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)

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		6	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
	TOTAL			**30**	**25**	**-**	**-**	**-**	**700**
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) @@	Digital Skills for Employability	-	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	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
	TOTAL			**30**	**27**	**-**	**-**	**-**	**700**
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	1. Microprocessor and C Programming 2. Nanotechnology	5	4	3	25	75	100
		Project		4	3	-	40	60	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) @@		-	2	3	25	75	100
	TOTAL			**30**	**27**	**-**	**-**	**-**	**800**
GRAND TOTAL				**180**	**154**	**-**	**-**	**-**	**4500**

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	0
17.	VI	Naan Mudhalvan Scheme	3	6	300
	Total		**46**	**154**	**4500**

PROGRAM OBJECTIVES:

PO1: To impart knowledge of basic concepts, laws and principles of various branchesof Physics.

PO2: To inculcate appropriate logical skills to translate physical description intomathematical equations and vice versa

PO3: To provide analytical skills to solve problems in physics

PO4: 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

PO5: 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

PSO1: learnt the basic concepts and principles of Physics

PSO2: understood the meaning of mathematical equations representing physical systems and thereby describe various aspects of physical states through graphs and diagrams.

PSO3: been trained to apply the understood concepts to solve the problems in physics

PSO4: acquired practical, analytical and logical skills to carry out experiments and interpret the observed results `

PSO5: 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 thelearner 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 continuityof 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 – Acousticssensors.

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, NewDelhi, 1979.

Semester: I	Core Course : I	Properties Of Matter & Acoustics	Credit : 5	Allotted hours per week: 5

CO1: Differentiate the moduli of elasticity of different materials
CO2: Analyze the moduli of elasticity of materials made in the form of beams.
CO3: Understand the practical applications of surface tension in real life.
CO4: Acquire the knowledge of the flow of liquids based on their viscous nature and the variation of viscosity with temperature and pressure
CO5: Understand the various characteristics of sound and their practical implications.

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PSO-PO-CO MAPPING MATRIX										
PO &	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**

PSO / CO										
CO1	**1**	**2**	**-**	**3**	**1**	**3**	**3**	**1**	**1**	**1**
CO2	**1**	**1**	**3**	**1**	**-**	**1**	**2**	**1**	**3**	**1**
CO3	**-**	**1**	**1**	**1**	**-**	**2**	**2**	**3**	**2**	**1**
CO4	**2**	**1**	**1**	**3**	**2**	**1**	**2**	**2**	**3**	**1**
CO5	**2**	**3**	**2**	**1**	**-**	**1**	**3**	**3**	**2**	**1**

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First Year	CORE PRACTICAL I PROPERTIES OF MATTER	Semester I
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 usingpin and microscope.
3. Determination of Young's modulus - Uniform bending using pinand microscope.
4. Determination of Young's modulus - Cantilever depression using scale and telescope.
5. Surface tension and interfacial surface tension – Drop weightmethod.
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 andElectronics*, 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.

Semester: I	Core Practical : I	Properties Of Matter	Credit : 4	Allotted hours per week: 4

CO1: Use the measuring instruments for accurate measurement of physical quantities required for the experiment.
CO2: Know the elastic properties of structural materials from the experimental results.
CO3: Realize practically the properties of liquids such as surface tensionand viscosity.
CO4: Acquire the experimental skill of verifying laws in Physics.
CO5: Understand experimentally the vibrations of stretched strings.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	-	-	3	3	1	1	1	1	3	1
CO2	1	2	-	3	1	2	2	2	3	1
CO3	1	1	1	3	1	1	2	3	3	1
CO4	1	1	2	1	1	1	2	3	2	1
CO5	-	2	2	3	1	2	2	2	3	1

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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 eventand their consequences.
- To inculcate the Newton's law of gravitation and Kepler's laws of planetary motion andtheir 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 withoutslipping - 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.
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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_

Semester: II	Core Course : II	Mechanics and Theory of Relativity	Credit : 5	Allotted hours per week: 5

CO1: Use the principles of projectiles to explain the manner in which gravity affects a projectile motion.

CO2: Gain a deeper knowledge of mechanics and its fundamental concepts.

CO3: Acquire the knowledge of gravitational force between objects and the centre of mass ofobjects.

CO4: Learn rigid body dynamics in terms of moment of inertia and also analyze the center ofgravity of different bodies.

CO5: Analyze the special theory of relativity and its applications.

PSO-PO-CO MAPPING MATRIX		

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**1**	**2**	**1**	**1**	**2**	**2**	**2**	**3**	**1**
CO2	**2**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**
CO3	**1**	**3**	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**1**
CO4	**1**	**2**	**1**	**3**	**1**	**3**	**2**	**1**	**2**	**1**
CO5	**1**	**2**	**2**	**1**	**3**	**1**	**2**	**1**	**3**	**1**

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First Year | **CORE PRACTICAL II GENERAL PHYSICS I** | **Semester II**

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.

Semester: II	Core Practical : II	General Physics I	Credit : 4	Allotted hours per week: 4

CO1: Know the techniques of handling laboratory instruments.
CO2: Evaluate a process based on the results obtained from the experiments quantitativelyand qualitatively.
CO3: Use the results of an experiment to describe a phenomenon.
CO4: Develop the capacity of experimenting collaboratively and ethically.
CO5: Acquire the skill of analyzing the properties of materials.

PSO-PO-CO MAPPING MATRIX										
PO & PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**2**	**1**	**1**
CO2	**1**	**2**	**1**	**3**	**1**	**1**	**1**	**1**	**3**	**1**
CO3	**2**	**-**	**2**	**3**	**1**	**1**	**2**	**1**	**3**	**1**
CO4	**2**	**-**	**-**	**3**	**1**	**1**	**1**	**1**	**2**	**3**
CO5	**1**	**1**	**1**	**3**	**1**	**1**	**2**	**1**	**3**	**1**

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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 ofsolids
- 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 Refrigeratingmechanism

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.
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7. M. Narayanamoorthy and N. Nagarathinam, *Heat*, National Publishing Co, Chennai, 8th edition, 1987
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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

Semester: III	Core Course : III	Thermal Physics	Credit : 5	Allotted hours per week: 5

CO1: Recall the different specific heat capacities of matters.
CO2: Understand the Maxwell's thermodynamic relations to relate the fundamental and derived quantities.
CO3: Apply the knowledge of conduction of heat in practical applications.
CO4: Use Stefan's constant to evaluate temperature of sun at a particular place.
CO5: Analyze the different principles used in liquefaction of gases

PSO-PO-CO MAPPING MATRIX										
PO & PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**1**	**1**	**-**	**-**	**1**	**1**	**1**	**3**	**1**	**1**
CO2	**2**	**1**	**1**	**-**	**1**	**1**	**3**	**3**	**1**	**1**
CO3	**2**	**1**	**-**	**1**	**1**	**1**	**1**	**3**	**3**	**1**
CO4	**1**	**1**	**-**	**3**	**1**	**2**	**2**	**2**	**3**	**1**
CO5	**2**	**1**	**3**	**3**	**1**	**2**	**2**	**1**	**3**	**1**

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Second Year | **CORE PRACTICA III GENERAL PHYSICS PRACTICALS 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.

Semester: III	Core Practical : III	General Physics – II	Credit : 4	Allotted hours per week: 4

CO1: Realize practically some phenomena of Physics.
CO2: Acquire the skill of handling instruments.
CO3: Develop the observation and circuit drawing skills.
CO4: Enhance the skill of performing process-oriented experiments.
CO5: Verify the laws in Physics through experimental results.

PSO-PO-CO MAPPING MATRIX										
PO & PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**1**	**3**	**3**	**1**	**-**	**1**	**2**	**2**	**3**	**1**
CO2	**1**	**3**	**3**	**3**	**1**	**1**	**2**	**1**	**3**	**1**
CO3	**-**	**1**	**1**	**3**	**1**	**1**	**3**	**1**	**3**	**1**
CO4	**-**	**1**	**3**	**3**	**1**	**1**	**2**	**3**	**2**	**1**
CO5	**1**	**1**	**1**	**3**	**-**	**1**	**2**	**2**	**3**	**1**

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) – Comparisonof 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– Sharpnessof 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
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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 LearningPrivate 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
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COURSE OUTCOMES:

Semester: IV	Core Course : IV	Electricity, Magnetism and Electro Magnetism	Credit : 5	Allotted hours per week: 5

CO1: Understand fundamental laws of electricity and magnetism
CO2: Analyze the calibration of electrical instruments.
CO3: Verify the laws of electromagnetic induction
CO4: Apply the knowledge of electricity and magnetism towards technological applications
CO5: Differentiate magnetic materials

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**3**	**1**	**-**	**3**	**3**	**1**	**3**	**-**
CO2	**1**	**1**	**3**	**1**	**-**	**3**	**1**	**1**	**3**	**-**
CO3	**3**	**1**	**-**	**2**	**-**	**1**	**1**	**1**	**3**	**1**
CO4	**1**	**2**	**1**	**1**	**-**	**1**	**1**	**3**	**3**	**1**
CO5	**1**	**-**	**-**	**1**	**1**	**-**	**1**	**3**	**3**	**1**

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

(ANY EIGHT EXPERIMENTS)

Course Objectives:

To provide the knowledge on utilization of electrical devices to determinesome 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.

Semester: IV	Core Practical : IV	Electricity	Credit : 4	Allotted hours per week: 4

CO1: Analyze the electrical parameters of some electrical components.
CO2: Carry out electrical experiments with better understanding.
CO3: Develop observation and circuit drawing skills.
CO4: Enhance the skills of troubleshooting electrical circuits.
CO5: Calibrate some electrical instruments

PSO-PO-CO MAPPING MATRIX										
PO & PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**-**	**-**	**3**	**3**	**1**	**1**	**1**	**1**	**3**	**1**
CO2	**1**	**-**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**-**
CO3	**1**	**1**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**1**
CO4	**1**	**-**	**-**	**3**	**1**	**1**	**1**	**1**	**3**	**-**
CO5	**1**	**1**	**1**	**3**	**3**	**1**	**1**	**3**	**3**	**1**

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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

Semester: V	Core Course : V	Optics	Credit : 5	Allotted hours per week: 5

CO1: Understand the geometrical optics
CO2: Get the knowledge about interference and holography
CO3: Acquire the theoretical aspects of diffraction and familiarize grating
CO4: Grasp the fundamentals of polarization and its classification
CO5: Understand the working principles of optical instruments like microscopes,telescopes and refract meters, etc.

PSO-PO-CO MAPPING MATRIX										
PO &	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5

PSO / CO										
CO1	**1**	**1**	**3**	**3**	**1**	**1**	**3**	**1**	**3**	**1**
CO2	**3**	**1**	**1**	**3**	**1**	**1**	**3**	**1**	**1**	**1**
CO3	**1**	**2**	**1**	**3**	**1**	**3**	**1**	**2**	**1**	**1**
CO4	**1**	**2**	**3**	**3**	**1**	**2**	**1**	**3**	**1**	**1**
CO5	**1**	**2**	**2**	**1**	**1**	**1**	**3**	**3**	**3**	**-**

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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 PHOTOELECTRICEFFECT:

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 –rotation spectrum of a molecule- Electronic spectra of molecules-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, RevisedEdition, 2010.
4. N. Subrahmanyam, BrijLal, Jivan Seshan, Atomic and Nuclear Physics, S. Chand Publishing, 2008.
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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

Semester: V	Core Course : VI	Atomic and Molecular Physics	Credit : 5	Allotted hours per week: 5

CO1: Learn about the elements that made up an atom.
CO2: Acquire the knowledge of underpinning atomic models and the impact ofmagnetic and electric fields on spectra.
CO3: Communicate the concept of photoelectric cells.
CO4: Enhance the knowledge of molecular spectra
CO5: Provide a detailed study of molecular orbital theories.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	2	1	1	3	1	3	2	1
CO2	1	2	1	1	1	1	1	3	3	1
CO3	1	1	2	1	1	1	2	1	-	-
CO4	3	1	1	2	1	1	1	3	3	3
CO5	1	2	2	1	-	1	1	2	1	3

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Third Year **CORE COURSE VII ELECTRONICS** **Semester V**

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 circuitsand 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 McGrawHill, New Delhi, 2011.
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9. Chattopadhyay T., *Advanced Electronics*, CBS publisher, ISBN -978-9390709007, 2021
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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

Semester: V	Core Course : VII	Electronics	Credit : 5	Allotted hours per week: 5

CO1: Understand the fundamental principles of semiconductors including p-n junctions andzener diode

CO2: Analyze the characteristics of transistor and transistor biasing circuits

CO1: Perform conversion between various number systems.

CO3: Apply knowledge of Boolean algebra and other minimization techniques for digitalcircuit design.

CO4: Identify, formulate and solve problems based on combinational circuits

CO5: Verify the functions of various digital integrated circuits. Carry out the project using digital integrated circuit

PSO-PO-CO MAPPING MATRIX										
PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	2	1	-	3	3	1	1
CO2	1	1	3	2	1	1	1	2	1	1
CO3	1	3	3	1	2	1	2	2	1	1
CO4	3	1	2	1	1	1	1	-	3	1
CO5	-	3	2	3	-	1	2	-	3	3

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Third Year	**CORE PRACTICAL V OPTICS AND DIGITAL ELECTRONICS**	**Semester V**
Code	**(Practical)**	**Credit: 4**

(ANY EIGHT EXPERIMENTS)

COURSE OBJECTIVES:

To ignite the minds of the learners with the practical knowledge of Physics by enhancing thehidden 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.

Semester: V	Core Practical : V	Optics & Digital Electronics	Credit : 4	Allotted hours per week: 4

CO1: Understand the characteristics of electronic components.
CO2: Evaluate a process based on the results obtained from the experiments quantitativelyand qualitatively.
CO3: Obtain the scope of the investigation as expected.
CO4: Link a process with help of the outcomes of an experiment.
CO5: Develop the skill of experimenting collaboratively and ethically.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**1**	**2**	**1**	**3**	**1**	**3**	**3**	**3**	**3**
CO2	**1**	**3**	**2**	**3**	**1**	**2**	**3**	**1**	**3**	**1**
CO3	**1**	**1**	**2**	**3**	**1**	**1**	**2**	**3**	**2**	**1**
CO4	**1**	**-**	**3**	**2**	**1**	**1**	**2**	**2**	**1**	**3**
CO5	**1**	**3**	**2**	**-**	**1**	**1**	**1**	**2**	**3**	**-**

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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 differenttypes 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
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8. A.E Siegman, *Lasers*, University Science Books, California, 1986
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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:

Semester: V	Major Based Elective: I	2) Laser Physics	Credit : 5	Allotted hours per week: 5

- ☐ 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.

PSO-PO-CO MAPPING MATRIX										
PO & PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5

CO										
CO1	1	1	3	3	-	3	1	2	-	3
CO2	1	2	3	2	3	1	1	2	3	3
CO3	1	1	2	3	1	1	2	2	3	3
CO4	1	-	-	3	3	1	2	2	3	3
CO5	1	-	-	1	2	1	2	2	3	3

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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:

Semester: V	Skill Based Elective: I	Electrical Wiring Fundamentals	Credit : 5	Allotted hours per week: 5

CO1: Understanding production of electricity
CO2: Distinguish various types of electrical components
CO3: Recall the basic principles of electrical wiring
CO4: Identify and rectify the defects in simple electrical circuits.
CO5: Do electrical wiring.

PSO-PO-CO MAPPING MATRIX										
PO & PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**1**	**1**	**2**	**3**	**1**	**1**	**3**	**1**	**-**	**-**
CO2	**2**	**1**	**1**	**2**	**1**	**1**	**3**	**3**	**3**	**1**
CO3	**1**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**2**	**1**
CO4	**3**	**1**	**3**	**2**	**1**	**1**	**1**	**3**	**3**	**1**
CO5	**1**	**1**	**3**	**3**	**3**	**1**	**1**	**3**	**3**	**-**

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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, elementaryparticles 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)

Semester: VI	Core Course : VIII	Nuclear Physics	Credit : 5	Allotted hours per week: 6

CO1: Gather advanced knowledge in nuclear physics.
CO2: Explain the general properties of the nucleus, shell model and collective model
CO3: Gain knowledge to explain the radioactive decays and apply various aspects ofnuclear reactions in view of compound nuclear dynamics.
CO4: Describe the working principles of nuclear detectors and accelerators
CO5: To explain the nuclear fusion, nuclear fission reaction and elementary particles.

PSO-PO-CO MAPPING MATRIX										
PO &	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**

PSO / CO										
CO1	**3**	**1**	**2**	**1**	**1**	**3**	**3**	**1**	**3**	**3**
CO2	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**1**	**1**	**3**
CO3	**3**	**2**	**1**	**1**	**2**	**1**	**1**	**2**	**3**	**3**
CO4	**1**	**2**	**1**	**2**	**1**	**1**	**3**	**2**	**2**	**3**
CO5	**-**	**2**	**2**	**1**	**1**	**1**	**2**	**3**	**2**	**3**

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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 – Massto 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 basedsearch 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).
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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:

Semester: VI	Core Course : IX	Theoretical Physics	Credit : 5	Allotted hours per week: 6

CO1: Grown familiarity with the foundation of Classical Mechanics.
CO2: Develop problem solving skills in Mechanics.
CO3: Understand the basic formalism of Quantum Mechanics.
CO4: Understand mathematical implication in Physics.
CO5: Acquire basic knowledge about our Universe.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**1**	**-**	**-**	**2**	**1**	**2**	**3**	**1**	**2**	**3**
CO2	**-**	**-**	**3**	**-**	**-**	**1**	**2**	**3**	**2**	**3**
CO3	**1**	**2**	**2**	**1**	**1**	**1**	**3**	**3**	**2**	**3**
CO4	**1**	**2**	**2**	**2**	**1**	**-**	**-**	**3**	**3**	**3**
CO5	**1**	**-**	**2**	**2**	**1**	**3**	**2**	**2**	**3**	**-**

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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
(ANY TWO 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.

Semester: VI	Core Practical : VI	ELECTRONICS, MICROPROCESSOR AND PROGRAMMING	Credit : 4	Allotted hours per week: 4

CO1: Perform few technical operations with electronic equipments.
CO2: Understand the use of electronic components in Digital computers.
CO3: Acquire the skill of verifying laws in Physics through experiments.
CO4: Realize the applications of electronic devices.
CO5: Acquire the skill of applying the developed software for some scientific and industrial applications.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	3	3	1	2	2	3	3
CO2	1	2	-	3	3	1	3	1	3	3
CO3	1	3	3	1	-	1	1	1	3	3
CO4	-	-	1	3	3	1	2	2	3	3
CO5	1	2	1	2	1	2	1	3	2	3

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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 theproperties 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, Chemicaletching 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 inenvironmental 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:

Semester: VI	Major Based Elective : II	2) Nano Technology	Credit : 4	Allotted hours per week: 5

CO1: Classify the synthesizing techniques based on the states of matter.
CO2: Make use of the available instruments to study the properties of nanomaterials
CO3: Assess the effect of grain sizes on various physical properties of nanomaterials.
CO4: Interpret the results of physical and chemical properties measurements.
CO5: Develop new materials for green energy and environmental applications.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**	**2**	**1**	**-**	**3**	**1**	**3**	**3**	**2**	**3**
CO2	**1**	**-**	**3**	**1**	**-**	**3**	**1**	**-**	**3**	**3**
CO3	**1**	**2**	**1**	**3**	**-**	**1**	**2**	**1**	**3**	**3**
CO4	**1**	**2**	**1**	**1**	**-**	**2**	**1**	**3**	**2**	**3**
CO5	**1**	**1**	**-**	**2**	**3**	**1**	**2**	**2**	**1**	**3**

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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 andpresentation 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-vocewithin 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 MEASURINGINSTRUMENTS

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 chokinginductors).

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.

Semester: VI	Skill Based Elective : II	Domestic Electrical Appliances & Measuring Instruments	Credit : 2	Allotted hours per week: 4

CO1: Recall the concepts of resistors, inductors and capacitors
CO2: Apply their skills on connecting various components like resistors, capacitors etc.
CO3: Identify the defects in electrical appliances.
CO4: Rectify the defects in the parts of electrical appliances.
CO5: Able to design prototypes of simple electrical appliances.

PSO-PO-CO MAPPING MATRIX										
PO & PSO CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	-	-	3	1	1	3	2	-
CO2	1	1	3	3	1	2	1	2	2	2
CO3	1	2	3	3	-	1	2	1	2	-
CO4	1	1	-	2	1	1	2	-	3	-
CO5	1	1	2	-	1	1	2	1	2	2

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ALLIED MATHEMATICS for

B.Sc. Physics / Chemistry / Electronics / Geology Programmes

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

ALLIED COURSE I
CALCULUS AND FOURIER SERIES

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

COURSE OBJECTIVES:

1. To learn the basic Mathematics for their concepts.
2. To train the students in the basic Integrations.

UNIT – I:

Successive Differentiation – nth derivative of standard functions (Derivation not needed) simple problems only-Leibnitz Theorem (proof not needed) and its applications- Curvature and radius of curvature in Cartesian only (proof not needed)–Total differential coefficients (proof not

needed) - Jacobians of two & three variables –Simple problems inall these.

UNIT – II:

Evaluation of integrals of types:

$$1)\int \frac{px+q}{ax^2+bx+c}dx \quad 2)\int \frac{px+q}{\sqrt{ax^2+bx+c}}dx \quad 3)\int \frac{dx}{(x+p)\sqrt{ax^2+bx+c}} \quad 4)\int \frac{dx}{a+b\cos x} \quad 5)\int \frac{dx}{a+b\sin x}$$

Integration by trigonometric substitution and by parts of the integrals

$$1)\int \sqrt{a^2-x^2}\,dx \quad 2)\int \sqrt{a^2+x^2}\,dx \quad 3)\int \sqrt{x^2-a^2}\,dx$$

UNIT – III:

General properties of definite integrals – Evaluation of definite integrals of types:

$$1)\int_a^b \frac{dx}{(x-a)(b-x)} \quad 2)\int_a^b \sqrt{(x-a)(b-x)}\,dx \quad 3)\int_a^b \sqrt{\frac{(x-a)}{(b-x)}}dx$$

Reduction formula (When n is a positive integer) for

$$1)\int_a^b e^{ax}x^n dx \quad 2)\int_a^b \sin^n x\,dx \quad 3)\int_a^b \cos^n x\,dx \quad 4)\int_0^x e^{ax}x^{\square}dx \quad 5)\int_0^{\frac{\pi}{2}} \sin^n x\,dx$$

UNIT – IV:

Evaluation of Double and Triple integrals in simple cases – Changing the order andevaluation of double integral. (Cartesian only)

UNIT – V:

Definition of Fourier Series – Finding Fourier Coefficients for a given periodic function with period 2π - Use of Odd & Even functions in evaluating Fourier Coefficients - Half range sine & cosine series.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Linear approximations of vector valued functions

REFERENCES:

1. T.K. Manickavasagam Pillai & others, Calculus, Volume I, S.V Publications, Reprint 2016 (Unit I).
2. T.K. Manickavasagam Pillai & others, Calculus, Volume II, S.V Publications, Reprint 2016 (Units II, III & IV).
3. S. Arumugam, Isaac and Somasundaram, Trigonometry & Fourier Series, New Gamma Publishers, Hosur, 1999 (Unit V).
4. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.

Semester: I	First Allied Course-I	Calculus and Fourier Series	Credit : 4	Allotted hours per week: 4

COURSE OUTCOMES:

CO1: Explain the relationship between the derivative of a function as a function and thenotion of the derivative as the slope of the tangent line to a function at a point.
CO2.Derive reduction formula and thereby evaluate some standard integrals.
CO3: Identify odd and even functions.
CO4: Use that to determine Fourier series expansion ofthe given functions.
CO5: Apply change of variable method to evaluate double integral.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	1	1	2	3	2	1	2	2
CO2	1	1	1	1	1	2	1	2	3	2
CO3	2	2	1	1	1	2	2	3	2	1
CO4	1	2	2	2	1	2	2	3	2	1
CO5	1	1	1	1	1	2	1	2	3	3

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ALLIED COURSE II
ALGEBRA, ANALYTICAL GEOMETRY (3D) AND TRIGONOMETRY

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

COURSE OBJECTIVES:

- To learn the basic concepts of Algebra
- To learn the basic needs Trigonometry

UNIT – I:

Binomial, Exponential and Logarithmic series (Formulae only) – summation & approximation related

problems only.

UNIT – II:

Non-Singular, Symmetric, Skew symmetric, Orthogonal, Hermitian, Skew Hermitian and Unitary matrices – Characteristic equation, Eigen values, Eigen vectors – Cayley - Hamilton's Theorem (proof not needed) –Simple applications only.

UNIT – III:

Finding the Shortest distance between two skew lines and the equation of the plane containing them– Condition for Coplanarity – Equation of a Sphere –Tangent plane – Plane section of a sphere.- Finding the center & radius of the circle of intersection – Sphere through the circle of intersection (only problems inall the above)

UNIT – IV:

Expansion of sin $n\theta$, cos $n\theta$, tan $n\theta$ (n being a positive integer) - Expansion of $\sin^n\theta$, $\cos^n\theta$, $\sin^n\theta\cos^m\theta$ in a series of sines & cosines of multiples of θ (θ - given inradians) - Expansion of sin θ, cos θ, tan θ in terms of powers of θ (only problems in all the above).

UNIT – V:

Euler's formula for $e^{i\theta}$ - Definition of Hyperbolic functions –Formulae involving Hyperbolic functions -Relation between Hyperbolic & circular functions – Expansion of sinh x , cosh x, tanh x in powers of x - Expansion of Inverse hyperbolic functions $\sinh^{-1}x$, $\cosh^{-1}x$ and $\tanh^{-1}x$-Separation of real & imaginary parts of $\sin(x+iy)$, $\cos(x+iy)$, $\tan(x+iy)$, $\sinh(x+iy)$, $\cosh(x+iy)$, $\tanh(x+iy)$.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

An Introduction to SAGEMATH

REFERENCES:

1. T.K. Manickavasagam Pillai & others, Algebra, Volume I, S.V Publications, Reprint 2016 (Unit I).
2. T.K.Manicavachagam Pillai & others, Algebra, Volume II, S.V Publications, Reprint 2016 (Unit II).
3. T.K.Manickavasagom Pillai, Analytical Geometry (3D) and Vector Calculus, New Gamma Publishing House, 1991(Unit III).
4. S. Arumugam, Isaac and Somasundaram, Trigonometry & Fourier Series, New Gamma Publishers, Hosur, 1999(Units IV & V).
5. M.L. Khanna, Differential Calculus, Jaiprakashnath and Co., Meerut-2004.

Semester: II	First Allied Course-II	Algebra, Analytical Geometry (3d) and Trigonometry	Credit : 2	Allotted hours per week: 3

COURSE OUTCOMES:

CO1: Applying the skills to solve problems in operative algebra.
CO2: Gain knowledge about the regular geometrical figures and their properties.
CO3: Understand the definitions of the inverse trigonometric functions
CO4: Compute the domain and range of the hyperbolic and inverse trigonometric functions
CO5: Find exact values of composite functions with inverse trigonometric functions.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	3	3	1	3	1	2	2	3
CO2	2	2	2	1	-	2	2	1	2	3
CO3	1	-	2	2	3	2	2	3	1	2
CO4	1	1	-	1	2	2	3	2	3	1
CO5	-	2	3	3	1	1	2	3	2	3

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ALLIED COURSE III
ODE, PDE, LAPLACE TRANSFORMS AND VECTOR ANALYSIS

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

COURSE OBJECTIVES:

- The Students will be able to apply the concepts and methods described in the syllabus they can solve problems using the ordinary and partial differential equation.
- They will know a number of applications The text and class discussion will introduce the concepts, methods, applications, and logical arguments
- Learn the application of Laplace transform in engineering analysis.

- Learn the required conditions for transforming variable or variables in functions by the Laplace transform.
- Learn the use of available Laplace transform tables for transformation of functions and the inverse transformation.
- Vector analysis is a mathematical shorthand and the vector form helps to provide the clear understanding of the physical laws. This makes the calculusof the vector functions the natural instrument for the physicist and engineersin solid mechanics, electromagnetism.

UNIT – I:

Ordinary Differential Equation of first order but of higher degree — Equations solvable for x solvable for Clairaut's form (simple cases only) — Linear equations with constant coefficients — Finding Particular integralsin the cases of e" , sin (kx) , cos (kx) (where k is a constant), x* where k is a positive integer , and e ''' *f(x)* where f(x) is any function of x- (only problems in all the above —No proof needed for any formula).

UNIT – II:

Formation of Partial differential equations by eliminating constants and by elimination of arbitrary functions — definition of general, particular & complete solutions — Singular integral (geometrical meaning not required) — Solutions of first order eqnations in the standard forms- $f(p, q) = 0$, $f(x, p, q) = 0$, $f(y, p, q) = 0$, $f(z, p, q) = 0$, $f_1(x, p) = f_2(y, q)$, $z = xp + yq + f(p, q)$ - Lagrange's method of solving
$Pp + Qq = R$,where P,Q,R are functions of x,y,z — (Geometrical Meaning is not needed)- (only problems in all the above — No proof needed for any formula).

UNIT – III:

Laplace Transform — Definition — Lee —') ,L(cos(at)) , L (sin (at)) L(t •) , where n is a positive integer. Basic theorems in Laplace Transforms (formula only)-L [e °— cos bt], L [e — sin bt], L |e _* f (t)] — L [f (t)], L[fi (t)], L [f " (t)]

UNIT – IV:

Inverse Laplace Transforms related to the above standard forms-SolvingSecond Order ODE with constant coefficients ii sing Laplace Transforms.

UNIT – V:

Gradient of a vector — directional derivative — unit normal vector tangent plane — Divergence-Curl — solenoidal & irrotational vectors — Double operatorsProperties connecting grad., div., and curl of a vector

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Introduction to Linear Systems of Differential Equations

REFERENCES:

1. S.Narayanan & T.K. Manicavachagam Pillay Differential Equation and its Applications, S. Viswanathan Publishers, 2015 (Units I, II, III & IV).
2. M.L. Khanna, Differential Calculus, Daiprakashnath and Co., Meerut-2004 (Unit V).
3.

Semester: II	First Allied Course-III	ODE, PDE, Laplace Transforms and Vector Analysis	Credit : 4	Allotted hours per week: 4

COURSE OUTCOME:

CO1:Solve differential equations using appropriate methods and to present mathematical solutions in a concise and informative manner.
CO2:Develop a logical understanding of the subject with mathematical skills so that students are able to apply mathematical methods & principles in solving problems in engineering fields.
CO3:Calculate Laplace transforms and inverses. Apply Laplace transforms to solution of differential and integral equations.
CO4:Explain the physical significance of vector calculus, parameterise curves and calculate line integrals.
CO5:Use vector operators, calculate double and triple integrals and surface integrals, apply the Green's, Stokes and Divergence theorems and calculate complex integrals.

PSO-PO-CO MAPPING MATRIX

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	-	2	1	3	2	2	3	1
CO2	1	2	3	1	1	2	3	2	1	2
CO3	1	1	2	3	1	1	2	3	2	2
CO4	2	1	2	1	1	2	1	2	3	2
CO5	1	2	2	3	3	1	2	3	2	3

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ALLIED COURSE I
CHEMISTRY I

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

COURSE OBJECTIVES:

1. To understand the various the ories of coord ination chemistry.
2. To study the various concepts of resonance and halogen compounds.
3. To study the properties of aromatic compounds and organic reactions.
4. To learn the concepts of solid-state chemistry.

UNIT – I COORDINATIONCHEMISTRYANDINDUSTRIALCHEMISTRY:

Coordination Chemistry: Nomenclature–Werner's, sidgwick and Pauling's the ories. Chelation-industrial importance of EDTA, Biological role of hemoglobin and Chrophyll.

Industrial Chemistry: Fuelgases – Watergas, producer gas, LPG gas, Gobar gas and natural gas. Fertilizers – NPK and mixed Fertilizers- soaps and detergents.

UNIT –II ELECTRON DISPLACEMENT EFFECTS AND HALOGENCOMPOUNDS:

Polareffects: Inductive effect –Relative Strength of Aliphatic monocarboxylic acid and aliphatic amines. Resonance–Condition for resonance. Consequences of resonance – resonance of energy. Basic property of aniline and acidic property of phenol. Hyper conjugation – Heat of hydrogenation – Bond length and dipole moment. Steric effect.

Halogen containing compounds: Important chloro-hydrocarbons use dassolvents. Pesticides–Dichloromethane, chloroform, carbon tetrachloride, DDT and BHC Types of solvents:-Polar, Non-polar.

UNIT – III AROMATIC COMPOUNDS AND ORGANIC REACTIONS:

Aromatic compounds: Structure, stability resonance and aromaticity of benzene. Substitution reaction: Nitration, Halogenations, Alkylation. Naphthalene – Isolation, properties and uses.

Organic reaction: Biuret, Decarboxylation, Benzoin, Perkin, Cannizaro, Claisen and Halo form reactions

Chemotherapy: Explanation with two examples each for analgesics, antibacterial, anti - inflammatory, antibiotics, antiseptic and disinfectant, anesthetics local and general (Structures not necessary).

UNIT – IV SOLIDSTATE, ENERGETICS AND PHASERULE:

Solidstate: Typical crystal lattices - unit cell, elements of symmetry, Bragg's equation, Weiss Indices, Miller indices, simple body centered and face centered lattices

Energetics: First law of thermodynamics – state and path function – need for the second law – carnotscycle and thermo- dynamic scale of temperature, spontaneous and Non–spontaneous processes–entropy – Gibbs free energy.

Phase rule: Phase, component, degree of Freedom, phase rule definitions – one component system–water system.

UNIT – V CHEMICALEQUILIBRIUMANDCHEMICALKINETICS:

Chemical equilibrium: Criteria of homo generous and heterogeneous equilibria, - decomposition of HI, N_2O_4, $CaCO_3$+Pd5.

Chemical Kinetics: Order of reaction and their determinations-activation energy, effects of temperature on reaction rate.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Assignments and seminar on industrial applications of coordination compounds, describing thermodynamic conditions for Haber and contact process, Arrhenius theory for rate constant of a reaction, Thermodynamic conditions for spontaneous and non- spontaneous processes, mode of action of antibiotic, analgesics and anti-inflammatory drugs.

REFERENCES:

1. Gopalan R, Text Book of Inorganic Chemistry, 2nd Edition, Hyderabad, Universities Press, (India), 2012.
2. Morrison R.T. and Boyd R.N., Bhattacharjee S.K. Organic Chemistry(7th edition), Pearson India, (2011).
3. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35thedition), New Delhi: Shoban Lal Nagin Chandand Co.
4. https://gascnagercoil.in/wp-content/uploads/2020/12/allied-chemistry-book.pdf

Semester: III	Second Allied Course-I	Allied Chemistry -I	Credit : 4	Allotted hours per week: 4

COURSE OUTCOMES:

CO1: To describe structure and functions of biologically important coordinationcompounds.

CO2: To apply eletromeric and resonance effect to predict reactivity and stability of organiccompounds

CO3: To classify the drugs based on their mode of actions.

CO4: To predict conditions for spontaneous and non-spontaneous reactions.

CO5: To calculate Gibb's free energy, work function and entropy of a reaction. To determine order of chemical reactions

PSO-PO-CO MAPPING MATRIX										
PO &	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5

PSO / CO										
CO1	**1**	**1**	**-**	**2**	**1**	**1**	**1**	**2**	**1**	**1**
CO2	**1**	**1**	**3**	**1**	**3**	**2**	**1**	**2**	**2**	**1**
CO3	**1**	**2**	**1**	**3**	**3**	**3**	**2**	**1**	**2**	**1**
CO4	**1**	**-**	**3**	**2**	**3**	**2**	**1**	**3**	**3**	**1**
CO5	**1**	**1**	**-**	**-**	**3**	**2**	**3**	**2**	**1**	**1**

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ALLIED PRACTICALS VOLUMETRIC AND ORGANIC QUALITATIVE ANALYSIS

Code: **(Practical)** **Credit: 2**

COURSE OBJECTIVES:

1. To learn the techniques of titrimetric analyses.
2. To know the estimation of several cations and anions.
3. To learn the techniques of qualitative analysis of organic compounds

I Volumetric Analysis:

1. Acidimetry and alkalimetry:

(a) Strongacid VS strongbase (b) Weakacid VS strongbase (c) Determination of hardness of water.

2. Permanganometry:

(a) Estimation off erroussulphate (b) Estimation of oxalic acid

3. Iodometry:

(a) Estimation of potassium dichromate (b) Estimation of potassium permanganate

II. Organic Analysis:

Analyse the following organic Compounds.

1. Carbohydrate, 2. Amide, 3. Aldehyde, 4. Ketone, 5. Acid & 6.Amine.

The students may be trained to perform the specific reactions like tests for aliphatic or aromatic, saturated or unsaturated and functional group present and record their observations.

REFERENCES:

1. R.Gopalan, Elements of analytical chemistry, S.Chand, New Delhi, 2000.

2. N.S.Gnanapragasam and G.Ramamurthy, Organic Chemistry lab manual, S.Viswanathan and Co. Pvt. Ltd. Chennai-1998
3.

Semester: IV	Second Allied Course-II	Volumetric And Organic Qualitative Analysis(Practical)	Credit : 3	Allotted hours per week: 2

COURSE OUTCOMES:

CO1: To understand the use of volumetric pipette, burette and analytical balance.
CO2: To explain the principles of volumetric analysis,
CO3: To prepare standard solution to find out the concentrations of unknownanalyte,
CO4: To understand the selection of indicators and can apply the knowledge inchemical experiments.
CO5: To understand the fundamental methods and procedures adopted in organic analysis. andperform systematic qualitative organic analysis of common organic compounds.

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	1	2	1	3	1	3	1	2	1
CO2	1	2	3	3	1	-	2	1	3	-
CO3	1	1	1	-	2	1	2	1	3	-
CO4	1	1	2	1	3	1	3	1	2	1
CO5	1	1	2	1	3	1	3	1	2	1

ALLIED COURSE
II
CHEMISTRY II

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

COURSE OBJECTIVES:

1. To learn the basics of nuclear chemistry and metallic bond.
2. To understand the properties and applications of carbohydrates,amino acids and proteins.
3. To study the basic concepts of polymers, heterocyclic compounds and stereoisomerism.

UNIT – INUCLEARCHEMISTRYANDMETALLICBOND:

Nuclear Chemistry: Fundamental particles of nucleus-isotopes, isobars, isotones and isomers – differences between chemical reactions and nuclear reactions, nuclear fusion and fission- radioactive series.
Metallic bond: Electron gas, Pauling and band theories, semiconductors – intrinsic, extrinsic – type and p – type

semiconductors.
Compounds of sulphur and sodiumthiosulphate

UNIT – II CARBOHYDRATES, AMINO ACIDS AND PROTEINS:

Carbohydrates: classification –glucose and fructose– preparation and properties – structure of glucose –Fischer and Haworth cyclic structures.
Amino acids and proteins: Amino acids – Classification based on structure. Essential and non – essentials amino acids – preparation, properties and uses – peptides (elementary treatment only) – proteins – Classification based on physical properties and biological functions. Structure of proteins–primary and secondary (elementary treatment).

UNIT – III POLYMERS, HETEROCYCLIC COMPOUND ANDSTEREOISOMERISM:

Synthetic polymers: preparation, properties and uses of Teflon, epoxy resins, polyester resin.
Heterocyclic compounds: Furan, pyrrole and pyridine – preparation, properties and uses – basic properties of pyridine and pyrrole.
Stereoisomerism: Optical isomerism – Lactic and tartaric acid – racemic mixture and resolution. Geometrical isomerism–maleic and fumaricacids.

Unit – IV Surface and photochemistry:

Surface Chemistry: Emulsions, gels–preparation, properties - Electrophoresis and applications, chromatography – Column, paper and thin layer Chromatography.

Photochemistry: Laws of photochemistry and applications.

Unit – V ELECTROCHEMISTRY, pH AND BUFFER

Electrochemistry: Specific and equivalent conductivity–their determination – effect of dilution on conductivity. Ostwald's Dilution law, Kohlrausch law, conductivity measurements, and conduct metric titrations.
pH and buffer: Importance of Ph and buffers –pH determination by colorimetric and electrometric methods.

UNIT – VI CURRENT CONTOURS (FOR CONTINUOUS INTERNALASSESSMENT ONLY):

Assignments and seminar on nuclear radiation, nuclear reactors, structure of carbohydrates and proteins, aromaticity of heterocyclic compounds. Hands on training to determine dissociation constant of acetic acid using conduct meter and to determination of pH of acetic acid sodium acetate buffer by conductivity measurements.

REFERENCES:

1. B.R. Puri, L.R. Sharma, K.C. Kalia, 'Principles of Inorganic Chemistry', 21st edition, Vallabh Publications, 2004-2005.
2. Bahl, B.S. and Bahl, A., Organic Chemistry, (12thedition), New Delhi, Sultan Chand & Co., (2010).
3. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.
4. https://oms.bdu.ac.in/ec/browse.php?type=UG
5.

Semester: IV	Second Allied Course-II	Chemistry-II	Credit : 4	Allotted hours per week: 4

COURSE OUTCOMES:

CO1: To explain theory of nuclear chemistry and chemical bonding.
CO2: To classify carbohydrates and proteins.
CO3: To synthesis polymers and hetero cyclic compounds.
CO4: To apply conductivity measurements to determine degree of dissociation of weak electrolyte and pH of buffer solution.
CO5: To explain preparation and applications of emulsion and gels in chromatography.

PO & PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	1	2	3	3	-	1	2	3	3	-
CO2	1	2	2	2	-	3	2	2	1	-
CO3	2	2	1	2	-	1	3	3	2	1
CO4	1	2	2	1	1	1	2	2	3	1
CO5	1	2	3	3	-	1	2	3	3	-

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