SARADHA GANGADHARAN COLLEGE PUDUCHERRY
(AUTONOMOUS)

DEPARTMENT OF PHYSICS

REGULATIONS, CURRICULUM & SYLLABUS

For
B.Sc. Physics (Honors with Research)
&
B.Sc. Physics (Honors)
[Effective from the Academic Year (2025 – 2026)]
(**Under the National Education Policy 2020**)

BoardofStudies Members

Sl. No.	Name of the Members	Designation	Category
1.	K.Manivannane	Assistant Professor SaradhaGangadharn College Pondicherry	Chairperson
2.	Prof . RavikanthKumar V.V.	Professor,Pondicherry University, Pondicherry	VC Nominee
3.	Prof .K. RameshBabu	Professor,Bharathidasan University, Tiruchi	AC Nominee
4.	DR . K. Mohanraj	Associate Professor,Central University of Tamil Nadu,Thiruvarur	AC Nominee
5.	Manikandaraj.V	Regional Business Manager Mankind Pharma,Sholinganalur, Chennai,TN-600119.	Industrialist
6.	DR.P.Mohanraj	Assistant Professor Vel tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology	Alumni
7.	K.Kalaiyarasi	Assistant Professor SaradhaGangadharn College Pondicherry	Faculty
8.	K.SivakamaSundari	Assistant Professor SaradhaGangadharn College Pondicherry	Faculty
9.	R.Sathana	Assistant Professor In Chemistry SaradhaGangadharn College Pondicherry	Faculty

SARADHA GANGADHARAN COLLEGE
(Autonomous)
VELRAMPET, PUDUCHERRY- 605004
(Affiliated to Pondicherry University)

Minutes of the meeting of the Board of Studies of Physics

The First Meeting of the Members of the Board of Studies of Physics held online on 05/09/2025 in the Department of Physics and following members of the Board attended the meeting:

Sl. No.	Name of the Members	Designation
1	K.Manivannane	Chairperson
2.	K.Kalaiarasi	Member
3..	K.Sivakamasundari	Member
4.	R.Sadhana	Member
5.	Prof .K. RameshBabu	AC nominee
6.	DR . K. Mohanraj	AC nominee
7.	Prof . RavikanthKumar V.V.	VC Nominee
8.	Manikandaraj.V	Industrialist
9.	DR.P.Mohanraj	Alumni

Prof. K.RameshBabu, DR. K.Mohanraj,Prof. RavikanthKumar V.V, Manikandaraj.V and DR.P.Mohanraj attended the meeting online in the Google Meet. The Chairperson welcomed and introduced all the Members and briefed the conferment of Autonomous Status for five years from the academic year 2025-26 by UGC and Pondicherry University to which the College is affiliated.The composition and the functions of the Board of Studies under Autonomous Status was explained. It was also informed that the NEP Curriculum and Schemes prescribed by Pondicherry University will be followed for the UG programs to the students who are admitted upto the academic year 2024-25 and the new curriculum to be approved will be followed for the students admitted from the academic year 2025-26onwards.

Thiru. K.Manivannane presented the NEP Curriculum & Schemes prescribed by the Pondicherry University. Based on this, the proposed Curriculum and Schemes for the UG Programs offered by the Department of Physics were presented.

The Chairperson informed the members that the Syllabi for the First and Second Semesters alone are to be finalized in the first meeting and for the remaining semesters in the next meeting before the commencement of second year.

After detailed discussion, the proposed NEP Curriculum, Schemes and Syllabi are approved by the Board duly incorporating the corrections and suggestions given by the Members.

Finally, The Chairperson thanked all the Members for attending the Board meeting and giving their valuable suggestions in bringing out the updated and innovative curriculum for the programs offered under Autonomous Status.

Sl.No.	Members	Signature with date
1	K.Manivannane	
2.	K.Kalaiarasi	
3..	K.Sivakamasundari	
4.	R.Sathana	
5.	Prof .K. RameshBabu	
6.	DR . K. Mohanraj	
7.	Prof . RavikanthKumar V.V.	
8.	Manikandaraj.V	
9.	DR.P.Mohanraj	

ANNEXURE

Corrections suggested by the Members:

Sl.No.	Name of the Member	Points suggested

PREAMBLE

Physics is one of the basic and fundamental sciences which deals with nature and nature related phenomena's. The new curriculum for physics is framed under NEP 2020 guideline with learner centric approach. The course offered in this program covers the core areas of mechanics, acoustics, optics and spectroscopy, electricity and magnetism, atomic and nuclear physics, solid state, electronics and other fields. The course develops a deeper understanding and trains the student in Theoretical and experimental aspect of physics. The laboratory course build competence in handling sophisticated instruments, measurement techniques, observation, analyses of data and errors in measurement. The course pattern provides students with profound knowledge in interdisciplinary areas. The course design builds critical & analytical thinking and logical ability to solve the problem of life. The advance course and research project motivate the students to follow career in research, academics, industries and others. The skill course included in the curriculum provides employability skills.

PROGRAM DURATION

The Bachelor of Science Physics (Honors) degree program shall extend over a period of 8 semesters spread over 4 academic years – two semesters constituting one academic year. The duration of each semester shall normally be 15 weeks excluding examinations. Exitoptions are available as per NEP 2020 regulations.

Exit options available as per NEP 2020 regulations:

Year of completion	*Number credits required for completion*	*Name of the certificate to be Issued*
1st year	40 + 4*.	Certificate
2nd year	80 + 4**	Diploma
3rd year	120	BSc
4th year	160 (without Project)	BSc Honors
4th year	160 (with Project)	BSc (Honors with Research)

* In addition, 4 credits of vocational courses are to be done during the summer vacation.
** In addition, 4 credits of vocational / internship course to be done in summer vacation.

ELIGIBILITY CRITERIA FOR ADMISSION

Candidates for admission to the first year B. Sc., Honors Degree shall be required to have passed Higher Secondary (12th Grade) Certificate of Central / State Board or equivalent in the Republic of India, with a subject combination of Mathematics, Physics, and Chemistry, and should have secured a minimum of 40% of marks for in Aggregate and for SC/ST 35 %.

CRITERIA FOR MULTIPLE ENTRY

Candidates seeking entry at the second, third and fourth year, should meet the necessary eligibility criteria with respect to the certificate/diploma/degree they possess, with necessary minimum credits banked in the Academic Bank of Credits(ABC).

AGE LIMIT

As per the regulations for admission of Pondicherry University.

BREAK UP OF COURSE AS PER NEP

COMPONENTS	**B.Sc., (Exit at the end of 3rd year) Credits**	**B.Sc., (Honors) (Exit at the end of 4th Year) Credits**	**B.Sc., (Honors with Research) (Exit at the end of 4th Year) Credits**
Major Disciplinary Courses (MJD)& Summer Internship	60 [15 courses of 4 credits each]	80 [20 coursesof 4 credits each]	80 [17 coursesof 4 credits each+ 1 Project]
Minor Disciplinary Courses (MID)	24 [6 courses of 4 credits each]	32 [8 Courseof 4 credits each]	32 [8 coursesof 4 credits each]
Multi-Disciplinary Courses (MLD)	09 [3 courses of 3 credits each]	09 [3courseof 3 credits each]	09 [3courseof 3 credits each]
Ability Enhancement Courses (AEC)	08 [4 courses of 2 credits each]	08 [4 courseof 2 credits each]	08 [4 course of 2 credits each]
Skill Enhancement Course Employability (SEC)	09 [3 courses of 3 credits each]	09 [3 courses of 3 credits each]	09 [3 courses of 3 credits each]
Value Added Courses (VAC)	08 [4 courses of 2 credits each]	08 [4 courses of 2 credits each]	08 [4 courses of 2 credits each]
Field Trip/ Community Engagement& Service	02 [1 course]	02 [1 course]	02 [1 course]
Research Project Work for Honors Degree	-	-	12 [1 course]
TOTAL CREDITS	**120**	**160**	**160**

DESCRIPTIONOF COURSES

1.Major Discipline (MJD)

Major discipline here means Physics courses under the program. Students should secure the prescribed number of credits (not less than 50% of the total credits) in the major discipline courses. The major discipline would provide the opportunity for a student to pursue in-depth study of a particular subject or discipline.

2.Minor Discipline (MID)

Minor discipline means the allied subjects mandatory for the program, which are offered by other departments. Minor discipline helps a student to gain a broader understanding beyond the major discipline. If necessary, 50% of the minor paper can be offered by the major department itself as recommended by the NEP 2020.

3.Skill Enhancement Courses (SEC)

These courses are aimed at imparting practical skills, hands-on training, soft skills, and other skills to enhance the employability of students. Courses are designed as per the students' needs with the available resources. Department running the program can choose these courses based on the availability of resources and faculty requirements..

4.Multidisciplinary courses (MLD)

All undergraduate students are mandated to pursue 9 credits worth of courses in Multidisciplinary areas. The college identified 7 multiple disciplinary streams listed below based on availability of resources and manpower.

(a) Natural Sciences
(b) Physical Sciences
(c) Mathematics & Statistics
(d) Computer Science/Applications
(e) Social Sciences
(f) Humanities
(g) Commerce & Management

Students are expected to learn basic/introductory courses designed by other departments for this purpose. College identified 3 introductory courses (among the seven streams listed above) for uniform adoption of all UG students and the courses for every program will be communicated by the concerned head of the department.

5.Winter Project - Community Engagement

The curricular component of "Community Engagement" seeks to expose students to the Social &economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real-life problems. Community Engagement shall be performed for a minimum of 2 weeks after the 3rd semester till the end-of-the 4th semester.

6.Summer Internship

All students will undergo Internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other Higher Education Institutions / Research institutions during the summer term. Students will be provided with opportunities for internships to actively engage with the practical side of their learning. Such Summer Internship is to be conducted in between 4thSemester and 5th semester. A review report and award of grade based on Summer-Internship by students is to be recorded during the 5th Semester.

7.Research Project (PRO)

Students choosing a 4 Year Bachelor's degree (Honors with Research) and secured equal to or greater than 75 % of aggregate marks in the first six semesters (7.5 CGPA) may take up research project under the guidance of a faculty member. The students are expected to complete the Research Project in the eighth semester.

8.Ability Enhancement Courses (AEC)

All Undergraduate (UG) students are mandated to complete at least 8 Credits worth of Courses which focus on Communication and Linguistic skills, Critical reading, and writing skills. These courses are expected to enhance the ability in articulation and presentation of their thoughts at workplace.

9.Value Added Courses (VAC)

Under NEP-2020, the UGC has proposed for 8 credits worth of common courses which are likely to add value to overall knowledge base of the students. These courses include:
(a) Understanding India
(b) Environmental Science
(c) Digital and Technological solutions
(d) Health & Wellness, Yoga Education, Sports, Fitness, Universal Human Values
The course structure and coverage of topics suggested by UGC and Pondicherry University was taken into consideration and a final syllabus was arrived. These value-added courses are uniform for all the major discipline.

EXAMINATION

There shall be examination at the end of each semester, i.e., December/ May. A student who fails in the examination in any course(s) shall be permitted to appear in such failed course(s) in the subsequent semester examinations. Students shall be allowed to register for a subsequent examination only if they have registered at the first appearance. The students must register for each semester whether they attend the examination(s) or not. The examination results will be communicated to the students by the Chief Controller of Examinations.

PATTERN OF EXAMINATION

All Credit courses are evaluated for100 marks. Continuous Internal Assessment (CIA) component is for 40 marks and the End Semester exam (ESE) is for 60 marks. In case of Practical, Project work etc., it is 50 marks for CIA and 50 Marks for End-Semester Exams.

1.Types Of Course

Category	Course Details
Category A	Theory Courses with Lecture hours and hours allotted for Tutorials wherever required.
Category B	Practical Courses with only Practical hours or Laboratory hours. Laboratory Courses, Internships, Research Project Works and other courses allotted only with practical hours in the curriculum shall be under this category.
Category C	Theory & Practical combined Courses where Lecture and Practical hours allotted.

2.Continuous Internal Assessment (CIA)

Principal of the College schedules the CIA tests and Model exam for all courses. All faculty members are expected to conduct this CIA tests and Model exam and evaluate, submit the marks to Controller of Examinations office of College. College needs to preserve the answer books of the tests and Model exams until declaration of results by the College. The CIA evaluation component and their mark distribution are given in the tables below

3.Category A
For Theory

Continuous Internal Assessment40 Marks	
Evaluation Component	**Marks**
IA Test (Best 2)	10
Model Exam	10
Assignment	10
Seminar and other Activities	05
Attendance	05
Total	**40**

4.Category B

For Practical and Internship

Continuous Internal Assessment 50 Marks	
Evaluation Component	**Marks**
Weekly observation book report	15
Practical Record/Internship report	15
Model Practical exam	15
Attendance	05
Total	**50**

For Research Project work

Continuous Internal Assessment50 Marks	
Evaluation Component	**Marks**
Monthly Review (3 Reviews)	30
Project Report	10
Project Work	10
Total	**50**

5.Category C

For Courses withTheory and Practical Component

Continuous Internal Assessment 40 Marks	
Evaluation Component	**Marks**
Observation note book and Record note book	10
IA Test (Best 2)	10
Model Exam	10
Seminar and other Activities	05
Attendance	05
Total	**40**

MarksforAttendance

Attendance%	Marks
Below75%	0
75%-80%	1
81%-85%	2
86%-90%	3
91%-95%	4
96%-100%	5

END SEMESTER EXAM (ESE)

Controller of Examinations (COE) of the College schedules the End-Semester exams for all three categories of courses. Question Papers shall be set externally based on BOS approved syllabus. All students who have a minimum of 75%attendance are eligible to attend the end-semester exams. Students with adequate attendance and having participated in the Continuous Internal Assessment (CIA) are eligible for end-semester examinations. Students who did not participate in the Continuous Internal Assessment (CIA) are not eligible for end-semester examinations. The course teacher/Department/College is responsible for not registering them for end- semester examinations. The breakup of end semester marks is as given below.

End Semester Assessment Examination Details for All Three Categories of Courses

Course Components	Marks	Duration
Category A. Theory subjects: Sec A:10 Multiple Choice Questionsof1Markeach(10Marks) Sec B: 5 Either or question type with 4 marks each (20Marks) Sec C:3 Out of 5 questions of10Marks each(30Marks) **Questions from all units of the Syllabus are equally distributed.**	60Marks	3 Hours
Category B. Skill Enhancement/Practical Courses Based on Practical Exams conducted **Internship/Research Project Work:** Presentation of the work / Report / Viva-voce examinations conducted	50Marks	3 Hours
Category C. Theory Subjects with Practical Components: **Theory Component:** Sec A:10 Multiple Choice Questionsof1Markeach(10Marks) Sec B: 5 either or question type with 4 marks each (20Marks) Sec C: 3 out of 5 questions of10Marks each(30Marks)	40Marks	3 Hours

Questions from all units of the Syllabus are equally distributed. **The examination shall be conducted for 60 Marks and reduced to 40 Marks.** **Practical Component:** Based on Practical Exams conducted **The examination shall be conducted for 50 Marks and reduced to 20 Marks.** **TotalMarks:60(Theory:40Marks+Practical:20Marks)**	20Marks	3 Hours

A student who earned the required number of 120/160 credits by clearing all the courses necessary shall be declared as passed and entitled to get a Degree .

SUPPLEMENTARYEXAMINATION

A failed student who meets the attendance requirement may be permitted to register for the subsequent supplementary examination within 30 days after declaration of results. However, Students who have failed due to insufficient attendance should repeat the course as and when it is offered.

EVALUATION

Theory/Practical examinations will be arranged by the Examination Cell, Controller of Examinations of the college.

ATTENDANCE

No Students with less than **75%** of attendance in any particular course shall be permitted to attend the end semester examination and shall be given a grade of FA (failure) due to lack of attendance. A student who has been awarded FA shall repeat the course when offered.

The Principal/Head of the Department shall ensure that the student is informed about the lack of attendance before the commencement of the end-semester examination and confirm that such students are not permitted to write the examination.

CLASSIFICATION OF SUCCESSFUL STUDENTS
Student's classification into I Class, II Class, and III Class based on CGPA will follow the guidelines under NEP as approved by Academic Council.

AWARD OF THE DEGREE

The student should have undergone the prescribed course of study with the exit option for a period of not less than 4 years and passed the prescribed examination in all the courses/years. Further, a student will get a maximum of 6-8 years only from the year of admission to pass all

the courses for award of B. Sc., (Honors), as prescribed by the NEP guidelines time to time.

REVISION OF REGULATIONS AND CURRICULUM

The college may, from time to time, revise, amend, and change the Regulations and Curriculum, if found necessary.

1. List of Major Discipline course

S.NO	Major Discipline course	COURSE TITLE	Semester
1.	MJD–I	Mechanics and Properties of Matter	1
2.	MJD-II	Kinetic theory and Thermodynamics	2
3.	MJD-III	Waves , Oscillations and Acoustics	3
4.	MJD-IV	Optics	3
5.	MJD-V	Electricity and Magnetism	4
6.	MJD-VI	Analog Electronics	4
7.	MJD-VII	Experimental Physics –I	4
8.	MJD-VIII	Atomic Physic& Relativity	5
9.	MJD-IX	Digital Electronics	5
10.	MJD-X	Experimental Physics –II	5
11.	MJD-XI	Summer Internship	5
12.	MJD-XII	Nuclear Physics	6
13.	MJD-XIII	Quantum Mechanics	6
14.	MJD-XIV	Solid State Physics	6
15.	MJD-XV	Experimental Physics –III	6
16.	MJD-XVI	Classical Mechanics	7
17.	MJD-XVII	Advanced Quantum Mechanics	7
18.	MJD-XVIII	Advanced Experimental Physics –I	7
19.	MJD-XIX	Electromagnetic Theory	8
20.	MJD-XX	Statistical Mechanics	8
21.	MJD XXI	Astro Physics	8
22.	MJD XXII	Advanced Experimental Physics –II	8
23.	MJD XXIII	Material Science	8

2.List of Minor Discipline course

S.NO	Minor Discipline course	COURSE TITLE	Semester
1.	MID-I	Basic Chemistry-I	1
2.	MID-II	Mathematics-I	2
3.	MID-III	Mathematics – II	3
4.	MID-IV	Basic Chemistry-II	4
5.	MID-V	Numerical Methods	5
6.	MID-VI	Microprocessor	6
7.	MID-VII	Mathematical Physics	7
8.	MID-VIII	Molecular Spectroscopy	7

3.List of Practical Course

S.NO	Major Discipline course	COURSE TITLE	Semester
1.	MJD-VII	Experimental Physics –I	4
2.	MJD-X	Experimental Physics -II	5
3.	MJD-XV	Experimental Physics –III	6
4.	MJD-XVIII	Advanced Experimental Physics –I	7
5.	MJD XXII	Advanced Experimental Physics –II	8

4.List of Multidisciplinary Course Offered by the Department of Physics

S.NO	Multidisciplinary course	COURSE TITLE	Semester
1.	MLD-I	Electronic in Every Day Life	1
2.	MLD-II	Chemistry in Every Day Life	2
3.	MLD-III	Energy in every Day Life	3

5.List of Skill Enhancement Course

S.NO	Skill Enhancement Course	COURSE TITLE	Semester
1.	SEC-I	Skill Physics –I	1
2.	SEC-II	Preparation of Simple House Hold Product	2
3.	SEC-III	Skill Physics-II	3

6.List of Ability Enhancement Course

S.NO	Ability Enhancement Course	COURSE TITLE	Semester
1.	AEC-I	Tamil-I	1
2.	AEC-II	English-I	2
3.	AEC-III	English-II	3
4.	AEC-IV	Tamil-II	4

7.List of Value Added Course

S.NO	Minor Discipline course	COURSE TITLE	Semester
1.	VAC-I	Environmental Studies	1
2.	VAC-II	Understanding India	1
3.	VAC-III	Health & Wellness/Yoga Education	2
4.	VAC-IV	Digital technology Education	2

SARADHA GANGADHARAN COLLEGE (Autonomous)
(For the students admitted from the academic year 2025 - 2026)
SYLLABUS FOR B.Sc. PHYSICS (Honors) /B.Sc. PHYSICS (Honors with Research)

YEAR : I	MECHANICS AND PROPERTIES OF MATTER	SEMESTER: I
PAPER : MJD-I		CREDIT : 4

OBJECTIVES

To understand motion of objects under the influence of forces, and to understand the characteristics of matter behavior in different states and under different force conditions.

COURSE OUTCOMES (COs):

CO1:To grasp and understand the principle parameter of motion and fictitious force
CO2:To learn the fundamental of central force problems and its application
CO3: To study the behavior of Rigid bodies
CO4: To Understand the concepts types of moduli and develop analytical relation for different load points.
CO5:To learn the fluid flow and fluid related phenomena

Unit –I

Vector Space and Vector- Change of basis – Scalar and Vector Field. Gradient ,Divergence and Curl of vectors. Vector operator . Coordinate Systems- Cartesian, Cylindrical and Polar coordinate. Coordinate transformation equation. Free body diagram problems. Newton's Law of motion. Equation of motion. Inertial frame of reference. Fictitious force. Constant of motion .Conservation laws.

Unit-II

Work energy principle. Degrees of freedom- translation and rotational motion .Centre of mass Angular velocity , angular momentum and moment of inertial. Centre of mass Parallel and perpendicular axis theorem. Calculation of M.I for circular ring, disc, hallow sphere and solid sphere. Collision & its types. Laws of collision. Line of Impact. Direct and Oblique collision. C-Frame and Laboratory frame of reference and their relation. Gyroscopic motion.

Unit –III

Differently orbit Equation. Motion under Central force. Two body problem reduction . Force as negative gradient of potential. Kepler's laws. Escape velocity. L- Point. Weightlessness. Variable mass system Field and potential calculation for shell and spherical bodies. Satellite and GPS.

Unit-IV

Hooke's law. Stress strain curve. Hysteresis. Relation between moduli. Youngs Modulus. Poisson' ratio. Bending of beam Uniform and Non Uniform loading. Cantilever and I -Grid. Rigidity modulus .Torsion and couple of thin wire.
Bulk modulus.

Unit -V

Laminar flow. Coefficient of Viscosity. Reynold's number. Equation of continuity. Euler 's equation. Bernoulli theorem. Naiver stoke equation Poiseuille method. Stokes method. Factors affecting Viscosity Surface tension . Molecular theory of S.T. Pressure on bubble and film. Interfacial surface Tension . Drop weight method.

Text Books

1.Mechanics, P K Srivastava, 2nd ed., 2007, New Age International Publishers,
2. Introduction to Mechanics, Mahendra K. Verma, 2016, Universities Press India Pvt Ltd.
3. Properties of Matter, D. S. Mathur, 1st Ed., 38th Reprint, 2010, S. Chand & Co.
4.Classical Mechanics, David Morin, 1st ed, 2008, Cambridge University Press.
5. Mechanics, DuraiPandiyan P et al, 1st ed., 1995, S. Chand, Limited.

Reference Books

1. Fundamentals of Physics, Resnick, Halliday and Walker, 10th ed., 2013, John Wiley & Sons.
2.. Feynman lectures on Physics, Volume - I, 1986, Narosa Publishing House.

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YEAR : I	KINETIC THEORY AND THERMODYNAMICS	SEMESTER: 2
PAPER : MJD-II		CREDIT : 4

CO1: The course makes the students able to understand the basic physics of heat and temperature and their relation with energy, work, radiation and matter.
CO2: They will acquire the knowledge about the fundamentals of gas kinetic theory and transport phenomenon.
CO3: The students will understand the fundamental principles of thermodynamics, including the first and second laws.
CO4: The students also learn how laws of thermodynamics are used in a heat engine to transform heat into work.
CO5: They would learn the idea of entropy and associated theorems, and the thermodynamic potentials and their physical meanings.

Unit-I

Zeroth Law of thermodynamics and temperature. First law and Internal Energy. Thermo dynamical Processes, Applications of First Law: General Relation between CP & CV. Work Done during Isothermal and Adiabatic Processes. Compressibility & Expansion Coefficient, Reversible & Irreversible processes. Second law& Entropy. Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes. Entropy temperature diagrams. Third law of thermodynamics, Unattainability of absolute zero.

Unit-II

Thermo dynamical potentials. Maxwell's relations & applications - Joule-Thompson Effect. Clausius-Clapeyron Equation. Expression for (CP – CV), CP/CV, TdS equations. Kinetic Theory of Gases. Derivation of Maxwell's law of distribution of velocities and its experimental verification. Mean free path . Wander Vaal's equation and critical constant .Transport Phenomena. Viscosity, Conduction and Diffusion . Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

Unit-III

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh Jeans Law. Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Unit-IV

Phase space, Macro state and Microstate, Entropy and Thermo dynamic probability, Maxwell-Boltzmann law - distribution of velocity. Quantum statistics. Fermi-Dirac distribution law. Electron gas .Bose-Einstein distribution law. Photon gas. Comparison of three statistics.

Text Books

1. Brijlal and Subramanian, Heat and thermodynamics, (S.Chand& Co)
2. Mathur, Heat and thermodynamics, (S.Chand& Co).
3. J B.Rajam and CL.Arrora, A Textbook of Heat and thermodynamics, (S.Chand& Co)
4. A.B.Gupta and H.Roy, Thermal Physics, (Allied Books, New Delhi)
5. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 13

Reference Books

1. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 13
2. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears&G.L.Salinger. 1988.

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SYLLABUS FOR B.Sc. PHYSICS (Honors) /B.Sc. PHYSICS (Honors with Research)

YEAR : II	WAVES , OSCILLATIONS AND ACOUSTICS	SEMESTER: 3
PAPER : MJD-III		CREDIT : 4

CO1 :Understand SHM, waves, wave motion and its behavior in boundaries
CO2:To Understand and form solution for constrained oscillation
CO3:Use Lissajous figures to understand simple harmonic vibrations of same frequency and Different frequency
CO4:Aquire knowledge on the propagation of waves in medium with boundaries

CO5: To use Fourier technique to for obtaining component of waves. And to Gain knowledge Of building acoustics.

Unit-I

Small oscillation about stable equilibrium. Simple harmonic motion differential equation and its solution .Time period of loaded spring - compound pendulum .Center of suspension and oscillation .Two masses connected by spring .Reduced mass .Oscillations of liquid in a U tube and floating body. Kinetic, potential and total energies of SHM.

Unit-II

Damped and Forced oscillations. Solution of damped and forced oscillators .Transient and steady states . Resonance and sharpness of resonance . Power dissipation and quality factor. Examples of electrical (vibration) systems like LCR resonance. Problems solving.

Unit-III

Superposition of two collinear harmonic oscillations - Superposition of two perpendicular harmonic oscillations for phase difference .Graphical and analytical methods. Lissajous figures with equal and unequal frequency and their uses. Superposition of a large number of simple harmonic vibrations of equal amplitude and uniform phase difference. Phase and group Velocities and their relationship. Coupled oscillations – Problems solving.

Unit-IV

Derivation of the wave equation (PDE). Transverse vibrations of stretched strings Fixed and free ends- Analytical solution - Plane wave representation in two and three-dimensions . Energy density of vibrating string. Transfer of energy. Normal modes of stretched strings – Plucked and struck strings - Solution by the method of separation of variables. Reflection and transmission of wave at a plane boundary. Speed of longitudinal waves in a fluid - velocity of sound in air - dependence on pressure and temperature vibrations of air columns.

Unit -V

Fourier's Theorem. Application to saw tooth wave Triangular and square wave. Acoustics. Intensity and loudness of sound Decibels . Intensity levels Musical notes Musical scale. Acoustics of buildings. Reverberation and time of reverberation - Absorption coefficient- Sabine's formula Measurement of reverberation time .Acoustic aspects of halls and auditorium

Text Book

1.Vibrations and Waves, I.G. Main, (Cambridge University press)
2. The Physics of Vibrations and Waves, H J Pain, (Wiley ELBS, 1976)
3. The mathematics of waves and vibrations, R K Ghosh, (Macmillan, 1975)
4. Oscillations and waves, A P French, (MIT Introductory Physics Series)
5. Vibrations and Waves, S.P.Puri, (Tata McGraw Hill)

Reference Book

1. Bajaj, Waves and Oscillations (Tata McGraw Hill)
2. D.P. Khandelwal, Oscillations and Waves (Himalaya Pub. House, Bombay)
3. M. Ghosh, A text book of Sound (S.Chand& Co.)

SARADHA GANGADHARAN COLLEGE (Autonomous)
(For the students admitted from the academic year 2025 - 2026)
SYLLABUS FOR B.Sc. PHYSICS (Honors) /B.Sc. PHYSICS (Honors with Research)

YEAR : II	Optics	SEMESTER: 3
PAPER :MJD-IV		CREDIT : 4

CO1: To understand the geometrical of ray propagation and its uses of lens and the types of error
CO2: Develop the concept about of interference and its use
CO3: To gain knowledge about diffraction phenomena and the various technique in observing diffraction
CO4: Build theoretical understanding on polarization and the law governing them
CO5: To study the propagation of light through different refractive index medium

Unit –I

Principles of Geometrical Optics. Laws of reflection and refraction. Snell's Law Total internal reflection and critical angle. Fermat's principle. Mirrors and Lenses. Reflection by plane and spherical mirrors. Refraction at spherical surfaces. Thin lens formula and lens maker's equation. Image formation by mirrors and lenses. Optical Instruments. Simple and compound microscopes. Telescopes (astronomical and terrestrial). Aberrations. Monochromatic aberrations (spherical aberration, coma, astigmatism, curvature of field, distortion).Chromatic aberration and its correction Optical Systems. Combination of lenses and mirrors. Optical fibers and their applications

Unit-II

Principle of superposition. Conditions for interference (coherence, path difference). Types of interference (constructive, destructive). Interference by Division of Wave front. Young's double-slit experiment. Fresnel's bi-prism experiment. Lloyd's mirror experiment. Interference by Division of Amplitude. Thin film interference (air wedge, Newton's rings). Interference in thin films (anti-reflective coatings, beam splitters). Interferometers. Michelson interferometer .Fabry-Perot interferometer Applications of Interference. Optical testing and metrology.. Holography. Spectroscopy. Optical communication systems.

Unit-III

Introduction to Diffraction. Definition and types of diffraction (Fresnel and Fraunhofer) Historical background and significance. Huygens' Principle and Fresnel-Kirchhoff Formula Huygens' principle and wave front propagation. Fresnel-Kirchhoff diffraction formula and its applications. Fresnel Diffraction. Fresnel's half-period zones and zone plates. Circular apertures and obstacles. Fresnel diffraction patterns and their characteristics. Fraunhofer Diffraction.

Single-slit diffraction and its pattern. Double-slit diffraction and interference-diffraction patterns. Diffraction gratings (grating equation, dispersion, and resolving power) Diffraction Gratings . Types of gratings (transmission and reflection). Grating equation and diffraction orders. Applications of diffraction gratings (spectroscopy, optical communication). Diffraction in Optical Systems. Diffraction-limited resolution and its implications. Applications in microscopy, telescopes, and other optical instruments. Bragg's law and crystal structure determination.

Unit-IV

Definition and types of polarization (linear, circular, elliptical). Polarization by reflection, refraction, and scattering. Polarization by Reflection and Refraction. Brewster's law and polarizing angle. Polarization by reflection and refraction at surfaces. Polarizers and Analyzers. Types of polarizers (linear, circular). Malus' law and polarization intensity. Applications of polarizers and analyzers. Polarization in Optical Systems. Polarization in microscopy and imaging. Polarization in spectroscopy and interferometry. Birefringence and Polarization. Birefringent materials and their properties. Polarization by birefringent materials. Applications of birefringence (wave plates, polarizing beam splitters). Liquid crystals and display technology.

Unit -V

Introduction to optical Fibers – Importance of glass as a medium – Coherent bundle – Numerical aperture. Single and multimode fibers. Pulse dispersion . Attenuation in optical fibers. Power law profile. Waveguide dispersion. Dispersion compensating fibers. Dispersion and maximum bit rates.

Textbooks

1. Ghatak, Optics, Tata McGraw Hill.
2. Pedrotti and Pedrotti, Introduction to Optics, Prentice Hall.
3. K K Sharma, Optics, Elsevier.
4.B Ghosh and K G Mazumdar, A Text Book on Light, Sreedhar Publishers.
5. Subrahmaniyam, Brijlal, and Avadhanulu. A Textbook of Optics, S. Chand.

Reference Books

1. Jenkins and White, Fundamental of Optics, McGraw-Hill.
2. Feynman. The Feynman Lectures on Physics, 3-volume set, Narosa.

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YEAR : II	ELECTRICITY AND MAGNETISM	SEMESTER: 4
PAPER : MJD-V		CREDIT : 4

CO1: Students to learn about one of the fundamental of electric field and potential and the guiding equation
.
CO2: Understand the nature of time varying current and it behavior in different electrical component
CO3: Gain knowledge about magnetic field and its association with current.
CO4: Learn the inducing effect of magnetic field and their measurement principles
CO5: Acquire the concepts of guiding equation for propagation of electromagnetic field

Unit-I

Gauss divergence theorem and Stokes theorem of vectors .Electric field and flux . Coulomb law. Gauss's law & its proof and application. Electric fields of spherical charge distribution. Electric potential relation between electric field and potential .Potential and field due to dipole. Poisson's equation. Laplace's equation. Image method. Electrostatic Energy. Electric quadruple pole. Dielectric and polarization Gauss law in dielectrics. Relation connecting E, D and P. Capacitance parallel plate capacitor with partially filled dielectric.

Unit-II

J-Operator .Alternating currents - series and parallel LR, LC, and LCR circuits. Resonance - Q-factor. Power dissipation and power factor. skin effect . Principle and working of AC generator.AC bridges. Balancing conditions .Anderson’s bridge to find L. Wien’s bridge to find C.

Unit-III

Magnetic field . Magnetic force on a current. Magnetic Induction and Boit-Savart Law, Lorentz Force. Vector and Scalar Magnetic potentials . Magnetic Dipole , Magnetomotive force and Ampere’s Circuital theorem & its applications to calculate magnetic field due to wire carrying current and solenoid .Classification of magnetic materials. Curie law, Curie-Wiess Law. Magnetic Hysteresis. Hard and Soft magnetic materials.

Unit-IV

Faraday's law of electromagnetic induction - Lenz’s law - Faraday's law in integral and differential forms . Self and mutual inductances . L of solenoid .M of solenoids. Energy stored in magnetic field. Measurement of L by Rayleigh’s method . Measurement of mutual inductance by Kirchhoff’s method.

Unit-V

Displacementcurrent.Equation of continuity.Maxwell's equations .Derivation of the solving Maxwell'sequations.CalculationofspeedoflightfromMaxwell’swaveequation Transverses nature of E&M waves. Poyntingtheorem. Reflection and refraction at a dielectric interface, transmission and reflection coefficients (normal incidence only) – Problems solving.

Text books

1. Electricity and Magnetism, K.K. Tewari, 13th ed., 2006, S. Chand & Co.
2. Electricity and Magnetism, A.S. Mahajan and A.A. Rangawala, 2007, Tata McGraw Hill.
3. Fundamentals of Physics, Halliday, Resnick, 10th ed., 2013, Wiley.
4.Electrodynamics, L.Gupta, V.Kumar&S.P.Singh, 2008, Pragati Prakashan,
5. Electromagnetic Theory and Electrodynamics, Sathya Prakash 2017,KedarNah RamNath ,CO

Books for Reference

1. Electricity and Magnetism, Edward M. Purcell, 3rd ed., 2013, Cambridge University Press.
2. D.J. Griffiths, Introduction to Electrodynamics, 3rd ed., 2007, Pearson Education.

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YEAR : II	ANALOG ELECTRONICS	SEMESTER: 4
PAPER : MJD-VI		CREDIT : 4

CO1: Learn aboutthe different network theorems and learn to apply it for complex networks
CO2: Learn about semiconductor material and formation junction diode and its V-I behavior
CO3: Understand the construction ,working and input output parameter.
CO4: Ability to understand the working of amplifier and oscillator circuits.
CO5: Acquire knowledge over the voltage controlled transistor and their construction

Unit –I

Kirchhoff's laws. Superposition theorem . Thevenin's theorem. Norton's theorem. Maximum power transfer theorem. Milkman's theorem .Substitution theorem. Reciprocity theorem.

Unit –II

Band Theory. Intrinsic and Extrinsic Semiconductor. Hole. PN junction Diode. Froward and Reverse bias. V-I Characteristics. Diode Current equation . Effect of temperature .Half wave and Full wave rectifier (centre tap and Bridge). Clipper and clamper. Types of Filters. Zener Diode –VI Characteristics. Regulator. LED, Photodiode. Solar Cell. Laser diode. Tunnel Diode. Gunn Diode.

Unit-III

Transistor. Construction. Transistor as amplifier. Working CE-Mode, CB mode CC-mode. VI characteristics. Q-Point Load line analysis. stabilization. Biasing Mode- Base resistor , Emitter bias, Collector feedback Bias and Voltage Divider. Two port analysis- h-Parameter . Limitation

Unit-IV

Classification of Amplifiers .Single stage CE Amplifier with voltage divider bias. h-parameter analysis and gain. Frequency response, band width. Cascade- RC Coupled and Transformer coupled amplifiers. Power amplifiers and their classification. Working of class B Push-pull amplifiers.
Tank circuit. Oscillator Classification – Feedback. Barkhausen criterion. Tunned oscillator.

Hartley oscillator Phsase shift Wien bridge. Monstable. Bi stable Astable.

Unit –V

JFET MOSFET, Construction , Depletion and Working, VI characteristic
Op-Amplifier –Characteristics. Common mode .Differential mode. CMRR. Inverting .Non inverting. Summing .Difference . Differentiator ,integrator. And comparator.

Text Books

1. Electronics devices and circuit theory, R L Boylestad&Nashelsky, 10th ed., 2009, Person India.
2. Basic electronics, B L Theraja, 5th ed., 2005, S. Chand & Co.
3. Electronic Devices, Thomas Floyd, 10th ed., 201 , Person, United Kingdom.
4. Electronic device and circuits , s.salivhanan and N.suresh Kumar. 3rd ed., 2008,Tata McGraw Hill.
5. Electrical Circuit Theory, S.S.Sabhapathy. 2004, Vani Publisher.

Reference books

1. Integrated electronics- Millman and Halkias, 2nd ed., 2017, McGraw Hill Education.
2. Microelectronic Circuits: Analysis and Design, Muhammad H. Rashid, 3rd ed., 2015, Cengage

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YEAR : III	ATOMIC PHYSICS AND RELATIVITY	SEMESTER: 5
PAPER : MJD VIII		CREDIT : 4

CO1: Establish the inadequacy of classical physics for microscopy world
.
CO2: Acquire knowledge about Chorological development about establishment of Particle radiation duality.
CO3: Device method to study atomic and subatomic measurement
CO4: Impart knowledge about consequence of measurement with respect to Frame of Reference in motion
CO5: Introduce the effects object nearing light speed.

Unit - I

Somerfield's atom model - elliptical orbit and relativistic correction – critical potential - excitation potential - Frank-Hertz experiment - Electron spin - Stern and Gerlach experiment - vector atom model – quantum numbers – Pauli's exclusion principle - arrangement of elements in periodic table.

Unit- II

Electronic spectra of atoms - Coupling schemes: L-S, J-J couplings - Spectral terms - s, p, d, f - notation - selection rules - fine structure of hydrogen lines - different series in alkali spectra and their features -- spectral series of sodium - fine structure of sodium lines. X-ray spectra: The continuum and characteristic spectrum and their origin - Duane and Hunt limit; Moseley's law, fine structure of x-ray levels, X-ray absorption spectra, absorption edges.

Unit - III

Magnetic moment of electron due to orbital motion and spin motion – Bohr magneton - gyro magnetic ratios for orbital and spin motions - Normal Zeeman effect – Lande's 'g' factor - anomalous Zeeman effect - Normal and anomalous Zeeman effects with reference to sodium D-lines - theory and experiment - Paschen-Back effect - simple Theory and experiment- Stark effect (experimental study only).

Unit-IV

Frame of reference. Newtonian relativity . Galilean transformations . Michelson-Morley experiment. Einstein's basic postulates. Lorentz transformations. Length contraction. Time dilation Twin paradox.- Einstein's velocity addition rule - relativistic Doppler effect

Unit –V

Variation of mass with velocity. mass energy equivalence . relativistic formulae for momentum and energy.Invariant mass. Minkowski's four-dimensional space .space-time diagrams. Relativistic view of aberration of star light.General theory of relativity (basic ideas) and its important predictions

Text Books

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw – Hill.
2.Quantum Mechanics, Gupta, Kumar, Sharma Jai Prakash Nath Pub. 31st Ed. 2012.
3.Essentials of Quantum Mechanics, B.N.Srivastava, Pragathi
4.Atomic Physics, S.N. Ghosal, 7th ed., 2004, S. Chand and Company.
5.Introduction to Modern Physics, R. B. Singh, 1st ed., 2002, New Age International.

Reference Book

1.A Primer of Special Relativity, P. L. Sardesai, 1st ed., 2004, New Age International.
2.Modern Atomic and Nuclear Physics, A B Gupta, 2nd R ed., 2009, S Books & Allied (p) Ltd.

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YEAR : III	DIGITAL ELECTRONICS	SEMESTER: 5
PAPER : MJD IX		CREDIT : 4

CO1: Build competence in numbers system and conversation. Establish the fundamental logical circuits
CO2: Acquire skills to apply Boolean algebra reduction and checking of outputs
CO3: Develop ability to understand the circuit which perform basic mathematical operation
CO4: Introduce the basic circuit principle involved in processor operation and its working
CO5: Details the types of memory device and conversion technique of signal

Unit –I

Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII. LOGIC GATES: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations.

Unit-II

Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization, Don't care conditions, Quine-McCluskey method.

Unit-III

Combinational circuits: Design procedure – Adders, Subtractors, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic using MUX, BCD to 7 segment decoder.

Unit-IV

Sequential circuits: Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops. Asynchronous/Ripple

counters, Synchronous counters, Modulo-n counter, Ring Counters. Design of Synchronous counters: state diagram, Circuit implementation. Shift registers

Unit-V

Memory devices: Classification of memories, RAM organization, Write operation, Read operation, Memory cycle. ROM organization, PROM, EPROM, EEPROM, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA). A/D & D/A CONVERTORS : Analog & Digital signals. sample and hold circuit, A/D and D/A conversion techniques (Weighted type, R-2R Ladder type, Counter Type, Dual Slope type, Successive Approximation type).

Textbooks

1. Malvino& Leach, Digital Principles and Applications (Tata McGraw Hill)
2. R.P Jain, Modem Digital Electronics (Tata McGraw-Hill)
3. Morris Mano.M Digital logic and computer design, (Prentice Hall of India)
4. Ramesh S.Gaonkar, Microprocessor Architecture of 8085 (Prentice Hall)
5.V.Vijayendran, Digital electronics and Microprocessor-8085,S.vishwanathan.

Reference Books

1.D.C.Green ,Digital Electronics, Pearson .
2.S.S.Bhatti Rahul Malhotra, Digital Electronics, I.K. International Publication.

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YEAR : III	SUMMER INTERNSHIP	SEMESTER: 5
PAPER : MJD XI		CREDIT : 4

General Guidelines:

- The Internship Coordinator (HOD) may divide the students in to a number of groups; maximum of 4 students depends upon the number of faculty available to guide.
- Each group of students will be guided by a faculty member (Internship Advisor).
- The Internship Coordinator (HOD) and Internship Advisor (Faculty-in-charge) will support students in making the Internship a valuable and productive experience.
- With the approval of the Faculty-in-charge, a student may choose a project topic related to the core or allied subject.
- If the Students is/are absent, they should carry out the work for the allotted four to six weeks by extending the presence.
- Upon completing the Internship, students must submit a detailed report of 30-40 pages, neatly typed in Times New Roman, Font size 12 with 1.5 line spacing on single side A4 size white paper and neatly bind with paper cover.
- The project report comprising 30 - 40 pages must have include, required graph, images, tabular column etc. Students are advised to adhere COE guidelines for any other relevant project documentation procedures.
- The Faculty-in-charge is fully responsible for the submission of the project report and he must ensure the project is submitted on time with relevant documents.

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YEAR : III	NUCLEAR PHYSICS	SEMESTER: 6
PAPER :MJD XII		CREDIT : 4

CO:1 Lear about the basic constituent of Nucleus and the properties of nucleus
CO:2 Understand the concepts and theories of force prevailing with in the nucleus
CO3: Introduce the students different radio activities and their theories formulated to explain them
CO4: Learn about the different kind of Particle detectors and accelerator
CO5: Student able to understand the basic constituent of nucleus, labeling and their interaction

Unit -I

Constituents of the nucleus and their Intrinsic properties. Nuclear size,mass,chargedensity. Mass equivalence of 1 amu. Bindingenergy,averagebindingenergyandits variation with mass number. .Binding energy versus mass number curve. Packing fraction N/Z plot. Angular momentum, parity, magnetic moment, electric moments, nuclear excites states. Aston mass spectrograph.

Unit-II

Nuclear force. Charge independence and saturation of nuclear force. Yukawa theory of nuclear force. Wood Saxon potential. Liquid drop model. Semi empirical mass formula. Magic number. Shell model. Collective model.

Unit-III

Classification of Radioactivity. Laws of radioactivity. Half-life and Mean life .Dating principle. Alpha ray properties. Alpha spectrum. Gamow Theory. Beta-decay. Beta spectrum. Fermi theory of beta decay. Neutrino K-capture. GammaRay. Gamma ray spectrum. Internal conversion. Internal pair conversion.

Nuclear reaction. Fission .Chain reaction. Criticality. Q-value calculation. Nuclear reactor. Projectile-thermal neuron and fast neutron. Reaction cross section. Concept of

compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering). Fusion. Stellar energy cycle.

Unit-IV

Particle detector. Ionization chamber. Proportional counter. Gigger-muller Counter. Wilson cloud chamber. Scintillation Counter. Semiconductor detector. Nuclear emulsion .Cherenkov Counter. Linear accelerator. Cyclotron. Betatron. Synchrotron.

Unit-V

Classification of elementary particles. Particle interaction .Conservation laws and Quantum numbers. Leptons. Hadrons. Pion Muons. Mesons Hyperons Strange particle. CPT theorem quark model. Gluon.

Text Books

1.Introduction to nuclear physics and Particle physics, V.K.Mittal,R.C. Verma. S.C. Gupta, PHI Learning,2013.
2.Nuclear Physics, S.N. Ghosal, 1st ed., 2009, S. Chand & Co
3.Concepts of Nuclear Physics, Bernard L. Cohen, 1st ed., 2008, Tata McGraw Hill.
4. Introduction to Nuclear Physics Tayal, D.C, 5th enl. ed , *Himalaya Publication.*
5.Concepts of Modern Physics, Beiser., Tata Mc-Graw Hil.

Reference Books

1. Nuclear Physics, . Kaplan, Narosa 1968
2. Introductory Nuclear Physics, Kenneth S. Krane, 3rd ed., 2022, Wiley India Pvt Ltd

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YEAR : III	QUANTUM MECHANICS	SEMESTER: 6
PAPER :MJD-XIII		CREDIT : 4

CO1:Devlope basic idea about the space and operator used to evaluate properties of microscopy particle
CO2: Student understand the use significance of Schrodinger equation and wave function
CO3: Understand the properties bound state and combination of wave function superposition
CO4: Use S.E to understand quantum development such as zero point energy, degeneracy
CO5: Ability to develop S.E a in polar coordinate and use it define Hydrogen atom.

Unit-I

Bohr's correspondence principle. Postulates of quantum mechanics. Linear independent space. Hilbert space. Operators. Hermitian Operator. Quantum observable. Operators for momentum, angular momentum, kinetic energy, total energy. Hamiltonian .Expectation values. Commuter algebra. Commuting and non-commuting operators .Commutator for position and momentum operators.

Unit-II

Schrodinger equation Time dependent Schrodinger equation , Properties of Wave Function, Interpretation of wave function, Probability and probability current densities in three dimensions, Conditions for Physical Acceptability of Wave Function, Normalization, Linearity and Superposition Principles. Wave function of a free particle ,Wave Packet, Fourier Transform and momentum space Wavefunction ,Spread of Gaussian Wave packet, Evolution with time, Position and MomentumUncertainty

Unit-III

Time Independent Schrodinger equation in one dimension (1d), 2d and 3d, Hamiltonian, stationary states and energy eigen values, expansion of an arbitrary wave function as a linear combination of energy eigen functions, General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states. General Discussion of Bound states in an arbitrary potential: Continuity of wave function, Boundary condition and emergence of discrete energy levels.

Unit-IV

Application to one dimensional problem-Square well potential, Quantum mechanics of simple Harmonic Oscillator-Energy Levels and energy eigen functions, ground state, zero point energy and uncertainty principle, One dimensional infinitely rigid boxenergy eigen values and eigen functions, normalization, quantum dot as example, Quantum mechanical scattering and tunneling in one dimension across a step potential and rectangular potential barrier.

Unit-IV

Time independent Schrodinger equation in spherical polar coordinates. separation of variables for the second order partial differential equation. Angular momentum operator and quantum numbers. Radial wavefunctions; Orbital angular momentum quantum numbers l and m; s, p, d,.. shells (idea only).

Text Books

1. Quantum Mechanics, G Aruldhas, 2 nded,PHI,(2013).
2.Quantum Mechanics, V.Devanathan,Narosa Publications
3.Introduction to QuantumMechanics, David Griffiths, 2nded,Pearson,(2015).
4.QuantumMechanics, TheoryandapplicationsA.GhatakandS.Lokanathan (McMillanIndia)
5.A Text book of Quantum Mechanics, PM Mathews & K Venkatesan, 2nded, Tata McGraw Hill, (2011).

Reference book

1.Quantum Mechanics, Leonard L. Schiff, 3rd edition, McGraw-Hill
2.Introduction to QuantumMechanics, David Griffiths, 2nded,Pearson,(2015).

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YEAR : III	SOLID STATE PHYSICS	SEMESTER: 6
PAPER :MJD-XIV		CREDIT : 4

CO1 : Student understand different types of bond prevailing in solids and about root cause of cohesion in solids
CO2 : Acquire knowledge over the propagation on thermal energy through lattice
CO3: Learn and understand the origin of dielectrics in solids
CO4: Grasp knowledge over the conducting nature of materials and the relevant quantum theories
CO5: Learn the underlying principle of super conduction in ultra cold temperature

Unit-I

Classificationofsolidsaccordingtothedistributionofvalenceelectrons–Interatomicbonding. Van der Waals bond. Covalent bonds, and Ionic crystals .Cohesive energy. Lennard-Jones potential for molecular crystals. Cohesion in ionic crystals. Madelung constant . Cohesion in covalent crystals and metals.

Unit-II

Vibration of monoatomic lattices - Lattices with two atoms per primitive cell - Quantization of lattice vibrations . Phonon momentum. Inelastic scattering of neutrons by phonons. Lattice heat capacity. Einstein theory of specific heat. Density of mode in one-dimension and three-dimension . Debye model of the lattice heat capacity. Thermal conductivity - Umklapp process

Unit-III

Dielectric materials - Polarization, Susceptibility and Dielectric constant - Local field Internal field - Clausius - Mossotti relation - Sources of Polarizability– Electronic Polarizability–Ionic Polarizability–Orientational Polarizability - Frequency and temperature effects on polarization - Dielectric Breakdown – Properties of different types of Insulating materials.

Unit-IV

Drude theory of metals. Calculation of relaxation times and DC electrical resistivity using Drude model. Hall effect and Hall coefficient . Lorentz number. Electron levels in a periodic potential. Bloch's theorem.- Von Karman boundary condition. Fermi surface and density of states. KronigPemiy model. Electrons in a weak periodic potential. Energy bands in one dimension. Formation of energy gap. General formulation for determination of band structure. Tight binding method .Experimental methods to study band structure. Zero dimension materials.

Unit-V

Superconductivity . Meissner effect. Critical field. Derivation of London equation . Isotope effect .Elementary BCS theory .Coherence length. Specific heat capacity and energy gap of superconductors. Type-I&II superconductors. Basics of high-temperature superconductors. YBaCu structure. Supercurrent tunneling - Qualitative treatment of DC and AC Josephson effect.

Text Books

1.Solid State Physics ,S.O.Pillai, New Age International (P) Ltd.,(2002).
2. Solid State Physics , A. J.Dekker, Macmillan India(1985).
3. Solid State Physics HC Gupta, Vikas Publishing House Pvt. Ltd., New Delhi 2001
4. Materials Science and Engineering , V. Raghavan, Prentice Hall of India Private Limited New Delhi2004.
5.J.P.Srivastava, Elements of Solid State Physics,2nd Ed.(PHI, 2007).

Reference Book

1.C Kittel, Introduction to Solid State Physics (Wiley Eastern , Ed., 1976)
2. Saxena et al, Fundamentals of Solid-State physics, , 28th ed., 2016, PragathiPrakashan, Meerut.

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YEAR : IV	CLASSICAL MECHANICS	SEMESTER: 7
PAPER :MJD-XVI		CREDIT : 4

CO1:Understand the formulation of Lagrangian and its application to solve equation of motion forSimple systems
CO2: Able to grasp the concepts of Hamiltonian form and conservation physical quantities.
CO3: Use the transformation of coordinate transformation and use passion bracket to symmetry and conservation law
CO4: To evaluate the rotation of rigid bodies and develop the solution for problems based on rotational motion.
CO5: Understand the fundamental concepts of special relativity and their physical consequences, such as the Lorentz transformation, invariant quantities, the metric, and four-vectors and more general tensors, as well as their use in covariant formulations of physical laws.

Unit-I

Lagrangian formalisms . Generalized Coordinate - Degrees of freedom-Constraints-classification- Examples of Constraints. Principle of Virtual work. D-Alembert's principle. Hamilton's least action principle. Derivation of Lagrange equations from Hamilton's principle. Lagrangian for Simple pendulum. Atwood's machine . LC –circuits.

Unit-II

Hamiltonian formalism Generalized momentum and Cyclic coordinates . Conservation theorem .Hamilton's equations. Different coordinate. system- Applications: Linear harmonic oscillator and particle in a central force field. Hamilton's variational principle. Hamilton's equation of motion from variational principle. Principle of least action.

Unit-III

Canonical transformations. Legendre transformations. Generating function. Poisson's brackets-properties . Hamilton's equation of motion in Poisson's bracket .Invariance of Poisson's bracket under canonical transformation. Hamilton-Jacobi Theory Hamilton-Jacobi equation - Hamilton-Jacobi equation for conservative systems. Hamilton's characteristic function- Separation of variables in the Hamilton -Jacobi equation - Action and Angle Variables – Application to Kepler's problem.

Unit-IV

Rigid Body Dynamics, Non-Inertial Frames and Oscillatory Motion (12 hours) Euler angles – Euler's theorem on the motion of the rigid body - moments and products of inertia - Euler's equations - symmetrical top - applications - non inertial frame of reference - pseudo and centrifugal force - uniform rotating frames - Coriolis force - theory of small oscillations and normal modes - frequencies of free vibration and normal coordinates - Linear tri-atomic molecule.

Unit -V

Relativistic mechanics. Lorentz transformations of energy-momentum. Force - Relativistic Lagrangian and Hamiltonian for a particle. Minkowski space and Lorentz transformations. Four vector Four-velocity vector, four momentum vector and four-acceleration vector.

Text Books

1. Classical Mechanics: B,D.Gupta, SatyaPrakash, 1st ed., 2020, Kedar Nath - Ram Nath Publication.

2. Classical Mechanics, J. C. Upadhyaya, 2nd ed., 2005, Himalaya Publishing House.

3. Classical Mechanics, G.Aruldhas, 1st ed., 2008, Prentice Hall of India Pvt. Ltd. Books for

4. Classical Mechanics: N C Rana and P S Joag, 1st ed., 2017, McGraw Hill Education (India),

5. Classical Mechanics, Gupta Kumar Sharma *, Pragati Prakashan* , 1 January 2012 ;

Reference

1. Classical Mechanics: H Goldstein, Poole, Safko, 3rd ed., 2011, Pearson Education.

2. Classical Dynamics of Particles and Systems, Thornton, Marion, 5th ed., 2012, Cengage

Learning,

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YEAR : IV	ADVANCED QUANTUM MECHANICS	SEMESTER: 7
PAPER :MJD-XVII		CREDIT : 4

Unit-I

Review of Fourier transforms – Postulates of classical mechanics versus quantum mechanics. Dirac Bra and Ket notation. Expansion of vector in an orthonormal basis in Hilbert space . Matrix elements of linear operators. Adjoint of an operator. Unitary transformations . Eigenvalues and eigenvectors of complex Hermitian matrix – Simultaneous diagonalization of two Hermitian operators. Functions of operators: Calculation of exponential of an operator – Outer product and density matrix . Schrödinger picture. Heisenberg picture (matrix mechanics) Interaction picture Relation among different pictures .

Unit-II

Dirac's Bra and Ket notation . Projection operator. Matrix theory of harmonic oscillator. Spin matrix (Pauli) for electron. Commutation relations .Pauli operator. Pauli Eigenvalues and Eigenfunction . Electron-spin formulation– Spin matrices and Eigenfunctions.

Unit-III

Angular momentum operators . The rotation operator and angular momentum – Spin angular momentum. Total angular momentum operator. Commutation relation of J^2, Jz, J_+, J-EigenValues of J^2, J_z. matrix representation of J^2, Jz, J_+, J_-, . Addition of angular momentum – Clebsch-Gordan coefficients – properties and evaluation . coupling of orbital and spin angular momenta

Unit-IV

Time independent perturbation theory for non-degenerate energy levels. Degenerate energy levels.Stark effect in Hydrogen atom. Ground and excited state . Variation method . Ground state of Helium atom . WKB approximation . Connection formulae– validity - application of WKB: Barrier penetration.

Unit-V

Time-dependent perturbation theory - first order transitions - constant perturbation - Transition probability - Harmonic perturbation - Fermi- Golden rule - Radiative transition in atoms - Dipole transition - Selection rules - Sudden and adiabatic approximation.

Text Books

1.Quantum Mechanics, R.K.Srivastava, 1st ed., 2007, Printice Hall of India Pvt. Ltd.
2. Quantum Mechanics, Ghatak and Loganathan, 6th ed., 2022, Laxmi Publications Pvt Ltd
3.Quantum Mechanics, Sathya Prakash, 1st ed., 2007, Pragati Prakashan,
4. Introduction to Quantum Mechanics, David J. Griffiths, 3rd ed, 2018, Cambridge University Press.
5. . A Text book of Quantum Mechanics, PM Mathews & K Venkatesan, 2nded, Tata McGraw Hill, (2011).

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Reference Books

1.Quantum Mechanics, Leonard L. Schiff, 3rd edition, McGraw-Hill.
2. Quantum Mechanics, Leonard L. Schiff, 3rd edition, McGraw-Hill.

SARADHA GANGADHARAN COLLEGE (Autonomous)
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SYLLABUS FOR B.Sc. PHYSICS (Honors) /B.Sc. PHYSICS (Honors with Research)

YEAR : IV	ELECTROMAGNETIC THEORY	SEMESTER: 7
PAPER :MJD-XIX		CREDIT : 4

CO1:Ability to use vector calculus to static electromagnetic fields in different engineering situations.

CO2: Understand the magnetic potential nature and its effects in different geometry shape

CO3 :Ability to formulate potential problems within electrostatics, magnetostatics and Stationary current distributions in linear, isotropic media, and also solve such problems Insimple geometries using separation of variables and the method of images.

CO4:Ability to define and derive expressions for the energy both for the electrostatic and magnetostatics fields, and derive Pointing's theorem from Maxwell's equations and physical interpret.

CO5:Analyze the nature of electromagnetic wave propagation in guided medium which are used in microwave applications

Unit-I

Gauss's law - Divergence of E - curl of E - Electric potential - Poisson's and Laplace's Equation -Potential of a localized charge distribution - Electrostatic Boundary conditions - Uniqueness theorems- Method of images: Classic image problem - induced surface charge - Force and energy - other imageproblems - boundary value problems on spherical symmetry and plane symmetry.

Unit-II

Biot-Savart Law - The Divergence and Curl of B - Applications of Ampere's Law –magneticpotential - uniform surface current of a long solenoid - toroidal coil - large parallel plate capacitor -magnetic field inside and outside a cylindrical wire - magnetic field inside and outside the slab -Magnetic vector potential - magnetostatics boundary conditions.

Unit-III

Faraday's law - induced electric field - Inductance - Energy in magnetic fields - Maxwell's equations in free space and linear isotropic media - Boundary conditions on fields at interface –continuityequations - Poynting theorem - Potential formulation - Lorentz and Coulomb Gauge transformations- retarded potentials

Unit-IV

Waves in one dimension - Reflection, transmission and polarization - wave equation for E and B monochromatic plane waves - Energy and momentum in EM waves - Propagation in linear media -Reflection and transmission at normal and oblique incidence - EM waves in conductors - Absorption, dispersion and reflection at a conducting surface

Unit – V

Wave guides - TE and TM waves in a rectangular wave guide - Coaxial transmission line - Electric dipole radiation - Magnetic dipole radiation - Radiation from an arbitrary source -power radiated by a point charge - Radiation reaction - radiation damping of a charged particle - Physical basis of the radiation reaction.

Text Books

1. David J. Griffiths, Introduction to Electrodynamics, 4th edition, 2018, Pearson.
2. Principles of Electromagnetics, N O Sadiku, 6th ed., 2015, Oxford University Press.
3. Electrodynamics, S L Gupta, V Kumar, S P Singh, 10th ed, 2002, Pragati Prakashan.
4. J.D. Jackson, Classical Electrodynamics, 3rd Edition, 1999, John Wiley, New York.
5.Electromagnetic fields and waves, Paul Lorrain and Dale Corson, 2rd ed., 2003, CBS Publishers.

Reference Books

1. Foundations of Electromagnetic Theory: J.R. Reitz and R.W.Milford, 4th ed., 2010, Pearson India.
2. Electromagnetic Theory & Electro Dynamics, Satya Prakash, 21st ed., 2020, KedarNathRamNath.

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YEAR : IV	STATISTICAL MECHANICS	SEMESTER: 7
PAPER :MJD-XX		CREDIT : 4

CO1:Acquires the knowledge of different laws of thermodynamics. Recognize the difference between macro-state and microstate.
CO2:Apply the Knowledge about Liouville's theorem and its importance to MB distribution
CO3:Comprehend the concept of ensembles and partition function
CO4:Understands to apply Bose-Einstein and Fermi-Dirac distribution laws to problems in statistical mechanics, such as photon gas, electron gas, etc.
CO5: Apply and analyze the statistical laws to study transport phenomena.

Unit-I

Phase space - volume in phase space - Density distribution in phase space . Liouville's theorem - Postulate of equal a priori probabilities . statistical equilibrium – other kinds of equilibrium-–

connection between entropy and thermodynamic probability - Microstates and macro states – Stirling's approximation. general statistical distribution law - Division of phase space into cells.

Unit-II

Classical Maxwell-Boltzmann distribution law - Evaluation of constants in the Maxwell Boltzmann distribution law Maxwell's law of distribution of velocities - most probable speed, rms speed, average speed - Principle of equipartition of energy - Calculation of gas pressure - Boltzmann entropy relation.

Unit-III

Concept of ensembles - micro canonical -canonical - grand canonical -Perfect gas in Microcanonical Ensemble - Partition Function - Gibb's paradox - Gibbs canonical ensemble- Perfect Monoatomic gas in Canonical Ensemble - Grand Canonical Ensemble - Comparison of Various Ensembles - Classical real gas - Cluster expansion - Virial theorem- equation of state.

Unit-IV

Need for quantum statistics - Indistinguishability and quantum statistics – Bose-Einstein statistics -Fermi-Dirac statistics - MB statistics - Limit of their applicability - Statistical weight - density matrix- Thermodynamic behavior of ideal Bose and Fermi gas - Bose-Einstein condensation - Liquid Helium - Super fluidity - Ideal FD gas - electron gas of metals.

Unit - V:

Boltzmann transport equations - Boltzmann transport equations for electrons and Lorentz solution -chambers equation - thermal conductivity of metals - mean square deviation - fluctuations in energy, Probability of one-dimensional random walk - Brownian movement - Fokker Planck equation -Nyquist's theorem.

Text Book

1. Statistical Mechanics, S.L Gupta & V Kumar, 12th ed., 2006, Pragati Prakashan, Meerut.
2. Statistical Mechanics, SatyaPrakash, 10th ed, 2021, KedarNath Ram Nath & Co, Meerut.
3. Statistical Thermodynamics, M.C. Gupta, 2nd ed., 1998, New Age International Publishers.
4.Halliday, Resnick Walker, Fundamentals of Physics, Wiley.
5.Zemansky and Dittman. Heat and Thermodynamics, McGraw-Hill.

References Book

1. Statistical Mechanics, Kerson Huang, 2nd ed., 2008, Wiley Eastern Ltd.
2. Fundamentals of statistical Mechanics, B B Laud, 2nd ed., 2020, New Age International Pub.
3. Statistical Mechanics, R.K. Srivastava & J. Ashok, 1st ed., 2005, Prentice Hall of India.

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YEAR : IV	ASTRO PHYSICS	SEMESTER: 8
PAPER : MJD-XXI		CREDIT : 4

CO1: Brief the different observation techniques involved in celestial observation.

CO2: Deliberate the ideas of planet system and natural satellite formation and their properties.

CO3: Student grasp the structure of sun and star classification.

CO4: Understand the star life cycle and their end.

CO5: Develop the concepts of galaxy and their classification

Unit-I

Reflection telescope - refraction telescope – types of reflecting telescopes – radio telescope - radio interferometry – principle of gamma ray and X- ray telescopes – Hubble space telescope (block diagram), space coordinates - right ascension and declination. Measurement units in Space science. Distance determination.

Unit-II

Solar System .Rotation and revolution of the Earth . Precession of the Earth - seasons on earth - Phases and the features of Moon – Solar and lunar eclipses - general properties of terrestrial & Jovian planets - dwarf planets - origin of solar system - Kuiper's Proto-planet theory.

Unit-III:

Sun. Different regions of sun and their characteristics. Transient phenomena of sun- Solar Wind and its effect on Earth - Aurora. Constellations - Binary stars - star clusters - absolute and apparent magnitudes of stars - Hertzsprung-Russel diagram - outline of Saha's ionization theory.

Unit-IV

Stellar Evolution and cycle. Nebulas as stellar nurseries.Proto-star. Main-sequence stars – energy production in stars – Red Giants – HR diagram pathways - White dwarfs – Chandrasekar's mass limit (qualitative ideas) - heavy element synthesis – Supernova – Neutron stars - Black holes.

Unit -V

Galaxy and Cosmology. Hubble classification of galaxies- galaxy clusters and super clusters- Milky way galaxy-Radio galaxies – characteristics - Active galaxies- Unified model of active galaxies. Expanding universe – Hubble's law - Big-Bang theory -standard model - inflation, evidences in favor of Big-bang theory – Pulsating theory- dark matter - future of the universe.

Text Books

1. Unfolding our Universe, Ion Nicolson, 1st ed, 1999, Cambridge University Press, UK.

2. Explorations-An Introduction to Astronomy, Thomas T. Arny, 8th ed., 2016, McGraw-Hill.

3. Astrophysics -Stars and Galaxies, K. D. Abhyankar, 1st ed, 2001, Universities Press. Books for

4. An Introduction to Astrophysics, Baidyanath and Basu, 1st ed., 2010, Prentice Hall of India.

5. Universe, Roger A Freedman et al., 10th ed., 2015, W. H. Freeman and Company, New York.

Reference Book

1. A text book of Astronomy and Astro physics Mohit Kumar Sharma ,I K International Pvt Ltd, 2024 ;

2. Dynamic Astronomy, Robert T. Dixen, 5th ed., 1989, Prentice Hall International. 4. Introduction to Cosmology, J. V. Narlikar, 3rd ed, 2002, Cambridge University Press, UK.

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YEAR : IV	MATERIAL SCIENCE	SEMESTER: 8
PAPER : MJD-XXIII		CREDIT : 4

CO1: Brief the students with ideas of solid solubility,the governing rule and phase diagram significance
CO2: Develops elaborate ideas about crystallography and structure determination
CO3: Student grasp the concepts of types of defects and it its significance in alteration of solid Properties
CO4: Understand the ideas of electrical conductivity and the microscopic theory guiding it
CO5: Helps the students understand the types of magnetic materials and about the theory formulated to explain magnetism in materials

Unit- I

Phase Rule. Classification of crystalline and amorphous materials .Structure-property relationships .Solubility limit and microstructure .Stability and meta stability -.Thermodynamic functions andkinetics of phase transformations. Phase diagrams, Gibb's phase rule . Lever rule. One andtwocomponent solid solutions. Examples of binary phase diagrams

Unit-II

Crystal geometry . Crystal lattice, crystal planes, and Miller indices - unit cells - Typical crystalstructures. coordination number, packing fraction. Symmetry elements: rotation, inversion andreflection, basics of point groups and crystal classes, space groups, reciprocal lattice.
Crystallography: Diffraction of X-rays by a crystal lattice. Laue's formulation of X-ray diffraction, Lauespots .Rotating crystal.

Unit-III:

Impurities in solids. Vacancies and interstitials. Point and line defects. Edge and screwdislocations – Planar defects and grain boundaries - Elastic deformation – Ductile and brittle fracture. Plastic deformation Slip . Critical shear stress . Effect of lattice defects on mechanical properties. Stress- strain curve. Yield stress. Young's modulus, Poisson ratio and hardness of materials .Atomic processes in solids. Diffusion and self-diffusion in solids. Vacancy diffusion. Interstitialdiffusion Concentration gradient . Diffusion constant. Fick's laws (first and second law) of diffusionand its applications. Factors affecting diffusion (like temperature) -

Unit-IV:

Origin of band gap in solids. Classification of metals, insulators, and semiconductors .Electronmobility. Derivation of electrical conductivity of metals based on Drude theory. Drift velocity of electrons in metals. Matthiessen's rule of electrical resistivity. Variation of resistivity withtemperature and due to impurities .Forbidden gap. Semiconductor materials (Ge, Si, GaAs) . Effectof temperature on semi-conductivity. Calculation of carrier density of semiconductors using Halleffect Introduction to compound semiconductors and bandgap engineering – n-type and p-type Materials. Majority and minority carriers.
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Unit-V:

Definition of Bohr magneton. Origin of magnetic moment. Magnetic moment of electrons and ofatoms. Classification as dia, para, ferro, anti-ferro and ferri magnetic materials . Classical theory ofparamagnetism – Derivation of Curie-Weiss law . Langevin theory .Basics of quantum theory ofparamagnetism – Lande's *g*-factor – Examples like the salts of transition elements, oxides of

rare-earth elements. Molecular field theory of ferromagnetism . Temperature dependence ofmagnetic susceptibility. Ferromagnetism and ferri-magnetism – Examples with their crystalstructures (like cubic ferrites). Crystalline materials exhibiting ferro- electricity and piezoelectricity .Details of barium titanate structure.

Text Books

1.Raghavan, Materials Science and Engineering, Prentice Hall.
2. Callister and Rethwisch. Materials Science and Engineering, Wiley.
3. Hummel, Electronic Properties of Materials, Springer.
4. Moffatt, Pearsall, and Wulff, Structure and Properties of Materials, 4-volume set, Wiley.
5. Cullity and Graham, Introduction to Magnetic Materials, Wiley.

Reference Books

3. Blackmore, Solid State Physics, Cambridge University Press.
4. Srivastava, Elements of Solid State Physics, (PH

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List of Minor Discipline course

S.NO	Minor Discipline	COURSE TITLE	Semester

	course		
9.	MID-I	Basic Chemistry-I	1
10.	MID-II	Mathematics-I [Offered By Department of mathematics]	2
11.	MID-III	Mathematics – II [Offered by department of Mathematics]	3
12.	MID-IV	Basic Chemistry-II	4
13.	MID-V	Numerical Methods	5
14.	MID-VI	Microprocessor	6
15.	MID-VII	Mathematical Physics	7
16.	MID-VIII	Molecular Spectroscopy	7

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YEAR : I	BASIC CHEMISTRY -I	SEMESTER: I
PAPER : MID-I		CREDIT : 4

CO1:To Study classification, nomenclature and some fundamentals of organicchemistry.
CO2:To Study atomic model and electronic structures and their valence tendency
CO3:To Study the stoichiometry and some basic concepts of chemical equilibrium
CO4:To Study radioactivity and its applications
CO5:To Analyze statistical and Analytical Data

UNIT-I **(12 Hrs)**

Classification and IUPAC nomenclature of organic compounds, hybridization (sp^3, $sp^2$and sp) in organic compounds. Localized and delocalized orbitals. Hydrogen bonding. Dipole moments in organic molecules. Homolytic and hetrolytic bond cleavage – electrophiles, nucleophiles and free radicals – carbo cations and carbanions.

UNIT-II **(12 Hrs)**

Atomic Structure and Periodic Classification of Elements: Structure of Atom, Fundamental Particles, Atomic Mass, Atomic number, Isotopes, Bohr Theory of atoms. Orbital –Quantum Numbers, Aufbau Principle, Hund's rule, Pauli's exclusion principle. Electronic configurations of the atoms –Half-filled and completely filled orbital's, Modern Periodic Table: Periods, Groups, Periodicity - Valency, Atomic Radius, Electronegativity, Ionization Potential & Electron Affinity.

UNIT-III **(12 Hrs)**

Stoichiometry – mole and equivalent concepts – concentration units – molarity, molality, percentage, ppm, and ppb.Types of solutions, stoichiometric calculations.Basic concepts of chemical equilibrium- equilibrium constants.Concepts of acids and bases. Ionization of weak acids and weak bases.Hydrogen ion concentration – pH of acids and bases. Buffer solutions, Henderson's equation of buffer.Physiological buffers

UNIT-IV (12 Hrs)

Radioactivity – properties of α, β and γ-radiations – rate of disintegration – half life period – nuclear fission and fusion – fertile and fissile nuclei – radioactive isotopes.Application in medicine, agriculture, geology and industry.Brief account of nuclear reactors. Neutron activation analysis.

UNIT-V

(12 Hrs)

Statistical Evaluation of Analytical Data: Mean, median and mode – Accuracy and Precision – ways of expressing accuracy and precision – Errors – types – Determinate,Indeterminate and

gross errors – minimization of errors – methods of reporting data –significant figures– confidence limits.

PRACTICAL COMPONENT:

A. Volumetric Analysis

1. Determination of sodium carbonate and sodium bi-carbonate in a mixture using selective indicator method (Acidimetry)
2. Determination of sodium hydroxide and sodium carbonate in a mixture using selective indicator method (Acidimetry)
3. Determination of oxalic acid (Permanganometry)
4. Determination of FAS (Permanganometry)
5. Determination of iron (Dichrometry)
6. Determination of potassium dichromate (Iodometry)
7. Determination of copper (Iodometry)
8. Determination of silver nitrate (argentometry)

B. Other Experiments:

1. Determination of melting point of organic compounds using water bath (m.pt.<100^{o}C).
2. Purification of organic compounds by recrystallisation.
3. Chromatographic separation of mixture by paper chromatography (for demonstration only)

TEXT BOOKS

1. Advanced Organic Chemistry by Bahl and Arun Bahl
2. Text Book of Organic Chemistry by P.S.Soni
3. Modern Inorganic Chemistry by R.D. Madan
4. Principles of Inorganic Chemistry by PuriandSharma
5. Principles of Physical Chemistry by Puri and Sharma

REFERENCE BOOKS

1. Physical Chemistry by Bahl and Tuli.
2. Analytical Chemistry by Gopalanetal

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YEAR : I	MATHEMATICS -I	SEMESTER: II
PAPER : MID-II		CREDIT : 4

CO1: Get knowledge in use of matrix and apply them independently.

CO2: Ability to understand equation of different degree of polynomial and their root determination

CO3: Grasp the basic structure of trigonometry and their series formation.

CO4: Develop knowledge about derivatives, measurement theorem, and maxima minima points

CO5: obtain knowledge vector span ,fields and properties of vector.

Unit 1

Matrices: Symmetric, Skew-Symmetric, Orthogonal, Hermetian, Skew-Hermetian and Unitary matrices. Eigen values and Eigen-vectors, Cayley-Hamilton theorem (without proof) – verification- Computation of inverse of matrix using Cayley - Hamilton theorem. -simple problems

Unit 2

Theory Of Equations: Polynomial equations with real coefficients, irrational roots, complex roots, symmetric functions of roots, transformation of equation by increasing or decreasing roots by a constant, reciprocal equation-simple problems.

Unit 3

Trigonometry: Expansions of $\sin(n\theta)$ and $\cos(n\theta)$ in a series of powers of $\sin\theta$ and $\cos\theta$ - Expansions of $\sin^n\theta$, $\cos^n\theta$, $\tan^n\theta$ in a series of sines, cosines and tangents of multiples of "θ" - Expansions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ in a series of powers of "θ" – Hyperbolic and inverse hyperbolic functions -simple problems

Unit 4

Differential Calculus: Successive differentiation, nth derivatives, Leibnitz theorem (without proof) and applications, Jacobians, Curvature and radius of curvature in Cartesian co-ordinates, maxima and minima of functions of two variables- Simple problems

Unit 5

Vector Differentiation: Introduction, Scalar point functions, Vector point functions, Vector differential operator Gradient, Divergence, Curl, Solenoidal, irrotational, identities.

Text Books

1.S. Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.
2. Allied Mathematics by Dr. A. Singaravelu, Meenakshi Agency.

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YEAR : II	**MATHEMATICS –II**	**SEMESTER: III**
PAPER : MID-III		**CREDIT : 4**

CO1: Get knowledge about integration by parts.

CO2: Grasp the concepts of vector integration and conversion theorem for interchangeability between line, surface and volume

CO3: Ability to apply to find component and result waves by using fourier

CO4: Grasp the knowledge to solve differential equation effective

CO5: To gain rule and properties to be adopted while transformation

Unit 1

Integral Calculus: Bernoulli's formula – Reduction formulae- $\int sinnxdx\pi/2\ 0$, $\int cosnxdx\pi/2\ 0$,$\int sinmxcosnxdx\pi/2\ 0$ (m, n being positive integers),

Unit 2

Vector Integration: Line, surface and volume integrals, Gauss, Stoke's (without proofs). Simple problems on these.

Unit 3:

Fourier Series: Definition –Finding Fourier Coefficients for a given periodic function with period 2π- Odd and even functions, Half range series

Unit 4:

Ordinary Differential Equations: Equations of first order but not of the first degree. Equations solvable for dy/dx, y, x, Clairaut's form (simple cases only). Linear equations with constant coefficients-e^{ax} , where a is any constant, for sinax or cosax, where a is any constant, for $x^k e^{ax}$, where k is a positive integer, for $e^{ax}f(x)$ where f(x) is a polynomial of degree m

Unit 5:

Laplace Transforms: Laplace transformations of standard functions and simple properties, inverse Laplace transforms, Application to solution of linear differential equations up to second order -simple problems.

1. S. Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.

2. Allied Mathematics by Dr. A. Singaravelu, Meenakshi Agency.

3. P. Duraipandiyan, Vector Calculuas, 1991

4. Allied Mathematics, Vital and Malini, V Margam Publisher,1997

Text Books

1. S. Narayanan and T.K. Manickavasagam Pillai – Ancillary Mathematics, S. Viswanathan Printers, 1986, Chennai.

2. Allied Mathematics by Dr. A. Singaravelu, Meenakshi Agency.

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YEAR : II	**BASIC CHEMISTRY -II**	**SEMESTER:IV**
PAPER : MID-IV		**CREDIT : 4**

CO1:To Study chemical kinetics and catalysis
'CO2:To Study isomerism in organic compounds and conformational analysis
CO3:To Study chromatography
CO4:To Study polymers and dyes
CO5:To Study electrochemistry

UNIT-I **(12 Hrs)**

Chemical Kinetics and Catalysis:

Chemical Kinetics: Rate of reaction – Factors affecting the rate of reaction- concentration, temperature, pressure, catalyst, solvent and light, order and molecularity. Examples for zero order, first and second order reaction. Half-life period; Pseudo order reactions.

Catalysis: Homogeneous and heterogeneous catalysis with examples, Acid-base catalysis with examples, Enzyme catalysis-general characteristics, Auto catalysis.

UNIT-II **(12 Hrs)**

Isomerism in organic compounds – Structural and Stereo isomerism, Geometrical isomerism – Cis, trans isomers, E and Z nomenclature of simple compounds; Optical isomerism – optical activity – specific rotation, enantiomers, diastereomers, and meso compounds. R, S configuration in organic molecules with single symmetric centre. Conformers – Newman and sawhorse projection formulae, conformational analysis of ethane, n-butane and cyclohexane.

UNIT-III **(12 Hrs)**

ChromatographyandSolidState: Theory and Principles – Classification of Chromatographic methods-Column chromatography: Principles and experimental Procedures – Adsorbents and solvent systems –Applications.Thin Layer Chromatography: Principles and experimental Procedures – Adsorbents –Preparation of TLC Plates – Rf Values – Applications – Separation of dyes.Paper Chromatography: Principles – Ascending, Descending and radial techniques – Rf Values –Applications.

UNIT-IV **(12 Hrs)**

Polymers and Dyes

Polymers–Preparation and uses of nylon (6,6), Terylene, polythene, polyvinyl chloride ,natural rubber and synthetic rubber (Buna-S rubber and neoprene) Vulcanization;

Dyes – Modern classification and examples (Indigo, congored – malachite green, Alizarin and Phenolphthalein)

UNIT-V **(12 Hrs)**

Electrochemistry: Electrolyte and galvanic cell – Daniel cell, standard Weston Cadmium cell. Conventional representation of electrochemical cells. Galvanic cell – EMF of a cell and its

measurement. Computation ofcell EMF , Nernst equation, single electrode potential and its determination, standard hydrogen electrode (SHE), reference electrode – Calomel electrode, standard electrode potential.

TEXTBOOKS

1. Advanced Organic Chemistry by Bahl and Arun Bahl
2. Text Book of Organic Chemistry by P.S.Soni
3. Modern Inorganic Chemistry by R.D. Madan
4. Principles of Inorganic Chemistry by Puri and Sharma
5. Principles of Physical Chemistry by Puri and Sharma

REFERENCE BOOKS

1. Physical Chemistry by Bahl and Tuli.
2. Analytical Chemistry by Gopalanetal.

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YEAR : III		SEMESTER:V
PAPER : MID-V	NUMERICAL METHODS	CREDIT : 4

CO1:Solve algebraic and transcendental equations using various numerical methods such
as Bisection, Successive Approximation, Regula Falsi, and Newton-Raphson.
CO2: Solve simultaneous linear algebraic equations using numerical techniques like
Gauss Elimination, Gauss Jordan, and Gauss Seidel methods.
CO3:Perform interpolation and numerical differentiation/integration using methods like
Newton-Gregory, Lagrange, and Simpson’s rules.
CO4: Apply numerical methods to solve ordinary differential equations of first and second

order using techniques like Taylor series, Picard's method, and others.
CO5: Implement advanced methods for solving ordinary differential equations, including
Euler's method, Runge-Kutta method, and Milne's predictor-corrector method.

UNIT-I

Numerical solution of algebraic and transcendental equations – Bolzano's bisection method - Successive approximation method – Regula falsi method – Newton-Raphson method.

UNIT-II

Numerical solution of simultaneous linear algebraic equations – Gauss elimination method - Gauss Jordan elimination method – Gauss Seidel iteration method.

UNIT-III

Finite difference operator - Interpolation – Newton-Gregory forward and backward interpolation – Newton's divided difference formula – Lagrange's interpolation formula for uneven intervals – Gauss interpolation formula – Numerical differentiation – Numerical Integration – Trapezoidal rule – Simpson's 1/3rd rule.

UNIT-IV

Numerical solutions of Ordinary differential equations of first and second order – Simultaneous equations – Taylor series method – Picard's method.

UNIT-V

Euler's method – Improved Euler's Method - Modified Euler's Method – Runge-Kutta method of second and fourth order – Milne's predictor corrector method.

Text Books

1.Numerical Method in Science and Engineering, M.K. Venkataraman, National Publication Co, Chennai(2001)
2.Computer oriented Numerical Methods by V.Rajaram–PHI(P)Ltd. e-Learning Source

3.Santosh Kumar, Computer based Numerical & Statistical techniques,(S. Chand & Co, 2008)
4.Kandasamy, Thilagavathy&Gunavathy, Numerical methods,(S.Chand& Co., 2007)

Reference Books

1. James B. Scarborough, Numerical Mathematical Analysis, (Oxford and IBH, New Delhi, 1971)
2. S.S.Sastry, Elementary Numerical Analysis,(PHI)

YEAR : III	MICROPROCESSOR	SEMESTER: VI
PAPER : MID-VI		CREDIT : 4

CO1: Understand the Architecture of 8085 and pin out details

CO2: Able understand the mnemonics of 8085 and to develop competency in programming

CO3: Competence to perform simple 8 bit programs

CO4: Ability to grasp the different types of interface chips and their working

CO5: Gain knowledge to key principle of microprocessor and microcontroller

Unit-I

Introduction to Microprocessor – Architecture of Microprocessor 8085-Internal registers (8-bit & 16-bit)-CPU-ALU-Types of System Bus-Bus Structure- multiplexing and demultiplexing address/data bus-Instruction Register and Decoder - Timing and Control Unit-Interrupts and Serial I/O (principle only)-external memory – Block diagram of 8085-Programmer's model of 8085-pin configuration of 8085.

Unit II

Machine Language and Assembly Language-Addressing modes-types of instruction format-Data Transfer type instructions-Arithmetic and logical instructions–Branching instructions-looping and time delay -system clock-T-state-instruction and machine cycles-Timing diagram for MOV Rd, Rs - MVI A, data8 - LXI RP, 16bits, memory read and memory write cycle.

Unit III:

Special Instructions: Rotate instructions-stack and subroutine related instructions-PSWperipheral instructions-I/O and Machine Control Instructions. Assembly Language Programs – Addition– Subtraction– Multiplication (8-bit) – Division (8-bit) Ascending / Descending Order, Largest/Smallest (single byte)-Addition of N numbers (single byte)-code conversion program.

Unit-IV

Memory Interface (Basics) – memory mapped I/O & I/O mapped I/O- Generating Control Signals – Interfacing 2KX8 EPROM – 2KX8 RAM -Interfacing I/O ports to 8085-Hand shake signals-Functional block diagram and working of PPI-8255-Interfacing 8255 to 8085-LED Interface.

Unit V:

Interrupts in 8085- Generation of RST codes-Hardware, software interrupts and their function Interrupts pulse width and Triggering levels-Interrupt priority-Vector interrupt model -SIM and RIM instructions-Simple polled and Interrupt controlled data transfer-Introduction to Microcontroller –Comparison of Microprocessor and Microcontroller.

Text Books

1. Microprocessor Architecture, Programming and Application with the8085, Ramesh S. Gaonakar, PenramLnternational Publishing, Mumbai, (2011).

2. Fundamental of Microprocessor 8085: Architecture Programming, and Interfacing, V. Vijayendran,Viswanathan, S., Printers & Publishers Pvt. Ltd (2009).

3. The 8051 Microcontroller, Architecture, Program and application, Kenneth J Ayala, Pen ram Books for reference:

4. Microprocessor Organisation and Architecture, LeventhalL.A , Prentice Hall India.

5. Ram, Fundamentals of microprocessors and microcomputers - DhanpatRai Publications, New Delhi 3. The 8080/85 Family: Design, Programming & Interfacing,John Uffenbeck, , PHI India.

1.. A. K. Ray & K. M.Bhurchandani, Advance Microprocessor and Peripherals, 2ndEdition, Tata McGraw Hill, 2006 5. Mathur A.P., Introduction to Microprocessors. 3rd edn., Tata McGraw, New Delhi,

2. Microprocessors & Microcontrollers by B.P.Singh, Galgotia publications Pvt.Ltd

SARADHA GANGADHARAN COLLEGE (Autonomous)
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SYLLABUS FOR B.Sc. PHYSICS (Honors) /B.Sc. PHYSICS (Honors with Research)

YEAR : IV	MATHEMATICAL PHYSICS	SEMESTER:VII
PAPER : MID-VII		CREDIT : 4

CO1: Impart knowledge on design of operator and its requirement .

CO2: Introduce the student about PDE and their solving technique.

CO3:Provide strong understanding about the complex solution and their properties.

CO4: Apply Fourier transforms to evaluate domain change properties and effective use in physical system

CO5: Provide detail understanding over special function to find solution.

Unit -I

The Hilbert space and wave functions: Dirac Notation - Operators: Hermitian, Projection, commutatoralgebra, uncertainty relation between two operators, functions of operators. Eigenvalues andEigenvectors of an operator, infinitesimal and finite unitary transformations. Representation inDiscrete bases: Matrix representation of Kets, Bras and operators, change of bases and unitarytransformations. Matrix representation of the Eigenvalues problems.

Unit -II:

First-Order equations: general PDEs, more than two independent variables - Second-Order equations:classes of PDEs. more than two independent variables - boundary conditions - Separation of variables:Cartesian coordinates, circular & cylindrical coordinates, spherical & polar coordinates - Laplace andPoisson equations - Wave equations: Alembert's solution - Diffusion PDE.

Unit- Cauchy - Riemann conditions - Cauchy's integral theorem - applications to multiply connected region- Cauchy's II integral theorem - derivatives of analytic complex function - singular points and theirclassification - Laurent series - Cauchy's residue theorem - calculation

of residue at a point -evolution of definite integrals: (i) around the unit circle, (ii) around a semi-circular contour.

Unit-IV

Fourier Transform: FT of a time dependent function - some important theorems: Parseval's, linearity,derivatives, shifting of origin and convolution, use of FT in solving partial differential equation for heatconduction. Laplace transform: Theorems - inverse transform - solution to ordinary differential equations -solvingequations for LCR circuit.

Unit-V

Gamma and Beta functions - properties and their basic relations - DE and series solution of Legendreand Hermite.Their polynomial - Rodrigues' formula - generating function - recurrent relation -orthogonality relations.

Text Book

1. Quantum Mechanics: Concepts and Applications, N Zettile, 2nd Ed, John Wiley & Sons, UK. 2009.
2. Mathematical Methods for Engineers & Physicists, Mukhopadhyay, 2nd Ed., Dreamtech Press, 2020.
3. Mathematical Physics, H.K Dass and Rama Verma, 8th Ed., S. Chand Pub. India, 2019.
4. Mathematical Methods for Physicists, Arfken. Weber and Harris, 7th Ed. Academic Press, 2013.
5.. Mathematical Methods in the Physical Sciences, M. L. Boas, 3rd Edn, John Wiley & Sons, 2006.

Reference Books.

1.Advanced Engineering Mathematics, E. Kreyszig, 10th Edn, Wiley, 2017.2. P.K. Chattopadhyay, Mathematical Physics, NEW AGE International Pvt Ltd, 3rd Ed., 2023.

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YEAR : III	MOLECULAR SPECTROSCOPY	SEMESTER:VI
PAPER : MID-VIII		CREDIT : 4

Unit - I

Modes of vibrations of a molecule - Regions of IR absorption spectroscopy - conditions forabsorption of IR radiation -theory of diatomic harmonic oscillator –anharmonic oscillator (basic idea)- Description and working of a double beam IR spectrophotometer - Fourier transform IRspectroscopy (basic ideas) – modes of vibration of polyatomic molecules- molecular structure of $H_2O$and CO_2 using IR spectroscopy.

Unit - II

Raman effect - stokes and anti-stokes lines - Classical & Quantum theory of Raman effect – Laser as Raman source - Design and working of Laser Raman spectrophotometer - Types of Raman spectrum -Rule of mutual exclusion - Raman spectrum to study molecular structure of CO_2, H_2O and N_2O -comparison between IR and Raman spectra.

Unit – III

Electronic spectra of Diatomic molecules - Bom Oppenheimer approximation - vibrational coarse structure, Frank-Condon Principle - Intensity of vibrational - electronic spectra – dissociation energy and dissociation products - Rotational Fine Structure of Electronic -Vibration Transitions -Molecular photo-electron spectroscopy - X-ray photoelectron spectroscopy.

Unit – IV

Principle of NMR- Magnetic properties of nuclei-resonance condition - Relaxation processes – NMR instrumentation-chemical shift- spin-spin coupling -NMR spectra of solids-NMR imaging interpretation of NMR spectra- Electron Spin Resonance Spectroscopy: Basic principles -

ESRspectrometer - Hyperfine structure-ESR spectra of Free radicals -g-factor - line widths - applications.

Unit -V

Quadrupole Hamiltonian- Nuclear Quadrupole energy level for axial and non-axial symmetry - Experimental techniques and applications - Mossbauer Spectroscopy: Principles of Mossbauerspectroscopy -Chemical shifts - Quadrupole splitting and Zeeman splitting - applications ofMossbauer spectroscopy.

Text Books

1.Fundamentals of molecular spectroscopy, Colin N. Banwell, 4th Ed, Tata McGraw-Hill Ltd, 2023.
2. Spectroscopy, Gurdeep & Chatwal, 5th Ed., Himalaya Publishing House, 2016.
3. Spectroscopy, B.K. Sharma, 20th Ed., Krishna Prakashan Media P. Ltd, 2015.
4. Organic Spectroscopy, William Kemp, 3rd Ed., Macmillan (Indian edition), 2019.
5.. Molecular Structure and Spectroscopy, G. Aruldhas, 2nd Ed, PHI Learning Private Ltd, 2014.

Reference Books

1. Aruldhas, Molecular Structure, and Spectroscopy, Prentice-Hall.
2. Gupta, Kumar, Sharma, Elements of Spectroscopy: *Atomic, Molecular and Laser Physics*, Pragati Prakashan.

List of Multidisciplinary Course Offered by the Department of Physics

S.NO	Multidisciplinary course	COURSE TITLE	Semester
1.	MLD-I	Electronics in Every Day Life	1
2.	MLD-II	Chemistry in Every Day Life	2
3.	MLD-III	Energy in every Day Life	3

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YEAR : I	Electronics in Everyday life	SEMESTER: I
PAPER : MLD-I		CREDIT : 3

Unit I

Binary system of numbers. Conversion of Binary number to other number system. Machine language. Signal types. Difference between analog and digital systems of electronics. Approximation circuits. Transducers. Magnetic Memory. Ferrite core memory. Types of memory in computers. Bits, bytes, speed ,duty cycle and fan speed. Processor classification.

Unit-II

Digital devices-Desktop, Laptop, Flash drive, Printers, scanners, Smart phones, Smart watch, Gaming consoles, and their types and working. IOT of things

Unit-III

Introduction to sensors. Piezoelectric material, electrostriction, Magnetostriction Shape memory alloys, Senor used in different digital device Technologies of inter-device communication. Wi-fi communication. Router fiber optic communication. Hand shake of devices. Data transmission

Unit –IV

Innovative applications, societal impact, and barriers to implementation. Future electronic devices. Quantum Computers

Unit –V

Introduction to Nanoscience and nanotechnology. Nano science is a multidisciplinary nature. Novel properties of nano phase material. Role of nano science in electronics

Textbooks

1. Malvino& Leach, Digital Principles and Applications (Tata McGraw Hill)
2. R.P Jain, Modem Digital Electronics (Tata McGraw-Hill)
3. Morris Mano.M Digital logic and computer design, (Prentice Hall of India)
4.V.Vijayendran, Digital electronics and Microprocessor-8085,S.vishwanathan.

Reference Books

1.D.C.Green ,Digital Electronics, Pearson .
2.S.S.Bhatti Rahul Malhotra, Digital Electronics, I.K. International Publication.

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YEAR : I	CHEMISTRY IN EVERYDAY LIFE	SEMESTER: II
PAPER : MLD-II		CREDIT : 3

Unit-I

Functional food additives and its importance, food adulteration, detection of food adulterations, food safety laws and fssai regulations. Food colours-permitted and non-permitted – Flavours – natural and synthetic, artificial sweeteners, toxic effect of additives.

Unit-II

Soaps and Detergents – saponification, classification, cleansing action of soap, manufacturing process, additives, fillers, flavours, bleaching agents and enzymes used in commercial detergents, environmental hazards

Unit-III

Cosmetics and perfumes – classification, ingredients and regulations, bathing oils, face creams, talcom powder, skin products, hair dyes, shaving cream, shampoo, conditioners, nail polish, deodorants, antiperspirants, oral hygiene products, toxic effect of cosmetics

Unit-IV

Glasses and ceramics – classification, manufacturing process, composition and properties of glasses, soda glass, borosilicate glass, coloured glass, photosensitive glass, armoured glass, safety glass, Important clays and fledspar, plasticity of clay, ceramic and its types, white pottery, glazing, applications.

Unit-V

Plastics in daily use. Polymerization process (brief). Thermosetting and thermoplastic polymers. Use of PET, HDPE, PVC, LDPE, PP, PS, ABS, and others. Recycling of plastics. Biodegradable plastics. Environmental Hazards of plastics. Paper news print, writing paper, paper boards, cardboards. Organic materials, wood, cotton, Jute, coir – International Universal recycling codes and symbols for identification.

Text Books:

1. Food – The Chemistry of its components, T.P. Coultate,. Royal Society of Chemistry London, 2001.
2. Engineering Chemistry, Shashi Chowla, DanpatRai& Co., 2017.
3. Industrial Chemistry, B.K. Sharma, Krishna Prakashan Publishers, 2012.
4. Understanding Chemistry, CNR Rao, Universities Press, 1999.
5. Engineering Chemistry, Jain and Jain, Darpat Rai Publication, 17th Ed., 2015.

Reference Book

1. Chemistry of cosmetics, Kumari R, Prestige publications, 2018

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YEAR : II	ENERGY IN EVERY DAY LIFE	SEMESTER: III
PAPER : MLD-III		CREDIT : 3

Unit I. **Energy**

Introduction to Energy, atoms, energy - atom interaction, energy consumption, units of energy - Energy sources: solar energy, geothermal energy and nuclear energy - bioenergy - wind energy- ocean energy and fossil fuels - human patterns of energy consumption: internal consumption and external consumption, Global energy cycle

Unit- II **Fossil Fuel and Energy conversion**

Energy sources: Fossil fuels and their types, energy content and energy potential, energy capacity measurement, energy conversion, conversion efficiency, Global potentials of fossil fuels and supply chain - origin of pollution - types of pollution and their impact on daily life - nexus between energy, environment and sustainable development.

Unit II. **Ecology and Environment**

Concept and theories of ecosystems, - energy flow in natural and man-made ecosystems. Examples of natural and manmade ecosystems - agricultural, industrial and urban ecosystems - sources of pollution from energy technologies and its impact on atmosphere: air, water and soil - environmental laws on pollution control.

Unit-IV - **Pollution free renewable energy Technologies Solar Energy**

potential, energy conversion through photosynthesis, Photovoltaic conversion and solar thermal energy conversion. **Wind Energy:** potential and energy conversion systems. **Ocean Energy:** potential and energy conversion principles **Bioenergy:** resources and types.

Unit V. Energy and Economy

Energy and Economics: gross domestic product (GDP) and energy- energy market and society - energy efficiency - exergy - exergy and economics - energy: security- equity - environmental sustainability index and global measure.

Text Books

1 . Energy and Environment, (Eds.) Loulou, Richard; Waaub, Jean- Philippe; Zaccour, Georges (2005).
2. Energy and the Environment, Ristinen, Robeti A. Kraushaar, Jack J. AK.raushaar, Jack P. Ristinen, Robert A., 2nd Edition, John Wiley, (2006)
3. Energy and the Challenge of Sustainability, World Energy assessment, UNDP, N York, (2000).
4. Solar Energy: principles of Thermal Collection and Storage, S.P. Sukhatme, Tata McGraw-Hill (1984).

5.Y. Goswami, F. Kreith and **J.** F. Kreider, Principles of Solar Engineering, Taylor and Francis, Philadelphia (2000).

Reference books

1. Wind Energy Conversion Systems, L.L. Freris, Prentice Hal 1990.
2.. Geothermal Energy: From Theoretical Models to Exploration and Development by Ingrid Sober and Kurt Bucher, Springer, 2013.
3. Ocean Energy: Tide and Tidal Power by R. H. Charlier and Charles W. Finkl, Springer 20 I 0
4. Energy Economic by Peter M. Schwarz, Routledge publications (2018).