ETHIRAJ COLLEGE FOR WOMEN

(AUTONOMOUS)

CHENNAI - 600 008

DEPARTMENT OF PHYSICS

Revised Syllabus for

M.Sc. PHYSICS

(For students admitted from the academic year 2015 – 2016)

Ethiraj College for Women (Autonomous), Chennai – 600 008

Department of Physics

Master of Science in Physics

(Revised syllabus effective from the academic year 2015 – 2016)

Department of Physics is revising regulations and syllabi with effect from 2015 - 2016, under 'CBCS' specified by the Government of Tamil Nadu.

Every academic year is divided into two semester sessions. Each semester will have a minimum of 90 working days and each day will have 5 working hours. Teaching is organized into a modular pattern of credit courses. Credit is normally related to the number of hours a teacher teaches a particular subject. It is also related to the number of hours a student spends learning a subject or carrying out an activity.

Regulations

1. Eligibility for Admission:

Candidates for admission to the first year of the Degree of M.Sc. Physics course shall be required to have passed the B.Sc. Degree Examinations conducted by any Indian Universities.

2. Eligibility for the Award of Degree:

A candidate shall be eligible for the award of the Degree only if he/she has undergone the prescribed course of study for a period of not less than two academic years, passed the examinations of all the Four Semesters prescribed.

3. Course of Study:

The main subject of study for Masters Degree shall consist of 15 core (10 theory, 4 practicals & 1 project) and 5 major elective papers. In the second and third semester, two inter disciplinary elective papers are offered by the PG department.

4. Passing Minimum:

A candidate shall be declared to have passed in each paper & practical of the main subject of study wherever prescribed, if she secured not less than 50% of the marks prescribed for the examination.

5. Classification of Successful Candidates:

Successful candidates passing the examination and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class respectively.

COURSE PROFILE

Sem	Course Code	Course Title	Hrs/ Week	Credits	CA Marks	End Sem. Marks	Total
I	14SP15/1C/MMP	Mathematical Physics	6	4	40	60	100
	14SP15/1C/CMR	Classical Mechanics & Relativity	6	4	40	60	100
	14SP15/1C/PR1	General Experiments*	6	4*	40	60	100
	14SP15/1E/ELS	Electronics	5	3	40	60	100
	14SP15/1E/FOC	Fiber Optics and Communications	5	3	40	60	100
		Soft Skill 1 – Personality Development	2	2	-	50	50
II	14SP15/2C/QM1	Quantum Mechanics - I	5	4	40	60	100
	14SP15/2C/STM	Statistical Mechanics	5	4	40	60	100
	14SP15/2C/ETP	Electromagnetic Theory and Plasma Physics	4	4	40	60	100
	14SP15/2C/PR2	Electronics Experiments	6	4	40	60	100
	14SP15/2E/NST	NanoScience and NanoTechnology	4	3	40	60	100
	14SP15/2E/MTG	Medical Technology	4	3	40	60	100
		Soft Skill 2 - Communication Skills in English/French for beginners / German for beginners / Computing Skills	2	2	-	50	50
III	14SP15/3C/QM2	Quantum Mechanics - II	5	4	40	60	100
	14SP15/3C/CMP	Condensed Matter Physics	5	4	40	60	100
	14SP15/3C/MMA	Microprocessor, Microcontroller – Architecture and Applications	4	4	40	60	100
	14SP15/3C/PR3	Microprocessor 8085 & Microcontroller 8051 Experiments*	6	4*	40	60	100
	14SP15/3E/CMC	Computational Methods and C Programming	4	3	40	60	100
	14SP15/3E/PHO	Digital Photography	4	3	40	60	100
		Soft Skill 3	2	2	-	50	50
IV	14SP15/4C/NPP	Nuclear and Particle Physics	6	4	40	60	100
	14SP15/4C/MSY	Molecular Spectroscopy	6	4	40	60	100
	14SP15/4C/PRO	Project & Viva voce	6	4	40	60	100
	14SP15/4C/PR4	Computational Methods & C Programming Experiments	6	4	40	60	100
	14SP15/4E/XRC	X- Ray Crystallography	4	3	40	60	100
		Soft Skill 4	2	2	-	50	50

***These credits will be given at the end of II and IV semesters after conduction of the practical examinations.**

Evaluation Pattern: 10 theory core papers, 5 major elective papers & 2 interdisciplinary elective papers

Sem	Course Code	Course Title	Continuous Assessment				
			Test I	Test II	Quiz/Assignment / Seminar / Field Visit	Participatory Learning	Total
I	14SP15/1C/MMP	Mathematical Physics	10	10	10	10	40
	14SP15/1C/CMR	Classical Mechanics & Relativity	10	10	10	10	40
	14SP15/1E/ELS	Electronics	10	10	10	10	40
	14SP15/1E/FOC	Fiber Optics and Communications	10	10	10	10	40
II	14SP15/2C/QM1	Quantum Mechanics - I	10	10	10	10	40
	14SP15/2C/STM	Statistical Mechanics	10	10	10	10	40
	14SP15/2C/ETP	Electromagnetic Theory and Plasma Physics	10	10	10	10	40
	14SP15/2E/NST	NanoScience and Nano Technology	10	10	10	10	40
	14SP15/2E/MTG	Medical Technology	10	10	10	10	40
III	14SP15/3C/QM2	Quantum Mechanics- II	10	10	10	10	40
	14SP15/3C/CMP	Condensed Matter Physics	10	10	10	10	40
	14SP15/3C/MMA	Microprocessor, Microcontroller – Architecture and Applications	10	10	10	10	40
	14SP15/3E/CMC	Computational Methods and C Programming	10	10	10	10	40
	14SP15/3E/PHO	Digital Photography	10	10	10	10	40
IV	14SP15/4C/NPP	Nuclear and Particle Physics	10	10	10	10	40
	14SP15/4C/MSY	Molecular Spectroscopy	10	10	10	10	40
	14SP15/4E/XRC	X- Ray Crystallography	10	10	10	10	40

The above Courses of the PG program enrich the skills in employability Skill development / Entrepreneurship which caters the need of the Student.

PRACTICALS:

Pattern for Continuous Assessment

			CA
Test I	4 hrs.	100 marks	10 marks
II	4 hrs.	100 marks	10
Participatory learning/ Problem Solving			10
Assignment/ Seminar /Demonstration			10

		Total	40

Project & Viva voce:

Component	CA Marks	End Semester	Final Marks
Choice of subject & Review of Literature	10	10	**100**
Project Presentation	10	20	
Final Report	10	20	
Viva – Voce	10	50	
Total	**40**	**100** (Reduced to **60** Marks)	

Rubrics for Continuous Assesment Evaluation :

Assignment :

Appearance/Contents/Originality/Presentation/Schematic representation and diagram/ Bibliography

Seminar :

Organization/Subject knowledge/Visual aids/Confidence level/Presentation

Participatory learning :

Answering Questions/ Clearing doubts/ Participation in discussion/ Attendance/ Communication and language

Field Trip :

Participation/Preparation/Respect/Attitude/Leadership

Project :

Preliminary work/Design/Content/Presentation

SEMESTER I

MATHEMATICAL PHYSICS

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/1C/MMP **LTP: 3 3 0**

Objectives:

- To equip the students with necessary mathematical techniques required for the understanding of advanced papers in Physics.

Course Outline:

Unit I: Linear Vector Spaces and Tensors

Linear vector space – Linear independence of vectors and dimensions – Basis and Expansion theorem – Inner product and unitary spaces – ortho-normal sets – Schwarz inequality – Schmidt's Orthogonalisation Method.

Tensors: Introduction – n dimensional space – Superscripts and Subscripts – Co-ordinate transformation – Indicial and summation conventions – Kronecker delta and properties. **18 Hrs**

Unit II: Linear Ordinary Differential Equations

Second order linear differential equations with variable, co-efficient, series and solution –Legendre, Hermite, Bessel and Laguerre differential equation – Generating function – Orthogonality of generating functions. **18 Hrs**

Unit III: Complex Variables

Functions of a complex variable – Single and Multivalued functions – Analytic functions – Cauchy Riemann conditions – Singular points – Cauchy's theorem and integral formulae – Taylor and Laurent expansions – Zeros and poles – Residue theorem and evaluation of integrals. **18 Hrs**

Unit IV: Laplace and Fourier Transforms

Fourier integral – Fourier transforms – Fourier sine and cosine transforms – Theorems & Applications.

Laplace & Inverse Laplace Transforms – Solution of linear equations with constant Co-efficient. **18 Hrs**

Unit V: Group Theory

Basic definitions – Lagrange's Theorem – Invariant subgroup – Homomorphism and Isomorphism – Representation of a group – Unitary representations – Schur's lemmas – Orthogonality theorem – Character table – Character table of C_{4v} – irreducible representation of C_{4v} – Simple applications – SU(2) and O(3) groups. **18 Hrs**

Books Recommended:

1. Satyaprakash, Mathematical Physics, 4th Edition, Sultan and Chand, 2002.
2. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, Wiley Eastern, Madras, 1995.
3. F.A. Cotton, Chemical Application of Group Theory, 3rd Edition, Wiley Eastern Ltd, New York 1990.
4. H.K. Dass, Mathematical Physics, 4th Revised Edition, S.Chand &Company Ltd., New Delhi 2003.

5. A.W.Joshi, Elements of Group theory for Physics, Revised 4th Edition, New Age International Pub. New Delhi 2005.

Books for Reference:

1. P.K.Chattopadhyay, Mathematical Physics, 1st Edition, New Age International Pub., 1990.
2. E.Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons, NY, 2001.
3. P.K.Chakrabarti and S.N.Kundu, A Text Book of Mathematical Physics, 1st Edition, New Central Book Agency, Kolkata, 1996.
4. Ajay kumar Bhagi & Vinoth Kumar J, Group Theory and Symmetry in Chemistry, 2nd Edition, Krishnaprakashan Media Ltd., Meerut.
5. Goyal Gupta, Laplace and Fourier Transforms, 1st Edition, Pragathi Prakashan Meerut.
6. A.Singaravelu, MA131,MA132 Mathematics I,II,III, Revised Edition, Meenakshi Publications, 2003.

Online Sources:

1. http://dmoz.org/Science/Physics/Mathematical Physics
2. http://www.thphys.nuim.ie/Notes/engineering/frame-notes.html
3. http://www.thphys.nuim.ie/Notes/frame-notes.html

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER - I

CLASSICAL MECHANICS AND RELATIVITY

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/1C/CMR **LTP: 3 3 0**

Objectives:

- To give the students a firm grounding in mathematical formulations needed in quantum mechanics and modern physics.

Course Outline:

Unit I: Lagrangian and Hamiltonian Formulations

Mechanics of a particle – Mechanics of a system of particles – D'Alembert's principle – Lagrange's equation of motion – Applications - simple pendulum, atwood's machine, compound pendulum – Hamilton's principle – Hamilton's equations – Applications - simple pendulum, compound pendulum, harmonic oscillator– Two body central force problem – Differential equation for an orbit – Kepler's laws – Scattering in a central force field – Rutherford central scattering potential. **19 Hrs**

Unit II: Mechanics of Rigid Bodies

Generalized Co-ordinates for Rigid body motion - Euler's Theorem– Euler angles — Angular velocity and angular momentum of rigid body - Moments and product of inertia-Rotational kinetic energy - Euler's equations of motion - Torque free motion – Rigid body motion – Kinetics – Dynamics – Symmetrical top. **18 Hrs**

Unit III: Canonical Transformation

Hamilton's principle of least action – Canonical transformations and their generators – Simple examples – Hamilton-Jacobi method - Solution of harmonic oscillator problem-Kepler's problem solutions by H-J method - Poisson Brackets – Invariance of Poisson Brackets with respect to canonical transformation – Equation of motion in Poisson Bracket form – Lagrange's Brackets - Relation between Poisson and Lagrange Bracket. **19 Hrs**

Unit IV: Small Oscillations

Stable and Unstable Equilibrium -Two coupled oscillators-Formulation of the problem – Properties of T,V and ω – Transformation to normal co-ordinates – Frequencies of normal modes –The Parallel pendula - Linear tri-atomic molecule. **17 Hrs**

Unit V: Relativity

Lorentz transformations – Four vectors – Lorentz invariance of the four product of two four vectors – Invariance of Maxwell's equations – Relativistic Lagrangian and Hamiltonian for a free particle. **17 Hrs**

Books for Recommended:

1. J.C. Upadhayaya, Classical Mechanics, 1st Edition, Himalaya Publishing House 2002
2. H.Goldstein, C.Poole and J.Safko, Classical Mechanics, 3rd Edition, Pearson Education Asia, New Delhi, 2002.
3. Guptha Kumar Sharma, Classical Mechanics, 21st Edition, Pragrati Prakashan, Meerut 2003.

Books for Reference:

1. C.R.Mondol, Classical Mechanics, 1st Edition, Prentice-Hall of India, New Delhi. 2002
2. R.Resnick, Introduction to Special Theory of Relativity, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1962

Online Sources:

1. www.damtp.cam.ac.uk/user/tong/dynamics/clas.pdf
2. http://web.mit.edu/8.01t/www/coursedocs/current/guide.htm
3. http://www.phys.psu.edu/~lammert/419/notes.html

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- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER I
GENERAL EXPERIMENTS

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/1C/PR1 **LTP: 0 3 3**

Objectives:

- To develop experimental skills in students.
- To apply Physics principles in experiments.

Course Outline:

Any Fifteen Experiments to be done

1. Cornu's method – Young's modulus by Elliptical fringes.
2. Stefan's constant.
3. Band gap energy – Thermistor.
4. B-H Curve using CRO.
5. Hall Effect.
6. Ultrasonics - Compressibility of a liquid.
7. Susceptibility by Quincke's method.
8. Solar constant.
9. F.P. Etalon using spectrometer.
10. e/m measurement – Magnetron Method
11. Cornu's method - Young's modulus by Hyperbolic fringes.
12. Susceptibility by Guoy's method.
13. Specific charge of an electron – J.J. Thomson's method.
14. Viscosity of liquid – Meyer's disc.
15. GM counter – Characteristics, inverse square Law, absorption coefficient.
16. Polarimeter – Specific Rotatory Power of an optically active solution
17. Hydrogen spectrum – Rydberg's constant.
18. Solar spectrum – Hartmann's formula.
19. Edser and Butler fringes – Thickness of air film.
20. Laser experiments:
    a. Diffraction at straight edge.
    b. Interference of laser beams – Lloyds single mirror method.
    c. Interference using an optically plane glass plate and a laser.
    d. Laser diffraction at a straight wire.
    e. Laser diffraction at a circular aperture.
    f. Study of Laser Beam Parameter

SEMESTER I
ELECTRONICS

Teaching Hours: 75 **Credits: 3**
Course Code: 14SP15/1E/ELS **LTP: 2 3 0**

Objective:

- To equip the students with knowledge of physical electronics to appreciate the usefulness of devices and understand their limitations.

→ Every topic is useful in device fabrication Industry.

Course Outline:

Unit I: Semiconductor Devices

FET, MOSFET UJT, SCR, TRIAC – construction, working, characteristics – FET amplifier - UJT relaxation oscillator – SCR / TRIAC for power control.
Memory Devices: ROM, EPROM, EEPROM – Static and Dynamic RAM – CMOS and NMOS – Charge Coupled Devices (CCD). **15 Hrs**

Unit II: Microwave Wave and Photo Electronic Devices

Klystron – Gunn diode – IMPATT diode - Construction – working as MW oscillator. Photonic Devices - LED – Diode photo detectors – Solar cell (open circuit voltage and short circuit current, fill factor) – Diode lasers (conditions for population inversion in active region, light confinement factor). **15 Hrs**

Unit III: Sequential Logic Systems

Counters and Registers – Asynchronous counters – Design of Asynchronous feedback technique counters - Nonbinary counters - Design of synchronous counters – Design of random sequence counters– BCD counters - Shift registers and their applications. **15 Hrs**

Unit IV: Linear Integrated Circuits and Applications

Analog differentiation and integration – Solution of simultaneous and differential equations using Op-amps – Active filters – Low Pass , High Pass, Band Pass- 1st Order, 2nd Order Butterworth Filter circuits – Wide Band and Narrow Band reject Filters - Sample and Hold circuits.
Wave form generators- 555 timer – Astable Multivibrator – Monostable multivibrator - Phase locked loop. **15 Hrs**

Unit V: Non Linear Applications of Op-amps and Data Converters

Precision comparators – Precision rectifiers - half wave and full wave rectifiers – Peak detector - Log and antilog amplifiers - Binary weighted resistor D/A converter – R-2R ladder D/A converter – Flash, counter type – Successive approximation and Dual slope A/D converters. **15 Hrs**

Books Recommended:

1. S.M.Sze, Physics of Semiconductor Devices, 3rd Edition , John Wiley & Sons, New York, 1985.
2. R.A.Gaekwad, Op-amps and Linear Integrated circuits, 3rd Edition, Prentice Hall of India Pvt Ltd, New Delhi, 1993.
3. Taub and Shilling, Digital Integrated Electronics, 13th Edition, McGraw Hill international, Singapore, 1987.
4. M.S.Tyagi, Introduction to Semiconductor Devices, 1st Edition, John Wiley & Sons, New York, 1988.

5. B.Somnath Nair, Electronic devices and applications, 1st Edition, Prentice-Hall of India, New Delhi, 2003.
6. Flyod & Jain , Digital Fundamentals, 8th Edition ,Dorling Kindersley Pvt.Ltd., New Delhi., 2006.
7. V.Vijayendran, Introduction to Integrated Electronics,1st edition, S.Viswanathan Printers and publishers Pvt.Ltd., Chennai, 2005.
8. R.F.Coughlin and F.F.Drisol, Op-amp and linear integrated circuits.6th edition, Prentice Hall of India Pvt., Ltd.,New Delhi, 2008.

Books for Reference:

1. Millman and Halkias, Integrated Electronics, 25th Edition, Tata McGraw Hill, 1983.
2. B.Somnath Nair, Digital Electronics and Logic Design, 1st Edition, Prentice-Hall of India, New Delhi, 2003.
3. A. Ghatak and K.Thyagarajan , Optical Electronics, 1st edition, Cambridge Univ. Press,2008.
4. S.P. Bali, Solid State devices & circuits, 1st Edition, New Age International Private Ltd, New Delhi, 1995.
5. R.K. Sharma, Semiconductor_Electronics, 1st Edition, New Age International PrivateLtd, New Delhi ,1996.
6. Leach and Malvino, Digital Principles and Applications, 5th Edition, TataMcGraw Hill, 2005.

Online Sources :

1. http://www.electronics-tutorials.ws/
2. http://www.electronics-tutorials.ws/counter/count_1.html
3. http://www.electronics-tutorials.ws/waveforms/waveforms.html
4. http://hyperphysics.phy-astr.gsu.edu/hbase/electronic/etroncon.html

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER I

FIBER OPTICS AND COMMUNICATIONS

Teaching Hours: 60 **Credits: 3**
Course Code: 14SP15/1E/FOC **LTP: 2 2 0**

Objective:

- To equip students with the broad outlines of different types of electronic communication systems and expose them to satellite communication, fiber optic communication and cellular mobile communication.

Course Outline:

UNIT I: Light Transmission through Fibers

Propagation of light waves in optical fiber-Basic structure of an optical fiber-propagation of light waves through it- acceptance angle- numerical aperture(General) – Fiber Classification- stepped index fiber-stepped index -monomode fiber- graded index multimode fiber- plastic fibers- Importance of optical fibers- Light sources-process involved in LED & LASERS- Light Detectors- photoemissive-photoconductive- photovoltaic devices. **12Hrs**

UNIT II: Fiber Optic Communication Systems

Transmitter- high performance transmitter -LED Digital Transmitter - LED Digital Transmitter- LASER transmitter- - digital laser transmitter- analog laser transmitter- - Transmitter design- Fiber optic receiver- high performance receiver- Repeaters- Fiber based modems,Transreceivers. Fibre Optic Communication in India. **12Hrs**

UNIT III: Aerials and Transmission Lines

Introduction to aerials- radiation from a short dipole in a free space- Propagation of radio waves- ground waves- sky waves- space waves- Transmission Lines-introduction to coaxial cables- strip lines- wave guide **12Hrs**

UNIT IV: Broad Band Communication Systems

Multiplexing- time division multiplexing- frequency division multiplexing- Computer communication- Microwave links- line of sight (LOS) microwave links- tropospheric scatter microwave links- ISDN- LAN- PBX- Introduction to Cellular mobile communication: concept of cell- basic cellular mobile radio system- FAX(Fascimile). **12Hrs**

UNIT V: Satellite Communications

Introduction to satellite communication systems- orbits- basic components of satellite communication systems- Constructional features of satellites- Commonly used frequency in satellite communication- Multiple Access- Satellite communication in India. **12Hrs**

Books Recommended:

1. Subir Kumar Sarkar, Optical Fibers and Fiber Optic Communication Systems, Reprint(2008) ,S.Chand Company Ltd, New Delhi.
2. Anok Singh, A.K.Chhabra, Principles of Communication Engineering, Sixth Revised Edition , S.Chand Company Ltd, New Delhi ,2004.
3. Gupta Kumar, Hand Book of Eectronics, Thirty Third Revised Edition, Pragati Prakashan, Meerut, 2006.
4. Pallab Battacharya, Semiconductor Optoelectronic Devices, 2nd Edition, Prentice Hall of India, New Delhi, 2004.

Books for Reference:

1. A.B.Carlson, Communication systems, 2nd Edition, Mc Graw Hill.,New Delhi,.
2. B.P.Lathi, Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press, Newyork, 2005.

Online Sources:

1.http://www.freebookcentre.net/networking-books-download/The-Fiber-Optic-Data-Communications-.html
2. http://fiberu.org/FOcomm/index.html
3. http://www.antenna-theory.com

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

POST GRADUATE COURSE

SEMESTER I

SOFT SKILLS I – PERSONALITY ENRICHMENT FOR WOMEN

Subject Code: PG15/1S//PEW
Credits: 2 **Teaching**
Hours: 30

The course offers an introduction to Women's personality Development - an interdisciplinary academic field that explores critical questions about the meaning of gender and women's space in society. It aims at honing the various skills and potentials of Women. It critically analyses themes of gendered performance and power in a range of contexts such as culture, education, work, health, law, governance and the family.

Course Objectives: to help the students to

- Define and utilize basic terms and concepts vital to women.
- Understand and engage with central debates in the field of Women's and Gender Studies to develop the capacity for leadership roles.

Unit I: Gender Roles, Needs and Capacity

Attitudinal differences between men and women - Social Construction of Gender - Gender vs Sexuality –Stereotyping-Constructionist and Essentialist thought - Public vs Private dichotomy- Financial Management and Gender Budgeting The Power of beliefs against women - Team Building and Decision making skills

Unit II: Women and Recognition of the Self

Feminist Movements and their significance – development of Communication, Negotiation and Data Management skills - Indian Feminist Movement and its place in the post Independent India–Recognition of Self Worth – Self introspection of pre conceived ideas - CEDAW and training of women – Skill building for Self-Esteem–Legal awareness and communication skills- Building Women's Assets through Managerial Skills

Unit III: Capacity Building through Education, Employment, Health Measures, Legal Rights, Leadership and Power

National Committees and Commissions for Women – Government Organizations for Women Recent trends in Women's Education –Lateral Learning and Gender gaps in enrolments – Concept of employment- Gender division of skills – the move beyond capacities to capabilities –Women as job Providers (Entrepreneurs) –Self-reliance - Human Rights and Women's rights women's rights & responsibilities, Statistical data about the women's representation in decision making bodies - Management and Women – Developing Leadership Qualities in Women – Understanding Psychic interventions in Leadership Skills - Access and Control over Resources SHG

Recommended Reading List:

1. **Personality Development for women: AManual** by the Centre for Women's Studies (UGC Funded), Ehiraj College for Women.
2. Material on Capacity Building Initiatives, UGC India

SEMESTER II

QUANTUM MECHANICS - I

Teaching Hours: 75 **Credits: 4**
Course Code: 14SP15/2C/QM1 **LTP: 3 2 0**

Objectives:

- To give the students an introduction to the fundamental concepts, mathematical formalism, methodology of quantum mechanics.
- To equip the students with the knowledge of Approximation methods and their applications in other branches of physics.

Course Outline:

Unit I: Basic Formalism

Interpretation and conditions on the wave function - Schroedinger equation - Postulates of Quantum mechanics - Ehrenfest's theorem- Stationary states – Expectation value - Operators – operator algebra - Hermitian operators for dynamical variables - Eigenvalues and eigen functions of operators – completeness of eigen functions – commutativity of eigenfunctions - Uncertainty principle for operators. **15 Hrs**

Unit II: One Dimensional Problems And Three Dimensional Problems

Particle in a box - Square-well potential - Barrier penetration - Simple harmonic oscillator by Ladder operator method

Orbital angular momentum- particle moving in a spherically symmetric potential- Two body problem - Rigid rotator - Hydrogen atom. **15 Hrs**

Unit III: General Formalism

Hilbert space – Dirac notation - Representation theory - Co-ordinate and momentum representations – Matrix representation of wavefunctions & operators – Symmetries and conservation laws- Unitary transformations associated with translations and rotations - Parity and time reversal- Time evolution - Schroedinger, Heisenberg and Interaction pictures. **15 Hrs**

Unit IV: Approximation Methods

Time-independent perturbation theory for non-degenerate and degenerate levels – Stark Effect in Hydrogen atom - Variation method – Helium atom - WKB approximation - Connection formulae (no derivation) - WKB quantization rule - Application to simple harmonic oscillator. **15 Hrs**

Unit V: Angular Momentum and Identical Particles

Eigenvalue spectrum from angular momentum algebra - Matrix representation - Spin angular momentum - Non-relativistic Hamiltonian including spin - Addition of angular momenta - Clebsch - Gordan Coefficients- Symmetry and anti-symmetry of wave functions – Spin and Pauli matrices. **15 Hrs**

Books Recommended:

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 1st edition(37th Reprint),Tata McGraw-Hill, New Delhi, 1976.
2. G.Aruldhas, Quantum Mechanics, 2nd edition,Prentice Hall of India, New Delhi, 2009.

3. Sathyaprakash, Advanced Quantum Mechanics, 5th edition, Kedarnath & Ramnath, Meerut, 2004.
4. SL Gupta and ID Gupta, Advanced Quantum Theory and Fields, 1st Edition, S Chand & Co., New Delhi, 1982,
5. Gupta, Kumar, Sharma, Quantum Mechanics, 28th Edition, Jayaprakash Nath Publishers, Meerut.
6. A. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4th Edition, Macmillan, India, 1984.
7. Schiff, Quantum Mechanics, 3rd Edition, International Student Edition, MacGraw-Hill , Kogakusha, Tokyo, 1968

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1. E. Merzbacher, Quantum Mechanics, 2nd Edition, John Wiley and Sons, New York, 1970.
2. V. K. Thankappan, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1985.
3. L. D. Landau and E. M. Lifshitz, Quantum Mechanics, 1st edition, Pergomon Press, Oxford, 1976.
4. S. N. Biswas, Quantum Mechanics, Books and Allied Ltd., Kolkata, 1999.
5. R. P. Feynman, R. B. Leighton, and M. Sands, The Feynman Lectures on Physics, Vols. 3, Narosa, New Delhi, 1998.
6. V. Devanathan, Quantum Mechanics, 1st edition,Narosa Publishing House, New Delhi.
7. V. Devanathan, Angular Momentum Techniques in Quantum Mechanics, Kluwer Academic Publishers, Dordrecht, 1999.

Online Sources:

1. http://www.netsa.org.lk/OcwWeb/Physics/index.htm
2. http://www.theory.caltech.edu/people/preskill/ph229
3. http://www.nscl.msu.edu/~pratt/phy851/lectures/lectures.html
4. http://walet.phy.umist.ac.uk/QM/LectureNotes

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER II

STATISTICAL MECHANICS

Teaching Hours: 75 **Credits: 4**
Course Code: 14SP15/2C/STM **LTP: 3 2 0**

Objectives:

- To expose the students to the physical systems consisting of large number of particles and its correlation with other branches like thermodynamics, classical and quantum mechanics.
- To expose the students to the fundamental mathematical tools that help in operation of the subject.

Course Outline:

UNIT I: Fundamentals of Statistical Mechanics:

Phase Space – Concept of ensembles – Density of Distribution in phase space – Liouville's theorem – Density of Phase points in a classical ensemble - Statistical equilibrium - Postulate of equal a priori probability – Time and Ensemble average – Division of phase space into cells. **15 Hrs**

UNIT II: Classical Statistics:

Microstates and Macrostates – General expression for probability – Stirling's formula – The most probable Distribution – Maxwell Boltzmann Distribution law – Evaluation of constants in the Maxwell Boltzmann Distribution law – Law of equipartition of energy – Connection between the partition function and thermodynamic quantities.. **14Hrs**

UNIT III: Methods of Ensembles:

Micro canonical ensemble – Perfect gas in micro canonical ensemble - Gibbs Paradox – Partition functions – Partition function and thermo dynamical quantities – Gibbs canonical ensemble – Partition function and thermo dynamical functions – Perfect monoatomic gas in canonical ensemble – Grand canonical ensemble – Partition function and thermodynamic functions – Perfect gas in grand canonical ensemble – Comparison of ensembles. **15Hrs**

UNIT IV: Quantum Statistics:

Density Matrix – Time dependence of Density Matrix – Density Matrix in microcanonical, canonical and grand canonical ensembles - Fermi-Dirac, Bose-Einstien and Maxwell-Boltzmann Statistics – Black body radiation and Planck radiation law – Bose-Einstien gas – Degeneracy and Bose-Einstien condensation – Fermi-Dirac gas – Degeneracy. **16Hrs**

UNIT V: Fluctuations & Phase Transitions:

Measure of Fluctuations – mean square deviation – Fluctuations in energy, pressure, volume and enthalpy – Probability of one dimensional random walk – Brownian movement – Motion due to fluctuating force – The Fokker Planck equation

Phase transition of first and second order – One dimensional Ising model – Bragg–William's approximation. **15 Hrs**

Books Recommended:

1. B.K. Agarwal and M.Eisner, Statistical Mechanics, 2nd Edition, New age International, New Delhi, 1998.

2. Satyaprakash, J.P.Agrwal, Statistical Physics, 7th Edition, Kedarnath Ramnath & Co., Meerut, 2004.
3. Sathya Prakash, Thermodynamics, Statistical Physics and Kinetics, 2009 Edition, Kedar Nath Ram Nath, Meerut.
4. S.L.Gupta,V. Kumar, Elementary Statistical Physics ,16th Edition, Pragathi Prakasan ,Meerut, 2000.

Books For Reference:

1. J.K.Bhatacharjee, Statistical Mechanics, 1st Edition, Sunil Sachdev, New Delhi 64, 2002.
2. F.W.Sears and G.L.Salinger, Thermodynamics, Kinetic theory and Statistical Thermodynamics, 2nd Edition, Narosa Publishing House. 2002
3. Federick Reif, Fundamentals of statistical and Thermal Physics, Special Indian Edition, McGraw-Hill Kogakusha Ltd., New Delhi,2008.

Online Sources:

1. www.spms.ntu.edu.sg/PAP/courseware/statmech.pdf
2. http://www.nyu.edu/classes/tuckerman/stat.mech/lectures.html
3. http://www.damtp.cam.ac.uk/user/tong/statphys.html

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER II

ELECTROMAGNETIC THEORY AND PLASMA PHYSICS

Teaching Hours: 60 **Credits: 4**
Course Code: 14SP15/2C/ETP **LTP: 3 1 0**

Objectives:

- To enable the students to appreciate the fundamental concepts in electromagnetic theory and the basic ideas of plasma physics.

Course Outline:

UNIT 1: Electrostatics

Gauss law - Dielectric Polarisation- Dielectric constant and Displacement vector- Electric Susceptibility and Dielectric constant- Boundary conditions on field vectors- Dielectric sphere in a uniform field- Molecular field in a Dielectric: The Clausius Mossotti Relation- Electrostatic energy in the presence of dielectric- Multipole Expansions. **12Hrs**

UNIT II: Magnetostatics

Biot-Savart Law- Force on a current carrying conductor and Lorentz force- Application of Biot Savart Law- magnetic field due to the current flowing in a straight wire- Ampere's Law- application of Ampere's Law- magnetic field inside a long solenoid- Curl and divergence of Magnetic Induction- Magnetization- Currents in material media- Magnetic materials- Hysteresis and Rowland ring for B-H Curve. **12Hrs**

UNIT III: Maxwell's Equations

Equation of continuity- Displacement current- Maxwell's Equations- physical significance- Energy in electromagnetic fields (Poynting's theorem)- Momentum in electromagnetic fields- Electromagnetic Potentials A and Φ- Maxwell's equations in terms of Electromagnetic Potentials- Concept of Gauge- Lorentz Gauge- Coulomb Gauge. **12Hrs**

UNIT IV: Wave Propagation

The wave equation- Plane electromagnetic waves in a free space- Plane electromagnetic waves in isotropic dielectrics- Propagation of electromagnetic waves in a conducting medium- Reflection and Refraction of E.M.W- Propagation of waves in a rectangular wave guide- Polarization of electromagnetic waves. **12Hrs**

UNITV: Elementary Plasma Physics

Plasma- An Introduction- Conditions for Plasma existence- Plasma Oscillations- Occurrence of Plasma- Charged Particles in electric and magnetic fields- Magneto hydrodynamics-Magnetic confinement(Pinch Effect)- Plasma Waves. **12Hrs**

Books Recommended:

1. Chopra Agarwal, Electromagnetic Theory, Fifth Revised Edition, K.Nath & Co, Meerut, 2009.
2. Sathyaprakash, Electromagnetic Theory and Electrodynamics,New Ed,Kedarnath and Ramnath and Co., Meerut, 2004.

3. D.J.Griffiths, Introduction to Electrodynamics, 3rd Edition, Prentice-Hall of India, New Delhi, 2002.
4. J.D.Jackson, Classical Electrodynamics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1975.

Books for Reference:

1. Bishwanath Chakraborty, Principles of Electrodynamics, 1st Edition, Books and Allied (P) Ltd., Kolkatta, April 2002.
2. Gupta Kumar Singh, Electrodynamics, Enlarged Ed, Pragathi Prakashan, Meerut. 2003.
3. S.N.Goswami, Elements of Plasma physics, 1st Edition, New Century Book Agency (P) Ltd., 1995.

Online sources

1.http://www.freebookcentre.net/physics-books-download/Electromagnetic-Theory-PDF-notes.html.
2.http://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=9&ved=0CF0QFjAI&url=http%3A%2F%2Fwww.ptep-online.com%2Findex_files%2Fbooks%2Flehnert2008.pdf&ei=dSSFVfToNI7IuATYtob4BQ&usg=AFQjCNE2aHFrWs4n7WChD4bckjje0zJS5Q&bvm=bv.96339352,d.c2E
3. http://nptel.ac.in/courses/115101005/

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER II
ELECTRONICS EXPERIMENTS

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/2C/PR2 **LTP: 0 3 3**

Objectives:

- To increase the practical knowledge in the field of electronics & instrumentations.
- To train them in handling all the kinds of electronics circuits.

Course Outline:
Any Fifteen Experiments to be done

1. Half-adder, half-subtractor and full-adder and full-subtractor using NAND/NOR gates.
2. Arithmetic operations using IC 7483.
3. BCD counter – Decoding and display
4. Up/Down counters using IC 7476/7473.
5. Shift register, Ring counter, Johnson counter using J-K flip flops 7476/7473.
6. Digital to Analog converter using IC 741 – R/2R ladder.
7. D/A converter – Binary weighted resistor.
8. Multiplexer and De-multiplexer
9. Decoders and Encoders
10. Construction of two stage transistor amplifier.
11. FET characteristics and Design of a FET amplifier
12. UJT Characteristics and design of Saw tooth generator.
13. Design of a square wave generator using IC 741 and Timer 555.
14. Design of the Wien bridge oscillator and the study of its attenuation characteristics.
15. Design of the Phase shift oscillator and the study of its attenuation characteristics.
16. Analog computer circuit design – Solving simultaneous equations.
17. Design of second order butter worth active filter circuits –Low pass, High pass and Multiple feed back Band pass filters..
18. Design of Monostable Multivibrator using IC 741 and Timer 555.
19. Design of Schmidt Trigger using IC 741 and Timer 555.
20. Construction of Colpitt's and Hartley oscillators using transistor

SEMESTER II

NANO SCIENCE AND NANO TECHNOLOGY

Teaching Hours: 60 **Credits: 3**
Course Code: 14SP15/2E/NST **L T P: 2 2 0**

Objectives:

- To familiarize the students with basics of Nano structured material for higher education.

Course Outline:

Unit I - Introductory Aspects

Introduction to Nano material- surface to volume ratio - Effect of nanosize on material by optical, magnetic and structural– Electronic structure of nanoparticles. **12Hrs**

Unit II – Concept of Nanostructured Materials

Solid disordered Nanostructures – Nanostructured crystals –Quantum wells, wires and Dots – Size and dimensionality effects- Excitons- single electron tunneling – Applications- Self assembly and catalysis **12Hrs**

Unit III – Preparation Technique

Methods of preparing Nanoparticle – Chemical Method – Sol-gel Method, hydrothermal, CVD-Physical Method – Sputtering, Vaccum Technology, MBE **12Hrs**

Unit IV - General Characterization Techniques

X- Ray Diffraction studies – UV – Vis- NIR - absorption and reflectance Spectroscopy, Bragg's law – particle size – Scherrer's equation – Photoluminescence (PL) studies – Fourier Transform Infrared Spectroscopy (FTIR) – Raman Effect - Applications – Surface Enhanced Infrared spectroscopy, Resonance Raman Spectroscopy. **12Hrs**

Unit – V - Nano Devices

Background – Quantization of resistance - Single electron transistors – OFET- OLED, Solar cell - Magnetic Nanodevices – Magneto resistance – Spintronics **12Hrs**

Books Recommended:

1. Charles P.Poole, Jr. and Frank J.Owens, Introduction to Nanotechnology, First edition, Wiley, 2003
2. G.M.Chow and K.E.Gonslaves Nanotechnology - Molecularly Designed Materials American chemical society, Symposium Series **622**. Ed. ACS Books.1996.
3. J.D.Plummer, M.D.Deal and P.B. Griffin, Silicon VLSI Technologies, second edition Prentice Hall, 2000
4. C.Kittel, Introduction to Solid State Physics, Eight edition, Wiley and Sons, USA 2005.
5. K.P.Jain, Physics of semiconductor Nanostructures: 3rd Edition, Narosa Publishers, New Delhi 1997.

Books for references:

1. Vladimir V. Mitin, V.A. Kochelap, M.A.Stroscio, Introduction to Nanoelectronics, 2nd Edition , Cambridge University press, 2011.
2. Sujaul Chowdhury, Nanosructure Physics an Microelectronics, 2nd Edition, Narosa Publishing house, Newdelhi
3. H. Nejo, Nanostructures – Fabrication and Analysis, 1st Edition , Springer International, Berlin

Online Sources:

1. https://en.wikibooks.org/wiki/Nanotechnology
2. http://www.nanowerk.com/nanotechnology/periodicals/ebook_a.php
3. http://bookboon.com/en/nano-technology-ebook

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER II

MEDICAL TECHNOLOGY

Teaching Hours: 60 **Credits: 3**

Course Code: 14SP15/2E/MTG **LTP: 2 2 0**

Objectives:

- To equip the students with basic principles of Physics Instrumentation used in various branches of medicine.
- It is of general nature and intended for the students with non-physics background.

All topics relevant to medical laboratories

Course Outline:

Unit I: Human Physiology & Bio potentials

Cells and their structure – Transport of ions through the cell membrane – Different systems of the human body –Bioelectric potentials in our body -Action potential and resting potential **12Hrs**

Unit II: Biometrics

Basic idea of Operational amplifier - Medical preamplifier design – Electrical signals from the heart- ECG - Origin of Cardiac action potential- placement of electrodes – lead configurations – EEG – origin – placements of electrodes **12 Hrs**

Unit III: Support Systems

Measurements of Heart sounds – Stethoscope – Clinical temperature measurements – Liquid crystal thermometer – mercury thermometer – Measurement of BP - sphygmomanometer- Patient care & monitoring - Elements of intensive care monitoring – patient monitoring displays. **12 Hrs**

Unit IV: Diagnostic Systems

X- Rays in medicine –- Ultrasound imaging systems —different displays -– MRI imaging – principle –CT scan- instrumentation, applications and limitations for the above. **12 Hrs**

Unit V: Therapeutic Techniques

Lasers in Medicine – basic principles – instrumentation – advantages of Laser surgery - Radiation safety instrumentation – effects of radiation exposure – radiation monitoring instruments – therapeutic effect of heat-Surgical diathermy – Shortwave diathermy – Microwave diathermy – Ultrasonic diathermy . **12 Hrs**

Books Recommended:

1. M.Arumugam, Bio Medical Instrumentation, 2nd Edition, Anuradha Agencies, Kumbakonam, India, 1994.
2. Cromwell, Biomedical instrumentation and measurements, 2nd Edition, Prentice Hall, 1980.
3. John G.Webster, Bio Instrumentation, 1 st Edition, John Wiley & sons, 2003.

4. Joseph J.Carr &John M.Brown, Introduction to Biomedical Equipment Technology, 4th Edition, Pearson Education, 2004.

Books for Reference:

1. Khandpur, A Handbook of Biomedical Instrumentation, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Elevier, 2003.
2. Jacobson & Webster, Clinical Engineering, 1st edition, Prentice Hall, 1977 .
3. Geddes & Baker, Applied Biomedical instrumentation, 3rd Edition, John wiley & Son – New York.
4. Guyton and Hall, Medical Physiology, 10th Edition.

Online Sources:

1. www.medical physics.org
2. www.biomed.abdn.ac.uk
3. http://www.impactscan.org/slides/impactcourse/basic_principles_of_ct/img6.html
4. http://www.emedicinehealth.com/electrocardiogram_ecg/article_em.htm

Elective (Interdisciplinary) Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (5 x 8 = 40 Marks)

- 1 – 8 questions
- All questions carry equal marks
- Descriptive/Derivation/Problems/ type questions
- **Open choice covering all the 5 units**

Part – B (3 x 20 = 60 Marks)

- 9 – 14 questions
- All questions carry equal marks
- Problems/Applications/Analysis/Evaluation.
- **3 questions to be answered out of 6 questions, covering all the 5 units.**

SEMESTER III

QUANTUM MECHANICS – II

Teaching Hours: 75 **Credits: 4**
Course Code: 14SP15/3C/QM2 **L T P: 3 2 0**

Objectives:

- To introduce the students to the basic concepts of Scattering theory
- To give the students a firm grounding in Relativistic Quantum Mechanics, with emphasis on Dirac equation and related concepts

Course Outline:

Unit I: Scattering Theory

Scattering amplitude - Cross sections - Born approximation - Partial wave analysis – Scattering length & Effective range theory for S-wave – Transformation from centre of mass to laboratory frame. **15 Hrs**

Unit II: Perturbation Theory

Time dependent perturbation theory - Constant and Harmonic perturbations - Transition probabilities - Adiabatic approximation - Sudden approximation - -Semi-classical treatment of an atom with electromagnetic radiation - Selection rules for dipole radiation **15 Hrs**

Unit III: Relativistic Quantum Mechanics

Klein-Gordon equation – charge and current densities- Dirac equation - Plane-wave solutions - Interpretation of negative energy states - Antiparticles - Spin of electron - Magnetic moment of an electron due to spin. **15 Hrs**

Unit IV: Dirac Equation

Covariant form of Dirac equation - properties of the Gamma Matrices - traces - Relativistic invariance of Dirac equation – Probability density-current four vector – Bilinear covariants - Feynman's theory of positron (Elementary ideas only without propagation formalism). **15 Hrs**

Unit V: Elements of Quantization

Quantization of the field - Second quantization of Schroedinger equation, Klein-Gordon field, Dirac field - Creation and annihilation operators – Commutation relations. **15 Hrs**

Books Recommended:

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 1st Edition, Tata McGraw-Hill, New Delhi, 1976.
2. G. Aruldhas, Quantum Mechanics, 2nd Edition, Prentice-Hall of India, New Delhi, 2009.
3. L. I. Schiff, Quantum Mechanics, 3rd Edition, International Student Edition, McGraw-Hill Kogakusha, Tokyo, 1968.
4. V. K. Thankappan, Quantum Mechanics, 2nd Edition, Wiley Eastern Ltd, New Delhi, 1985.
5. V. Devanathan, Quantum Mechanics, 1st Edition, Narosa Publishing House, New Delhi, 2005.

6. Sathyaprakash, Advanced Quantum Mechanics, 5th Edition, Kedarnath & Ramnath, Meerut , 2004.
7. S.L Gupta and I.D Gupta, Advanced Quantum Theory and Fields, 1st Edition, S Chand & Co, New Delhi,1982.
8. Gupta, Kumar, Sharma, Quantum Mechanics, 28th Edition, Jayaprakash Nath Publishers, Meerut, 2009.

Books for Reference:

1. P. A. M. Dirac, The Principles of Quantum Mechanics, 4th Edition,Oxford University Press, London, 1973.
2. B.K.Agarwal & Hari Prakash, Quantum Mechanics, 7th reprint, PHI Learning Pvt.Ltd., New Delhi, 2009.
3. Deep Chandra Joshi, Quantum Electrodynamics and Particle Physics,1st edition, I.K.International Publishing house Pvt.Ltd., 2006.
4. A. Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, 4th Edition, Macmillan India, New Delhi.
5. E. Merzbacher, Quantum Mechanics, 2nd edition, John Wiley and Sons, New York, 1970
6. W.Greiner, Relativistic Quantum Mechanics, 3rd edition , Springer International, New Delhi,2000.
7. Amitabha Lahiri and Palash B.Pal, A First book of Quantum Field theory,2nd edition, Narosa Publishing house, New Delhi ,2000.

Online Sources:

1. http://www.netsa.org.lk/OcwWeb/Physics/index.htm
2. http://www.theory.caltech.edu/people/preskill/ph229
3. http://www.nscl.msu.edu/~pratt/phy851/lectures/lectures.html
4. http://walet.phy.umist.ac.uk/QM/LectureNotes

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER III

CONDENSED MATTER PHYSICS

Teaching Hours: 75 **Credits: 4**
Course Code: 14SP15/3C/CMP **L T P: 3 2 0**

Objectives:

- To give the students basic ideas on properties and structure of materials.
- To expose the students to the field of research in solid-state physics.

Course Outline:

UNIT I: Crystal Physics

Periodicity in crystalline solids – Weigner-Sertz primitive cell – Bravais lattices in 2D & 3D – symmetric operations – Miller Indices of lattice planes – Atomic Packing Fraction of SC, BCC & FCC – Density and lattice constant – Reciprocal lattice – Brillouin zones – Reciprocal lattice to SC, BCC & FCC lattices – Other common crystal structures- NaCl, CsCl, Hexagonal closed packed structure, Diamond & ZnS – Diffraction by crystals – Bragg's law. **15Hrs**

UNIT II: Theory of Free Electrons

Classical free electron theory of metals – Quantum mechanical approach – Density of states – Fermi Dirac distribution and filling of bands – Heat capacity of electron gas – Electrical conductivity and Ohm's law – Resistivity of metals – Hall effect – Umklapp scattering - Thermal conductivity of metals. **15Hrs**

UNIT III: Energy Band Theory

Nearly free electron model – Brillouin Zone – Bragg reflection of electrons in a crystal – Origin of forbidden bands – Standing wave at zone boundary – Electron filling in metals, insulators and semiconductors – Bloch theorem - Kronig-Penney model **14Hrs**

UNIT IV: Fermi Surfaces and Metals

Harrison's method of constructing Fermi surfaces – extended zone scheme – periodic zone scheme – Fermi Surfaces in metals –SC lattice, BCC lattice & FCC lattice – Characteristics of Fermi surface – Effect of electric field on Fermi surface – Effect of magnetic field on Fermi surface – Experimental study of Fermi surface – de Hass-Van Alphen effect - Band gap - direct and indirect band gap. **15Hrs**

UNIT V: Superconductivity

Experimental survey – Occurrence of superconductivity – Destruction of superconductivity by magnetic fields - Meissner effect – Type I and II superconductors – Heat capacity – Energy gap – Isotope effect – Thermodynamics of the superconducting transition – London's equation – Coherence length – BCS theory of superconductivity – BCS ground state – Flux quantization in a superconducting ring – Single particle tunneling Josephson superconductor tunneling - ac and dc Josephson tunneling **16Hrs**

Books Recommended:

1. Charles Kittel, Introduction to Solid State Physics, 7th edition, John Willey & sons, Inc., New York, 1996
2. Rita John, Solid State Physics, 1st Edition, McGraw Hill Education (India) private Limited, New Delhi 2014.

3. M A Wahab, Solid State Physics, 2nd Edition, Narosa publishing House, New Delhi, 2005
4. V.Raghavan, Materials Science and Engineering, 3rd Edition, Prentice Hall India, New Delhi 1993.
5. S.O. Pillai, Solid State Physics, 6th Edition, New Age International, New Delhi, 1997.

Books for Reference:

1. A.J.Dekker, Solid State physics, 1st Edition, Macmillan India Ltd., New Delhi, 1957
2. Ashcroft & Mermin, Solid State Physics, 1st Edition, Rhivehart & Winton, New York 2005.
3. R.Asokamani, Solid State Physics:Principles and Applications,1st Edition, Anshan Ltd;
4. M. Ali.Omar, Elementary Solid State Physics Principles and Application, 6th Edition, Pearson education, Addison – Wesley 1974.

Online Sources:

1. http://personal.ph.surrey.ac.uk/~phs1ss/2SS/2SS%2520lecture%25201.pdf
2. http://wwwthphys.physics.ox.ac.uk/people/SteveSimon/condmat2012/LectureNotes 2012.pdf
3. http://folk.uio.no/yurig/fys448/f448pdf.pdf

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER III

MICROPROCESSOR, MICROCONTROLLER - ARCHITECTURE AND APPLICATIONS

Teaching Hours: 60 **Credits: 4**
Course Code: 14SP15/3C/MMA **L T P: 3 1 0**

Objectives:

- To provide an entry point to learn about microprocessor and controllers
- To study the interfacing and applications of various peripherals

To Fabricate the electronic devices

Course Outline:

Unit I: Microprocessor 8085

Organization of 8085 microprocessor – Register Structure – Architecture – Pin Configuration – Addressing modes – Instruction set – Interrupts. **12 Hrs.**

Unit II: Interfacing Devices

Programmable Peripheral interface 8255 – Programmable Interval Timer8253/54 – 8251Serial Communication Interface – 8279 Programmable Keyboard/Display Interface. **12 Hrs**

Unit III: Microcontroller Architecture

Organization of 8051 Microcontroller – Register Structure – Architecture – Program memory – Data memory – Special Function Register – Input/Output Pins – Ports and Circuits – Counters and Timers – Interrupts – Addressing modes – Instruction set. **12 Hrs**

Unit IV: Programming

Assembly language program in 8085 – Addition, Subtraction, Multiplication and Division of 16-bit data – Interfacing Stepper motor – Interfacing key board – Ascending and descending order – Evaluation of simple expressions.
Delay – Routines – Calculation of Time Delay.
Assembly language program in 8051 – Addition, Subtraction, Multiplication and Division of 8-bit data – Smallest and Greatest number – Interfacing DAC & ADC – Pattern Comparison. **12 Hrs**

Unit V: Applications

Digital to Analog Interface – Analog to Digital Interface – Stepper motor interface – Speech Synthesizer – Temperature measurement and controller – Frequency measurement & Pulse width Calculation – Hex Key board interface. **12 Hrs**

Books Recommended:

1. R.S.Gaonkar, Microprocessor Architecture Programming and Application with the 8085, 5th Edition, Penram International Publishing, Mumbai, 1999.
2. Kenneth J.Ayala, The 8051 Microcontroller – Architecture, Programming and Applications, 3rd Edition, Penram International Publishing (India) Pvt. Ltd. 1996.
3. Douglas V. Hall, Microprocessors and Interfacing – Programming and Hardware, 2nd Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.

Books for Reference:

1. B.Ram, Fundamentals of Microprocessors and Microcomputers, 4th revised and Enlarged edition, Dhanpat Rai Publications, New Delhi, 2005.
2. A.Nagoor Kani, Microprocessor and its applications, 1st Edition, RBA Pub., Chennai.
3. V.Vijayendran, Fundamentals of Microprocessor 8085 , Architecture, Programming and Interfacing, 2nd Edition, Viswanathan Pvt. Ltd., Chennai, 2004.
4. Aditya P.Mathur, Introduction to Microprocessor, 3rd Edition, Tata McGrawHill Pub. Co., Ltd., New Delhi.

Online Sources:

1. www.onesmartclick.com/engineering/microprocessor.html
2. http://en.wikipedia.org/wiki/Microprocessor

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER III

MICROPROCESSOR 8085 & MICROCONTROLLER 8051 EXPERIMENTS

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/3C/PR3 **L T P: 0 3 3**

Course Outline:
Any fifteen Experiments to be done

Microprocessor 8085 experiments

1. Addition, subtraction, multiplication – 16-bit
2. Code conversions:
   a) Binary to BCD & BCD to Binary – 16-bit
   b) Binary to ASCII & ASCII to Binary
   c) BCD to ASCII & ASCII to BCD
3. Clock Program
4. LED interface - single LED ON-OFF – Binary counter, BCD counter, Ring counter and Johnson counter (8-bit)
5. DAC 0800 Interface and waveform generation
6. ADC 0809 interface
7. Hex keyboard interface
8. Stepper motor interface
9. 8253/54 Timer Interface
10. Interfacing Traffic controller

Microcontroller 8051 experiments

11. Addition, subtraction, Multiplication and division 8 - bit
12. Pattern comparison
13. Interfacing Stepper motor
14. Smallest and Largest of an array
15. Ascending and descending order of n elements.
16. Hex keyboard interface
17. ADC 0809 interface
18. DAC 0800 Interface and waveform generation
19. Interfacing Traffic controller
20. Elevator

SEMESTER III

COMPUTATIONAL METHODS AND C PROGRAMMING

Teaching Hours: 75 **Credits: 3**
Course Code: 14SP15/3E/CMC **L T P: 2 3 0**

Objectives:

- To familiarize the students with solutions to complex problems using simple computational methods.
- To expose the students to learn the programming in C, which is essential to develop numerical method, programs.

All the Units covered The Programming Techniques.

Course Outline:

Unit I: Solutions of Equations

Determination of zeros of polynomials – Roots transcendental equations–Bisection method, Newton-Raphson method, Iteration method, Regular–Falsi method – Convergence of solutions. **14 Hrs**

Unit II: Linear Systems

Solution of simultaneous linear equations – Gaussian elimination – Gauss Jordan – Gauss Seidal – Gauss Jacobi – Matrix inversion – Eigen values and Eigen vectors - Power and Jacobi Methods. **15 Hrs**

Unit III: Interpolation and Curve Fitting

Interpolation with equally and unequally spaced points – Newton's forward and backward interpolation – Lagrange interpolation – Curve fitting – Least square fitting –Non linear curve fitting –Power function – Exponential function - Polynomial fitting. **14 Hrs**

Unit IV: Differentiation, Integration and Solution of Differential Equations

Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's rule – Error estimates – Gauss quadratures – Numerical solution of ordinary differential equations – Euler and Runge Kutta methods. **15 Hrs**

Unit V: Programming With C

Basic structure of C programs – Constants – Variables and Data types – Operators and Expression – Managing Input and Ouput operators – Decision making with IF statement – GOTO Statement – Decision making and Looping – Arrays – Handling of Character strings – User Defined Functions. **17 Hrs**

Books Recommended:

1. M.K Jain, SRK Iyenkar, R.K.Jain, Numerical methods for scientific and engineering computation, 5th Edition, New Age International Pvt Ltd., New Delhi, 2007.
2. S.S.Sastry, Introductory Methods of Numerical Analysis, 4th Edition, Prentice Hall of India (P) Ltd., New Delhi.
3. Dr.A.Singaravelu,Numerical methods, New revised edition Dec 2007
4. Dr.P.Kandasamy, Dr.K.Thilagavathy,Dr.K.Gunavathy, Numericalmethods, New revised edition Dec 2008 (Reprint 2009).
5. E.Balaguruswami, Programming in ANSI C, 4th Edition,Tata McGraw-Hill Pub. Com Ltd., New Delhi, 2008.

6. Yashvant Kanetkar, Let us C, 8th Edition, BPB Pub., New Delhi, 2007.

Books for reference:

1. Francis scheid, Numerical Analysis, 2nd Edition, Tata Mc Graw Hill Publishing company Ltd., New Delhi.
2. Schaum's Outlines, Numerical analysis, 2nd Edition, Tata McGraw Hill Pub.Co., Ltd., New Delhi-15, 2004
3. Radhey. S Gupta, Elements of Numerical Analysis, 1st Edition, Macmillan India Ltd., New Delhi, 2009.
4. T Veerarajan and T. Ramachandran, Numerical Methods with Programs in C, 2nd Edition, Tata Mc Graw Hill Education Pvt. Ltd., New Delhi, 2006.
5. Ashok N. Kamthana, Programming with ANSI and TURBO C, 1st Edition, Dorling Kindersley India Pvt. Ltd., New Delhi, 2006.

Online Sources:

1. http://www.sst.ph.ic.ac.uk/angus/Lecturs/compphys/comphys.html
2. http://www.library.cornell.edu/nr

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER III

DIGITAL PHOTOGRAPHY

Teaching Hours: 60 Hrs **Credits: 3**
Course Code: 14SP15/3E/PHO **L T P: 2 2 0**

Objectives:

- To build up confidence in camera handling and picture composition among students and introduce them to the basic concepts of digital photography.
- To acquire the essential skills required to become a professional photographer and to teach them the skills of a good photography.
- To learn both the technical and creative aspects of Photography.

Course Outline:

UNIT I: Basic Principles of Light

Electromagnetic theory - Wavelength – Visible spectrum – Illumination fall off– Changes when light meets a surface - Transmission – Reflection – Refraction- Pinhole camera –practical limitations to pin hole images –Simple positive lens – focal length and image size- Compound lenses- focal length. **12Hrs**

UNIT II: Camera as a Whole

Camera principles-Light sensitive films and sensors – The camera – types of camera – beginner's cameras – advanced compacts - single lens reflex(SLR) cameras – manual SLR's - automatic SLR's - Accessories. **12Hrs**

UNIT III: Creative use of camera controls

Image brightness –Effective aperture – Relative aperture - F number scales – Exposure times- Depth of field – practical significance – Depth of focus – Shutter – construction and types- selection of shutter speeds and subject movements – Filters – types of filters – Lens sets- Care of lenses. **12Hrs**

UNIT IV: Digital camera

Digital image capture – The megapixel debate – Screen output- Grain and noise – Optical and digital zoom – Image stabilizer – White balance – Transferring picture from camera to computer– file types –TIFF(tagged image file format) – RAW – JPEG(joint photographic experts group)- The digital archive – Downloading . **12Hrs**

UNIT V: Digital Image - Post Production Editing

The hardware – the computer – peripherals – Software program – Program structure – Navigating the program interface- navigating within an image-– Basic image editing – undo/redo/history – crop, rotate, level horizon- dodge/burn – brightness/contrast – color adjustments(color balance) – hue/saturation – cloning /retouching – image size-red eye reduction – Saving digital file –file formats – Printing. **12Hrs**

Books Recommended:

1. Michel J.Langford &Philip Andrews, Starting photography, 6th Edition, Focal press, London,2009
2. Michel J.Langford , Anna Fox & Richard Sawdon Smith, Basic photography, 8th Edition, Focal press, London,2007
3. 35mm Handbook, 3rd Edition, Ebury Press., 2000.

Books for Reference:

1. Mark Galer, Digital Photography in Available Light essential skills, 3rd edition, Focal press, London,2006
2. Paul Harcourt Davies, The Photographer's practical handbook , 1st edition, UK, 2005.
3. Deke McClellannd & Katrin Eismann, Real World Digital Photography, 1st Edition , Peachpit press, California, 1999.

Online Sources:

1. www.physics.utah.edu/~jonpaul/basic%20photography.pdf
2. www.iop.ie/tutorials/BDP03SoftLightA4.pdf
3. https://pyango.wikispaces.com/

Elective (Interdisciplinary) Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (5 x 8 = 40 Marks)

- 1 – 8 questions
- All questions carry equal marks
- Descriptive/Derivation/Problems/ type questions
- **Open choice covering all the 5 units**

Part – B (3 x 20 = 60 Marks)

- 9 – 14 questions
- All questions carry equal marks
- Problems/Applications/Analysis/Evaluation.
- **3 questions to be answered out of 6 questions, covering all the 5 units.**

SEMESTER III
SOFT SKILLS II – COMPUTING SKILLS

Teaching Hours: 30 **Credits: 2**
Course Code: PG15/3S/CPS

Unit – 1

Windows Basics – Introduction – Control Panel – Managing multiple windows – Windows Explorer – Restore items – Managing Files and Folders – Network Neighborhood.

Unit – 2

Introduction to word – Editing a document - Finding and Replacing Text - Inserting Symbols - Changing Dictionaries – Using Thesaurus - Enhancing document – Columns, Tables and Other features.

Unit – 3

Introduction to worksheet– Editing cell & using Commands and functions – Formatting a Work Sheet - Printing work sheet.- Creating charts – Naming ranges and using statistical, math and financial functions– Additional formatting commands and drawing toolbar – multiple worksheet and macros.

TEXT BOOK:

1. PC Software for Windows 98' made simple – R.K.Taxali – Tata McGraw Hill Publishers, 2005.

SEMESTER IV

NUCLEAR AND PARTICLE PHYSICS

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/4C/NPP **L T P: 3 3 0**

Objective:

- To give the students a theoretical grounding in nuclear and particle physics and to expose them to the experimental methodology in this field.

Course Outline:

Unit I: Two Body Problem and Nuclear Forces

Theory of Ground state of Deuteron – Nucleon – nucleon interactions – Partial wave analysis – Low energy n-p scattering – Effective range Theory – Spin dependence of nuclear forces – Low energy p-p Scattering – Tensor forces – Meson theory of nuclear forces – Yukawa potential – Charge independence of nuclear forces – Isobaric analogue states. **18 Hrs**

Unit II: Nuclear Reactions

Types of Nuclear reactions – Conservation laws – Energetic of nuclear Reaction – Q-value equation – Nuclear Reaction cross-section and partial wave analysis – Black nucleus – Compound nucleus – Energy levels of compound nucleus and resonance – Resonance scattering – Breit-Wigner one level formulae – Direct reactions. **18 Hrs**

Unit III: Nuclear Decay

Beta decay – Disintegration energies – Continuous beta ray spectra – Consequences – Fermi theory of beta decay – Kurie plot – Selection rules in beta decay processes – Energy levels and decay schemes – Non conservation of parity in beta decay – Neutrino hypothesis – Gamma Emission – Selection rules – Internal conversion – Nuclear isomers. **18 Hrs**

Unit IV: Nuclear Stability and Nuclear Models

Nuclear stability – Liquid drop model – Magic numbers – Nuclear shell model – Nuclear magnetic moments – Nuclear quadrupole moments – Short comings of shell model – Collective model of Bohr and Mottelson. **18 Hrs**

Unit V: Elementary Particle Physics

Types of interaction between elementary particles – Classification of elementary particles – Conservation laws – Invariance principles and Symmetries – Properties of elementary particles – Mass less bosons – Leptons – Mesons – CP violation in neutral K-meson decay – Baryons – Hyperons – Eight fold way – SU(2) and SU(3) multiplets – Gell Man Okubo Mass Formula – Quarks and its types. **18 Hrs**

Books Recommended:

1. K.S.Krane, Introductory Nuclear Physics, 4th Edition, Wiley, NY, 1987.
2. D.C. Tayal, Nuclear Physics, 5th Revised & Enlarged Edition, Himalaya Publishing House, New Delhi, 2008.
3. R.C. Sharma, Nuclear Physics, 6th Revised & Enlarged Edition, K. Nath &

Co. Meerut, 2007.

Books for Reference:

1. R.R.Roy and B.P.Nigam, Nuclear Physics, I[st] US Edition, New Age International, 1967.
2. S. N. Ghoshal, Nuclear Physics, 1[st] Edition (Reprint 2013), S.Chand & Co. Ltd., New Delhi. 1994
3. I. Kaplan, Nuclear Physics, 2[nd] Edition, Narosa, New Delhi, 1989.
4. D.Griffiths, Introduction to Elementary Particles, 2[nd] Edition, Harper and Row, NY 1987.
5. M.L.Pandya, R.P.S. Yadav, Elements of Nuclear Physics, 7[th] Edition, Reprint 2010, Kedarnath Ramnath, Meerut, Delhi.1995.
6. Stya Prakash, Nuclear Physics and Particle Physics, 1[st] Edition 2005, Reprint 2014, Sultan Chand & Sons, New Delhi.

Online sources

1. http://www.freebookcentre.net/Physics/Nuclear-Physics-Books.html
2. http://www.freebookcentre.net/physics-books-download/Elementary-introduction-to-nuclear-reactor-physics.html
3. http://www.freebookcentre.net/physics-books-download/Elementary-Particle-Physics-I.html

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER IV

MOLECULAR SPECTROSCOPY

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/4C/MSY **L T P: 3 3 0**

Objective:

- To gain a fundamental understanding of the interactions of atoms, molecules and electromagnetic radiation.
- To expose the students to the scope of research in the field of spectroscopy

Course Outline:

UNIT I: Microwave and Electronic Spectroscopy

Classification of Molecules-Instrumentation of radiation with rotating molecules-Rotating molecules – Rotational spectra of rigid diatomic molecules – Isotope effect in rotational spectra – Non rigid rotator – linear polyatomic molecules – Symmetric top molecules –Asymmetric top molecules.

Theory of electronic spectroscopy –Frank Condon Principle – Rotational and Vibrational Structure of electronic spectra - Applications. **18 Hrs**

UNIT II: Infrared Spectroscopy

IR spectroscopy –Theory of infrared spectrum-Origin of infrared spectrum-Selection rules-Vibrations of polyatomic molecules-Normal modes of molecular vibrations-Normal coordinate analysis-Procedure for Normal coordinate analysis Instrumentation –Double beam spectrophotometer – FTIR spectroscopy. **18 Hrs**

UNIT III: Raman Spectroscopy

Nature of Raman effect – Pure rotational Raman spectra-Vibrational Raman Spectra.

Instrumentation Techniques – Sources – Sampling methods –Degree of depolarization – FT Raman Spectroscopy- Application of IR and Raman Spectroscopy in molecular structural confirmation. **18 Hrs**

UNIT IV: NMR Techniques

Magnetic Properties of Nuclei – Theory of NMR method – Bloch equations – Steady state solution –Instrumentation-Single coil and double coil method-Pulse r.f method-Theory of chemical shifts – Relaxation Processes – Types of Coupling-Spin-Spin Coupling-High resolution NMR **18 Hrs**

UNIT V: ESR and Mossbauer Spectroscopy

Principle of ESR – Quantum mechanical treatment of ESR – ESR spectrometer – Total Hamiltonian – Hyperfine structure effects – Application of ESR method.

Principles of Mossbauer spectroscopy- Instrumentation- – Chemical shift Quardrupole splitting and Zeeman splitting– Simple chemical applications of Mossbauer spectroscopy. **18 Hrs**

Books Recommended:

1. C.N.Banwell and E.M. McCash, Fundamentals of Molecular Spectroscopy, 4th Edition, TMH New Delhi, 1994.
2. Gurdeep R.Chatwal and Sham K.Anand, Spectroscopy, 2nd Edition, Himalaya Publishing House, 1979.
3. H.Kaur,Spectroscopy, 4th Edition, Pragati Prakasan,2008
4. G.Aruldhas, Molecular Structure and Spectroscopy, 2nd Edition Prentice-Hall of India, New Delhi, 2001.

Books for Reference:

1. M.C.Gupta, Atomic and Molecular Spectroscopy, 2nd Edition, New Age International, New Delhi, 2001.
2 Walker and Straughan, Spectroscopy, Vols, I and II, 4th Edition, Chapman and Hall, 1967
3. D.N.Sathyanarayana, Vibrational Spectroscopy and Applications, 2nd Edition, New Age International Publication, 2004.
4. V.B.Patania, Spectroscopy, 1st Edition, Campus books International, 2002.

Online Sources:

1. http://www.freebookcentre.net/chemistry-books-Spectroscopy-Lecture-Notes.html
2. http//:chemwiki.ucdavis.edu
3. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/Spectrpy/spectro.htm

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER - IV

PROJECT & VIVA VOCE

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/4C/PRO **L T P: 0 3 3**

Objective:

For Students to adventure into preliminary research field both in theory and experiment, the project has been introduced in the final semester. Here the student will explore new developments from books and journals, collecting literature/data and write a dissertation based on her work and studies. The project work can also be based on experimental work.

SEMESTER IV

COMPUTATIONAL METHODS AND C PROGRAMMING EXPERIMENTS

Teaching Hours: 90 **Credits: 4**
Course Code: 14SP15/4C/PR4 **LTP: 0 3 3**

Objective:

- To equip the students with the programming skills in the C language essential for developing numerical methods.

Course Outline:

Any sixteen experiments to be done

1. Summation of series Sin(x), Exp(x), Cos(x) and comparison with built in functions.
2. Sum of the first ten terms of the Fibonacci series
3. Bisection method with Algorithm, Flow chart, C PROGRAM, and output.
4. Addition , subtraction and multiplication of two matrices.
5. Generation of Legendre Polynomial (n=2,3) ,Roots by Newton Raphson Method.
6. Generation of Chebhyshev Polynomial (n=2,3) ,Roots by Newton Raphson Method
7. Newton forward interpolation with Algorithm, Flow chart, C PROGRAM and output.
8. Newton backward interpolation with Algorithm, Flow chart, C PROGRAM and output.
9. Numerical integration by the trapezoidal rule, with Algorithm, Flow chart, C PROGRAM, and output.
10. Numerical integration by the Simpson rule, with Algorithm, Flow chart, C PROGRAM, and output.
11. Determination of Trace & Determinant of a matrix
12. Determination of Transpose and inverse of a square matrix.
13. Curve-fitting: Least-squares fitting with Algorithm, Flow chart, C PROGRAM, and output.
14. Generation of Laguerre Polynomial (n=2,3) ,Roots by Newton Raphson Method.
15. Generation of Hermite Polynomial (n=2,3) ,Roots by Newton Raphson Method
16. Lagrange interpolation with Algorithm, Flow chart, C PROGRAM, and output
17. Numerical solution of ordinary first-order differential equations by the Euler method, with Algorithm, Flow chart, C PROGRAM, and output.
18. Numerical solution of ordinary first-order differential equations by the Runge-kutta method, with Algorithm, Flow chart, C PROGRAM, and output
19. Gauss Elimination method, Flowchart, Algorithm, C program and output.
20. Gauss Jacobi's iteration method, Flowchart, Algorithm, C program and output.

SEMESTER IV

X- RAY CRYSTALLOGRAPHY

Teaching Hours: 60 **Credits: 3**
Course Code: 14SP15/4E/XRC **LTP: 2 2 0**

Objectives:

- To introduce the students to the fundamental concepts behind structure determination using X-ray crystallography
- To equip the students with basic ideas on the geometries and symmetries of crystals
- To help the students grasp the concept of conformational analyses

Course Outline:

UNIT I: Symmetry in Crystals

Crystals- Symmetry- crystal axes -unit cell – Plane lattices – Space lattices – Bravais lattice- Lattice planes – Symmetry operations- point groups- space groups- screw axis- glide plane – equivalent positions **12Hrs**

UNIT II: Diffraction of X-rays

Reciprocal lattice - relation between direct and reciprocal space – Diffraction & Fourier transforms - Production of X-rays – X-ray diffraction by crystals- Laue equations – Bragg's law – Ewald's sphere – Diffraction methods- Laue diffraction – Powder diffraction – Atomic scattering factor – Structure factor – Intensity expression - Friedel's law – systematic absences. **12Hrs**

UNIT III: Crystal Structure Determination

Phase problem in crystallography- significance of centrosymmetry -Methods of solving Phase Problem – Patterson methods – Isomorphous replacement method- Anomalous dispersion method –Unitary and normalized structure factors - Direct methods procedure – Fourier map. **12Hrs**

UNIT IV: Data collection techniques

Four circle diffractometer - CCD detector –image plates – Intensity estimation - data reduction – extinction, Lorentz –Polarization & absorption corrections- thermal & scale factors – Wilson's plot- space group determination. **12Hrs**

Unit V: Crystal Structure Refinement & Analysis

Weighting schemes – residual factor – refinement by Fourier synthesis- locating hydrogen atoms- thermal parameters - Least square refinement – Goodness of fit- Structural analysis- bond lengths – bond angles – torsion and dihedral angles – Conformational analysis – molecular packing – Vander Waal's interactions – hydrogen bonds – crystal packing. **12Hrs**

Books Recommended:

1. Dennis Sherwood & Jon Cooper, Crystal, X-ray and Proteins, 1st Edition, Oxford University press, London, 2011
2. D. Velmurugan, Elementary Crystallography, 1st Edition, MJP Publishers, Chennai, 2008
3. Stout and Jensen, X-ray Structure Determination, 2nd Edition, John Wiley Publications.

4. Ladd and Palmer , Structure Determination by X-ray Crystallography, 2nd Edition, Plenum Press, London
5. M.A.Wahab, Essentials of Crystallography, 1st Edition, Narosa publishing house,2009.

Books for reference

1. C.Giacovazzo, H.L.Monaco, D.Viterbo, F.Scordari, G.Gill, G.Zanotti and M.Catti , Fundamentals of Crystallography ,2nd Edition, Oxford Press,1992.
2. M.M.Woolfson, Introduction to X-ray Crystallography, 1st Edition, Cambridge University Press Publications
3. Leonid V. Azaroff, Elements of X-ray crystallography, 1st Edition McGraw Hill Publications
4. Glusker, Lewis and Rossi , Crystal Structure analysis for Chemist and Biologist, 1st Edition, Wiley - VCH Publishers Inc. 7.

Online Sources:

1. http://www.mic.ucla.edu/X-ray/tutorials.htm
2. http://ocw.mit.edu/courses/chemistry/5-069-crystal-structure-analysis-spring-2010/lecture-notes/
3. www.youtube.com/watch?v=oj4QJ-1lxgU

Question Paper Template

Total Marks: 100 **Time Duration: 3 Hrs.**

Part – A (2 x 10 = 20 Marks)

- 1 – 10 questions
- All questions carry equal marks
- Short answers
- **2 questions from each unit, covering all the 5 units.**

Part – B (5 x 8 = 40 Marks)

- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- **Either or type**
- **Both the choices of each question must belong to the same unit, covering all the 5 units**

Part – C (2 x 20 = 40 Marks)

- 16 – 19 questions
- All questions carry equal marks
- Applications/Analysis/Synthesis/Evaluation.
- **2 questions to be answered out of 4 questions, covering all the 5** units.

SEMESTER IV
SOFT SKILLS IV – SPOKEN AND PRESENTATION SKILLS

Teaching Hours: 30 **Credits: 2**
Course Code: PG15/4S/SPS

Objectives:

- Illustrate role of skills in real-life work situations with case studies, role play, etc.
- enable students to perceive cultural codes involved in presentation and design language performance accordingly

Course Outline:

Unit – I:

Communication Skills for effective Presentation - Reading Skills Formal and Informal Conversations - Introducing, Opening and closing speeches - Inviting, thanking, Apologizing, Expressing anger Resolving conflict - Giving and taking information.

UNIT II:

Social Communication Skills for Presentation – socializing – ice breakers; small talk – dialogue, debate, discussion – overcoming shyness, hesitation – understanding cultural codes.

UNIT III:

Professional Communication Skills for Presentation – technical presentations – presentation by over head projector – board and chalk method – power point presentation.

Etiquettes for presentations –Individual presentation.

Books for Reference:

1. Lucas, Stephen.2001. *Art of Public Speaking*. Mc-Graw Hill.
2. Pillai, Radhakrishnan, 2006. Spoken English for you. Emerald Publishers, Chennai.
3. Peter, Francis. *Soft Skills and Professional Communication.* New Delhi: Tata McGraw Hill.2012. Print.
4. Gardner, Howard. 1993. Multiple Intelligences: *The Theory in Practice*: A Reader Basic Book. New York.
5. De Bono, Edward. 2000. *Six Thinking Hats.* 2nd Edition. Penguin Books.