PROGRAMME GUIDE

MASTER OF SCIENCE (M.Sc.) - PHYSICS

SESSION : 2020-21

- Scheme of Examination (Elective Based)
- Detailed Syllabus

DR. C.V.RAMAN UNIVERSITY

Deputy Registrar (Academic)
Dr. C.V. Raman University
Kota, Bilaspur (C.G.)

DR. C.V. RAMAN UNIVERSITY
KARGI ROAD, KOTA, BILASPUR, CHATTISGARH
PHONE : 07753-253737, 8827920016, 8827920019 FAX : 07753-253728
Website: www.cvru.ac.in

W.E.F. July-2020-21

Vision of the Department:

To build foundation for excellence and spur development of the university as a premier university by igniting and nurturing enthusiasm, interest and passion in the study of physics. The Department of Physics is actively in teaching and research to be transformed into a Department of global standards, importing world class education through skilled manpower which can make a significant contribution to the nation building and cater to the needs of the society by creating an intellectual domain that initiates, nourishes and perpetuates values of humanity conscious coexistence & achievement of excellence. To accept uphill challenges for the better upliftment of the nation as well as humanity is also part and parcel vision of our Department.

The Department will continue to play a major role in the field of higher education by seeding new ideas and creating knowledge, and by imparting high level of training with values and social commitment.

Mission of the Department:

- To awaken the young minds and discover their talents both in theory and practical physics.
- To support the developmental activities of the University and make the department vibrant.
- To inculcate scientific temperament from very beginning.
- To aware physical interpretation and experimental application during teaching.
- To vigilant all along for development of 360 degree views.
- To promote excellence in value based education and skill based teaching – learning.
- To establish as a pioneer in the field of research.
- To develop as a centre of excellence for higher education and knowledge resources.
- To interact with all esteemed universities for achieving our target.
- To enhance multimedia technique for teaching – learning evaluation (TLE).
- To establish ourselves as a role model in the field of quality education.
- To connect globally in the field of development.
- To achieve short term goal and long term goal within time period.
- To restore punctuality, sincerity, commitment, transparency, foresightedness especially in the department.
- To develop intrinsic and inherent quality.

Values of the Department:

Really values play pivotal role in any university. It has been restored into students as well as teachers through values. Values acts as a bridge in between life and soul. It is said that –

"Man may leave or die,
Nations may rise or fall,
But idea lives."

The values of Department of Physics are as follows:

- To build up competency for better future.
- To inculcate moral values & Character value.
- To imbibe training as well as skill, for survival.
- To prepare for excellence in all fields.
- To stress for holy prayer, worship ,reading hobbits of spiritual books and story of great men.
- To develop emotional technology for strengthen as the best manager.
- To practice for self assessment.

Programme Objective:

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The structure of the M.Sc. (Physics) Programme is designed to produce graduates of physics and relative subjects with rigorous practical, analytical and research based skills, who are exceptionally well-equipped to go onto Masters in physics, or employment in industrial, academic and the public service.
The M.Sc. (Physics) programme provides:

- To analyze the quantum mechanical problems.
- To impart knowledge about various mathematical tools employed to study physics problems.
- The objective of this course is to learn the properties of macroscopic system using the knowledge of the properties of individual particles.
- To Study some of the basic properties of the condensed phase of materials specially solids.
- Drawing attention toward the theory related to the Radiation Detection and practical use of Dosimetry in industrial and research institutions.
- To study basic properties of different types of lasers .
- To gain knowledge of modern techniques, theory and observational results in relative topics
- To understand research and knowledge of different parts of research.
- To promote research culture and an environment that encourages the student's originality and creativity in their research.
- Skills to enable the student to critically examine the background literature relevant to their specific fields.

Programme Outcomes:

- Updation and confidence in subjects.
- Development of orientation.
- Participation in the field of scientific laboratory, research centre.
- Value added achievements.
- Promotion in higher education.
- Useful in competing the national level examination as NET, SLET, CSIR, Gate, JEST, CAT, MAT, etc.

Programme Specific Outcomes:

- Understanding the scientific temperaments.
- Enhancing the advance concepts.
- Updation with relevant scenario in field of physics.
- Knowledge and application of modern equipments.
- Preliminary knowledge of research.
- Especially jobs in research centre.
- Critical thinking of a problem.
- Preparation of self employability.

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DEAN
Faculty of Sc

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MASTER OF SCIENCE (PHYSICS)
Duration: 24 Months (2 Years)
Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC PHYSICS SEMESTER I														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMPH101	Core Course	Mathematical Physics	100	50	17	20	08	30	12	4	-	-	4
6SMPH102	Core Course	Classical Mechanics	100	50	17	20	08	30	12	4	-	-	4
6SMPH103	Core Course	Quantum Mechanics I	100	50	17	20	08	30	12	4	-	-	4
6SMPH104	Core Course	Electronic Devices	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
6SMPH105	Practical	LAB - I	50	25	08	-	-	25	08	-	-	2	2
6SMPH106	Practical	LAB - II	50	25	08	-	-	25	08	-	-	2	2
	Grand Total		500							16	-	4	20

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Lab Performance Assignment 50%

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COURSE STRUCTURE M.SC PHYSICS SEMESTER II														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits	
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution	
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks					
Theory Group														
6SMPH201	Core Course	Quantum Mechanics II	100	50	17	20	08	30	12	4	-	-	4	
6SMPH202	Core Course	Statistical Mechanics	100	50	17	20	08	30	12	4	-	-	4	
6SMPH203	Core Course	Solid State Physics	100	50	17	20	08	30	12	4	-	-	4	
6SMPH204	Core Course	Atomic & Molecular Physics	100	50	17	20	08	30	12	4	-	-	4	
Practical Group				Term End Practical Exam		Lab Performance		Sessional						
6SMPH205	Practical	LAB -I	50	25	08	-	-	25	08	-	-	2	2	
6SMPH206	Practical	LAB-II	50	25	08	-	-	25	08	-	-	2	2	
Skill Courses								Sessional						
	Skill Enhancement	Skill Enhancement Elective Course-1	50	-	-	-	-	50	20	1	-	1	2	
	Grand Total		550							17		5	22	

Minimum Passing Marks are equivalent to Grade D
L- Lectures T- Tutorials P- Practical
Major- Term End Theory / Practical Exam
Minor- Pre University Test
Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%
Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

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COURSE STRUCTURE M.SC PHYSICS SEMESTER III														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMPH301	Core Course	Condensed Matter Physics	100	50	17	20	08	30	12	4	-	-	4
6SMPH302	Core Course	Nuclear Physics	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –I	100	50	17	20	08	30	12	4	-	-	4
***	Discipline Specific Elective	Elective –II	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
6SMPH307	Practical	LAB -I	50	25	08	-	-	25	08	-	-	2	2
6SMPH308	Practical	LAB-II	50	25	08	-	-	25	08	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-1	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		550							17	-	5	22

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

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COURSE STRUCTURE M.SC PHYSICS SEMESTER IV														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
****	Discipline Specific Elective	Elective –III	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –IV	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
6SMPH405	Practical	LAB-I	50	25	08	-	-	25	08	-	-	2	2
6SMPH406	Practical	LAB-II	50	25	08	-	-	25	08	-	-	2	2
	Research Component	Project/Internship/Field work & Viva Voce	200	100	33	-	-	100	40	-	-	8	8
	Grand Total		500							8	-	12	20

Minimum Passing Marks are equivalent to Grade D L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Compulsory Project/Dissertation with choice in any Disciplinary specific elective. Compulsory one paper presentation certificate in related discipline.

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PROJECT

All the candidates of M.Sc. (Physics) are required to submit a project-report based on the work done by him/her during the project period. A detailed Viva shall be conducted by an external examiner based on the project report. Students are advised to see the detailed project related guidelines on the website of CVRU. (www.cvru.ac.in) under Project Guidelines for student section.

Outcome-The student will identify a problem on which he/she would be able to work, identify the scope of research on the chosen topic and will frame the objectives to be addressed in the project through a work plan.

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SPECILIZATION WITH ELECTIVE

****Note** - Students need to select any one group and choose any two subjects from selected group for third and fourth semester.

Electives for Third Semester			Electives for Fourth Semester		
Course Code	**Course Type**	**List of Elective**	**Course Code**	**Course Type**	**List of Electives**
GROUP ELECTIV- I Name – M.Sc (Physics)			**GROUP ELECTIVE- III Name –M.Sc (Physics)**		
6SMPH303	Discipline Specific Elective-1	Electrodynamics	6SMPH401	Discipline Specific Elective-3	Material Science
6SMPH304	Discipline Specific Elective-1	Plasma Physics	6SMPH402	Discipline Specific Elective-3	Physics of Nano Materials
GROUP ELECTIVE -II NAME: M.Sc (Physics)			**GROUP ELECTIVE – IV Name – M.Sc (Physics)**		
6SMPH305	Discipline Specific Elective-2	Digital Electronics & Microprocessor	6SMPH403	Discipline Specific Elective-4	Computational Methods & Programming
6SMPH306	Discipline Specific Elective-2	Environmental Physics	6SMPH404	Discipline Specific Elective-4	Communication Electronics

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SKILL ENHANCEMENT ELECTIVE COURSES

Non-Technical			
Elective No.	**Department/ Faculty Name**		
	Faculty of Information Technology		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	Faculty of Management		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	Faculty of Commerce		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	Faculty of Humanities		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	Faculty of Science		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	Faculty of Education		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)

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Semester- 1st | **Course Code: 6SMPH101**
Programme: M.Sc. Physics | **Theory Max. Marks: 50**
Course: Mathematical Physics | **Theory Min. Marks: 17**

COURSE OBJECTIVE: To impart knowledge about various mathematical tools employed to study physics problems.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Special Functions & Vector Analysis:** Recursion relation, Generating functions and Orthogonality of Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials, Dimensional analysis, Vector algebra and Vector Calculus.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Integral Transforms:** Fourier integrals, Fourier transforms and inverse Fourier transforms, Fourier transform of derivatives, Convolution theorem, Elementary Laplace transforms; Laplace transform of derivatives, Laplace transformation of Dirac's delta function.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Green's Functions:** Non-homogenous boundary value problems, Green's function for one dimensional problem, Eigen function expansion of Green's function, Fourier transform, Method of constructing Green's function, Green's function for electrostatic boundary value.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Complex Variables & Matrix:** Analyticity of complex functions, Cauchy Riemann equations, Cauchy theorem, Cauchy integral formula, Taylors, McLaren, Laurent series & Mapping, Theorem of residues, Simple cases of contour integration, Matrices, Cayley – Hamilton theorem, Matrix representation, Eigen values & Eigen functions.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. Various techniques to solve differential equations.
2. How to use special functions in various physics problems.

TEXT/REFERENCEBOOKS:

- Mathematics of Engineers and Physicists — L. A. Pipes, Tata McGraw Hill, Edition
- Mathematical Physics — Gupta, Yadav & Mallik, Kedarnath& Ramnath Publication, Meerut
- Mathematical Physics — H. K. Dass
- Mathematical Physics — Ghatak, Goyal & Guha
- Mathematical Physics — B.S. Rajput, Pragati Prakashan
- Complex variable & Laplace Transform — M.R. Spiegel- Schaum Series

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Mathematical Scientist, Quality Research Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (quality Education)	Service consultancy

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Semester- 1st
Programme: M.Sc. Physics
Course: Classical Mechanics

Course Code: 6SMPH102
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To apprise the students of Lagrangian and Hamiltonian formulation and their applications.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Newtonian Mechanics of One and Many Particles Systems:** Conservation laws, Constrains & their classification, Principle of virtual work, D'Almbert's principle in generalized coordinates, The Lagrange's equation from D'Almbert's principle. Configuration space, Hamilton's principle deduction from D'Almbert's principle, generalized moment and Lagrangian formulation of the conservation theorems, Reduction to the equivalent one body problem, the equation of motion and first integrals.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Hamiltonian Formulation of Mechanics & Motion under Central Force:** The equations of canonical transformation and generating functions, The Hamilton-Jacobi Action, Poisson's bracket, Simple algebraic properties of Poisson's bracket, The equation of motion in Poisson's Bracket notation, Poisson theorem, Principle of least action, Kepler's problem, Inverse central force field, Rutherford scattering.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Rotating Frames & Rigid Bodies:** Theory of small oscillations, Equations of motion, Eigen frequencies and general motion, normal modes and coordinates, Rotating coordinate systems, Acceleration in rotating frames, Coriolis force and its applications, Elementary treatment of Eulerian coordinates and transformation matrices, Angular momentum inertia tensor, Euler equations of motion for a rigid body, Torque free motion for a rigid body.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Special Relativity in Classical Mechanics:** Symmetries of space and time, Special theory of relativity, Mass-energy equivalence, Galilean transformation, 4-Vectors and 4–Scalars, Relativistic generalization of Newton's laws, 4-momentum and 4-force, variance under Lorentz transformation relativistic mechanics.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. Necessity of Lagrangian and Hamiltonian formulation
2. Essential features of a problem (Like motion under central force, rigid body dynamics, periodic motion) use them to set up and solve the appropriate mathematical equations and make quick and easy checks on the answer to catch simple mistakes.
3. Theory of small oscillations which is important in several areas of physics i.e. molecular spectra, acoustics, variation of atoms in solids, coupled mechanical oscillators and electrical circuits.

TEXT / REFERENCE BOOKS:

- Classical Mechanics — H. Goldstein, Addison Wesley
- Classical Mechanics — N. C. Rana & P. S. Jog
- Classical Mechanics — Landu&Lifshitz- Pergamann Press
- Classical Mechanics — Sommarfield, Academic Press
- Introduction to Classical Mechanics — R.G. Takwale& P.S. Puranik
- Classical Mechanics — Gupta, Kumar & Sharma, Pragati Prakashan, Meerut
- Classical Mechanics — Satya Prakash, Kedar& Ramnath Publication

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, IGARG Scientist, Researcher, Model Developer, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (quality Education)	Service consultancy

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Semester- 1st | **Course Code: 6SMPH103**
Programme: M.Sc. Physics | **Theory Max. Marks: 50**
Course: Quantum Mechanics-I | **Theory Min. Marks: 17**

COURSE OBJECTIVE: To give exposure about various tools employed to analyze the quantum mechanical problems.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Foundation of Quantum Mechanics:** Basic Postulates of quantum Mechanics, wave – particle duality, Schrodinger time dependent & time independent wave equation, Equation of continuity, Normality, Orthogonality, Expectation values and Ehrenfest theorem, Solution of Schrodinger equation for one dimensional motion in Potential well, Potential step and Potential barrier, Wave packets.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**General Formalism of Wave Mechanics:** Linear vector space, Concept of Hibert space, Bra and Ket notation for state vector, unitary transformation (translation and rotation), Matrices for Position (x) and Momentum (p), Heisenberg uncertainty relation and its applications, Schwartz inequality.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Exactly Soluble Eigen Value Problems:** Solution of Schrodinger equation for linear harmonic oscillator, hydrogen - like atom, square well potential and their respective application to atomic spectra, Molecular spectra and low energy nuclear states (Deuteron).	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Angular Momentum in Quantum Mechanics:** Theory of angular momentum, Orbital angular momentum, Spin angular momentum, Eigen values and Eigen function of L^2 and L_z in term of spherical harmonics, Commutation relations.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. Importance of quantum mechanics compared to classical mechanics at microscopic level.
2. Various tools to calculate Eigen values and total angular momentum of particles.
3. Application of approximation method and scattering theories.

TEXT/REFERENCE BOOKS:

- Quantum Mechanics — L. I. Schiff, TMH Ed.
- Introduction Quantum Mechanics — Pauling, TMH Ed
- Quantum Mechanics — B.Craseman and J. D. Powell, Narosa Pub. House, Kolkatta
- Quantum Mechanics — AjoyGhatak& S. Loknathan, Mcmillan India Ltd.
- Modern Quantum Mechanics — J. J. Sakurai
- Quantum Mechanics — Gupta, Kumar & Sharma, Jai Prakasdnath and Com.

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Researcher, Accelerator Operator, Spectral Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (quality Education)	Service consultancy

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Semester- 1st **Course Code: 6SMPH104**
Programme: M.Sc. Physics **Theory Max. Marks: 50**
Course: Electronic Devices **Theory Min. Marks: 17**

COURSE OBJECTIVE: To introduce students to entire circuit design and to provide in depth theoretical base of electronics and digital electronics.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Transistors:** Introduction and types of transistors, JFET, BJT, MOSFET and MESFET: structure derivations of the equations for I-V characteristics under different condition, Microwave devices, Tunnel diode, Transfer electron devices (Gunn diode), Avalanche transits time devices, Impatt diodes and Parametric devices.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Photonic Devices:** Photo conductive devices (LDR), Photo detectors, Solar cell (open circuit voltage and short circuit current, fill factor), LED (high frequency limit, Effect of surface and indirect recombination current, operation of LED), Diode lasers (Conditions for population inversion in active region), Light confinement factor, Optical gain and Threshold current for lasing.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Memory Devices:** Review of logic gates, Read Only Memory (ROM) and Random Access Memory (RAM), Types of ROM, PROM, EPROM, EEPROM and EAPROM, Static and Dynamic RAMs (SRAM & DRAM), Characteristics of SRAM and DRAM, Hybrid Memories: CMOS and NMOS memories, Non-volatile RAM, Ferroelectric memories, Charge coupled devices (CCD), **Storage devices:** Optical Storage devices (CD-ROM, CD-R, CD-R/W, DVD).	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Optical Electronics:** Electro-optics, Magneto-optic and Acousto-optic effects, Materials properties related to get these effects, Important Ferroelectric, liquid crystal and polymeric materials for these devices, Piezoelectric, Electrostrictive and magnetostrictive effects. Acoustic delay lines, Piezoelectric resonators and filters, High frequency piezoelectric devices surface, Acoustic wave devices.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Fundamental design concept of different types of logic gates, minimization techniques etc.
2. Characteristics of device like PNP, NPN, Diodes and truth table of various logic gates.
3. Basic elements and to measure their values with multimeter and their characteristics study.

TEXT / REFERENCE BOOKS:

- Semiconductors devices - physics technology — S.M. Sze, Willey India Pvt. Ltd.
- Hand Book of Electronics — Gupta & Kumar, Pragati Prakashan
- Modern Digital Electronics — R.P. Jain, TMH Ed.
- Optical Electronics — AjoyGhatak and Thyagrajam, Mcmillan India Ltd.
- Integrated Electronics — Millman&Halkias, TMH Ed.

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Researcher, Process Engineer, Technical Specialist, QA- Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry, Innovation and Infrastructure), Goal-12 (Responsible Consumption and Production), Goal-17 (Partnership for the Goals)	Service consultancy

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Kargi Road, Kota, Bilaspur (C.G.)

Semester- 1st | **Course Code: 6SMPH105**

Programme: M.Sc. Physics | **Practical Max. Marks: 25**

Course: LAB-I - Electronics | **Practical Min. Marks: 08**

COURSE OBJECTIVE: To provide student practical based learning environment and to get familiar with the basics of electronics.

1. To determine the energy band gap of a semiconductor material using P–N Junction diode.
2. To study and draw the characteristics curve of P–N Junction diode.
3. To study and draw the characteristics curve of Zener diode.
4. To study the characteristics of the given NPN or (PNP) transistor in the common emitter (CE) mode.
5. To study the characteristics of the given NPN or (PNP) transistor in the common base (CB) mode.
6. To study the characteristics of the given NPN or (PNP) transistor in the common collector (CC) mode.
7. To study the stable, mono stable and bi-stable multi vibrators by using IC-555.
8. To study the characteristics and applications of Silicon Controlled Rectifier (SCR).
9. To study the frequency response / output voltage gain & charge in critical frequency with and without feedback capacitor with the help of common emitter transistor amplifier. (Miller Effect)
10. To study the input impedance with the help of common emitter transistor amplifier.
11. To study the output impedance with the help of common emitter transistor amplifier.
12. To study the effect of negative feedback on output gain with the help of common emitter transistor amplifier.
13. To study the characteristic curve of Field Effect Transistor (FET).
14. To study the characteristics curve of Uni-Junction Transistor (UJT).
15. To study the Hall Effect and to calculate: -
    (i) The hall coefficient (R_H).
    (ii) The concentration of the majority charge carriers.
    (iii) The mobility of the majority charge carriers.
    (iv) An identification type of the given semiconductor.

NOTE

- **Two experiments will be asked in the semester practical examination.**

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Semester- 1st **Course Code: 6SMPH106**
Programme: M.Sc. Physics **Practical Max. Marks: 25**
Course: LAB-II Fiber Optics **Practical Min. Marks: 08**

COURSE OBJECTIVE: To inculcate the temperament of doing practical and to understand the basic phenomena of Fiber Optics through practical.

1. Determination of NA by using optical fibre cable.
2. Setting up fiber optic analog link.
3. Setting up fiber optic digital link.
4. Intensity modulation system using analog input signal.
5. Intensity modulation system using digital input signal.
6. Frequency modulation system.
7. Pulse width modulation system.
8. Study of propagation loss in optical fiber.
9. Study of bending loss
10. Measurement of optical power using optical power meter.
11. Measurement of propagation loss using OPM.

NOTE

- **Two experiments will be asked in the semester practical examination.**

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Semester- 2nd | **Course Code: 6SMPH201**
Programme: M.Sc. Physics | **Theory Max. Marks: 50**
Course: Quantum Mechanics-II | **Theory Min. Marks: 17**

COURSE OBJECTIVE: To impart knowledge of advanced quantum mechanics for solving relevant physical problems.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Approximation Method for Bound States:** Rayleigh-Schrodinger Perturbation theory of non-degenerate and degenerate levels and their applications, Variation method and its applications, W K B Approximation method, Connection formulae and ideas on potential barrier with applications to theory of alpha decay.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Time Dependant Perturbation Theory:** Methods of variation of constants and transition probability, Adiabatic and sudden approximation, Wave equation for a system of charged particles under the influence of external electromagnetic field, Absorption and induced emission, Einstein's A and B coefficients and transition probability.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Theory of Scattering:** Physical concepts, Scattering amplitude, Scattering cross section, Born Approximation and partial waves, Scattering by perfectly rigid sphere, Complex potential and absorption, Scattering by spherically symmetric potential, Identical particles with spin, Pauli's spin matrices.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Relativistic Quantum Mechanics:** Schrödinger's relativistic equation (Klein-Gordon equation), Probability and current density, Klein - Gordon equation in presence of electromagnetic field, Short comings of Klein-Gordon equation, Dirac's relativistic equation for free electron, Dirac's Matrices, Dirac's relativistic equation in electromagnetic field, Negative energy states and their interpretation in hydrogen atom, Hyperfine splitting.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Importance of relativistic quantum mechanics compared to non – relativistic quantum mechanics.
2. Various tools to understand filled quantization and related concept.
3. Exposure to quantum field theory and universal interactions.

TEXT / REFERENCE BOOKS:

- Quantum Mechanics — L. I. Schiff, TMH Ed.
- Advanced Quantum Mechanics — Satya Prakash, Kedarnath& Ramnath, Co. Meerut
- Quantum Mechanics — B. Craseman and J. J. Powell Narosa Pub. Kolcatta
- Relativistic Quantum Mechanics — Bajorken&Drell, TMH Ed.
- Modern Quantum Mechanics — J.J. Sakurai
- Quantum Mechanics — Mathews and Venkatessan
- Quantum Mechanics — A .K. Ghatak and Loknathan

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Researcher, Accelerator Operator, Spectral Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (quality Education)	Service consultancy

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Semester- 2nd **Course Code: 6SMPH202**
Programme: M.Sc. Physics **Theory Max. Marks: 50**
Course: Statistical Mechanics **Theory Min. Marks: 17**

COURSE OBJECTIVE: The objective of this course is to learn the properties of macroscopic system using the knowledge of the properties of individual particles.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Basic Principles of Statistical Mechanics:** Foundation of statistical mechanics, Specification of states of a system contact between statistics and thermodynamics, Classical ideal gas entropy of mixing and Gibb's paradox, Micro canonical ensemble, Phase space, Trajectories and density of states, Liouville theorem, Canonical and Grand canonical ensembles, Partition function, Calculation of statistical quantities, Energy and density fluctuations.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Ideal Bose and Fermi Systems:** Statistics of ensembles, Statistics of indistinguishable particles, Density matrix, Maxwell- Boltzmann, Fermi Dirac and Bose- Einstein statistics, Properties of ideal Bose gases, Bose -Einstein condensation, properties of ideal Fermi gas, Electron gas in metals, Boltzmann transport equation.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Imperfect Gases & Ising Model:** Cluster expansion for a classical gas, Virial equation of state, Mean field theory of Ising model in 3, 2 and 1 dimension, Exact solution in one-dimension.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Dynamical Theory of Gases:** Thermodynamics fluctuation, spatial correlation, Brownian motion, Langevin theory, Fluctuation dissipation theorem, Fokker-Planck equation, Onsager reciprocity relations.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES:Students will have understanding of:

1. Connection between statistics and thermodynamics.
2. Difference ensembles and theories to explain the behaviour of the system.
3. Difference between classical statistics and quantum statistics.
4. Statistical behaviour of ideal Bose and Fermi systems. .

TEXT / REFERENCE BOOKS:

- Statistical and thermal Physics — F. Reif, TMH Ed.
- Statistical Mechanics — K. Huang, TMH Ed.
- Statistical Mechanics — R. K. Pathria
- Statistical Mechanics — Allis &Herling, TMH Ed.
- Statistical Physics — S. K. Sinha, Narosa Pub. Kolcatta
- Statistical Mechanics — Satya Prakash and J.P. Agrawal, Kedarnath and Ramnath Co. Meerut

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Data Scientist, Research associate, Statistical Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (quality Education)	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY
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Semester- 2nd
Programme: M.Sc. Physics
Course: Solid State Physics

Course Code: 6SMPH203
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To Study some of the basic properties of the condensed phase of materials specially solids.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Electron Theory:** Drude Model, Electrical and thermal conductivity, Wiedemann–Franz law, Lorentz theory, Somerfield theory of Metals, Boltzmann differential equation, Relaxation-time approximation, Solution of the Boltzmann equation for metals, Peltier coefficient.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Electrons in a Periodic Lattice:** Nearly free electron model, Bloch theorem, Kronig – Penney model, Fermi energy, Metals–Semimetals–Semiconductors–Insulators, Tight binding approach, Fermi surface, De-Haas Van Alfen effect, Magneto resistance, Quantum Hall effect.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Elementary Excitations:** Polarizability and dielectric function of the electron gas, Collective excitations, Screening, Metal-insulator transition, Electron-electron interaction, Polaritons, Polarons, Excitons, Ferroelectric effects.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Superconductivity:** Macroscopic electromagnetic properties, Thermal properties, Isotope effect, Energy gap, London theory, Two fluid model, Flux quantization, Single particle tunnelling, dc and ac Josephson effect, Quantum interference, Electron-phonon interaction, Cooper pair, BCS theory for ground and excited states, High temperature superconductors.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Sturucture in solids and their determination using XRD.
2. Behaviour of electrons in solids including the concept of energy bands and effect of the same on material properties.
3. Electrical, thermal, magnetic and dielectric properties of solids.

and dielectric properties of solids.

TEXT / REFERENCE BOOKS:

- Solid State Physics — S. O. Pillai, New Age Int. (P) Ltd Pub.
- Introduction to Solid State Physics, — C. Kittel, John Willey Pub.
- Solid State Physics — R. L. Singhal, Kedarnath and Ramnath, Co. Meerut
- Solid State Electronics Devices — Streetman and Banarjee, PHI Pvt., New Delhi
- Solid State Electronics — Wang, TMH Ed.
- Quantum Theory of Matter — Slater, TMH Ed.

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Process Engineer, Aero-Space System Engineer, Research Associate, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry Innovation and Infrastructure)	Service consultancy

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Semester- 2nd | **Course Code: 6SMPH204**
Programme: M.Sc. Physics | **Theory Max. Marks: 50**
Course: Atomic & Molecular Physics | **Theory Min. Marks: 17**

COURSE OBJECTIVE: Objective of this course is to learn atomic, molecular and spin resonance spectroscopy.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Atomic Structure and Methods of Molecular Quantum Mechanics:** Quantum states of one electron atom, Atomic orbital, Hydrogen spectrum, Paulis exclusion principle, Spectra of alkali elements, Spin orbit interaction and line structure of alkali Spectra, Methods of molecular quantum mechanics, Thomas Fermi statistical model, Hartree and Hartreefock method , Two electron system, Interaction energy in L-S and J-J coupling, Hyperfine structure (qualitative), Line broadening mechanisms (general ideas), Zeeman Effect, Stark effect, Paschen Back effect.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Pure Rotational Spectra:** Diatomic linear, Symmetric top, asymmetric top and spherical top molecules, Intersteller molecules, Rotational spectra of diatomic molecules as a rigid rotator, Energy level and Spectra of non-rigid rotator, Intensity of rotational lines.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Vibrational Spectra:** Vibration energy of diatomic molecule, Diatomic molecule as a simple harmonic oscillator, Energy levels and spectrum, Morse potential energy curve, Molecules as vibrating rotator, Vibration spectrum of diatomic molecule, PQR branches, IR spectrometer(qualitative).	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Introduction to Spectroscopy:** Introduction to Ultraviolet, Visible and Infra-red (IR)Spectroscopy, **Raman spectroscopy:** Introduction, pure rotational and vibration spectra, Techniques and instrumentation, Photo electron spectroscopy, Elementary idea about photo acoustic spectroscopy and Mossbauer spectroscopy (principle).	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Atomic spectroscopy of one and two valence electron atom.
2. The change in behaviour of atoms in external applied electric and magnetic field.
3. Rotation, vibrational, electronic and Raman spectra molecules.
4. Electron spin and nuclear magnetic resonance spectroscopy.

TEXT / REFERENCE BOOKS:

- Introduction to atomic spectra — H.E. White, TMH Ed.
- Fundamental of molecular spectroscopy — C.B. Banwell, TMH Ed.
- Application of Spectroscopy — H. Kaur
- Introduction to molecular spectroscopy — G.M.Barrow, TMH Ed.
- The Atomic Nucleus — Evans, TMH Ed.
- Molecular Spectroscopy — Jeanne L and McHale
- Molecular Spectroscopy — J.M. Brown
- Atomic & Molecular Spectra — Rajkumar, Kedarnath and Ramnath Co. Meerut
- Elements Spectroscopy — Gupta, Kumar & Sharma, PragtiPrakashan

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Research Associate, Lab Operator, Spectral Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry Innovation and Infrastructure)	Service consultancy

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Semester- 2nd **Course Code: 6SMPH205**
Programme: M.Sc. Physics **Practical Max. Marks: 25**
Course: LAB-I Solid State Physics & Advanced Electronics **Min. Marks: 08**

COURSE OBJECTIVE: To utilize the knowledge of electronics and to use it in understanding solid state physics.

1. To study and verify the truth table of Basic & Universal logic gates.
2. To study the characteristics curve of Tunnel Diode and its application.
3. To study the characteristics of MOSFET and its application.
4. To draw and study the characteristic curve of DIAC.
5. To draw and study the characteristic curve of TRIAC.
6. To study the pulse amplitude modulation using sample output, sample & hold output and flat top output.
7. To study the pulse amplitude demodulation using sample output, sample & hold output and flat top output.
8. To study the voice signal using pulse amplitude modulation.
9. To study the wave form of Operational Amplifier (741).
10. To study the wave form Differential Amplifier.
11. To study of crystal faces & structure by using given model.
12. **Solar Energy Trainer:**
    - 12.1 To study the voltage and current of the solar cells.
    - 12.2 Study of the voltage and current of the solar cells in series and parallel combinations.
    - 12.3 Study of both the current–voltage characteristic and the power curve to find the maximum power point (MPP) and efficiency of a solar cell.
    - 12.4 To determine the efficiency (η) of the solar cell.
    - 12.5 To study of both the current–voltage characteristic and the power curve to find the maximum power point (MPP) and efficiency of a solar cell.
    - 12.6 Study of the application of solar cells of providing electrical energy to the domestic appliances such as lamp, fan and radio.
13. **Fabrication:** To study the characteristics of FET, MOSFET, UJT, SCR, P-N Junction Diode & Zener Diode by designing its circuit.

NOTE

- **Two experiments will be asked in the semester practical examination.**

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Semester- 2nd
Programme: M.Sc. Physics
Course: LAB-II - Laser

Course Code: 6SMPH206
Practical Max. Marks: 25
Practical Min. Marks: 08

COURSE OBJECTIVE: To study the basic properties of different types of lasers and with the help of those lasers solve & verify various problems at spectral levels.

1. To determine the wavelength of given laser light.
2. To determine the beam divergence of a laser beam.
3. To observe the diffraction pattern and to calculate the slit width.
4. Verification of Inverse Square Law.
5. Study of photo cell.
6. Study of polarization of light by reflection and thus verify Brewster's law.
7. Study and verify Malus Law using a plain glass plate and a Polaroid.
8. Study and verify Malus Law using two polaroids.
9. Study of Spectrophotometer.
10. To determine λ_{max} (wave length of maximum absorption) of solution of $KMnO_4$ using spectrophotometer.
11. Verify the Beer's law $\log\frac{I_0}{I} = A = \epsilon\, cl$.

NOTE

- **Two experiments will be asked in the semester practical examination.**

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Semester- 3rd
Programme: M.Sc. Physics
Course: Condensed Matter Physics

Course Code: 6SMPH301
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSEOBJECTIVE: To study some of the basic properties of the condensed phase of materials specially solids.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Crystal Physics & X-ray Crystallography:** Interaction of X-ray with matters, Absorption of X-rays, Fundamental types of lattices (Two and Three dimensional), SCC, BCC and FCC, Miller indices, The reciprocal lattice and its application to diffraction techniques, The Laue, powder and rotating crystal methods, Crystal structure factor, Point defects, Line defects and planer (stacking) faults, The role of dislocation in plastic deformation and crystal growth.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Electrical Properties of Matter & Superconductivity:** Free electron Fermi gas, Energy levels of orbital in one and three dimensions, Electrons in a periodic lattice, Band theory of solids, Classification of solids effective mass, cellular and pseudo potential methods, Superconductivity, Type I & Type II Superconductors, Critical temperature, Persistent current, Meissner effect.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Polarizability:** Atomic and molecular Polarizability, Claussius-Mossotti relation, Types of Polarizability, Dipolar Polarizability and frequency dependence of dipolar Polarizability, Ionic and Electronic Polarizability, Hall Effect.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Magnetism Quantum View:** Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, Spin waves and magnous, Curie - Weiss law for susceptibility, Ferro and Anti-ferro-magnetic domains.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Sturucture in solids and their determination using XRD.
2. Behaviour of electrons in solids including the concept of energy bands and effect of the same on material properties.
3. Electrical, thermal, magnetic and dielectric properties of solids.

properties of solids.

TEXT / REFERENCE BOOKS:

- Solid State Physics — C. Kittle, John Wiley Pub.
- Semiconductor Devices — S.M. Sze, John Wiley Pub.
- Introduction to Solid State Physics — L.V. Azaroff
- Crystallographic Solid State Physics — Verma & Srivastava
- Solid State Physics — A.J. Dekke
- Principles of Condense Matter Physics — P.M. Chaiken& T.C. Lubensky

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Researcher, XRD-Operator, Process Engineer, Lab Assistant, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry Innovation and Infrastructure)	Service consultancy

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Semester- 3rd
Programme: M.Sc. Physics
Course: Nuclear Physics

Course Code: 6SMPH302
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To impart knowledge about basic nuclear physics provide the students with an understanding of basic radiation interaction and detection techniques for nuclear physics, radioactive decays, nuclear reactions and elementary particle physics.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Nuclear Interactions and Nuclear Reactions:** Nucleon- nucleon interaction, Exchange forces and tensor forces, Meson theory of Nuclear forces, Nucleon - Nucleon scattering, Effective range theory, Spin dependence of nuclear forces, Charge independence, Yukawa interaction. Direct and Compound nuclear reaction mechanisms, Compound nucleus. Scattering matrix, Reciprocity theorem, Breit-Winger one level formula, Resonance scattering.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Nuclear Models:** Liquid drop model, Bohr Wheeler theory of fission, Experimental evidence for shell effects, Shell model, Spin orbit coupling, Magic numbers, Angular moment and parities of nuclear ground states, Magnetic moment and Schmidt lines, Collective model of Bohr and Mottelson.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Nuclear Decay:** Beta Decay, Fermi theory of beta decay, Comparative half lives, Parity violation, Detection and properties of neutrino, Gamma decay, multiple transitions in nuclei, Shape of the beta spectrum, Total decay rate, Angular momentum and parity selection rules, General ideas of nuclear radiation detectors, Linear accelerator, Betatron, Proton synchrotron, Electron synchrotron.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Elementary Particle:** Types of interaction between elementary particles, Hadrons and Leptons, symmetry and conservation laws, Elementary idea of CP and CPT invariance, Classification of Hadrons, Lie algebra, SU(2), SU(3) multiples, Quark model, Gell-mann, Cosmic Rays : Nature, composition, charge and energy spectrum of primary cosmic rays, Production and propagation of secondary cosmic rays, Soft penetrating and nucleonic component, Origin of cosmic rays, Rossi curve, Bhabha- Heitlr theory of cascade showers.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Basic properties of nucleus and nuclear models to study the nuclear structure properties.
2. Various aspects of nuclear reactions will give idea how nuclear power can be generated.
3. Need of standard model and its limitations.
4. Week interaction between quarks and how that this is responsible for beta decay.
5. Laptons and how the electron neutrons and antineutrons are produced during beta plus and beta minus decays.

TEXT / REFERENCE BOOKS:

- Elements of Nuclear Physics — Pandya & Yadav, Kedarnath and Ramnath, Co. Meerut
- Introduction to Modern Physics — Richtmyer, Kennard and Cooper, TMH Ed.
- Nuclear Physics — I. Kaplon
- Nuclear Physics — Roy & Nigam
- Nuclear Physics — S.N. Ghoshal, S. Chand, Co. Ltd.
- Nuclear Physics — D.C. Tayal, Himalaya Pub. House, Mumbai

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Nuclear Physicist, Researcher, Radiation Safety Officer, Scientific Technician, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry Innovation and Infrastructure), Goal-12 (Responsible Consumption and Production)	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

Semester- 3rd
Programme: M.Sc. Physics
Course: Electrodynamics (Elective I)

Course Code: 6SMPH303
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: Completion, the students will be able to: Demonstrate an understanding of the use of scalar and vector potentials of Gauss invariance, know and use methods of solution of Poisson and Laplace equations, and use principle of Lorentz covariant formalism and tensor analysis and basic understanding of plasma state essential for higher study.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Basics of Electrostatics and Magneto Statics:** Laplace's and Poisson equations, Method of images, Biot-Sawart law, Ampere law, Maxwell's equations, Scalar and vector potentials, Gauge transformation, Lorentz gauge, Coulomb Gauge, Solution of Maxwell equations in conducting media radiations by moving charges, Retarded potentials, Lienard-Wiechrt potentials, Fields of charged particles in uniform motion.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Relativistic Electrodynamics:** Fields of an accelerated charged particles at low velocity and high velocity, Angular distribution of power radiated, Invariance of electric charge, relativistic transformation properties of E and H fields, Electromagnetic fields tensor in 4-dimensional Maxwell equation, Four Vector current and potential and their invariance under Lorentz transformation, Co-variance of electrodynamics, Lagrangian and Hamiltonian for a relativistic charged particle in external E M field, Motion of charged particles in electromagnetic field, Uniform and non uniform E and B fields.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Production of Plasma & Wave in a Fluid Plasma:** Elementary concept of occurrence of plasma, Gaseous and solid state plasma, Production of gaseous and solid state plasma, Plasma parameters, Plasma confinement, pinch effect, instability in a pinched- plasma column, Electrical neutrality in a plasma, Plasma oscillations: Transverse oscillations and longitudinal oscillations.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Domain of Magneto Hydrodynamics and Plasma Physics:** Magneto hydrodynamic equations, Magnetic hydro-static pressure, Hydrodynamic waves: Magneto-sonic and Alfven waves, particle orbits and drift motion in a plasmas, Experimental study of Plasma, The theory of single and double probes.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of:

1. Time varying field and Maxwell Equations.
2. Various concepts of electromagnetic waves.
3. Radiation from ionised time varying sources and charged particle dynamics.

TEXT / REFERENCE BOOKS:

- Introduction to Electrodynamics — David J. Griffiths, PHI, Pvt. Ltd.
- Plasma Physics — F.F. Chen
- Electrodynamics — Gupta, Kumar & Singh, Pragati Prakashan
- Plasma state and matter — Sen, Pragati Prakashan
- Classical electrodynamics — Jackson
- Classical electricity and Magnetism — Pamolsky& Philips

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Scientist, Research Associate, Lab Technician, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education),	Service consultancy

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W.E.F. July. 2020-21

C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

Semester- 3rd
Programme: M.Sc. Physics
Course: Plasma Physics (Elective I)

Course Code: 6SMPH304
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To expose the students to theory related to motion charge particle in inhomogeneous field, production of plasma and uses of plasma.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Occurrence of Plasma in Nature:** Criteria for plasmas, Single particle motion in uniform and non uniform electric (E) and magnetic (B) fields, Time varying E and B field, Adiabatic invariants, Fluid equation of motion. Fluid drifts parallel and perpendicular to B. Plasma Oscillations, Electron Plasma waves, Ion Waves, Validity of Plasma approximation.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Single Particle Orbit Theory & Diffusion:** Electrostatic electron and ion perpendicular to B, Electromagnetic waves with B_0=0, Propagation Vector (K) perpendicular and parallel to B_0, Diffusion in weakly and fully ionized plasmas, Decay of Plasma by diffusion.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Stability:** Two stream instability, Gravitational Instability, Weibel instability, Equations of kinetic theory, Derivation of the Fluid equations, Landau damping.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Waves in Plasma & Problem of Controlled Fusion:** Ion acoustic shock waves, Pondermotive Force, Instability threshold, Oscillating two stream instability; Plasma Echoes, Magnetic confinement, Magnetic Mirrors, Pinch effect, Plasma heating, Laser induced fusion.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. What are theoretical method to study the charged particle motion.
2. How to generate plasma in the laboratory.
3. How plasma production is helpful to make fusion reactors.

TEXT / REFERENCE BOOKS:

- Controlled Fusion — F.F. Chen-Volume-I
- Introduction to Plasma Theory — D.R. Nicholson
- The Plasma State — J. L. Shohet

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Plasma Physicist, Research Associate, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education),	Service consultancy

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Kargi Road, Kota, Bilaspur (C.G.)

Semester- 3rd
Programme: M.Sc. Physics
Course: Digital Electronics & Microprocessor (Elective II)

Course Code: 6SMPH305
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To provide theoretical knowledge and develop practical skill in digital systems, logic systems and microprocessor, Electronic systems and microprocessors.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Communication Electronics:** Amplitude modulation - generation of AM waves, Demodulation of AM waves, DSBSC modulation, Generation of DSBSC waves, Coherent detection of DSBSC waves, SSB modulation, Generation and detection of SSB waves, Vestigial sideband modulation.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-II	**Propagation of Waves:** Ground Waves, Sky wave, Space wave propagation, Maximum usable frequency, Skip distance, Virtual height, Fading of signals, **Satellite communication:** Orbital satellite, Geostationary satellites, Orbital pattern, Look angles, Orbital spacing, Satellite system, Link modules.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-III	**Microwave:** Advantages and disadvantages of microwave transmission, loss in free-space, Propagation of microwaves, Atmospheric effects on propagation, Fresnel Zone problem, Used in microwave communication systems.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.
Unit-IV	**Microprocessors and Micro Computers:** Microprocessor and Architecture: Intel 8086, Microprocessor architecture modes of memory addressing, 8086/8088 Hardware specification: Pin-outs and pin functions, Clock generator (8284A), Bus buffering and latching, Bus timing, Ready and wait state, Minimum mode versus maximum mode.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. Logic circuits, digital systems and microprocessor and their peripheral devices.
2. Operating and designing digital systems.
3. How to solve problems in design and /or implementation of digital electronics.

TEXT / REFERENCE BOOKS:

- Modern Digital Electronics — R.P. Jain, TMH Ed.
- Microwave Devices & Circuits — S.Y. Lio, Pearson
- Microwave Devices & Radar Engineering — Kulkarni
- Digital Principles & Applications — Malvino& Leech
- Microprocessor Architecture, Programming& Applications with 8085/8086 — R.S. Gaonker
- Intel Microprocessor — Barry B. Brey, Pearson
- Fundamentals of Electronics — Borker
- Electronic & Communication Simplified: — A. K. Maini, Khanna Publ.

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, QA – Analyst, Researcher, Process Engineer, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry Innovation and Infrastructure),	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

Semester- 3rd
Programme: M.Sc. Physics
Course: Environmental Physics (Elective II)

Course Code: 6SMPH306
Theory Max. Marks:50
Theory Min. Marks: 17

COURSE OBJECTIVE: The students shall acquire basic knowledge within selected environmental topics viz ionizing radiation, radioactivity, U-V & I-R radiation, ozone depletion problem, greenhouse effect and climate, whether and biological effects related to environments.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Essentials of Environmental Physics:** Structure and thermodynamics of the atmosphere, Composition of air, Greenhouse effect, Transport of matter, Energy and momentum in nature, Stratification and stability of atmosphere, Laws of motion, Hydrostatic equilibrium.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Solar and Terrestrial:** Physics of radiation, Interaction of light with matter, Rayleigh and Mie scattering, Laws of radiation (Kirchoffs law, Planck's law, Wien's displacement law, etc.), Solar and terrestrial spectra, UV radiation, Ozone depletion problem, IR absorption.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Environmental Pollution and Degradation:** Elementary fluid dynamics, Diffusion, Turbulence and turbulent diffusion, Factors governing air, water and noise pollution, Air and water quality standards, Waste disposal, Gaseous and particulate matters, Wet and dry deposition.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Environmental Changes and Remote Sensing:** Energy sources and combustion processes. Renewable sources of energy: Solar energy, Wind energy, Bio energy, Hydropower, Fuel cells, Nuclear energy. **Global and Regional Climate:** Elements of weather and climate, Stability and vertical motion of air, Horizontal motion of air and water, Pressure gradient forces, viscous forces.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of -

1. Students will describe and analyze the current national and global environmental problems.
2. Students interpret biological and chemical data related to environments.
3. Know how climate models can be used for weather forecasting, climate simulation, and investigations of the causes of climate change.

TEXT / REFERENCE BOOKS:

- Environmental Physics — Egbert Boeker&Rienk Van Groundelle, Wiley
- The Physics of Atmosphere — J.T. Hougtion, Cambridge Univ. Press
- Renewable Energy Resources — J. Twidell and J. Weir, Eibs, 1988
- An Introduction to Solar Energy for Scientists and Engine — Sol Wieder, John Wiley,
- The Physics of Monsoons — R. N.Keshavamurthy and M. ShankerRao
- Numerical Weather Prediction — G. J. Haltiner and R.T. Williams

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Health Physicist, Energy Policy Analyst, Researcher, Solar Physicist, Radiation Physicist, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry, Innovation and Infrastructure), Goal-13 (Climate action), Goal-14 (Life Below Water), Goal-15 (Life on Land)	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

Semester- 3rd
Programme: M.Sc. Physics
Course: LAB-I Digital Electronics & Communication

Course Code: 6SMPH307
Practical Max. Marks: 25
Practical Min. Marks: 08

COURSE OBJECTIVE: To inculcate temperament of finding new areas in the field of electronics & communication.

1. Verification of De-Morgan's Theorem.
2. To study and verify various laws of Boolean algebra.
3. To study and verify the truth table of Compound logic gates.
4. To study the characteristics of JK flip-flops.
5. To study the characteristics of SR flip-flops.
6. To study the Pulse Position Modulation using Sine Wave Input.
7. To study the Pulse Position Demodulation.
8. To study the Voice Communication using Pulse Position Modulation.
9. To study the Pulse Width Modulation using different sampling frequency.
10. To study the Pulse Width Demodulation.
11. To study the Voice Communication using Pulse Width Modulation.
12. To study the microwave propagation by using X-band setup.
13. **Motorised Antenna Trainer Setup**
    - 13.1 Arranging the trainer and performing the functional checks.
    - 13.2 Plotting the Polar graph/ radiation pattern of an Antenna using software.
    - 13.3 Study of Simple Dipole ($\lambda/2$) antenna.
    - 13.4 Study of Simple Dipole ($\lambda/4$) antenna.
    - 13.5 Study of Folded Dipole ($\lambda/2$) antenna.
    - 13.6 Study of Simple Dipole ($3\lambda/2$) antenna.
    - 13.7 Study of Yagi-UDA 5 Element Simple dipole antenna.
    - 13.8 Study of Yagi -UDA 3 Element Folded dipole antenna.
    - 13.9 Study of Yagi-UDA 5 Element Folded dipole antenna.
    - 13.10 Study of Yagi-UDA 7 Element Simple dipole antenna.
    - 13.11 Study of Hertz antenna.
    - 13.12 Study of Zeppelin antenna.
    - 13.13 Study of $\lambda/2$ Phase Array (End fire) antenna.
    - 13.14 Study of $\lambda/4$ Phase Array (End fire) antenna.
    - 13.15 Study of Combined Co-linear Array antenna.
    - 13.16 Study of Broad Side Array antenna.
    - 13.17 Study of Log Periodic antenna.
    - 13.18 Study of Cut Paraboloid Reflector antenna.
    - 13.19 Study of Loop Antenna.
    - 13.20 Study of Rhombus antenna.
    - 13.21 Study of Ground Plane antenna.
    - 13.22 Study of Slot antenna.
    - 13.23 Study of Helix antenna.

NOTE

- **Two experiments will be asked in the semester practical examination.**

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Semester- 3rd
Programme: M.Sc. Physics
Course: LAB-II - Nuclear Physics

Course Code: 6SMPH308
Practical Max. Marks: 25
Practical Min. Marks: 08

COURSE OBJECTIVE: To understand the basics of Nuclear & Atomic level physics in order to counter the radiation pattern and to utilize radiation as a resource.

1. To draw the plateau characteristics of GM Counter using radioactive source ($_{55}Cs^{137}$).
2. To study the pulse height with the applied voltage to the GM Tube.
3. To study the absorption of beta and gamma radiation.
4. To verify the Inverse Square Law using GM Counter.
5. Study of GM counter.
6. Study of design structure of GM counter.

NOTE

- **Two experiments will be asked in the semester practical examination.**

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Kargi Road, Kota, Bilaspur (C.G.)

Semester- 4th
Programme: M.Sc. Physics
Course: Material Science (Elective III)

Course Code: 6SMPH401
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To give comprehensive exposures to the students regarding various materials, crystalline, non-crystalline materials, crystal structure and their defects the concept of phase and different type of phase diagram.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Classification of Materials:** Crystalline, Polycrystalline, Amorphous (Introduction and their structure), Elementary idea of polymers (Structure and properties), Methods of polymerization, Glasses: Structure and properties, Type of Glasses, Fracture in glasses, Composite Materials: Introduction, their types and properties, Different types of bonding.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-II	**Phase Transitions:** Thermodynamics of phase transformation, Free-energy calculation, I and II order transformation, Hume-Rother rule, Solid solution and types of solid solutions, Phase rule, One-, Two- component systems, Eutectic and paratactic phase diagrams, Lever rule, phase diagrams of Mg- Al, Fe-C Kinetics of transformations, Homogeneous and heterogeneous nucleation, Growth kinetics.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-III	**Diffusion in Materials:** Mechanism of diffusion, Energy of formation and motion, Rate theory of diffusion, Einstein relation (relation between diffusivity and mobility), Fick's laws of diffusion and solution of Fick's second law, Kirkendal effect, Diffusion of vacancies in ionic crystals, Experimental determination of Diffusion coefficient.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-IV	**Transport Properties of Solids:** Electrical conductivity of metals and alloys, Extrinsic & intrinsic semiconductors and amorphous semiconductors, Scattering of electrons by phonons, Impurity, Carrier mobility and its temperature dependence, Mathiessio's rule for resistivity, Temperature dependence of metallic resistivity.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. Different type of materials and their structure.
2. Structure dependence of various thermal, optical and mechanical properties.

TEXT/ REFERENCE BOOKS:

- Introduction to Solids — L. V. Azaroff
- Introduction to Solid State Physics — C. Kittle, John Wiley
- Material Science and engineering — V. Raghawan, PHI Learning Pvt. Ltd.
- Diffusion Kinetics for Atoms in Crystals — Manning
- Theoretical solid State Physics — Huang
- Material Science & Engineering — Tripathi, Padhy& Panda, Scitech Pub. Chennai

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Material Scientist, Research Associate, QA- Analyst, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry Innovation and Infrastructure),	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

Semester- 4th
Programme: M.Sc. Physics
Course: Physics of Nano Materials (Elective III)

Course Code: 6SMPH402
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To provide knowledge about physics based nano processes, to design and conduct experiments relevant to nano physics as well as to analyse the results, to improve usage of physics for modern technology, to provide an adequate knowledge on various nano physics aspects.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Free electron theory:** Idea of band structure; metals; insulators; semiconductors; density of states in bands; variation of density of states with energy; band gap with size of crystal.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-II	**Nanotechnology:** Definition of nano-science & Nanotechnology. Structure of carbon nano-tubes, nano wires, application of Nanotechnology in different field.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-III	**Quantum size effect:** Idea of quantum well structure; quantum dots; quantum wires ; determination of particle size; increase in width of XRD peaks of nanoparticles; shift in photoluminescence peaks; variations in Raman spectra of Nanomaterials.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-IV	**Different methods of preparation of Nanomaterials:** Cluster beam evaporation; ion beam deposition; chemical bath deposition with capping techniques and Top down, ball milling, Bottom up.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.

COURSE OUTCOMES: Students will have understanding of –

1. Fundamental principles of nanotechnology and their application.
2. Apply physical concepts to the nano scale and non – continuum domain.
3. Evaluate processing conditions to engineer functional nano materials.

TEXT / REFERENCE BOOKS:

- Physics of semiconductor nano structures: K.P.Jain; Narosa 1997.
- Nontechnology : Molecular Speculations on global abundance: B.C.Crandall, MIT Press 1996.
- Nanoparticles and nanostructures films: Preparation characterization and application: Ed. J.H.Fendler, John Wiley & Sons 1998.

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Material Scientist, Data Scientist, Research Associate, QA – Analyst, Process Engineer, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry, Innovation and Infrastructure), Goal-17 (Partnership for the Goals)	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY

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Semester- 4th
Programme: M.Sc. Physics
Course: Computational Methods & Programming (Elective IV)

Course Code: 6SMPH403
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To provide various numerical methods for solving differential and integral equations to physical equations.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Programming in C:** Data type (int, float, double, char, long, long double etc.), Operators (Unary. Binary and ternary), Input /output statement (scan(), print()), Control statements (if, for, while, do while, switch -case-default), Function (Type of Function, Function definition, Function calling, Formal arguments, Actual arguments, Function prototype), Program structure, String (Array, character array), String manipulation functions like strlens(), strcpy(), strcat(), strecmp() etc.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-II	**Method for Determination of Zeros of Linear and Non-linear Algebraic Equation and Transcendental Equations**: Bisection method, Regula-falsi method, Secant method, Newton raphson method, Solutions of simultaneous linear equation, Gaussian elimination method, Pivoting, Iterative method, Matrix inversion.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-III	**Eigen Value Problems, Curve Fitting & Numerical Differentiation and Integration:** Eigen Value and Eigen Vectors of Matrices, Power and Jacobi method; Finite difference interpolation with equally and unequally spread points, Polynomial least squares and cubic sp-line fittings; Newton-Cotes Formulae, Error estimation, Gauss-Method.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.
Unit-IV	**Numerical Solution of Ordinary Differential Equation & Numerical Solution of Partial Differential Equation:** Taylor's series method, Picard's Methods, Eular and Modified Eular's method, Runga-Kutta Methods, Predicators and Corrector method, Solution of Laplace equation, Solution of one dimensional heat equation, Classification of second order equation.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) as per requirement of the topic.

COURSE OUTCOMES:Students will have understanding of –

1. Uses of computer in various fields.
2. Various technique to solve differential and integral equations.

TEXT / REFERENCE BOOKS:

- Introduction method of numerical analysis — Sastry
- Numerical Analysis — Rajaraman
- Programming with C — Gottfried
- Programming with C — Balagururswamy
- Numerical Analysis — Balaguruswamy
- Numerical recipes press and Flannery — VettermingTeukolsky

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, Computational Scientist, Data Scientist, Researcher, Programmer, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education),	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY
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Semester- 4th
Programme: M.Sc. Physics
Course: Communication Electronics (Elective IV)

Course Code: 6SMPH404
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: To built up the concept integrated circuits and its application in the electronics and communications.

Units	Unit Wise Course Contents	Methodology Adopted
Unit-I	**Binary Logic, Digital Switching Circuits & Counters:** Binary number systems and other codes, Binary arithmetic, Boolean theorem, Syntheses of Boolean functions, Karnaugh diagram, Half and full adders, Demultiplexers, Multiplexers, D/A and A/D converters, Clock generator, RS flip, flip-flop, T flip flop, JK flip flop, Master- Slave flip flop, Shift Register, Ripple counter, Decade counter, Up-down counter, Divide by n counters, Synchronous counters, Application of counters.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-II	**Operational Amplifier:** Differential amplifier circuit configurations: dual input balanced output dual input, single input unbalanced output (ac analysis) only, block diagram of a typical op amp analysis, Schematic symbol of an op- amp., Ideal op-amp., Op-amp parameters; Input offset voltage, Input offset current, Input bias current, CMRR, SVRR, Large signal voltage gain, Slew rate, Gain band width product, Output resistance, Supply currents power consumption, Inverting and non-inverting inputs.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-III	**Application of Operational Amplifier:** Inverting and non-inverting amplifier, Summing, Scaling and averaging amplifier, integrator and differentiator. Oscillator Principles: Oscillator types, Frequency, Stability response, The Phase shift oscillator, Wein-bridge oscillator, L-C tunable oscillator, Square wave generator.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.
Unit-IV	**Digital Communications:** Pulse-Modulation system, Sampling theorem, Low pass and Band pass signals, PAM, channel BW for a PAM signal, Natural Sampling, Flat top sampling, Signals Recovery through Holding, Quantization of signals, Quantization, Differential PCM Delta Modulation, Adaptive Delta Modulation, CVSD.	Usage of ICT (Powerpoint, PDF and video lectures) and black board (traditional) and field work/ training as per requirement of the topic.

COURSE OUTCOMES: **Students will have understanding of –**

1. Operational amplifier and its applications.
2. Knowledge of computer and wave from generator.
3. Construction working and applications 555 timer, they will also acquire the knowledge of digital to analog and analog to digital techniques.

TEXT/REFERENCE BOOKS:

- Digital Principles and Application — A. P. Melvino & D. P. Leech
- Op-Amps & Linear Integrated circuits — R. A. Gayakwad
- Electronics — D. S. Mathur
- Digital Communications — W. Tomasi

Job Opportunities	Employability Skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Lecturer, System Engineer, Process Engineer, Data Scientist, Researcher, Consultant.	Developing commercial awareness, able to understand and manage competition, able to plan different course of action.	Goal-04 (Quality Education), Goal-09 (Industry, Innovation and Infrastructure), Goal-12 (Responsible Consumption & Production)	Service consultancy

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Dr. C.V. RAMAN UNIVERSITY

Kargi Road, Kota, Bilaspur (C.G.)

Semester- 4th
Programme: M.Sc. Physics
Course: LAB-I COMMUNICATION ELECTRONICS & COMPUTATION

Course Code: 6SMPH405
Practical Max. Marks: 25
Practical Min. Marks: 08

COURSE OBJECTIVE:

Study of Microprocessor 8086.

1. Study of Microprocessor 8086.
2. To write a program to perform subtraction X – Y where X & Y are 48 bit numbers.
3. To find the largest number form a block of 15 bytes.
4. To find the smallest number for a block of 15 bytes.
5. To write a program to add series of 20 bytes.
6. To write a program to compare two data blocks.

Note:-

- **Two experiments will be asked in the semester practical examination.**

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Dr. C.V. RAMAN UNIVERSITY

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Semester- 4th
Programme: M.Sc. Physics
Course: LAB-II ADVANCED COMPUTATION

Course Code: 6SMPH406
Practical Max. Marks: 25
Practical Min. Marks: 08

COURSE OBJECTIVE:

1. To write an assembly language program to solve following arithmetic equation: 3AX+5DX+BP.
2. To write a program to arrange a data block in ascending order.
3. To write a program to arrange a data block in descending order.
4. To write a program to convert an 8-bit BCD number into equivalent binary.
5. To write a program to insert a specific data byte under certain given conditions.

Note:-

- **Two experiments will be asked in the semester practical examination.**

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Semester- 4th
Programme: M.Sc. Physics
Course: Project Work & VIVA VOCE

Course Code:
Max. Marks: 100
Min. Marks: 33

COURSE OBJECTIVE: The basic objective behind this project is to test the knowledge through practical observations which he has got during the course.

PROJECT

All the candidates of M.Sc.(Physics) are required to submit a project-report based on the work done by him/her during the project period. A detailed Viva shall be conducted by an external examiner based on the project report. Students are advised to see the detailed project related guidelines on the website of CVRU. (www.cvru.ac.in) under Project Guidelines for student section.

COURSE OUTCOMES: **Students will have understanding of -**

1. Understanding selecting relevant topic.
2. Development of research from beginning level.
3. Prepared as a mentor, leader in the field of research.
4. Application in research.
5. Useful in as an entrepreneur.

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