%B5%E0%AF%81
5. https://www2.lbl.gov/abc/wallchart/chapters/15/2.html
6. https://www.radiologyinfo.org/en/info.cfm?pg=safety-hiw_09
7. https://www.youtube.com/watch?v=DvSNlmGu55c
8. http://webfiles.ehs.ufl.edu/rssc_stdy_chp_5.pdf
9. https://www.world-nuclear.org/information-library/non-power-nuclear-applications/overview/the-many-uses-of-nuclear-technology.aspx
10. https://www.youtube.com/watch?v=ySnG4JZa7Go

Course Outcomes

1. After studied unit-1, the student will be able to study the basics of atomic structure and nuclear composition.
2. After studied unit-2, the student will be able to describe properties of alpha, beta and gamma rays and also to study the interaction of charged particles.
3. After studied unit-3, the student will be able to explain radiation qunatities and units and also able to know the principle and working of radiation detectors.
4. After studied unit-4, the student will be able to conceptualize the radiation safety management.
5. After studied unit-5, the student will be able to know the application of nuclear techniques in medicinal science.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	No	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	Yes	No
4	Yes	Yes	No	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	No

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	L	M	M	M	M
CO2	S	S	M	M	S	M	M	M	M	L
CO3	S	M	S	S	S	M	M	M	S	L
CO4	S	S	M	M	S	M	S	M	M	M

CO5	S	S	M	S	M	S	M	S	S	S

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Semester: VI **Paper type: Core Elective 3 – Group (C)**

Paper code: **Name of the Paper: Astrophysics** **Credit: 3**

Total Hours per Week: 4 **Lecture Hours: 60** **Tutorial Hours: Nil** **Practical Hours: Nil**

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Course Objectives

1. To give basic principle and types of astronomical instruments.
2. To study the big bang theory, types of galaxies and to astronomical units.
3. To learn the birth and age of stars and to know about comets.
4. To teach the structure of the sun and other planets.
5. To give the overview of India's space programme and calendars.

UNIT- I **Teaching Hours: 12**

ASTRONOMICAL INSTRUMENTS

Optical telescope - reflecting telescope - types of reflecting telescope - advantages of reflecting telescopes - radio telescope - astronomical spectrographs - photographic photometry - photoelectric spectrometry- detectors and image processing.

UNIT- II **Teaching Hours: 12**

SPACE

Introduction -Hubble's Law -Big bang theory - Shape of Universe -Expanding universe in space - Galaxies- Types of Galaxies- Spiral, Elliptical and Irregular Galaxies - Clusters of Galaxies - Milky Way - Quasars - Cislunar space -Translunar space - Inter planetary distance

-Interesteller space - Inter galactic space - Light Year - Astronomical Unit- Astronomical Map.Astronomical Systems -Astronomical co-ordinates - Celestial Sphere - Celestial Equators - Celestial Poles.

UNIT- III **Teaching Hours: 12**

STARS

Birth of Stars -Colour and Age- Life of Stars - Red giant stars - With dwarf star - Neutron Star -Black hole - Supernovae - Constellations - Zodiac - Asteroids - Meteors -Meteorites-Comets.

UNIT- IV **Teaching Hours: 12**

SOLAR SYSTEM

Introduction - Sun - Structure of Sun - Nuclear reactions in sun - Sun spot and solar flares-Earth - Structure of earth - Atmosphere - Moon and its structure - Inner planets Outer planets - Introduction - Sidereal month - Synodic month - daily motion of the moon- age of moon - phase of moon - position of moon at rising and setting-Eclipses-Introduction - umbra and penumbra - lunar eclipse - solar eclipse -durationof lunar and solar eclipse - comparison of solar and lunar eclipses.

UNIT- V **Teaching Hours: 12**

INDIA'S SPACE PROGRAMME

Overview - Methodological issues in cost beneficial analysis of spaceprogramme - The INSAT system - Broadcasting - Telecommunication -Meteorology - Indian remote sensing programme-Geoinformatics (basic idea only) - The launching program-Latest Launchers-PSLV and GSLV - Mission-Chandrayan 2 - Lunar and Solar calendars - Egyptian - Mayan - Roman - Julian andGregorian calendars - Indian National calendar - Tamil and Malayalamcalendars.

Text Books

1. BaidyanathBasu, An introduction to Astrophysics,Pentice Hall of India Private Ltd., New Delhi - 2001.
2. A.Hewish, Physics of the Universe , CSIR publication, New Delhi, 1992.
3. BimanBasu, Inside Stars, CSIR Publication, New Delhi, 1992.
4. K.S.Krishnasamy, Astro Physics a Modern Perspective, New Age International, New Delhi.
5. R. Murugesan, Modern Physics, S. Chand &Co.,New Delhi, 2003.

Reference Books

1. Prof. P. Devadas, The fascinating Astronomy, Devadas Telescopies, Chennai.
2. S. Kumaravelu and SusheelaKumaravelu,Astronomy,2013.
3. Textbook of astronomy an astrophysics with elements of cosmology, V.B.Bhatia, Narosapublishing house, 2001.
4. Astrophysics - Stars and Galaxies, K. D. Abhyankar, University Press, 2001.
5. Theoritical Astrophysics (Vols. I,II,III) - T. Padmanavan (CUP)

6. Black Holes, White Dwarfs and Neutron Stars -S.L.Shapiro and S.A.Teukolsky (John Wiley, 1983).

E-Materials

1. https://www.youtube.com/watch?v=zlioUjguQk8
2. https://en.wikipedia.org/wiki/Reflecting_telescope
3. https://en.wikipedia.org/wiki/Milky_Way
4. https://www.youtube.com/watch?v=BcjmoEspoRI
5. https://www.youtube.com/watch?v=ZrS3Ye8p61Y
6. https://en.wikipedia.org/wiki/Star
7. https://en.wikipedia.org/wiki/Solar_System
8. https://www.youtube.com/watch?v=AC0HdUD1RfA (Tamil video)
9. https://www.youtube.com/watch?v=eeS7byxWDM4
10. https://en.wikipedia.org/wiki/Indian_National_Satellite_System

Course Outcomes

1. After studied unit-1, the student will be able to study the different types of optical instruments like telescopes and spectrographs will be used for observing/recording the space objects.
2. After studied unit-2, the student will be able to describe big bang theory, different types of galaxies, milky way and astronomical unit.
3. After studied unit-3, the student will be able to explain about stars, constellations, asteroids, meteorites and comets.
4. After studied unit-4, the student will be able to know the details of solar system and able to know the formation eclipse due to sun, moon and earth.
5. After studied unit-5, the student will be able to understanding the different space programmers/missions carried out by our Indian Space Research Organization (ISRO) and also to study the lunar and solar calendars.

Matching Table (Put Yes / No in the appropriate box)

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	Yes	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	Yes	Yes

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	L	M	M	M	L
CO2	S	S	S	S	S	M	M	S	M	S
CO3	M	M	S	S	S	M	M	S	S	S
CO4	S	S	S	S	S	M	S	M	M	M
CO5	M	S	S	S	M	S	M	S	S	M

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Semester: VI **Paper type: Core Practical**
Paper code: **Name of the Paper: Practical –3** **Credit: 3**

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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List of Experiments (Any 15 Experiments only)

1. Bifilar Pendulum - Parallel Threads - Verification of Parallel and Perpendicular axes theorems.
2. Young's modulus - Koenig's method - non- uniform bending.
3. Young's modulus -Koenig's method - uniform bending.
4. Newton's rings -Refractive index of material a convex lines.
5. Spectrometer i- i' Curve.
6. Spectrometer -Narrow angled prism - angle of deviation - normal incidence and normal emergence - refractive index.
7. Spectrometer-Dispersive power of a prism.
8. Spectrometer-Dispersive power of a grating.
9. Field along the axis of circular coil -Deflection magnetometer -M and B_H- Null Deflection Method.
10. Field along the axis of circular coil –Vibration magnetometer -Determination of B_H.
11. Potentiometer –Calibration of high range Voltmeter.
12. Potentiometer – EMF of a thermo couple.
13. Potentiometer - Conversion of galvanometer into Voltmeter.
14. Potentiometer - Conversion of galvanometer into Ammeter.
15. BG - Absolute capacitance of a capacitor.
16. BG - Comparison mutual inductances.
17. BG - Internal resistance of a cell.
18. Voltage regulator -Bridge Rectifier-Using IC 7805
19. Transistor Characteristics-CE mode
20. FET -Characteristics.
21. UJT - Characteristics.
22. SCR- Characteristics
23. RC Coupled Amplifier- Single stage.
24. Colpitt's Oscillator- Using transistor.
25. Hartley oscillator-Using transistor.

Text Books

1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai,2018.
2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

Reference Books

1. Samir Kumar Ghosh, A Textbook of Advanced Practical Physics, NCBA, Kolkatta, 2000.

2. D. Chattopadyay, P.C.Rakshit, An Advanced Course in Practical Physics, NCBA, Kolkatta, 2011
3. C.L.Arora, B.Sc., Practical Physics,S. Chand and Company., New Delhi.
4. D.P..Khandelwal D.P., A Laboratory Manual of Physics for Undergraduate Classes. Vani Publications.
5. B.Saraf et al, Physics through Experiments,Vikas Publications.
6. Harnaam Singh., B.Sc., Practical Physics,S. Chand and Company., New Delhi.
7. D C Tayal, University Practical Physics, Himalaya Publishing House.
8. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut.

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Semester: VI **Paper type: Core Practical**
Paper code: **Name of the Paper: Practical -4** **Credit: 3**

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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List of Experiments (Any 12 Experiments only)

1. Transistor - Phase shift oscillator.
2. Transistor - Wien bridge oscillator.
3. FET-Amplifier.
4. Verification of associative laws for AND and OR gates
5. K-Map reduction and logic circuit implementation.
6. Verification of DeMorgan's Laws.
7. Half adder and Full adder - using NAND gate.
8. Half subtractor and Full subtractor- using NAND gate.
9. RS, Clocked RS, and D Flip Flops using NAND gate.
10. Shift Register using IC 7473
11. Four bit ring and Johnson's counter using IC 7473
12. Four bit BCD up/down counter using IC 7473
13. D/A converter-4-bit binary weighted resistor method.
14. OP-AMP-Voltage follower, Adder, Subtractor, Averager (inverting mode).
15. OP-AMP- Differentiator and Integrator
16. OP-AMP- Inverting amplifier with frequency gain response.
17. OP-AMP-Astablemultivibrator.
18. Microprocessor 8085-ALP for 8 bit addition and Subtraction
19. Microprocessor 8085-ALP for 8 bit Multiplication and Division
20. Microprocessor 8085- ALP Largest/Smallest Number in an array

Text Books

1. C.C. Ouseph, U.J. Rao, V. Vijayendran, Practical Physics and Electronics, S. Viswanathan, Printers & Publishers Private Ltd, Chennai,2018.
2. M.N.Srinivasan, S. Balasubramanian, R.Ranganathan, A Text Book of Practical Physics, Sultan Chand & Sons, New Delhi, 2015.

Reference Books

1. Samir Kumar Ghosh, A Textbook of Advanced Practical Physics, NCBA, Kolkatta, 2000.
2. D. Chattopadyay, P.C.Rakshit, An Advanced Course in Practical Physics, NCBA, Kolkatta, 2011
3. C.L.Arora, B.Sc., Practical Physics,S. Chand and Company., New Delhi.
4. D.P..Khandelwal D.P., A Laboratory Manual of Physics for Undergraduate Classes. Vani Publications.
5. B.Saraf et al, Physics through Experiments,Vikas Publications.
6. Harnaam Singh., B.Sc., Practical Physics,S. Chand and Company., New Delhi.
7. D C Tayal, University Practical Physics, Himalaya Publishing House.

8. Gupta & Kumar, Practical Physics, Pragatiprakashan, Meerut.

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Semester: VI **Paper type: Project**
Paper code: **Name of the Paper: Compulsory Project** **Credit: 3**

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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Preamble

The concept of introducing the project will help the student community to learn and apply the principles of Physics and explore the new research avenues - In the course of the project the student will refer books, Journals or collect literature / data by the way of visiting research institutes/ industries or social relevance problem. He/she may even do experimental /theoretical work in his/her college and submit a dissertation report with a minimum of 25 pages not exceeding 30 pages.

Format for Preparation of Project

The sequence in which project should be arranged and bound should be as follows

1. Cover Page and title Page
2. Declaration
3. Certificate
4. Acknowledgement (not exceeding one page)
5. Contents (12 Font size, Times new Roman with double line spacing)
6. Chapters
7. References

Distribution of marks for Project: (25+75 = 100 Marks)

Internal : 25 Marks

External : 75 Marks

(a) For Organization and presentation of Project - 40 marks
(b) For the novelty /Social relevance - 10 marks
(c) Presentation of work /Participation in state/ National level Seminar/publication - 5 marks
(d) Viva voce (Preparation, Presentation of work and Response to questions) - 20 marks