BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024.

B.Sc. PHYSICS

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2022-23 onwards)

(NAAN MUDHALVAN SCHEME was implemented from 2nd to 6th Semester)

Sem.	Part	Course	Title	Ins. Hrs	Credit	Exam Hours	Marks		Total
							Int.	Ext.	
I	I	Language Course – I Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course - I		6	3	3	25	75	100
	III	Core Course – I (CC)	Properties of Matter and Acoustics	5	5	3	25	75	100
		Core Practical – I (CP)	Properties of Matter	4	4	3	40	60	100
		First Allied Course – I (AC)		4	4	3	25	75	100
		First Allied Course – II (AC)		3	-	-	-	-	-
	IV	Value Education		2	2	3	25	75	100
	TOTAL			**30**	**21**	**-**	**-**	**-**	**600**
II	I	Language Course - II Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course - II		4	3	3	25	75	100
	III	Core Course – II (CC)	Mechanics and Theory of Relativity	5	5	3	25	75	100
		Core Practical – II (CP)	General Physics I	4	4	3	40	60	100
		First Allied Course – II (AC)		3	2	3	25	75	100
		First Allied Course – III (AC)		4	4	3	25	75	100
		Add on Course – I ##	Professional English – I	6*	4	3	25	75	100
	IV	Environmental Studies		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Language Proficiency for Employability - Effective English	2	2	3	25	75	100
	TOTAL			**30**	**29**	**-**	**-**	**-**	**900**

III	I	Language Course – III Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course – III		6	3	3	25	75	100
	III	Core Course – III (CC)	Thermal Physics	5	5	3	25	75	100
		Core Practical - III (CP)	General Physics II	4	4	3	40	60	100
		Second Allied Course – I (AC)		4	4	3	25	75	100
		Second Allied Course (AP)		3	-	-	-	-	-
		Add on Course – II ##	Professional English - II	6*	4	3	25	75	100
	IV	Non-Major Elective I @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studied in school level **or** b) Special Tamil if Tamil language was studied upto 10^{th} & 12^{th} std.	Digital Electronics	2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Digital Skills for Employability – Microsoft Digital Skills	-	2	3	25	75	100
	TOTAL			**30**	**27**	**-**	**-**	**-**	**800**
IV	I	Language Course –IV Tamil $ / Other Languages + #		6	3	3	25	75	100
	II	English Course – IV		6	3	3	25	75	100
	III	Core Course - IV (CC)	Electricity and Magnetism	5	5	3	25	75	100
		Core Practical - IV (CP)	Electricity	4	4	3	40	60	100
		Second Allied Course (AP)		3	2	3	40	60	100
		Second Allied Course – II (AC)		4	4	3	25	75	100
	IV	Non-Major Elective II @ - Those who choose Tamil in Part I can choose a non-major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studied in school level **or** b) Special Tamil if Tamil language was studied upto 10^{th} & 12^{th} std.	Medical Physics	2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Employability Skills - Employability Skills	-	2	3	25	75	100
	TOTAL			**30**	**25**	**-**	**-**	**-**	**800**

V	III	Core Course -V (CC)	Optics	5	5	3	25	75	100
		Core Course – VI (CC)	Atomic and Molecular Physics	5	5	3	25	75	100
		Core Course – VII (CC)	Electronics	5	5	3	25	75	100
		Core Practical -V (CP)	Optics and Digital Electronics	4	4	3	40	60	100
		Major Based Elective – I (Any one)	1. Solid State Physics 2. Laser Physics	5	4	3	25	75	100
	IV	Skill Based Elective I	Electrical Wiring Fundamentals	4	2	3	25	75	100
		Soft Skills Development		2	2	3	25	75	100
	VI	Naan Mudhalvan Scheme (NMS) @@	Computational Intelligence for Employability – Drone Pilot Techniques	-	2	3	25	75	100
	TOTAL			**30**	**29**	**-**	**-**	**-**	**800**
VI	III	Core Course - VIII (CC)	Nuclear Physics	6	5	3	25	75	100
		Core Course - IX (CC)	Theoretical Physics	6	5	3	25	75	100
		Core Practical – VI (CP)	Electronics, Microprocessor and Programming	4	4	3	40	60	100
		Major Based Elective – II (Any one)	1. Microprocessor and C Programming 2. Nanotechnology	5	4	3	25	75	100
		Project		4	3	-	20	80	100
	IV	Skill Based Elective – II	Domestic Electrical Appliances and Measuring Instruments	4	2	3	25	75	100
	V	Gender Studies		1	1	3	25	75	100
		Extension Activities **		-	1	-	-	-	-
	VI	Naan Mudhalvan Scheme (NMS) @@	Drone Application & Aerial Survey	-	2	3	25	75	100
	TOTAL			**30**	**27**	**-**	**-**	**-**	**800**
GRAND TOTAL				**180**	**158**	**-**	**-**	**-**	**4700**

List of Allied Courses

First Allied Course	**Second Allied Course**
Mathematics	Chemistry / Computer Science

$ For those who studied Tamil upto 10th +2 (Regular Stream).

+ Syllabus for other Languages should be on par with Tamil at degree level.

Those who studied Tamil upto 10th +2 but opt for other languages in degree level under Part- I should study special Tamil in Part – IV.

The Professional English – Four Streams Course is offered in the 2nd and 3rd Semester (only for 2022-2023 Batch) in all UG Courses. It will be taught apart from the Existing hours of teaching / additional hours of teaching (1 hour /day) as a 4 credit paper as an add on course on par with Major Paper and completion of the paper is must to continue his / her studies further. (As per G.O. No. 76, Higher Education (K2) Department dated: 18.07.2020).

* The Extra 6 hrs / cycle as per the G.O. 76/2020 will be utilized for the Add on Professional English Course.

@ NCC Course is one of the Choices in Non-Major Elective Course. Only the NCC cadets are eligible to choose this course. However, NCC Course is not a Compulsory Course for the NCC Cadets.

** Extension Activities shall be outside instruction hours.

@@ Naan Mudhalvan Scheme

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	No. of Credits	Marks
1.	I	Language Courses	4	12	400
2.	II	English Courses	4	12	400
3.	III	Core Courses	9	45	900
4.		Core Practical	6	24	600
5.		Allied Courses I & II	4	16	400
6.		Allied Practical	2	4	200
7.		Major Based Elective Courses	2	8	200
8.		Add on Courses	2	8	200
9.		Project	1	3	100
10.	IV	Non-Major Elective Courses	2	4	200
11.		Skill Based Elective Courses	2	4	200
12.		Soft Skills Development	1	2	100
13.		Value Education	1	2	100
14.		Environmental Studies	1	2	100
15.	V	Gender Studies	1	1	100
16.		Extension Activities	1	1	--
17.	VI	Naan Mudhalvan Scheme	5	10	500
	Total		**48**	**458**	**4700**

PROGRAM OBJECTIVES:

- To impart knowledge of basic concepts, laws and principles of various branches of Physics.
- To inculcate appropriate logical skills to translate physical description into mathematical equations and vice versa
- To provide analytical skills to solve problems in physics
- To provide systematic training on experimental methods so as to mould the learners to address the problems encountered during their practical sessions on their own
- To make available all learning methods of physics to enable the students become independent learners and thereby promote them for further studies as well as employment.

PROGRAMME SPECIFIC OUTCOMES:

On successful completion of B.Sc., Physics Programme, the students would have

- learnt the basic concepts and principles of Physics
- understood the meaning of mathematical equations representing physical systems and thereby describe various aspects of physical states through graphs and diagrams
- been trained to apply the understood concepts to solve the problems in physics
- acquired practical, analytical and logical skills to carry out experiments and interpret the observed results `
- discovered the capability to be independent learners so as to become eligible for higher studies as well as employment and cope with the ever- changing societal needs.

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First Year **CORE COURSE I** **Semester I**

PROPERTIES OF MATTER AND ACOUSTICS

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To inculcate the knowledge of certain properties of matter namely, elasticity, surface tension and viscosity.
- To enable the students to understand the basic concepts of sound.
- To describe the experimental techniques for the determination of properties so that the learner can do the experiments with better understanding.

UNIT – I ELASTICITY:

Introduction on the elastic and plastic nature of materials - Hooke's law-Stress-Strain diagram – Factors affecting elasticity – Different moduli of elasticity - Relation between the elastic moduli – Poisson's ratio -Twisting couple on a cylinder – Determination of rigidity modulus by static torsion– Work done in twisting a wire - Torsional oscillations of a body – Torsion pendulum – Determination of rigidity modulus and moment of inertia.

UNIT – II BENDING OF BEAMS:

Bending of beams – Expression for bending moment – Cantilever –Expression for depression of the loaded end of a cantilever – Young's modulus by measuring the tilt in a loaded cantilever – Oscillation of a cantilever - Non-uniform bending – Expression for depression – Uniform bending – Expression for elevation – Experimental determination of Young's modulus using pin and microscope method (Non-uniform bending – Uniform bending) –Determination of Young's modulus by Koenig's method.

UNIT – III SURFACE TENSION:

Definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – Work done on increasing the area of a surface - Angle of contact - Neumann's triangle - Excess pressure inside a liquid drop and soap bubble –Force between two plates separated by a thin layer of a liquid – Experimental determination of surface tension - Drop- weight method – Capillary rise method-Variation of surface tension with temperature.

UNIT – IV VISCOSITY:

Newton's law of viscous flow – streamlined and turbulent motion – Reynold's number - Poiseuille's formula for the flow of a liquid through a horizontal capillary tube – Experimental determination of co-efficient of a liquid by Poiseuille's method - Ostwald's viscometer – Terminal velocity and Stokes' formula – Viscosity of gases - Meyer's formula - Rankine's method -Variation of viscosity with temperature and pressure – Lubrication – Equation of continuity of flow -Bernoulli's theorem – Filter pump and Wings of an airplane.

UNIT – V ACOUSTICS:

Newton's Formula for the velocity of sound – Musical Sound and Noise – Speech – Characteristics of Musical sound – Intensity of sound – Measurement of intensity of sound – Decibel and Phon-Bel – Reverberation– Sabine's Reverberation formula– Factors affecting the Acoustics of Buildings – Sound distribution in an Auditorium – Requisites for good acoustics – Ultrasonics –Production of ultrasonic waves – Piezoelectric method–Detection of ultrasonic waves - Quartz crystal method – Applications of Ultrasonic waves.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Modulus of toughness and modulus of elasticity for different types of concrete - Elasticity and Seismic waves – Bending beam load cell – Composite beams - Surface tension and wetting behaviour of nanofluids – Viscosity of nanofluids – Acoustics sensors.

REFERENCES:

1. R. Murugeshan, *Properties of Matte*r, S. Chand & Co. Pvt. Ltd., Revised edition, 2012.
2. D. S. Mathur, *Elements of Properties of Matter*, S. Chand & Co. Pvt. Ltd., Revised edition, 2010
3. Brijlal& N. Subramanyam, *Properties of Matter*, Vikas Publishing. Pvt. Ltd, 2005.
4. Brijlal& N. Subramanyam, *ATextBook of Sound*, Vikas Publishing. Pvt. Ltd, 2008.
5. Feynman,*Lectures on Physics*, Vol.I& II by Richard P. Feynman, The New Millennium Edition, 2012.
6. David Halliday and Robert Resnick, *Fundamentals of Physics* by Wiley Plus, 2013.
7. B. H. Flowers and E. Mendoza, *Properties of matter*, Wiley Plus, 1991.
8. H. R. Gulati, *Fundamentals of General properties of matter*, S. Chand & Co. Pvt. Ltd, 2012.
9. Chatterjee and Sen Gupta, *A treatise on general properties of matter*, New central Books agency (p) Ltd, Kolkata, 2001.
10. R.L.Saihgal, *A Text Book of Sound*, S. Chand & Co. Pvt. Ltd, New Delhi, 1979.

COURSE OUTCOME:

On successful completion of the course, the students will be able to

- Differentiate the moduli of elasticity of different materials
- Analyze the moduli of elasticity of materials made in the form of beams.
- Understand the practical applications of surface tension in real life.
- Acquire the knowledge of the flow of liquids based on their viscous nature and the variation of viscosity with temperature and pressure
- Understand the various characteristics of sound and their practical implications.

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First Year | **CORE PRACTICAL I** | **Semester I**

PROPERTIES OF MATTER

Code: | **(Practical)** | **Credit: 4**

(**ANY EIGHT EXPERIMENTS)**

COURSE OBJECTIVES:

- To impart the skill of using measuring instruments
- To motivate the learner to study some properties of materials by determining the elastic constants, surface tension and viscosity through experiments.
- To make the learner to realize the vibrations of stretched strings.

EXPERIMENTS:

1. Measurement of length (or diameter) using Vernier calipers, Screw gauge and travelling microscope.
2. Determination of Young's modulus - Non-uniform bending using pin and microscope.
3. Determination of Young's modulus - Uniform bending using pin and microscope.
4. Determination of Young's modulus - Cantilever depression usingscale and telescope.
5. Surface tension and interfacial surface tension – Drop weight method.
6. Surface tension by capillary rise method.
7. Coefficient of viscosity of a liquid - Poiseuille's flow method.
8. The viscosity of highly viscous liquid - Stoke's method.
9. Verification of laws of vibration of a stretched string and determination of the frequency of a tuning fork – Sonometer.
10. Determination of frequency of a tuning fork using Melde's string apparatus.
11. Absolute determination of M and H using deflection and vibration magnetometer.
12. Spectrometer - Determination of refractive index of a solid prism.

REFERENCES::

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirappalli, 2009.
2. Dr. S. Somasundaram, *Practical Physics*, Apsara Publications, Tiruchirappalli, 2012.
3. C. C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd, 2014.
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand Publications, 2005

5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Del, 2011.

COURSE OUTCOMES:

Upon completion of this course, the student would be able to

- Use the measuring instruments for accurate measurement of physical quantities required for the experiment.
- Know the elastic properties of structural materials from the experimental results.
- Realize practically the properties of liquids such as surface tension and viscosity.
- Acquire the experimental skill of verifying laws in Physics.
- Understand experimentally the vibrations of stretched strings.

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First Year **CORE COURSE II** **Semester II**

MECHANICS AND THEORY OF RELATIVITY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To provide a better insight into the change of position of any physical object or event and their consequences.
- To inculcate the Newton's law of gravitation and Kepler's laws of planetary motion and their implications
- To impart the knowledge of theory of relativity and its applications.

UNIT – I PROJECTILE, IMPULSE AND IMPACT:

Projectile – Particle projected in any direction – Path of a projectile is a parabola - Range of a projectile on plane inclined to the horizontal - Maximum range on the inclined plane - Impulse of a force - Laws of impact - Direct impact between two smooth spheres - oblique impact between two smooth spheres - Loss of KE due to direct impact - Oblique impact.

UNIT – II MOTION ON A PLANE CURVE:

Centripetal and centrifugal forces - Hodograph - Expression for normal acceleration - Motion of a cyclist along a curved path - Motion of a railway carriage round a curved track- Motion of a carriage on a banked-up curve - Effect of earth's rotation on the value of the acceleration due to gravity - Variation of 'g' with altitude, latitude and depth.

UNIT – III GRAVITATION:

Newton's law of gravitation - Mass and density of earth - Inertial and Gravitation mass - Determination of G-Boy's experiment -Kepler's Laws of planetary motion -Deduction of Newton's law of gravitation from Kepler's Law - Gravitation - Field - potential -Intensity of Gravitational field - gravitational potential due to a point mass - Equipotential surface - Gravitational potential and field due to a spherical shell and solid sphere.

UNIT – IV DYNAMICS OF RIGID BODY AND CENTRE OF GRAVITY:

Moment of Inertia - Kinetic energy and angular momentum of rotating body - Perpendicular and parallel axes theorems - Acceleration of a body rolling down on inclined plane without slipping - Compound pendulum - Centre of suspension and centre of oscillation - Minimum period of a compound pendulum. - Centre of gravity of a body - C.G. of a solid hemisphere - C.G. of a solid cone – Centre of pressure – Centre of pressure of a triangular lamina immersed in a liquid.

UNIT – V THEORY OF RELATIVITY:

Galilean – Newtonian relativity - Galilean transformations – Michelson Morley experiment and its importance –Basic ideas of general theory of relativity - Lorentz transformations and its interpretation – consequence of Lorentz transformation – Length contraction, time dilation – relativistic addition of velocities – Mass energy equivalence.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Applied mechanics and growing utilization of theoretical mechanics - Structural Engineering – Hydraulics - External fluid dynamics.

REFERENCES:

1. M. Narayanamurthi and N. Nagarathinam, *Dynamics*, The National Publishing Company 2005, Chennai.
2. M. Narayanamurthi and N. Nagarathinam, *Statics, Hydrostatics and Hydrodynamics* - The National Publishing Company 2005, Chennai.
3. R. Murugesan and KiruthigaSivaprasath - *Modern physics*, 18th Revised edition November -2017, S.Chand& Company Ltd., New Delhi.
4. D.S. Mathur, *Mechanics*, S. Chand & Company Ltd., New Delhi, 2007.
5. Venkataraman, M K, *Dynamics*, Trichy: Agasthiar Book Deport, 2011
6. R. Murugesan, *Mechanics and Mathematical Physics*, S. Chand & Company Ltd., New Delhi, 2008.
7. I. H. Shames, *Introduction to Solid Mechanics,* 2009.
8. David Tong, *Dynamics and Relativity*, University of Cambridge, 2012.
9. M. Ray and G. C. Sharma, *A text book of Dynamics*, Chand & Company Ltd., New Delhi. 13th revised edition, 2005.
10. D. RajanBabu, E. James Jebaseelan Samuel, P. Ramesh Babu, V. Ramasubramanian and C. AnuRadha, *Modern Physics*, Anuradha Publisher, 2010.
11. P. Duraipandian, LaxmiDuraiPandiyan and MuthamizhJayapragasam, *Mechanics* Chand & Company Ltd., New Delhi. 2000.
12. Agarwal, J P, *Elements of Mechanics*, India: PragatiPrakashan, 2010.
13. Knight W D, Ruderman M A, Helmholz A C and Moyer B J, *Mechanics*, Berkeley Physics Course: Volume 1, 2nd Edition (2011)
14. Kleppner D and Kolenkow R J, *An Introduction To Mechanics* (Special Indian Edition) (2007).
15. *University Physics*. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986.Addison-Wesley.
16. https://www.mooc-list.com/tags/gravitation
17. https://archive.org/details/NPTEL-Physics
18. https://www.academia.edu/8233163/Basics_of_Mechanics_notes_

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

- Use the principles of projectiles to explain the manner in which gravity affects a projectile motion.
- Gain a deeper knowledge of mechanics and its fundamental concepts.
- Acquire the knowledge of gravitational force between objects and the centre of mass of objects.
- Learn rigid body dynamics in terms of moment of inertia and also analyze the center of gravity of different bodies.
- Analyze the special theory of relativity and its applications.

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First Year | **CORE PRACTICAL II** | **Semester II**

GENERAL PHYSICS I

Code: | **(Practical)** | **Credit: 4**

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

- To enhance the experimental skills of students.
- To develop the knowledge of laws and theorems in Physics through experimental study.
- To make the students realize the optical properties of certain materials by doing experiments.

EXPERIMENTS:

1. Determination of Young's modulus – Uniform bending by Koenig's method.
2. Determination of Rigidity modulus- Static Torsion method.
3. Determination of Rigidity modulus and moment of inertia using Torsional pendulum.
4. Sonometer - AC frequency.
5. Determination of 'g' and 'k' using a compound pendulum.
6. The figure of merit of a mirror Galvanometer.
7. Concave lens – Determination of focal length.
8. Determination of focal length, radius of curvature and refractive index of a long focus convex lens.
9. Air wedge- Determination of thickness of a thin wire.
10. Spectrometer – Determination of Refractive index of a hollow prism
11. Spectrometer– Determination of Refractive index of a liquid using a prism.
12. Spectrometer – Small-angle prism.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirappalli, 2009.
2. Dr.S. Somasundaram, *Practical Physics*, Apsara Publications, Tiruchirappalli, 2012.
3. C.C.Ouseph, U.J.Rao and V.Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai – 2014.
4. S. Srinivasan, *A Text Book of Practical Physics*, S.Sultan Chand Publications. 2005.
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

Upon completion of this course, the students would be able to

- Know the techniques of handling laboratory instruments.
- Evaluate a process based on the results obtained from the experiments quantitatively and qualitatively.
- Use the results of an experiment to describe a phenomenon.
- Develop the capacity of experimenting collaboratively and ethically.
- Acquire the skill of analyzing the properties of materials.

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Second Year **CORE COURSE III** **Semester III**

THERMAL PHYSICS

Code **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To make the students understand the Quantum theory of specific heat capacities of solids
- To impart the knowledge of changes of entropy in different process
- To make the learners evaluate the thermal conductivities of good and bad conductors
- To make the students to know the different sources of energy
- To provide knowledge so that the students can apply the principle of Refrigerating mechanism

UNIT – I THERMODYNAMICS:

Laws of Thermodynamics: Zeroth law - First law – Second law of Thermodynamics - Heat engines -Isothermal and adiabatic processes - Reversible and irreversible processes - Carnot's theorem - Proof - Internal combustion engine (diesel engine). Entropy: Change of entropy in adiabatic process - Change of entropy in reversible and irreversible process - T-S diagram – Thermodynamic scale of temperature –Thermodynamic potentials - Maxwell's thermo dynamical relations.

UNIT – II CONDUCTION:

Conduction: Coefficient of thermal conductivity –Rectilinear Flow of Heat along a Bar - Thermal conductivity of good conductors: Forbe's method -Thermal conductivity of a bad conductor: Lee's disc method –Heat flow through a Compound Wall – Accretion of Ice on Ponds – Wiedemann- Franz law- Practical Applications of Conduction of Heat.

UNIT – III RADIATION:

Stefan's law – Stefan- Boltzmann law- Deduction of Newton's law of Cooling from Stefan's law-Determination of Stefan's constant (laboratory method) –Black Body Radiation – Wien's Displacement law- Rayleigh – Jeans law- Planck's Law - Solar constant –Surface Temperature of the Sun – Angstrom's Pyrheliometer – Sources of Solar Energy- Photovoltaic cell – Green House Effect.

UNIT – IV LOW TEMPERATURE PHYSICS:

Joule - Kelvin effect - Temperature of inversion - Porous plug experiment - Liquefaction of gases -Principle of regenerative cooling -Linde's process - Liquefaction of Hydrogen - Adiabatic demagnetization - Liquefaction of Helium – Practical Applications of Low Temperature - Refrigerating mechanism – Air Conditioning mechanism- Solid Carbon dioxide (Dry Ice).

UNIT – V SPECIFIC HEAT CAPACITY:

Specific heat capacity of solids – Regnault's method of mixtures - Radiation correction- Dulong and Petit's law – Einstein's theory - Specific heat of liquids – Newton's law of cooling

– Specific heat of gases –Mayer's Relation – Quantization of various contributions to energy of diatomic molecules – Specific heat of diatomic gases.

UNIT – VI CURRENT CONTOURS (For Continuous internal assessment only):

Waste thermal Energy – Waste Heat Recovery – Thermal Energy Storage – Thermal Storage materials – Phase change Materials – Thermal Energy Storage Applications: Waste heat to Electricity and Solar Thermal Energy

REFERENCES:

1. Brij Lal, Dr. N. Subrahmaniyam and P.S. Hemine, *Heat, Thermodynamics and Statistical Physics* - S.Chand& Co., New Delhi. 2015.
2. J.B. Rajam and C.L.Arora, *Heat and Thermodynamics* - S.Chand & Co., New Delhi, 1983.
3. R. Murugesan, *Thermal Physics* - 1stEdition2002.
4. D.S. Mathur, *Heat and Thermodynamics* - S.Chand& Co.,2014.
5. Agarwal, Singhal, Sathyaprakash, *Heat andthermodynamics*.
6. H.C. Saxena and Agarwal,*Thermalphysics*.
7. M. Narayanamoorthy and N. Nagarathinam, *Heat*, National Publishing Co, Chennai, 8th edition, 1987
8. K. Pathak and Poppy Hazarika, *Thermal Physics,* Vishal Int. Ltd., 2020.
9. A.B Gupta And H.P.Roy, *Thermal Physics 5th Edition, Books & Allied P Ltd* 2020
10. Dr. UtpalJyotiMahanta, JunmiGogoi, et al., *Basic Thermal Physics,* Mahaveer Publications, 2020.
11. https://doi.org/10.1016/j.aej.2021.11.003
12. https://web.mit.edu
13. http://www.thermalfluidscentral.org/
14. https://www.grc.nasa.gov
15. https://peer.asee.org

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Recall the different specific heat capacities of matters.
- Understand the Maxwell's thermodynamic relations to relate the fundamental and derived quantities.
- Apply the knowledge of conduction of heat in practical applications.
- Use Stefan's constant to evaluate temperature of sun at a particular place.
- Analyze the different principles used in liquefaction of gases

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Second Year	**CORE PRACTICAL III GENERAL PHYSICS II**	**Semester III**
Code	**(Practical)**	**Credit: 4**

(ANY EIGHT EXPERIMENTS)

Objective:

To develop the skill of using laboratory instruments to determine some physical quantities required for the understanding of the logics and principles in physics.

Experiment

1. Specific heat capacity of a liquid- Newton's Law of cooling.
2. The emissive power of a surface -Spherical Calorimeter.
3. Joule's calorimeter- Specific heat capacity of a liquid.
4. Thermal conductivity of a bad conductor – Lee's disc method.
5. Spectrometer- i-d curve.
6. Spectrometer – i - i' curve
7. Spectrometer – Cauchy's constants.
8. Spectrometer – Grating – Normal incidence method.
9. P.O box – Determination of temperature coefficient of a coil.
10. Potentiometer – Calibration of an Ammeter.
11. Potentiometer – Temperature co-coefficient of a thermistors
12. Characteristics of a Junction diode and a Zener diode.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr. S .Somasundaram, *Practical Physics*, Apsara publications, Tiruchirapalli, 2012.
3. C.C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai.- 2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

On completion of the course the learner will be able to:

- Realize practically some phenomena of Physics.
- Acquire the skill of handling instruments.
- Develop the observation and circuit drawing skills.
- Enhance the skill of performing process-oriented experiments.
- Verify the laws in Physics through experimental results.

Second Year **NON-MAJOR ELECTIVE I** **Semester III**

DIGITAL ELECTRONICS

Code **(Theory)** **Credit: 2**

Course Objectives:

- To understand the basics of Digital Electronics.
- To Study various logical circuits and their implementation.
- To acquire knowledge on various digital circuits like Adder, Subtractor, Multiplexer, Demultiplexer, Decoder and Encoder.

UNIT – 1 NUMBER SYSTEM AND BINARY CODES:

Number System: Binary –octal - decimal - hexadecimal number system – conversion- Binary addition and subtraction - Binary Codes: BCD - Excess 3– ASCII.

UNIT – II LOGIC GATES:

Basic logic gates – AND- OR – NOT – NAND - NOR - EX-OR gates - Boolean equations- NAND - NOR as Universal Building blocks.

UNIT - III BOOLEAN THEOREMS:

Laws of Boolean algebra - De-Morgan's theorem - Min term - Max term – POS – SOP - K Map - Simplification by Boolean theorems -Don't care condition.

UNIT – IV COMBINATIONAL LOGIC CIRCUITS:

Combinational Circuits and its implementations - Arithmetic Circuits - Adders and Subtractors - BCD Adder -Multiplexer - Demultiplexers - Encoders and Decoders.

UNIT - V SEQUENTIAL LOGIC CIRCUITS:

R-S and D Flip-flop - J-K and T Flip-flop - Ripple Counter - UP/Down Counters - Shift Register-Serial in serial out - Parallel in Parallel out.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Memory Devices

Anatomy of Computer - A computer Systems - Computer Memory - RAM and ROM - Expanding Memory Capacity.

REFERENCES:

1. Anil K. Maini, "Digital Electronics: Principles, Devices and Applications" Wiley-India Pvt. Ltd, 1st Edition, 2008
2. David J. Comer "Digital Logic & State Machine Design", 3rd Indian Edition, Oxford University Press.
3. M Morris Mano, *Digital Logic and Computer Design*, 4th Edition, 2009,
4. Pearson, LPE, R.P.Jain, *Modern Digital Electronics*, McGraw-Hill, 4th ed. 2010.
5. Malvino& Leach *Digital Principles and Applications*, 7th Edition, McGraw-Hill Education
6. https://www.classcentral.com/course/youtube-digital-electronics-48205
7. https://www.youtube.com/watch?v=DBTna2ydmC0
8. https://nptel.ac.in/courses/108105132

COURSE OUTCOME:

Upon completion of this course, the student would be able to

- Perform conversion between various number systems.
- Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
- Identify, formulate and solve a problem based on combinational circuits
- Select the appropriate hardware and software tools for combinational circuit design.
- Verify the functions of various digital integrated circuits.
- Evaluate the specifications of logic families.
- Create a course project using digital integrated circuits.

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Second Year **CORE COURSE IV** **Semester IV**

ELECTRICITY AND MAGNETISM

Code **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To study the fundamental ideas on electrostatics and current electricity
- To classify materials based on their magnetic properties
- To understand the concept of resonance circuits

UNIT – I 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 – Energy stored in a charged capacitor–Loss of energy on sharing of charges between two capacitors.

UNIT – II CURRENT ELECTRICITY:

Ampere's circuital law and its applications -Field along the axis of a circular coil and Solenoid–Theory of Ballistic Galvanometer –Figure of merit– Damping Correction– Kirchhoff's Laws of Electricity – Wheatstone's bridge – Carey Foster's Bridge–Potentiometer– Calibration of Ammeter – Calibration of Voltmeter (Low range and High range) – Comparison of Resistances.

UNIT – III ELECTROMAGNETIC INDUCTION:

Laws of electromagnetic induction– Self and mutual induction– Self-inductance of a 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 of charge in a circuit containing C and R– Measurement of High resistance by leakage.

UNIT – IV AC CIRCUITS:

Alternating EMF applied to series circuits containing LC, LR and CR– Alternating EMF applied to circuits containing L, C and R–Series and Parallel resonance circuits– Sharpness of resonance–Q factor– Comparison between Series and Parallel resonant circuits –Power in AC circuits (R, L-R, L-C-R only) – Power factor–Watt less current – Choke Coil – Transformer – Uses of Transformers – Skin Effect.

UNIT – V MAGNETIC PROPERTIES OF MATERIALS:

Magnetic field – Magnetic induction – Intensity of Magnetization – Magnetic permeability – Susceptibility – Properties of para, dia, and ferromagnetic materials – Curie point - Curie temperature - Hysteresis – Retentivity – Coercivity – Experiment to draw B-H curve by magnetometer method – Loss of energy per cycle.

UNIT – VI Current contours (For continuous internal assessment only):

Maxwell's Equations, electromagnetic waves, reflection and refraction, wave guides, retarded potential, antennas, relativistic electrodynamics, four vectors, Lorentz, and transformation of fields.

REFERENCES:

1. BrijLal and N. Subrahmanyam, *A Text Book of Electricity and Magnetism*, S. Chand & Company Pvt. Ltd, New Deihi-2020.
2. R. Murugeshan, *Electricity and Magnetism*, S. Chand & Company Pvt. Ltd., New Delhi – 2017.
3. M. Narayanamurthy & N. Nagarathnam, *Electricity & Magnetism*, NPC pub., Revised edition-1992.
4. D. L. Sehgal, K. L. Chopra and N. K. Sehgal, *Electricity and Magnetism*, Sultan Chand& Sons. New Delhi-2020.
5. D.N.Vasudeva, *Electricity and Magnetism*, S.Chand& Co- 2011
6. K.K.Tewari, *Electricity and Magnetism*, S.Chand& Co-2002.
7. E.M.Pourcel, *Electricity and Magnetism*- Berkley Physics Course,Vol.2,McGrawHill Education; 2nd edition -2017.
8. D.C. Tayal, *Electricity and Magnetism*, Himalaya Publishing Co., Fourth Edition-2019.
9. D. Halliday, R.Resnick and J.Walker, *Fundamentals of Physics–Electricity and Magnetism*, iley India, Pvt Ltd -2011
10. David Griffith, *Introduction to Electrodynamics*, Pearson Education India Learning Private Limited; 4th edition- 2012.
11. R.B. Singh, *Fundamentals of Electricity and Magnetism,* New Age International (P) Ltd., Publishers-2018
12. BasudevGhosh,*Foundations of Electricity and Magnetism,* Books & Allied., Publishers-2021
13. Edward M. Purcell and Edward M. Purcell, *Electricity and Magnetism,* University printing house Cambridge- 2013
14. https://nptel.ac.in/courses/115104088
15. https://www.uou.ac.in/sites/default/files/slm/BSCPH-102.pdf

COURSE OUTCOMES:

On the completion of the course students will be able to:

- Understand fundamental laws of electricity and magnetism
- Analyze the calibration of electrical instruments.
- Verify the laws of electromagnetic induction
- Apply the knowledge of electricity and magnetism towards technological applications
- Differentiate magnetic materials

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Second Year	**CORE PRACTICAL IV ELECTRICITY**	**Semester IV**
Code	**(Practical)**	**Credit: 4**

(ANY EIGHT EXPERIMENTS)

Course Objectives:

Toprovide the knowledge on utilization of electrical devices to determine some electrical parameters by executing experiments.

EXPERIMENTS:

1. Meter bridge – Determination of specific resistance of a coil.
2. Determination of specific resistance – Carey Foster's Bridge.
3. Potentiometer – Calibration of low range voltmeter.
4. Potentiometer – Determination of resistance of a coil.
5. Potentiometer – emf of a thermocouple
6. Potentiometer – Calibration of high range voltmeter.
7. Anderson's Bridge – Self-inductance of a coil.
8. Field along the axis of a coil – Determination of moment.
9. B.G – Figure of merit.
10. B.G – Determination of mutual inductance.
11. Series resonance circuit.
12. Parallel resonance circuit.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr.S.Somasundaram,*PracticalPhysics*,Apsara Publications, Tiruchirapalli, 2012.
3. C.C.Ouseph,U.J.Rao and V.Vijayendran, *Practical Physics and Electronics*,Viswanathan Printers and Publishers,PVT Ltd (www.svprinters.com), Chetpet, Chennai- 2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

On completion of the course the learner will be able to

- Analyze the electrical parameters of some electrical components.
- Carry out electrical experiments with better understanding.
- Develop observation and circuit drawing skills.
- Enhance the skills of troubleshooting electrical circuits.
- Calibrate some electrical instruments

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Second Year **NON-MAJOR ELECTIVE II** **Semester IV**

MEDICAL PHYSICS

Code **(Theory)** **Credit: 2**

Course Objectives:

- To familiarize students with basic principles of radiation physics and also X-ray Generators, Particle Accelerators used in radiotherapy.
- Understand the basic physics of the electromagnetic and particulate forms of ionizing & non ionizing radiation and understand the interaction of photons.
- Understand the distinctions between the units of radiation quantity, exposure and dose.

UNIT – 1 NON-IONIZING RADIATION:

Electromagnetic spectrum - Different sources of NonIonizing radiation, Radio-frequency, Microwaves, Infrared, Visible and Ultra violet radiation production, physical properties and their interaction with tissues.

UNIT – II IONIZING RADIATION:

Radiation sources- Exposure to ionizing radiation- Health effects of ionizing radiation- Interaction of electromagnetic radiation with matter - Photoelectric and Compton process and energy absorption - Pair production - Attenuation and mass energy absorption coefficients.

UNIT – III RADIATION QUANTITIES AND UNITS:

Particle flux and fluence - energy flux and fluence -Linear and mass attenuation coefficients - Mass energy transfer and mass energy absorption coefficients - Stopping power - LET Absorbed dose - Kerma – Exposure.

UNIT – IV MEDICAL PHYSICS IN DIAGNOSTIC RADIOLOGY:

Discovery - Production - Properties of X-rays -– characteristics of X-ray – different modalities of X- ray – fluoroscopy – mammography – C arm – Digital radiography – Computed tomography (CT) – different generation of CT - Nuclear Medicine.

UNIT – V MEDICAL PHYSICS IN RADIOTHERAPY APPLICATIONS:

Construction and working of Tele-cobalt units - The Resonant transformer - Cascade generator - Van De Graff Generator - Pelletron - Cyclotron - Betatron - Synchro-Cyclotron - Design and working of Linear Accelerator

Unit – VI Current Contours (For continuous internal assessment only):

Positron emission tomography (PET) – Single photon emission tomography (SPECT)- Electron Synchrotron - Proton synchrotron.

REFERENCES:

1. K. Thayalan, Basic Radiological Physics ***(2nd Ed)***, Jaypee Brothers Medical Publishers, New Delhi, (2017).
2. Faiz M. Khan & John P. Gibbons, *The Physics of Radiation Therapy* ***(4th Ed)***, Lippincott Williams & Wikins, Philadelphia, (2010).
3. E.B. Podgorsak, *Radiation Oncology Physics: A Handbook for Teachers and Students***,** INTERNATIONAL ATOMIC ENERGY AGENCY VIENNA, (2005).
4. W. R. Hendee, *Medical Radiation Physics*, Year Book Medical Publishers Inc., London, (2003).
5. Martin Hollins, *Medical Physics,* Nelson Thornes Ltd, 1991
6. Dinesh K Baghel, *Medical Physics, Peepee Publishers, 2017*
7. Stephen Keevil, Renato Padovani, SlavikTabakov, Tony Greener, Cornelius Lewis, *An Introduction to Medical Physics,* CRC Press, 2022
8. B.H Brown, R.H Smallwood, D.C. Barber, P.V Lawford, D.R Hose, Medical Physics and Biomedical Engineering, CRC Press, 1999.
9. J. R. Cameron, J. G. Skofronick, *Medical Physics,* John Wiley & Sons, 1980.
10. https://www.youtube.com/watch?v=p2rx8Qpw49w
11. https://www.aapm.org/meetings/2010AM/documents/biggs2.pdf
12. http://www-naweb.iaea.org/nahu/DMRP/documents/Chapter5.pdf

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

- Gained knowledge about basic principle of medical physics.
- Understood the basic principles of Ionizing and non-ionizing radiations.
- Learnt the units of radiation.
- Understood the production and working principles of X-ray Generators.
- Learnt the theory of Interactions of photons with matter.

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Third Year | **CORE COURSE V** | **Semester V**

OPTICS

Code | **(Theory)** | **Credit: 5**

COUSE OBJECTIVES:

- To impart knowledge of geometrical optics
- To inculcate the fundamental laws concerning interference, diffraction, polarization and allied phenomena.
- To make the students gain knowledge of basic optical instrumentation

UNIT - I GEOMETRICAL OPTICS:

Spherical aberration - Spherical aberration of a thin and thick lens – Methods of reducing Spherical aberration – Skew rays-Coma – Aplanatic surface – Astigmatism – Curvature of the field – Meniscus lens – Distortion – Chromatic aberration - Chromatic aberration in a lens – Circle of least Chromatic aberration – Achromatic lenses –Computerized lens

UNIT - II INTERFERENCE:

Air wedge – Newton's rings – Haidinger's fringes – Brewster's fringes – Michelson Interferometer and its applications – Fabry- Perot Interferometer – Interference filter – Stationary waves in light – Colour photography (qualitatively) – Holography – Construction and reconstruction of a hologram – Applications.

UNIT - III DIFFRACTION:

Fresnel's diffraction – Diffraction at a (1) circular aperture (2) Straight edge (3) narrow wire – Fraunhofer diffraction at a single slit – Double slit – Missing orders in a Double slit, Diffraction pattern – Grating (theory) – Oblique incidence – Overlapping of spectral lines - Resolving power – Rayleigh's criterion of resolution- Resolving power of a Telescope and Grating – Dispersive power and resolving power of a grating.

UNIT - IV POLARIZATION:

Polarization - Nicol prism – Nicol prism as an analyzer and polarizer – Huygens's explanation of Double refraction in uniaxial crystals – Double Image polarizing prisms – Elliptical and Circularly polarized light – Production and detection – Quarter wave and half wave plates – Babinets compensator – Optical activity – Fresnel's explanation of optical activity – Specific rotation - Laurent's Half shade polarimeter.

UNIT - V OPTICAL INSTRUMENTS AND FIBRE OPTICS:

Microscopes -Simple microscope (magnifying glass) – Eyepieces- Huygens's eyepiece – Ramsden's eyepiece – Telescope. Optical Fibre–Advantages of optical fibre over copper wires - Total internal reflection – propagation of light through an optical fibre - Acceptance angle - Numerical aperture – Types of Optical Fibres based on materials, refractive index and modes of propagation – Fibre optic communication system.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Fibre optic sensors - Temperature sensors: Intensity modulated sensor, Phase modulated sensor - Displacement sensor – Force sensor –Liquid level detector.

REFERENCES:

1. N. Subrahmanyam Brijlal, M N Avadhanulu, *Optics*,S. Chand Publishing. Pvt. Ltd. New Delhi, 25th revised edition, 2013.
2. Manna Anandamoy Ghosh Krishnapada, *Text book of Physical Optics*, McMillan India Ltd, First edition, 2007.
3. Kiruthiga Sivaprasath, R. Murugeshan, *Optics and Spectroscopy*, S. Chand & Co, 5th edition, 201
4. Singh & Agarwal, *Optics and Atomic Physics*, Pragati Prakashan Meerut, Nineth edition, 2002.
5. A.B. Gupta, *Modern Optics*, Books and Allied (P) Ltd, Kolkata, 5thedition, 2021.
6. AjoyGhatak, *Optics*, McGraw Hill, New Delhi, 7th edition, 2020.
7. Arial Lipson, Stephen G. Lipson and Hentry Lipson, *Optical Physics*, Cambridge University Press, 4thedition, 2011.
8. Hect Eugene, Schaum's Outlines, *Optics*, Tata McGraw Hill, 2011.
9. R.S. Longhurst, *Geometrical and Physical Optics*, Longman Group Ltd, UK, Third edition,1999

COURSE OUTCOMES:

Upon completion of this course, the students would be able to

- Understand the geometrical optics
- Get the knowledge about interference and holography
- Acquire the theoretical aspects of diffraction and familiarize grating
- Grasp the fundamentals of polarization and its classification
- Understand the working principles of optical instruments like microscopes, telescopes and refract meters, etc.

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Third Year **CORE COURSE VI** **Semester V**

ATOMIC AND MOLECULAR PHYSICS

Code **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To familiarize the constituents of the atom, atomic models, the impact of magnetic and electric fields on spectra.
- To provide the necessary knowledge of the concepts of photoelectric cells.
- To provide the knowledge of molecular spectra and molecular orbital theories

UNIT – I CATHODE AND POSITIVE RAY – ANALYSIS:

Production and Properties of Cathode rays - Electronic charge - Millikan 'soil-drop method - Production and properties of positive rays - Thomson's parabola method-Aston's, Dempster's and Bain bridge mass spectrographs(e/m)–Mass defect and Packing Fraction.

UNIT – II Atom Model:

Introduction– Vectoratommodel - Quantum numbers- Pauli's exclusion principle - Magnetic dipole moment due to orbital motion and spin of the electron –The Stern and Gerlach experiment – Zeeman effect –Experimental arrangement for the normal Zeeman effect - Larmor's theorem - Quantum mechanical explanation of the normal Zeeman effect-Anomalous Zeeman effect-Paschen Back Effect –Stark effect.

UNIT – III FREE ELECTRON THEORY OF METALS AND PHOTOELECTRIC EFFECT:

Free electron theory of metals - Properties of metals -Drude and Lorentz theory – Electrical and thermal conductivities – Wiedemann and Franz law – Photoelectric effect- Lenard's experiment-Richardson and Compton experiment – Experimental investigation son the photoelectric effect-Laws of photoelectric emission - Einstein's photoelectric equation – Experimental verification - Millikan's experiment – Photoelectric cells – Photo emissive cell – Photovoltaic cell – Photoconductive cell-Applications of Photoelectric cells.

UNIT – IV MOLECULAR PHYSICS:

Molecular spectra – Theory of the pure rotational spectrum of a molecule - Theory of the origin of vibration -rotationspectrumofamolecule-Electronicspectraofmolecules-Molecular orbital theory of Hydrogen molecule ion – Heitler-London theory of Hydrogen molecule.

UNIT – V MOLECULAR ORBITALS:

Molecular Orbitals – Introduction – Linear Combination of Atomic Orbitals (LCAO) – Proper overlap between atomic orbitals – Molecular Orbital Theory – Introduction –Postulates – Types of molecular orbitals – Formation of molecular orbitals – Characterization of molecular orbitals – Features of molecular orbitals.

UNIT – VI CURRENT CONTOURS (For internal continuous assessment only):

Cold Atoms – Cold Molecules – Quantum Optics– Ultra fast Phenomena – Quantum Simulation – Atom interferometer and its applications – Molecular aspects of Cold Chemistry.

REFERENCES:

1. R. Murugesan, Kiruthiga Sivaprasath, *Modern Physics*, S. Chand & Co Ltd., New Delhi, 14th revised edition, 2016.
2. J.B. Rajam, *Atomic Physics*, S. Chand & Co Ltd., New Delhi, Revised edition, 2009.
3. S.N. Ghoshal, *Atomic Physics*, S. Chand & Co Ltd., New Delhi, Revised Edition, 2010.
4. N. Subrahmanyam, BrijLal, Jivan Seshan, Atomic and Nuclear Physics, S. Chand Publishing, 2008.
5. Puri, Sharma, Pathania, *Principles of Physical Chemistry*, Vishal Publications, 47 Edition, 2021.
6. Sehgal, Chopra and Sehgal, *Modern physics*, Sultan Chand & Sons, New Delhi, 2004.
7. Arthur Beiser, Shobhit Mahajan, S.RaiChoudhury, *Concepts of Modern Physics*, Sixth edition, SIE, 2009.
8. Robert L Brooks , *The Fundamentals of Atomic and Molecular Physics*, Springer, New York, 2014.
9. Dr. P.S Tambade, Dr. S.D. Aghav, Dr. G.R. Pansare, B.M. Laware, V.K.Dhas, Dr. B.G. Wagh, *Atomic and Molecular Physics*, Nirali Prakashan, Pune, India, 2018.
10. Christopher J. Foot, *Atomic Physics,* Oxford University Press, New York, 2005.
11. Peter W. Atkins, Ronald S. Friedman, Molecular Quantum Mechanics, Oxford University Press, Oxford, 2011.
12. https://www.pdfdrive.com/atomic-
13. https://content.kopykitab.com
14. https://collegedunia.com
15. http://chem.libretexts.org

COURSE OUTCOMES:

Upon completion of this course, the student would be able to:

- Learn about the elements that made up an atom.
- Acquire the knowledge of underpinning atomic models and the impact of magnetic and electric fields on spectra.
- Communicate the concept of photoelectric cells.
- Enhance the knowledge of molecular spectra
- Provide a detailed study of molecular orbital theories.

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Third Year	**CORE COURSE VII**	**Semester V**
	ELECTRONICS	
Code	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To provide the knowledge of intrinsic, extrinsic semiconductors and transistor circuit configuration
- To inculcate the digital electronic concepts required to analyse and design digital electronic circuits and systems.
- To impart knowledge of various number systems, data representation, logical circuits and their implementation, combinational, sequential digital systems and operational amplifiers.

UNIT – I SEMICONDUCTOR DIODES AND BIPOLAR TRANSISTORS:

Intrinsic and extrinsic semiconductors –PN junction diode – Biasing–V-I Characteristics– Rectifiers – Half wave – full wave and Bridge rectifiers – Break down mechanisms – Zener diode- Characteristics of Zener diode – Zener diode as voltage regulator-Bipolar junction transistor – Basic configurations -Relation between α and β – Characteristics of a transistor – CB and CE configuration.

UNIT – II AMPLIFIERS AND OSCILLATORS:

Single stage CE amplifier – Analysis of hybrid equivalent circuit – Power amplifiers – Efficiency of class A,B& C Power amplifier - General theory of feedback – Properties of negative feedback – Criterion for oscillations – Hartley oscillator – Colpitt's oscillator.

UNIT – III NUMBER SYSTEMS, LOGIC GATES AND BOOLEAN ALGEBRA:

Number Systems: Introduction to decimal, binary, octal, hexadecimal number systems – Inter conversions– 1's and 2's complements. Logic Gates: Symbols and their truth tables – AND, OR, NOT, NAND, NOR, XOR, and XNOR – Universality of NAND and NOR gates. Boolean Algebra: De-Morgan's theorems -Reducing Boolean expressions using Boolean laws – SOP forms of expressions (minterms) – Karnaugh map simplification (Four variables).

UNIT – IV COMBINATIONAL AND SEQUENTIAL DIGITAL SYSTEMS:

Combinational Digital Systems- Half and full adders – Half and full subtractors – Decoder(2:4 line) – Encoder(4:2 line)– Multiplexer(4:1 line) – Demultiplexer (1:4 line) – Sequential Digital Systems Flip flop – RS –clocked RS – T and D flip flops – JK and master slave flip flops – Counters –Four bit asynchronous ripple counter – Mod-10 counter - Shift registers – SISO and SIPO shift registers.

UNIT – V OPERATIONAL AMPLIFIER:

Operational amplifier - Characteristics of an ideal op-amp – Inverting and Non-inverting amplifier – Voltage follower – Adder, Subtractor, Integrator and Differentiator circuits – Log and antilog amplifiers.

UNIT – VI CURRENT CONTOURS (For Continuous internal assessment only):

4-bit parallel binary adder and subtractor – BCD adder – instrumentation amplifier – Karnaugh map reduction and logic circuit implementation.

REFERENCES:

1. Mehta V.K., *Principles of Electronics*, S. Chand and company Ltd, 2014.
2. A.P. Malvino, D.P. Leach, *Digital Principles and Application*, IV Edition, Tata McGraw Hill, New Delhi, 2011.
3. V. Vijayendran, *Digital Fundamentals*, S. Viswanathan (Printers & Publishers) Private Ltd, Chennai, 2014.
4. Theraja. B.L, *Basic electronics - Solid State*, S.Chand and Company Ltd 2002.
5. Sedha R.S., *A text book of applied Electronics*, S.Chand & company Ltd 2002.
6. W.H.Gothmann, *Digital Electronics*, Prentice Hall of India, Pvt. Ltd., New Delhi 1996.
7. Mehta V.K., Rohit Mehta, *Principles of Electronics*, S. Chand and company Ltd, Revised edition 2010, ISBN 81-219-2450-2.
8. Ben G. Streetman, Sanjay Banerjee, *Solid state electronic device,* Pearson Education (pvt.Ltd.,) NewDelhi, India, fifth edition 2004.
9. Chattopadhyay T., *Advanced Electronics,* CBS publisher, ISBN -978-9390709007, 2021
10. Ganguly, Partha Kumar, *Principles of Electronics,* PHI Learning Pvt. Ltd., 2015.
11. D. H. Horrocks, *Feedback circuits and Op. Amps*, Springer Science & Business Media, 2013.
12. https://www.youtube.com/watch?v=_dQ3OdbyDMk
13. https://nptel.ac.in/courses/108105113
14. https://nptel.ac.in/courses/108101091
15. https://nptel.ac.in/courses/108102145
16. https://www.classcentral.com/course/youtube-digital-electronics-48205
17. https://www.youtube.com/watch?v=DBTna2ydmC0
18. https://nptel.ac.in/courses/108105132
19. https://www.youtube.com/watch?v=kiiA6WTCQn0
20. https://www.youtube.com/watch?v=kbVqTMy8HMg

COURSE OUTCOMES:

On completion of the course the students will be able to:

- Understand the fundamental principles of semiconductors including p-n junctions and zener diode
- Analyze the characteristics of transistor and transistor biasing circuits
- Perform conversion between various number systems.
- Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
- Identify, formulate and solve problems based on combinational circuits
- Verify the functions of various digital integrated circuits.
- Carry outthe project using digital integrated circuit

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Third Year **CORE PRACTICAL V** **Semester V**

OPTICS AND DIGITAL ELECTRONICS

Code **(Practical)** **Credit: 4**

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

To ignite the minds of the learners with the practical knowledge of Physics by enhancing the hidden talents in troubleshooting experiments.

EXPERIMENTS:

1. B.G. – Absolute capacity of a condenser.
2. Spectrometer – Grating – Minimum deviation position.
3. Spectrometer – Dispersive power of a grating.
4. Construction and study of a Full Wave Rectifier.
5. Transistor characteristics – CE configuration.
6. FET characteristics.
7. Single-stage RC coupled amplifier – Transistor.
8. AND, OR and NOT Gates – Discrete components.
9. AND, OR and NOT Gates – Using ICs
10. Realizing NOR gate as a Universal gate.
11. Realizing NAND gate as a Universal gate.
12. OP-AMP - Adder and Subtractor

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr.S.Somasundaram, *Practical Physics*, Apsara publications, Tiruchirapalli, 2012.
3. C.C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics,* Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai-2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand Publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOME:

On completion of the course the learner will be able to:

- Understand the characteristics of electronic components.
- Evaluate a process based on the results obtained from the experiments quantitatively and qualitatively.
- Obtain the scope of the investigation as expected.
- Link a process with help of the outcomes of an experiment.
- Develop the skill of experimenting collaboratively and ethically.

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Third Year **MAJOR BASED ELECTIVE I** **Semester V**

1) SOLID STATE PHYSICS

Code **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To impart the knowledge of crystallography.
- To introduce the basic ideas of bonding and defects in solids
- To make the students understand the properties of metals and semiconductors
- To inculcate the knowledge of dielectric, magnetic and superconducting properties of materials.

UNIT – I CRYSTAL SYSTEMS:

Basic concepts of crystal –Lattice – Basis – Crystal structure - Unit cell – primitive cell-lattice parameters – crystal systems – Bravais lattices – SC, BCC, FCC, HCP crystal structures –number of atoms in unit cell- atomic radius-coordination number - packing fraction- crystal planes – Miller indices- Bragg's law-crystal structure analysis-Laue's photographic method-Powder crystal diffraction method.

UNIT– II BONDING AND DEFECTS IN SOLIDS:

Interatomic forces – Bonding in solids – Primary bonds – Ionic, Covalent and metallic bonds – Secondary bonds – Dipole, dispersion and hydrogen bonds.
Defects in solids – point defects: vacancy, interstitials, impurity – Line defects: Edge dislocation, screw dislocation –Surface defects: Grain boundary, stacking faults-volume defects.

UNIT– III ELECTRON THEORY OF METALS AND SEMICONDUCTORS:

Classical free electron theory of metals- – Electrical and Thermal conductivity-Wiedemann Franz law – Quantum free electron theory –Fermi energy- density of states – Band theory of solids – Brillouin zones. Semiconductors – carrier concentration of intrinsic-electrical conductivity- carrier concentration of P-type and n-type – Hall Effect – experimental determination of carrier concentration and mobility – application.

UNIT– IV DIELECTRIC AND MAGNETIC PROPERTIES:

Dielectrics: – polarization — dielectric constant- types of polarization – Lorentz field (derivation) – Clausius - Mossotti relation – Properties of dielectric materials – Dielectric loss and breakdown. Magnetism:dia, para, ferro, antiferro and ferri-magnetism – Ferromagnetic domains- Anti ferromagnetic materials – Ferrimagnetic materials.

UNIT– V SUPER CONDUCTIVITY:

Introduction – Historical developments – General properties of superconductivity - Critical field and Crystal temperature – Meissner effect — Type I and Type II superconductors – London equations - penetration depth - Isotope effect– BCS theory – Applications of superconductors.

UNIT – VI CURRENT CONTOURS (For Continuous internal assessment only):

Smart Materials

Introduction to smart materials – Components of smart materials – Classification of smart materials – Shape memory alloys – Applications of smart materials.

REFERENCES:

1. *Solid State Physics* – N. Singh, Wiley India, ISBN: 978-9390455249, 2021
2. *Solid State Physics* – Gupta & Kumar, K. Nath & Co, Meerut,2000.
3. *Solid State Physics* – Singhal, Kedarnath Ramnath & Co,Meerut,2005.
4. *Material Science* – M.Arumugam, Anuratha Agencies, 2002.
5. *Materials Science* – S. L. Kakani and AmitKakani, 3rd Edition, New Age International, 2016
6. *Introduction to Solid State Physics* – Charles Kittel, John Wiley, 2004.
7. *Elementary Solid State Physics* – Ali Omar, Addison Wesley Publishing Company, 1975.
8. *Elements of Solid State Physics* – J.P. Srivastava, Second Edition, PHI learning Pvt. Ltd., 2006.
9. *Solid State Physics and Electronics* – A.B. Gupta & NurulIslam, Books & Allied Ltd, 2012 ISBN: 978-8187134831
10. *Solid State Physics* - V. K. Dhas Dr. S. D. Aghav, B. M. Laware, Dr. P. S. Tambade, Nirali Prakashan Publishers, 2019.

COURSE OUTCOME:

Upon completion of this course, students would be able to

- To find the crystal structure of materials applying their learnt knowledge.
- To differentiate the bonding in solids and identify the defects prevalent in crystalline solids
- To apply the gained knowledge about theories on conductors and semiconductors for learning related advanced topics
- To analyze the dielectric and magnetic various materials.
- To review the peculiar properties of superconducting materials and their implications.

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Third Year **MAJOR BASED ELECTIVE I** **Semester V**

2) LASER PHYSICS

Code **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To provide knowledge of the principle and characteristic features of lasers.
- To impart the concepts of the transient operations
- To make the students acquire knowledge of the working principles of different types of Lasers
- To inculcate the Industrial and Medical applications of lasers
- To transfer the knowledge about the holography and its applications

UNIT – I FUNDAMENTALS OF LASER:

Introduction to LASER - Principle – Characteristics of LASER – Einstein's co-efficient - Derivation - Population Inversion - Pumping action - Optical resonator- different configurations of optical resonators – Stability condition (no derivation required) and stability diagrams for optical resonators

UNIT – II TRANSIENT EFFECT:

Transverse and longitudinal mode selection- Principle of Q- switching and Mode locking – Different types of Q- switching: Electro-optic Q- switching and Pockel's cell.

UNIT – III LASER SYSTEMS:

Ruby LASER – Nd-YAG LASER– He-Ne LASER - CO2 LASER - Dye LASER - Semiconductor LASER: - Homo junction and Hetero junction.

UNIT – IV APPLICATIONS OF LASERS:

Material processing: Welding, Drilling, Cutting and Heat treatment – Medical: Surgery – Ophthalmology – Dermatology –Endoscope - Communication: LIDAR – LASER in Fibre Optics – Optical waveguides and sensors – Laser safety precautions

UNIT – V HOLOGRAPHY:

Introduction – Principle of Holography – Co axial Holography – Off – axis Holography – Holograms – Important Properties of Hologram – Classification of Holograms applications – Medical applications of Holography.

UNIT – VI CURRENT CONTOURS (For Continuous internal assessment only):

Atom laser: Bose-Einstein condensation – Methods of cooling atoms – Laser doppler cooling - Basic atom Laser –Atom laser applications.

REFERENCES:

1. N. Subrahmanyam Brijlal, M N Avadhanulu, *Optics*, S. Chand Publishing. Pvt. Ltd. New Delhi, 25th revised edition, 2013.
2. B. B. Laud, *Lasers and nonlinear optics* – Wiley Eastern Ltd., (1985)
3. K. Thiyagarajan and A. K. Ghatak, *LASERS: Theory and* Ap*plications* – Macmillan India Ltd.
4. A. Sundaravelusamy, *Applied Physics II,* Priya publications, Revised edition 2015.
5. A.K. Pandey, C. K. Pandey and Manisha Bajpai, Fundamentals of LASER Systems and Applications, Wiley publisher, 1st Edition, 2017, ISBN: 9788126568260, 8126568269.
6. William Silfvast, *Laser Fundamentals*, Cambridge press, 2004
7. O. Svelto,*Principles of lasers*, 5th Edition 2010, SPRINGER
8. A.E Siegman, *Lasers*, University Science Books, California, 1986
9. Peter W. Milonni, Joseph H. Eberly, *Laser Physics*, John Wiley & Sons, 2010.
10. Orazio Svelto, *Principles of Lasers,* Springer Science & Business Media, 2013.
11. Karl F. Renk, Basics of Laser Physics, Springer, 2017
12. Kusam Devgan, SurinderKaur, *Quantum and Laser Physics,* Newrays Publishing House, 2021
13. https://ebook-new.com/gets/book.php?id=dpVDTLPySTQC&item=basics-of-laser-physics&data=bookarchive.net
14. https://ebook-new.com/gets/book.php?id=z13wEOBwn1wC&item=lasers&data=bookarc
15. http://www.youtube.com/c/IIT
16. http://www.youtube.com/c/Nanotechnology

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- Recall the basic light matter interaction, characteristics of atomic transitions
- Analyze the different types of lasers and their features
- Apply the working principle to produce different types of Lasers
- Describe how the Lasers can be used in various Industries and Medicine
- Adapt appropriate safety measures when handling laser experiments.

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Third Year **SKILL BASED ELECTIVE I** **Semester V**

ELECTRICAL WIRING FUNDAMENTALS

Code **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To impart the knowledge about generation of Electricity.
- To provide knowledge of AC, DC, types of electrical circuits, transformers etc.
- To develop skills on electrical wiring.

UNIT – I GENERATION OF ELECTRICITY:

Conventional methods of power generations – Thermal power plant – Atomic power station – Solar energy – wind mill energy.

UNIT – II FUNDAMENTALS OF ELECTRICITY:

Electron theory – Flow of electrons and current – Resistance - Electromotive Force - voltage – potential difference – voltage drop – alternating current – direct current – Ohm's law – Effects of electric current – Types of electrical circuits – work, power and energy.

UNIT – III SINGLE PHASE AND POLYPHASE AC CIRCUITS:

Alternating current – amplitude – time period – frequency – RMS value – polyphase – 2 phase – 3 phase – advantage of polyphase over single phase – star connection – delta connection.

UNIT – IV TRANSFORMER:

Construction – principle of operation – classification of transformers – types of core – Transformer losses – Efficiency – Alternator – Parts of an alternator – AC three phase motors – AC single phase motors.

UNIT – V HOUSE WIRING:

Earthing – Necessity of earthing – Types of earthing – safety fuse – circuit breaker – thermal fuses – Toggle switch – keyboard switches – wires and cables – connectors.

REFERENCES:

1. Electrical power – Dr. S. L. Uppal.
2. Basic Electrical Engineering – M. L. Anwani.

COURSE OUTCOMES:

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

- Distinguish various types of electrical components
- Recall the basic principles of electrical wiring
- Identify and rectify the defects in simple electrical circuits.
- Do electrical wiring.

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Third Year **CORE COURSE VIII** **Semester VI**

NUCLEAR PHYSICS

Code **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To introduce basic concepts and properties of the atomic nucleus.
- To impart knowledge of radioactivity and related phenomena.
- To inculcate various interactions of nuclear radiation with matter.
- To make the students understand the fission and fusion reactions and their applications.
- To emphasize the understanding of nuclear forces, nuclear models, elementary particles and accelerators.

UNIT – I GENERAL PROPERTIES OF NUCLEI & NUCLEAR FORCES:

Classification of nuclei – General properties of nucleus–determination of nuclear size – electron scattering experiment –Dempster's mass spectrograph – binding energy, mass defect and packing fraction – stability and binding energy curve – Semi-empirical mass formula – Nuclear spin and magnetic moment – Electric quadruple moment – Nuclear forces – basic properties- Meson theory of Nuclear forces.

UNIT – II RADIOACTIVITY:

Laws of Natural radioactivity – Law of radioactive disintegration – Half life period – Mean life period – Law of successive disintegration – Radioactive Equilibrium – Types of radioactive radiations –Properties – Alpha emission –Geiger and Nuttal law – Alpha particle spectra – Theory of alpha decay –Gamow's theory – Beta ray spectra – line and continuous spectrum – Neutrino theory – Gamma raysspectra – origin of Gamma rays – Nuclear isomerism – Internal conversion.

UNIT – III NUCLEAR REACTIONS:

General ideas of nuclear reactions –types of Nuclear reactions – energy balance in nuclear reaction – threshold energy – nuclear transmutations – types of transmutations with examples – discovery of neutron – properties -Nuclear models: liquid drop model – shell model - fission – fusion.

UNIT – IV DETECTORS AND ACCELERATORS:

Solid state detectors – Geiger-Muller counter – Wilson-cloud chamber – Bubble chamber –Scintillation counters – Cerenkov counter – Linear accelerator – Cyclotron – Synchrocyclotron – Betatron – Electron synchrotron – Proton synchrotron.

UNIT – V COMIC RAYS AND ELEMENTARY PARTICLES:

Discovery of Cosmic rays – Latitude effect – Azimuth effect – Altitude effect – Primary and Secondary cosmic rays – cosmic ray showers – Van Allen belts – Origin of cosmic rays – Elementary particles: classification – Particles and antiparticles – fundamental interactions – elementary particle quantum numbers – conservation laws and symmetry.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Radiation monitoring – Dosimeters – Biological effects of radiation –Penetration and ionizing power of nuclear radiation in human body – Nuclear power plants in India

REFERENCES:

1. R. Murugesan, S. Kiruthiga, *Modern Physics,* S. Chand Company Ltd. Revised edition (2006).
2. M.L. Pandya, R.P.S. Yadav, Amiya Dash, *Elements of Nuclear Physics*, KedaarNath& Ram Nath (2000).
3. Satya Prakash*, Nuclear Physics*, A Pragati Prakasan Publication (2011).
4. Vimal Kumar Jain, *Nuclear and Particle Physics,* Ane Books (2016)
5. N. Subrahmanyam BrijLal, Jivan Seshan, *Atomic and Nuclear Physics*, S. Chand; Reprint Edn. (2006) edition.
6. Gupta & Roy., *Physics of the Nucleus*, Books and Allied (P) Ltd. Kolkatta (2011).
7. S. N. Ghoshal, *Nuclear Physics (Revised Edition)*, S. Chand & Company PVT, LTD, New Delhi (2016).
8. S. B. Patel, *Nuclear Physics: An Introduction,* New AGE (2020)
9. W. J. Price, *Nuclear Radiation Detectors*, McGraw-Hill
10. D. C. Tayal, *Nuclear Physics,* Himalaya Publishing House, (2009).
11. https://onlinebooks.library.upenn.edu/webbin/book/lookupid?key=olbp75446)

COURSE OUTCOMES:

Upon completion of this course, students would be able to

- Gather advanced knowledge in nuclear physics.
- Explain the general properties of the nucleus, shell model and collective model
- Gain knowledge to explain the radioactive decays and apply various aspects of nuclear reactions in view of compound nuclear dynamics.
- Describe the working principles of nuclear detectors and accelerators
- To explain the nuclear fusion, nuclear fission reaction and elementary particles.

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Third Year **CORE COURSE IX** **Semester VI**

THEORETICAL PHYSICS

Code **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To give an exposure to advanced topics in Physics and to learn the basis of fundamental principles and the Lagrangian formulation.
- To enhance students understanding about relativity.
- To build a strong base on the foundation of Quantum Mechanics.
- To get acquainted with problem solving skills in the basic aspects of Lagrangian Mechanics, relativity and foundation of Quantum mechanics.
- To provide a basic knowledge in the topic Universe.

UNIT – 1 FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION:

Mechanics of a particle and system of particles – Conservation laws - Constraints – Generalized coordinates – Principle of virtual work – D' Alembert's principle and Lagrange's equation – Hamilton's principle – Lagrange's equation of motion – Simple pendulum – Atwood's machine – Conservation theorem and symmetry properties.

UNIT – II RELATIVISTIC DYNAMICS:

Lorentz Scalars and Lorentz Vectors – Relativistic Linear Momentum and Energy – Energy and Linear momentum of subatomic Particles – Conservation Laws and Transformation Rules for Energy and Linear Momentum – Photons and Doppler Shift - Relativity and Subatomic Particles; Relativistic Collisions and Decay – Mass to Energy Conversion.

UNIT – III DUAL NATURE OF MATTER:

De Broglie concept of matter waves – De Broglie wavelength – Wave velocity and group velocity for the De Broglie waves – Experimental study of matter waves – Davison and Germer experiment – Heisenberg's uncertainty principle.

UNIT – IV BASICS OF QUANTUM MECHANICS:

Basic postulates of wave mechanics – Development of Schrödinger wave equation – Time independent and dependent forms of equation – Properties of wave function – Orthogonal and normalized wave function and eigenvalues – Expectation values and Ehrenfest's theorem – Particle in a box.

UNIT – V THE UNIVERSE:

Introduction –Galaxy - Milky way galaxy - Structure of the Sun – Temperature of the Sun – The Earth-Moon system – Composition of Earth's internal shells and Earth's

magnetic field – Neutron stars – Pulsars – Black Holes – The origin of the Universe (Big Bang Theory) – Stellar evolution – Proton-proton cycle.

UNIT – VI CURRENT CONTOURS (For Continuous internal assessment only):

Quantum sensors – Quantum sensing for gravity cartography – Quantum based search for dark matter – Relativistic astrophysics.

REFERENCES:

1. S. I. Gupta, V. Kumar and Hv. Sharma, *Classical Mechanics* (Pragati Prakashan, Meerut, 2019).
2. J. C. Upadhyaya, *Classical Mechanics* (Himalaya Publishing House, Bangaluru, 2019).
3. G. Aruldas, *Quantum Mechanics* (PHI Learning Pvt. Ltd., New Delhi, 2008).
4. A. K. Saxena, *Principle of modern physics* (Narosa, New Delhi, 2014).
5. R. Murugesan, KiruthigaSivaprasath, *Modern Physics* (S. Chand, 2006).
6. H. Goldstein, C. P. Poole and J. Safko, *Classical Mechanics* (Pearson, London, UK, 2019).
7. N. C. Rana and P. S. Joag, *Classical Mechanics* (Tata McGraw-Hill, New Delhi, 2017).
8. N. Zettili, *Quantum Mechanics* (Wiley Pvt. Ltd., India, 2016).
9. L. D. Landau and E. M. Lifshitz, *Mechanics* (Elsevier, India, 2010).
10. Georg Joos, Ira M. Freeman, *Theoretical Physics,* (Dover Publications; 3rd Revised ed. edition 2013).
11. https://Theoretical-Physics-1-Classical-Mechanics-ebook/dp/B01HPHM7HE
12. https://Theoretical-Physics-Dover-Books-ebook/dp/B00C8UR0B2

COURSE OUTCOMES:

Upon completion of this course, Students would be able to

- Grown familiarity with the foundation of Classical Mechanics.
- Develop problem solving skills in Mechanics.
- Understand the basic formalism of Quantum Mechanics.
- Understand mathematical implication in Physics.
- Acquire basic knowledge about our Universe.

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Third Year **CORE PRACTICAL VI** **Semester VI**

ELECTRONICS, MICROPROCESSOR AND PROGRAMMING

Code **(Practical)** **Credit: 4**

COURSE OBJECTIVE:

- To improvise the knowledge on utilization of electronic devices in electrical appliances by performing some experiments and executing programmes in order to realize the applications of microprocessors and computers.

EXPERIMENTS:

SECTION A
(ANY FOUR EXPERIMENTS)

1. Construction of a regulated power supply using Zener diode – Percentage of regulation.
2. Hartley oscillator using Transistor.
3. OP-AMP –Integrator and Differentiator.
4. Half adder and full adder using basic and EX-OR gates.
5. Half subtractor and full subtractor using basic and EX-OR gates.
6. Verification of Boolean laws (Any four).

SECTION B - MICROPROCESSOR 8085
(ANY TWO EXPERIMENTS)

1. 8 – bit addition and 8 – bit subtraction.
2. 8 – bit multiplication and 8 – bit division.
3. Finding the larger and the smaller number in a data array.
4. Block data transfer.

SECTION C - COMPUTER PROGRAMMING IN C
(ANYTWO EXPERIMENTS)

1. Conversion from Centigrade to Fahrenheit.
2. Calculation of volume of Sphere, Cone, Cube and Cuboid.
3. Sum of series of numbers of a given array.
4. Finding the average of the set of numbers in an array.

REFERENCES:

1. Department of Physics, *Practical Physics*, (B.Sc. Physics Main), St. Joseph's College, Tiruchirapalli 2009
2. Dr. S. Somasundaram, *Practical Physics*, Apsara Publications, Tiruchirapalli, 2012.

3. C.C. Ouseph, U.J. Rao and V. Vijayendran, *Practical Physics and Electronics*, Viswanathan Printers and Publishers, PVT Ltd (www.svprinters.com), Chetpet, Chennai - 2014
4. S. Srinivasan, *A Text Book of Practical Physics*, S. Sultan Chand publications. 2005
5. R. Sasikumar, *Practical Physics*, PHI Learning Pvt. Ltd, New Delhi, 2011.

COURSE OUTCOMES:

On completion of the course, the learner will be able to:

- Perform few technical operations with electronic equipments.
- Understand the use of electronic components in Digital computers.
- Acquire the skill of verifying laws in Physics through experiments.
- Realize the applications of electronic devices.
- Acquire the skill of applying the developed software for some scientific and industrial applications.

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Third Year **MAJOR BASED ELECTIVE II** **Semester VI**

1) MICROPROCESSOR AND C PROGRAMMING

Code **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

The purpose of this course is to introduce students about the key features and implementation of C language and 8085 Microprocessor ALP.

- To introduce algorithms and flowcharts for language independent programming logic development.
- To provide fundamental knowledge on the Architecture and Instruction Set of8085.
- To impart the various features and components of C program writing.

UNIT – I BASICS OF DIGITAL COMPUTER, INTEL 8085 MICROPROCESSOR ARCHITECTURE AND INSTRUCTIONS

Basic components of digital computer - Semiconductor memories – Hardware and Software –History of microprocessors - INTEL 8085 - Pin Diagram - Architecture - Various registers - Status Flags - 8085 Instructions: Machine Language, Assembly Language, Instruction Set and Format - Data Transfer, Arithmetic, Logical, Branching and Machine Control Operations - Addressing Modes: Register, Implied, Immediate, Direct and indirect addressing.

UNIT – II ASSEMBLY LANGUAGE PROGRAMMING:

Addition - subtraction - multiplication -division of two 8- bit numbers - Finding the largest and smallest number in a data array-Arranging a list of numbers in ascending or descending order-complement – shift – mask-look up table– multibyte addition and subtraction –decimal addition - subtraction.

UNIT – III ESSENTIALS OF C LANGUAGE:

Basic Structure of C Programs – Character set – C tokens - Keywords and identifiers – constants – variables – Data types – declaration of variables – Assigning values to variables – Symbolic constants – Operators and Expressions -Arithmetic operators - Relational, Logical and Assignment operators, Increment and Decrement operators – Conditional operator, Bitwise and Special operators– Arithmetic Expressions – Mathematical functions.

UNIT – IV I/O FUNCTIONS AND CONTROL STATEMENTS:

Data input and output: getchar, putchar, scanf, printf functions - Decision making and branching : simple if - if…else - else if ladder – switch – break - continue -goto – Looping : while - do… while - for - nested loops.

UNIT – V ARRAYS AND C LANGUAGE PROGRAMMING:

Introduction to Arrays – Declaration - Initialization — One dimensional array —Two dimensional arrays – Library functions.

C Language Programming:

1. Conversion of Centigrade into Fahrenheit.
2. Calculation of volume of sphere/cone/cube/rectangular cuboid.
3. Solving quadratic equation.
4. Sum of digits of a series
5. Finding the largest and smallest number in a data array
6. Arranging numbers in ascending order/descending order.
7. Matrix arithmetic operation (Addition/Subtraction/Multiplication)

UNIT – VI CURRENT CONTOURS: (For continuous internal assessment only):

Introduction to functions - Function Declaration -Function definition -Function call – Recursion -Structures – Unions.

REFERENCES:

1. B. Ram – *Fundamentals of Microprocessors and Microcontrollers*–DhanpatRai Publications (P) Ltd., New Delhi, 2013.
2. E. Balagurusamy – *Programming in ANSI C* – Tata McGraw Hill Education Private Limited, New Delhi,2018.
3. YashavantKanetkar, *Let us C,* BPB Publications, Fifteenth edition 2017.
4. Carl Hamacher, ZvonkoVranesic, SafwatZaky*Computer Organization*, McGraw-Hill, Fifth Edition, Reprint 2017
5. R. S.Gaonkar- *Microprocessor Architecture, Programming, and Applications with the 8085*, Penram International Publishing (India) Private Limited, Mumbai,2007.
6. Dr D A Godse and A P Godse, *Microprocessors & Introduction to Microcontroller: 8085, 8086, 8051 - Architecture, Interfacing and Programming,* Technical Publications, 2020
7. K. R. Venugopal and S. R. Prasad – *Programming with C* – Tata McGraw-Hill Publishing Company Limited, New Delhi, 2002.
8. *Advance Microprocessor*, DenielTabak, TMH.
9. IBM PC *Assembly Language & Programming*, Peter Abel, PHI.
10. S. Palaniswamy, *Physics through C- Programming*, A Pragati Edition, 2004.
11. https://www.youtube.com/watch?v=4pTiujyY4IM
12. https://www.youtube.com/watch?v=zAXAb_ttazY
13. https://nptel.ac.in/courses/106106210
14. https://nptel.ac.in/courses/108105102
15. https://archive.nptel.ac.in/courses/106/104/106104128/

COURSE OUTCOMES:

Upon completion of this course, the students would be able to:

- Study of the basic structure and operation of a digital computer system.
- Describe architecture of 8085 processors.
- Write, compile and debug programs in assembly language
- Develop algorithms for arithmetic and logical problems and write programs in Assembly and C language.
- Design programs involving decision structures, loops, and arrays.
- Create and perform different Programs.

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Third Year **MAJOR BASED ELECTIVE II** **Semester VI**

2) NANOTECHNOLOGY

Code **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To introduce basics of nanoscience, nanomaterials and nanotechnology.
- To impart the knowledge of nanomaterials preparation methods
- To make the students learn the characterization techniques for analysing the properties of nanomaterials and applications of nanomaterials.

UNIT– I INTRODUCTION TO NANOTECHNOLOGY:

Nanoscience – Nanotechnology – Definitions - History of nanotechnology – Nanomaterials: classification – Zero, one and two dimensional nanomaterials – Properties of nanomaterials– Surface area to volume ratio (S.A/V) – Effect of S.A/V on the properties of materials –Quantum dots– Production of quantum dots – Applications of quantum dots– Quantum wires –properties and applications of quantum wires-Challenges in nanotechnology.

UNIT – II PREPARATION METHODS:

Top-down and Bottom-up approaches–Top-down methods: Ball milling, Chemical etching photolithography and Electron beam lithography –Advantages– Limitations. Bottom-up methods: Vacuum evaporation, Sputter deposition process, Laser ablation, Hydrothermal method – Advantages– Limitations.

UNIT– III FULLERENES:

Fullerenes–Types of fullerenes–Bucky ball/Buckminster fullerene-Carbon nano tubes (CNTs) - Single walled CNTs – Multi walled CNTs – Differences – Properties of CNTs: mechanical, electrical and superconducting properties – Preparation of CNTs – Plasma discharge method – Chemical vapour deposition method – Applications.

UNIT–IV CHARACTERIZATION TECHNIQUES:

Construction, working principle, merits and demerits of X-ray diffractometer-Scanning Electron Microscope (SEM) – Atomic Force Microscope (AFM) – UV-Vis–NIR double beam spectrophotometer– Energy dispersive X-ray analysis (EDAX)- SQUID – Raman spectroscopy.

UNIT– V APPLICATIONS:

Nanoelectronics – Molecular electronics – Nanophotonics – Nanorobotics – Nanomechanics –Carbon nanotubes FETs–Nano MOSFETs – Molecular diodes and transistors – Biomedical applications: Targeted drug delivery –targeted chemotherapy.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Bandgap engineered quantum devices – Quantum computers– Nanomaterials in environmental applications – Nanomaterials in energy

REFERENCES:

1. K. Ravichandran, K. Swaminathan, P. K. Praseetha, P. Kavitha, *Introduction to Nanotechnology*, JAZYM publications, 2019 ISBN 978-93-87360-40-2
2. M. Ratner et. al., *Nanotechnology*; A Gentle intro Practices–hall, 2002, ISBN 0-13-101400-5, 2003.
3. Nanotechnology; *Basic Science and Emerging Technologies*, CRC Press, 2002, ISBN 9781584883395
4. Charles P. Poole Jr and Frank J. Owens. "*Introduction to Nanotechnology*" Wiley, 2003, DOI: 10.1002/anie.200385124
5. R. B. Bhise, A. B. Bhise, V.D. Kulkarani, A.P Zambare, *Physics of Nanomaterials*, 2019 ISBN 978-93-89406-80-1
6. A. S. Edelstien and R.C. Cornmarata, *Nanomaterials; synthesis, Properties and Applications*, 2ed, Iop (U.K), 1996.
7. Shubra Singh M.S. Ramachandra Rao, Nanoscience and Nanotechnology: Fundamentals of Frontiers, Wiley publications, 2013.
8. Thomas Varghese & K.M. Balakrishna, *Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials,*Atlantic; Reprint 2016 edition (1 January 2021)
9. William Illsey Atkinson, *Nanotechnology,* Jaico Publishing House; First edition (9 July 2006)
10. Risal Singh ShipraMital Gupta, *Introduction to nanotechnology,* Oxford University Press (2018)
11. https://en.wikibooks.org/wiki/Nanotechnology
12. https://bookboon.com/en/nano-technology-ebook

COURSE OUTCOMES:

Upon completion of this course, the students would be able to:

- Classify the synthesizing techniques based on the states of matter
- Make use of the available instruments to study the properties of nanomaterials
- Assess the effect of grain sizes on various physical properties of nanomaterials
- Interpret the results of physical and chemical properties measurements
- Develop new materials for green energy and environmental applications

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Third Year **PROJECT** **Semester-VI**

Code: **Credit: 3**

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External)

   I. Plan of the Project - 20 marks

   II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc and presentation of the report. - 45 marks

   III. Individual initiative - 15 marks

2. Viva-Voce / Internal & External - 20 marks

TOTAL **- 100 marks**

PASSING MINIMUM:

	Vivo-Voce 20 Marks	**Dissertation 80 Marks**
Project	40% out of 20 Marks (i.e. 8 Marks)	40% out of 80 marks (i.e. 32 marks)

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

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Third Year **SKILL BASED ELECTIVE II** **Semester VI**

DOMESTIC ELECTRICAL APPLIANCES AND MEASURING INSTRUMENTS

Code **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To inculcate the knowledge of resistors, capacitors and electrical appliances
- To provide training on measuring instruments
- To provide knowledge of the working principles and constructions of house appliances

UNIT – I RESISTORS:

Resistance – unit – Law of resistance – effect of temperature on resistance (carbon, metal film, thin film, wire wound) – variable resistors – colour code.

UNIT – II INDUCTORS:

Inductance – General information – types of inductors (ferrite and choking inductors).

UNIT – III CAPACITORS:

Capacitors - Principle – types of capacitors (Air, Paper, electrolyte and mica) – fixed and variable capacitors – specifications - applications.

UNIT – IV LIGHT SOURCES:

Definition and units of light – luminous flux - Luminous intensity – illumination – units of luminous intensity – types of light sources – Sodium vapour lamp – Mercury vapour lamp – Fluorescent lamp.

UNIT – V MEASURING INSTRUMENTS:

Galvanometer – Ammeter – Voltmeter – Ohmmeter – Multimeter – CRO.

UNIT – VI ELECTRICAL APPLIANCES (For continuous internal assessment only):

Electric iron – Soldering iron – water heaters – Electric Oven – Geysers – Electric mixer - Bell and Buzzer – Electric fan – Emergency lamp – Refrigerator – Water cooler.

REFERENCES:

1. Home appliances GT Publications, Jaipur.

2. Electrical power – Dr. S. L. Uppal.
3. Basic Electrical Engineering – M. L. Anwani, Dhanapat Rai and Co. New Delhi.

COURSE OUTCOMES:

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

- Recall the concepts of resistors, inductors and capacitors
- Apply their skills on connecting various components like resistors, capacitors etc.
- Identify the defects in electrical appliances
- Rectify the defects in the parts of electrical appliances.
- Able to design prototypes of simple electrical appliances.

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