ETHIRAJ COLLEGE FOR WOMEN

(AUTONOMOUS)

CHENNAI - 600 008

DEPARTMENT OF PHYSICS

Revised Syllabus for

M.Sc. PHYSICS

(For students admitted from the academic year 2018 – 2019)

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

Department of Physics

Master of Science in Physics

(Revised syllabus effective from the academic year 2018 – 2019)

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. Physics or equivalent Degree of 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	14SP18/1C/MMP	Mathematical Physics	6	4	40	60	100
	14SP18/1C/CMR	Classical Mechanics & Relativity	6	4	40	60	100
	14SP18/1C/EMT1	Electromagnetic Theory I	5	4	40	60	100
	14SP18/1C/PR1	*General Experiments	6	*4	40	60	100
	14SP18/1E1/ELS	Electronics	5	3	40	60	100
	PG18/1S/PEW	Soft Skill 1 – Personality Enrichment for Women	2	2	-	50	50
II	14SP18/2C/QM1	Quantum Mechanics - I	5	4	40	60	100
	14SP18/2C/STM	Statistical Mechanics	5	4	40	60	100
	14SP18/2C/EMT2	Electromagnetic Theory II	4	4	40	60	100
	14SP18/2C/PR2	Electronics Experiments	6	4	40	60	100
	14SP18/2E2/MSY	Molecular Spectroscopy	4	3	40	60	100
	14SP18/2E/MTG	Medical Technology	4	3	40	60	100
	PG18/2S/LCE PG18/2S/FRE PG18/2S/GER	Soft Skill 2 - Communication Skills / Soft skills in French / German for beginners	2	2	-	50	50
III	14SP18/3C/QM2	Quantum Mechanics - II	5	4	40	60	100
	14SP18/3C/SSP	Solid State Physics	5	4	40	60	100
	14SP18/3C/MPC	Microprocessor 8085 and Microcontroller 8051	4	4	40	60	100
	14SP18/3C/PR3	*Microprocessor 8085 & Microcontroller 8051 Experiments	6	*4	40	60	100
	14SP18/3E3/CMC	Computational Methods and C Programming	4	3	40	60	100
	14SP18/3E/PHO	Digital Photography	4	3	40	60	100
	PG18/3S/CPS	Soft Skill 3 - Computing Skills	2	2	-	50	50
IV	14SP18/4C/NPP	Nuclear and Particle Physics	6	4	40	60	100
	14SP18/4C/PRO	Project & Viva voce	6	4	40	60	100
	14SP18/4C/PR4	Computational Methods & C Programming Experiments	6	4	40	60	100
	14SP18/4E4/NST	NanoScience and NanoTechnology	5	3	40	60	100
	14SP18/4E5/XRC	X- Ray Crystallography	5	3	40	60	100
	PG18/3S/SPS	Soft Skill 4 – Spoken and Presentation Skills	2	2	-	50	50
		&Internship		2			

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

& Internship will be carried out during the summer vacation of the II semester

Pattern for Continuous Assessment:

10 theory core papers, 5 major elective papers & 2 interdisciplinary elective papers

Sem	Course Code	Course Title	Test I	Test II	Quiz/Assignment / Seminar / Field Visit	Participatory Learning	Total
I	14SP18/1C/MMP	Mathematical Physics	10	10	10	10	40
	14SP18/1C/CMR	Classical Mechanics & Relativity	10	10	10	10	40
	14SP18/1C/EMT1	Electromagnetic Theory I	10	10	10	10	40
	14SP18/1E1/ELS	Electronics	10	10	10	10	40
II	14SP18/2C/QM1	Quantum Mechanics - I	10	10	10	10	40
	14SP18/2C/STM	Statistical Mechanics	10	10	10	10	40
	14SP18/2C/EMT2	Electromagnetic Theory II	10	10	10	10	40
	14SP18/2E2/MSY	Molecular Spectroscopy	10	10	10	10	40
	14SP18/2E/MTG	Medical Technology	10	10	10	10	40
III	14SP18/3C/QM2	Quantum Mechanics - II	10	10	10	10	40
	14SP18/3C/SSP	Solid State Physics	10	10	10	10	40
	14SP18/3C/MPC	Microprocessor 8085 and Microcontroller 8051	10	10	10	10	40
	14SP18/3E3/CMC	Computational Methods and C Programming	10	10	10	10	40
	14SP18/3E/PHO	Digital Photography	10	10	10	10	40
IV	14SP18/4C/NPP	Nuclear and Particle Physics	10	10	10	10	40
	14SP18/4E4/NST	NanoScience and NanoTechnology	10	10	10	10	40
	14SP18/4E5/XRC	X- Ray Crystallography	10	10	10	10	40

4 core practical

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

		Total	40

One 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: 14SP18/1C/MMP **LTP: 3 3 0**

Objectives:

- To equip the students with essential mathematical methods 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 series – Dirichlet conditions – Determination of Fourier coefficients - Fourier integral – Fourier transforms – Sine and Cosine transforms – Theorems: similarity, shifting, modulation, convolution and Parseval - Fourier transforms of derivatives-solutions of heat conduction problems

Laplace and inverse Laplace transforms – shifting and convolution theorems - Transforms of derivatives and integrals - Transforms of Heaviside and Dirac-delta functions - inverse Laplace transforms using Partial Fraction methods - solution of differential equations – solution of transmission line equations **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 **(10 x 2 = 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: 14SP18/1C/CMR **LTP: 3 3 0**

Objectives:

- To introduce the student to various aspects of Classical Mechanics such as Lagrangian and Hamiltonian formulation. These will form the essential background for other courses such as Quantum mechanics, Electrodynamics, High Energy Physics and general Relativity.

Course Outline:

Unit I: Lagrangian and Hamiltonian Formulations

Mechanics of a Particle – Mechanics of a System of Particles – Lagrangian Dynamics: Coordinate System – Degrees of Freedom – Constraints – Generalized Coordinates – D'Alembert's Principle – Lagrange's Equation of Motion – Applications: Simple Pendulum, Atwood's Machine, Compound Pendulum – Conservative Force (Problems) - Hamilton's Principle – Lagrange's Equation from Hamilton's Principle – Superiority of Lagrangian Mechanics over Newtonian Approach – Hamiltonian Dynamics: Generalized Momentum and Cyclic Coordinates – Hamilton's Equations – Applications: Simple Pendulum, Compound Pendulum, Harmonic Oscillator – Reduction of Two Body Central Force Problem to the Equivalent One Body Problem (Problems) – Differential Equation for an Orbit – Kepler's Laws of Planetary Motion and their Deduction. **19 Hrs**

Unit II: Mechanics of Rigid Bodies

Generalized Co-ordinates for Rigid Body Motion - Euler's Theorem– Euler Angles – Components of Angular Velocity Vector along Body Set of Axes and Space Set of Axes —Angular Velocity and Angular Momentum of Rigid Body - Moments and Product of Inertia (Problems) - Rotational Kinetic Energy - Euler's Equations of Motion of a Rigid Body - Torque Free Motion of a Rigid Body – Equations of Motion – Force-Free Motion of a Symmetrical Top – Motion of a Heavy Symmetrical Top – First Integrals of Motion – Steady Precession. **18 Hrs**

Unit III: Canonical Transformation and Brackets

Hamilton's Principle of Least Action – Canonical Transformations and Generating Functions – First, Second, Third and Fourth Form – Advantage of Canonical Transformation – Condition for a Transformation to be Canonical (Problems) – Simple Examples – Hamilton-Jacobi Method - Kepler's Problem Solutions By H-J Method - Poisson Brackets (Problems) – Invariance of Poisson Brackets with respect to Canonical Transformation – Equation of Motion in Poisson Bracket Form – Lagrange's Brackets (Problems) - Relation Between Poisson and Lagrange Bracket. **19 Hrs**

Unit IV: Small Oscillations

Stable and Unstable Equilibrium -Two Coupled Oscillators-Formulation of the Problem: Lagrange's Equations of Motion for Small Oscillation – Properties of T,V and Ω – Normal Co-Ordinates and Normal Frequencies of Vibration –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 Recommended:

1. J.C. Upadhayaya, Classical Mechanics, 1st Edition, Himalaya Publishing House 2009
2. H.Goldstein, C.Poole and J.Safko, Classical Mechanics, 3rd Edition, Pearson Education Asia, New Delhi, 2011.
3. Guptha Kumar Sharma, Classical Mechanics, 21st Edition, Pragrati Prakashan, Meerut 2012.

Books for Reference:

1. C.R.Mondol, Classical Mechanics, 1st Edition, Prentice-Hall of India, New Delhi. 2008
2. R.Resnick, Introduction to Special Theory of Relativity, 1st Edition, Wiley Eastern Ltd., New Delhi, 1968

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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- 11 – 15 questions
- All questions carry equal marks
- Descriptive type questions
- Either or type
- One choice of any two questions can be a problem
- 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

ELECTROMAGNETIC THEORY – I

Teaching Hours: 75 **Credits: 4**
Course Code: **14SP18/1C/EMT1** **LTP: 3 2 0**

Objectives:

- To elucidate the principles of electromagnetic theory to the students.
- To equip the students with the skill of correlating the theory and applications.

Course Outline:

UNIT 1: Electrostatics

The electric field – Coulomb's law – charge distributions – divergence and curl of E – field lines, flux and Gauss law (problems) electric potential - potential of a localized charge distribution - boundary conditions- work done to move a charge - electrostatic energy – charge distribution - conductors - induced charges – surface charge – force on a conductors – capacitors. **15Hrs**

UNIT II: Electric Scalar Potential

Laplace's Equation, one dimension, two dimension, three dimension- boundary conditions and uniqueness theorems – first and second – the method of images – the classic image problem - potential- induced surface charge – force- energy- applications: grounded conducting sphere - uniform line charge on an infinite straight wire - separation of variables- Cartesian coordinates - spherical coordinates (problems)

15Hrs

UNIT III: Dielectrics

Multipole Expansion – monople and dipole terms - origin of coordinates (problems) – electric field of a dipole – dielectrics - induced dipoles – alignment of polar molecules – (problems) - polarization – bound charges (problems) - Gauss's law in the presence of dielectrics- electric displacement – boundary conditions - susceptibility – permittivity - dielectric constant – boundary values – energy and force in dielectric systems - Clausius Mossotti Formula – Langevin Formula.

15Hrs

UNIT IV: Magnetostatics

The magnetic field – Lorentz force law – currents - line – surface volume (problems) – Biot - Savart law – applications- divergence and curl of B – Ampere's law – applications - magnetic vector potential- boundary conditions - multipole expansion of the vector potential - comparison of magnetostatics and electrostatics – magnetic fields in matter - torque and forces on magnetic dipoles- magnetization.

15Hrs

UNIT V: Electrodynamics

Bound currents - Ampere's law in magnetized materials – boundary conditions – magnetic susceptibility and permeability – ferromagnetism – hysteresis – Rowland Ring method - electromotive force - Ohm's law – Joule's heating law – electromagnetic induction – Faraday's law- induced electric field – inductance – Newmann formula – energy in magnetic fields - Maxwell's equations - Maxwell's equation in free space and matter - boundary conditions. **15Hrs**

Books Recommended:

1. D.J. Griffiths, Introduction to Electrodynamics, 4th Edition, Prentice-Hall of India, New Delhi, 2017.
2. J.D. Jackson, Classical Electrodynamics, 3rd Edition, Wiley Eastern Ltd, New Delhi, 2002-2006.
3. Chopra Agarwal, Electromagnetic Theory, Fifth Revised Edition, K.Nath & Co, Meerut, 2009.
4. Sathyaprakash, Electromagnetic Theory and Electrodynamics,New Ed,Kedarnath and Ramnath and Co., Meerut, 2004.

Books for Reference:

1. Bishwanath Chakraborty, Principles of Electrodynamics, 2nd Edition, Books and Allied (P) Ltd., Kolkatta, April 2008.
2. S.N.Goswami, Elements of Plasma physics, 2nd Edition, New Century Book Agency (P) Ltd., 2000.

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/

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- Short answers
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- All questions carry equal marks
- Descriptive type questions
- Either or type
- One choice of any two questions can be a problem
- 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: 14SP18/1C/PR1 **LTP: 0 3 3**

Objectives:

- To develop experimental skills in students and 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 constan
9. F.P. Etalon using spectrometer
10. Cornu's method - Young's modulus by Hyperbolic fringes
11. Susceptibility by Guoy's method
12. Specific charge of an electron – J.J. Thomson's method
13. Viscosity of liquid – Meyer's disc
14. GM counter – Characteristics, inverse square Law, absorption coefficient
15. Polarimeter – Specific Rotatory Power of an optically active solution
16. Hydrogen spectrum – Rydberg's constant
17. Solar spectrum – Hartmann's formula
18. Edser-Butler fringes – Thickness of air film
19. 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: 14SP18/1E1/ELS **LTP: 2 3 0**

Objective:

- To impart the knowledge of integrated electronics and electronic devices.
- To equip the students with an appreciation of their effectiveness.

Course Outline:

Unit I: Semiconductor Devices

Field effect transistor, junction field effect transistor - metal oxide semiconductor field effect transistor - construction, working, characteristics - FET as an amplifier - uni junction transistor - construction, working, characteristics - UJT relaxation oscillator (problems) - silicon controlled rectifier – construction, working, characteristics – SCR for power control .

Memory devices: 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 **–** Non-binary 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

Solution of simultaneous and differential equations using Op-Amps (problems) – active filters – low pass , high pass, band pass- 1^{st} order, 2^{nd} order butterworth filter circuits – wide band and narrow band reject filters - sample and hold circuits.

wave form generators using 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. R.A.Gaekwad, Op-amps and Linear Integrated circuits, 3rd Edition, Prentice Hall of India Pvt Ltd, New Delhi, 1993.
2. Taub and Shilling, Digital Integrated Electronics, 13th Edition, McGraw Hill international, Singapore, 1987.
3. B.Somnath Nair, Electronic devices and applications, 1st Edition, Prentice-Hall of India, New Delhi, 2003.
4. Flyod & Jain , Digital Fundamentals, 8th Edition ,Dorling Kindersley Pvt.Ltd., New Delhi., 2006.
5. V.Vijayendran, Introduction to Integrated Electronics,1st edition, S.Viswanathan Printers and publishers Pvt.Ltd., Chennai, 2005.
6. R.F.Coughlin and F.F.Drisol, Op-amp and linear integrated circuits.6th edition, Prentice Hall of India Pvt., Ltd.,New Delhi, 2008.
7. Millman and Halkias, Integrated Electronics, 25th Edition, Tata McGraw Hill, 1983.

Books for Reference:

1. B.Somnath Nair, Digital Electronics and Logic Design, 1st Edition, Prentice-Hall of India, New Delhi, 2003.
2. A. Ghatak and K.Thyagarajan , Optical Electronics, 1st edition, Cambridge Univ. Press,2008.
3. S.P. Bali, Solid State devices & circuits, 1st Edition, New Age International Private Ltd, New Delhi, 1995.
4. R.K. Sharma, Semiconductor Electronics, 1st Edition, New Age International PrivateLtd, New Delhi ,1996.
5. Leach and Malvino, Digital Principles and Applications, 5th Edition, TataMcGraw Hill, 2005.
6. S.M.Sze, Physics of Semiconductor Devices, 3rd Edition , John Wiley & Sons, New York, 1985.

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 **(10 x 2 = 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
- One choice of any two questions can be a problem
- 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.

SOFT SKILLS I – PERSONALITY ENRICHMENT FOR WOMEN

Course Code: PG18/1S/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:** A Manual by the Centre for Women's Studies (UGC Funded), Ethiraj College for Women.
2. Material on Capacity Building Initiatives, UGC India

SEMESTER II

QUANTUM MECHANICS - I

Teaching Hours: 75 **Credits: 4**
Course Code: 14SP18/2C/QM1 **LTP: 3 2 0**

Objectives:

- To emphasise a thorough understanding of the principles of quantum mechanics and their applications to various physical and chemical problems.
- To equip the students with the knowledge of the mathematical formalism and methodology of quantum mechanics.

Course Outline:

Unit I: Basic Formalism

Postulates of quantum mechanics- probability interpretation and admissibility conditions of the wave function (problems) - Schrödinger equation- - stationary states - expectation value (problems) - operators - operator algebra –eigen values and eigen functions of operators - completeness of eigen functions- Hermitian operators and their properties - simultaneous measurability and commutators (problems) - Uncertainty principle for operators - Ehrenfest's theorem **15 Hrs**

Unit II: Applications of Schrödinger Equation- One Dimension

The free particle- square well potential – rigid walls (problems)- finite walls- potential barrier - barrier penetration – alpha emission - simple harmonic oscillator – Schrödinger Method - ladder operator method (problems). **15 Hrs**

Unit III: Applications of Schrödinger Equation- Three Dimension

Square well potential- rigid walls- simple harmonic oscillator (problems) -particle moving in a spherically symmetric potential- system of two interacting particles - hydrogen atom- rigid rotator. **15 Hrs**

Unit IV: General Formalism

Linear vector space - Hilbert space – Dirac's notation - Heisenberg's matrix representation of wave functions and operators -momentum representation-wave functions, operators and Schrödinger equation- symmetry transformations and conservation laws - translation and rotation - parity and time reversal- quantum mechanical pictures - Schrödinger, Heisenberg and Interaction pictures. **15 Hrs**

Unit V: Approximation Methods

Time-independent perturbation theory for non-degenerate and degenerate levels – Stark effect in hydrogen atom - Variation method – helium atom - WKB approximation - bound states in a potential well-application to simple harmonic oscillator. **15 Hrs**

Books Recommended:

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd edition(37th Reprint),Tata McGraw-Hill, New Delhi, 2010.
2. G.Aruldhas, Quantum Mechanics, 2nd edition, Prentice Hall of India, New Delhi, 2009.
3. David J Griffiths, Introduction to Quantum Mechanics. 4th revised Edition, Pearson, 2011
4. Nouredine Zettili, Quantum mechanics concepts and applications, 2nd Edition, Wiley, 2017
5. SL Gupta and ID Gupta, Advanced Quantum Theory and Fields, 1st Edition, S Chand & Co., New Delhi, 1982.
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
8. Sathyaprakash, Advanced Quantum Mechanics, 5th edition, Kedarnath & Ramnath, Meerut, 2004.

Books For Reference:

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 **(10 x 2 = 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
- One choice of any two questions can be a problem
- 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: 14SP18/2C/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.

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 – Microstates and Macrostates - Number of Microstates in the Energy Range E to $+\delta E$ **15 Hrs**

UNIT II: Classical Statistics

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 – Atomicity of Gases – Interpretation of Temperature – Condition of Equilibrium between Two Systems in Thermal Contact – β parameter. **14 Hrs**

UNIT III: Ensembles

Micro Canonical Ensemble – Condition for Equilibrium: Thermal, Mechanical and Particle Equilibrium – Connection between Statistical and Thermodynamical Quantities - Perfect Gas in Micro Canonical Ensemble – Partition Functions: Derivation of Translational Partition Function for a Gas Molecule – Gibbs Paradox – Gibbs Canonical Ensemble – Perfect Monoatomic Gas in Canonical Ensemble – Grand Canonical Ensemble – Perfect Gas in Grand Canonical Ensemble – Comparison of Ensembles. **15 Hrs**

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's Radiation Law – Bose-Einstien Gas – Degeneracy and Bose-Einstien Condensation – Fermi-Dirac Gas – Degeneracy. **16 Hrs**

UNIT V: Fluctuations and Phase Transitions

Measure of Fluctuations: The Standard Deviation – an Illustration of Fluctuation : Molecules in Two Halves of a Box – Fluctuations in Ensembles: Canonical and Grand Canonical – Probability of One Dimensional Random Walk – Brownian Movement – Motion Due to Fluctuating Force – The Fokker-Planck Equation.

Phase Transition of First and Second Order – Ehrenfest's Equations – Ising Model – Bragg-William Approximation - One Dimensional Ising Model. **15 Hrs**

Books Recommended:

1. B.K. Agarwal and M.Eisner, Statistical Mechanics, 2nd Edition, New age International, New Delhi, 2012.
2. Satyaprakash, J.P.Agrwal, Statistical Physics, 7th Edition, Kedarnath Ramnath & Co., Meerut, 2008.
3. Sathya Prakash, Thermodynamics, Statistical Physics and Kinetics, 2010 Edition, Kedar Nath Ram Nath, Meerut.
4. S.L.Gupta,V. Kumar, Elementary Statistical Physics ,18th Edition, Pragathi Prakasan ,Meerut, 2012.

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. 2008
3. Federick Reif, Fundamentals of statistical and Thermal Physics, Special Indian Edition, McGraw-Hill Kogakusha Ltd., New Delhi,2011.

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 **(10 x 2 = 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 - II

Teaching Hours: 60 **Credits: 4**
Course Code: **14SP18/2C/EMT2** **LTP: 2 2 0**

Objectives:.

- To equip the students with the skill of correlating the theory and applications.

Course Outline:

UNIT 1: Potential Formulation of Electrodynamics

Conservation law - charge and energy – the continuity equation – Poynting's theorem – momentum – Maxwell's stress tensor – conservation of momentum – angular momentum – scalar and vector potential – Gauge transformations – Coulomb gauge – Lorentz gauge (problems) **12 Hrs**

UNIT II: Electromagnetic Potentials and Radiation

Continuous distributions – retarded potentials – point charges – Lienard Wiechert potential – the electric and magnetic fields of a moving point charge – velocity and acceleration fields – electric dipole radiation – magnetic dipole radiation – radiation from an arbitrary source – power radiated by a point charge – Larmor formula – Lenard generalization of Larmor formula – Bremsstrahlung – Radiation Reaction – Abraham Lorentz formula. **12 Hrs**

UNIT III: Electromagnetic Waves I

The wave equation – boundary conditions – reflection and transmission – polarization – electromagnetic waves in vacuum – monochromatic plane waves – energy and momentum in electromagnetic waves – electromagnetic waves in matter – propagation in linear media. **12 Hrs**

UNIT IV: Electromagnetic Waves II

Reflection and transmission at normal incidence – oblique incidence – Fresnel equations – Brewster's angle – absorption and dispersion – electromagnetic waves in conductors – reflection at a conducting sphere – electromagnetic waves in an isotropic dielectrics. **12 Hrs**

UNIT V: Wave Guides

Essential conditions for guided waves – TEM waves in coaxial cables – TE waves – rectangular wave guide – electric and magnetic fields on the surface and inside rectangular wave guide – TE and TM waves in rectangular wave guide- cut off frequency and wavelength – circular wave guides – energy flow and attenuation in wave guides – cavity resonators. **12 Hrs**

Books Recommended:

1. D.J.Griffiths, Introduction to Electrodynamics, 4th Edition, Prentice-Hall of India, New Delhi, 2017.
2. J.D.Jackson, Classical Electrodynamics, 3rd Edition, Wiley Eastern Ltd, New Delhi, 2002-2006.
3. Chopra Agarwal, Electromagnetic Theory, Fifth Revised Edition, K.Nath & Co, Meerut, 2009.
4. Sathyaprakash, Electromagnetic Theory and Electrodynamics,New Ed,Kedarnath and Ramnath and Co., Meerut, 2004.

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 **(10 x 2 = 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
- One choice of any two questions can be a problem
- 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: 14SP18/2C/PR2 **LTP: 0 3 3**

Objectives:

- To enhance the practical knowledge in the field of electronics & instrumentations.
- To train them in handling all the kinds of electronic 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 Colpitts and Hartley Oscillators using Transistor

SEMESTER II

MOLECULAR SPECTROSCOPY

Teaching Hours: 60 **Credits: 3**
Course Code: 14SP18/2E2/MSY **L T P: 2 2 0**

Objective:

- To expose the students to the scope of research in the field of spectroscopy
- To introduce students to various spectroscopic instrumentation technique for quantitative and qualitative analysis of a given compound

Course Outline:

UNIT I: Microwave and Electronic Spectroscopy

Classification of molecules- rotational spectra – diatomic molecules: rigid diatomic molecule – intensities of spectral lines – isotope effect in rotational spectra – non rigid rotator: spectrum of non-rigid rotator – polyatomic molecules: linear molecules – symmetric top molecules – asymmetric top molecules – outline – techniques and instrumentation of microwave spectroscopy.

Theory of electronic spectroscopy –Frank -Condon principle – rotational and vibrational structure of electronic spectra - applications. **12 Hrs**

UNIT II: Infrared Spectroscopy

IR spectroscopy –theory of infrared spectrum-origin of infrared spectrum-selection rules vibrating diatomic molecule – simple harmonic oscillator – anharmonic oscillator - vibrations of polyatomic molecules-fundamental vibrations and their symmetry – overtone and combination frequencies – influence of rotation on the spectra of polyatomic molecules – linear molecules – influence of nuclear spin – symmetric top molecules – techniques and instrumentation ; double and single beam operation – Fourier transform spectroscopy. **12 Hrs**

UNIT III: Raman Spectroscopy

Classical and quantum theory of Raman effect – molecular polarizability -– pure rotational Raman spectra: linear molecules – symmetric top molecules – spherical top molecules -vibrational Raman spectra – overtone and combination vibrations – rotational fine structure – polarization of light and the Raman effect – vibrations of spherical top molecules – structural determination from Raman and IR Spectroscopy: techniques and instrumentation – sources – sampling methods **12 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 **12 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. **12 Hrs**

Books Recommended:

1. C.N.Banwell and E.M. McCash, Fundamentals of Molecular Spectroscopy, 5th Edition, TMH New Delhi, 2013.
2. Gurdeep R.Chatwal and Sham K.Anand, Spectroscopy, 1st Edition, Himalaya Publishing House, 2010.
3. H.Kaur,Spectroscopy, 4th Edition, Pragati Prakasan,2008
4. G.Aruldhas, Molecular Structure and Spectroscopy, 2nd Edition Prentice-Hall of India, New Delhi, 2009.

Books for Reference:

1 Walker and Straughan, Spectroscopy, Vols, I and II, 4th Edition, Chapman and Hall, 1976
2. D.N.Sathyanarayana, Vibrational Spectroscopy and Applications, 2nd Edition, New Age International Publication, 2004.
3. 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 **(10 x 2 = 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: 14SP18/2E/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.

Course Outline:

Unit I: Bio potentials and Signal Acquisition

Cells and their structure – transport of ions through the cell membrane –resting and action potentials-bioelectric potentials in our body.

medical instruments- factors – components – fundamentals of electrodes and transducers – bioelectric amplifiers – desired properties – operational amplifiers – basic configurations (an overview). **12 Hrs**

Unit II: Potential Sources: Heart and Brain

Electrical signals from the heart- ECG - origin of cardiac action potential- placement of electrodes – lead configurations – electrical signals from the brain- EEG – origin – action potentials- evoked potentials- brain waves - 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: Imaging Systems

X- rays in medicine – CT scan- principle- mathematical basis – instrumentation-applications.

Ultrasound- principle - instrumentation- construction of an ultrasonic transducer-ultrasonic propagation through tissues- display – recording devices – applications-limitations. **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 – introduction to diathermy-surgical 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, 1st 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:

- Khandpur, A Handbook of Biomedical Instrumentation, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd., Elevier, 2003.
- Jacobson & Webster, Clinical Engineering, 1st edition, Prentice Hall, 1977 .
- Geddes & Baker, Applied Biomedical instrumentation, 3rd Edition, John wiley & Son – New York.
- 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: 14SP18/3C/QM2 **L T P: 3 2 0**

Objectives:

- To familiarise the students to the 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: Angular Momentum

Orbital angular momentum – eigen value spectrum for L^2, L_x, L_y and L_Z – spin angular momentum - non-relativistic hamiltonian including spin - generalized angular momentum - eigenvalue spectrum for J^2 and J_z - matrix representation - addition of angular momenta - Clebsch - Gordan coefficients (problems) –identical particles and their properties- symmetry and anti-symmetry of wave functions – spin and Pauli matrices. **15 Hrs**

Unit II: Scattering Theory

Scattering cross sections- amplitude - Born approximation and validity - partial wave analysis – phase shifts –optical theorem – low energy scattering -scattering length and effective range theory– transformation from centre of mass to laboratory frame. **15 Hrs**

Unit III: Perturbation Theory

Time dependent perturbation theory - constant and harmonic perturbations - transition probabilities – Fermi Golden rule - semi-classical treatment of an atom with electromagnetic radiation – Einstein's coefficients - selection rules for dipole radiation. **15 Hrs**

Unit IV: Relativistic Quantum Mechanics

Klein-Gordon equation – plane wave solutions – charge and current densities- Dirac equation – Dirac matrices -plane-wave solutions - interpretation of negative energy states - spin of electron - magnetic moment of an electron due to spin. **15 Hrs**

Unit V: Dirac Equation

Covariant notation - covariant form of Dirac equation -properties of the Gamma matrices - traces - invariance of Dirac equation under Lorentz transformations (forms of transformations not included) – probability density-current four vector – bilinear covariants -Feynman's theory of positron (elementary ideas only without propagation formalism). **15 Hrs**

Books Recommended:

1. P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics, 2nd Edition, Tata McGraw-Hill, New Delhi, 2010.
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. Devanathan, Quantum Mechanics, 1st Edition, Narosa Publishing House, New Delhi, 2005.
5. Sathyaprakash, Advanced Quantum Mechanics, 5th Edition, Kedarnath & Ramnath, Meerut, 2004.
6. S.L Gupta and I.D Gupta, Advanced Quantum Theory and Fields, 1st Edition, S Chand & Co, New Delhi, 1982.
7. David J Griffiths, Introduction to Quantum Mechanics. 2nd Edition, Pearson, 2011
8. Nouredine Zettili, Quantum mechanics concepts and applications, 2nd Edition, Wiley, 2017

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 **(10 x 2 = 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
- One choice of any two questions can be a problem
- 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

SOLID STATE PHYSICS

Teaching Hours: 75 **Credits: 4**
Course Code: 14SP18/3C/SSP **L T P: 3 2 0**

Objectives:

- To explore the importance of the crystalline order in solids
- To acquire knowledge on crystalline lattice and techniques to study them
- To get a view on various electronic theories and Density Functional Theory

Course Outline:

UNIT I: Crystal Physics

periodicity in crystalline solids – Wigner-Seitz primitive cell – Bravais lattices in 2D and 3D – symmetric operations – Miller indices of lattice planes (problems) – atomic packing fraction of SC, BCC and FCC – density and lattice constant (problems) – reciprocal lattice – brillouin zones – reciprocal lattice to SC, BCC and FCC lattices – crystal structures- NaCl, CsCl, hexagonal closed packed structure, diamond and ZnS – diffraction by crystals – Bragg's law (Problems). **15 Hrs**

UNIT II: Theory of Free Electrons

Classical free electron theory of metals: basic postulates – contribution of classical free electron theory – electrical conductivity and Ohm's law (problems) – thermal conductivity – Wiedemann-Franz law (problems) – drawbacks – quantum free electron theory: density of states – Fermi-Dirac distribution and filling of bands – outcome of the quantum free electron theory: heat capacity of the electron gas – electrical conductivity and Ohm's law – motion of electrons in combined electric and magnetic fields – hall effect (problems)– nearly free electron model – Brillouin zone – Bragg reflection of electrons in a crystal – Bragg's formula in terms of K(problems) – first Brillouin and convention of notation – origin of forbidden bands – standing wave at zone boundary – electron filling in metals, insulators and semiconductors. **15 Hrs**

UNIT III: Energy Band Theory

An overview of bands – Bloch theorem – one dimensional approach: the Kronig-Penny (K-P) model – reduced, periodic and extended zone schemes – number of electrons per band (problems) – the effective mass of an electron (problems) – distinction between metals, insulators and intrinsic semiconductors – concept of the hole – limitations of K-P Model – many-electron problem – one electron approximation – Hartree method – Hartree-Fock method – density functional theory (DFT) an overview – Kohn-Hohenberg theorems – Kohn-Sham equations – limitations of band structure methods. **14 Hrs**

UNIT IV: Fermi Surfaces and Semiconductors

Introduction to Fermi surfaces - Harrison's method of constructing Fermi surfaces – extended zone scheme – periodic zone scheme

bands in solids – elemental and compound semiconductors – conduction in semiconductors – formation of holes – band structure of semiconductors – direct and indirect band gap semiconductors – nature of band gaps from absorption curves – concentration of charge carriers – intrinsic semiconductors – extrinsic semiconductors – intrinsic and extrinsic natures and doping concentration – mobility and conductivity in semiconductors – influence of temperature on mobility – recombination of electron-hole pairs – electrical conductivity in semiconductors. **15 Hrs**

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 equation – coherence length – BCS theory of superconductivity – BCS ground state – flux quantization in a superconducting ring – single particle tunnelling - Josephson superconductor tunnelling - Ac and Dc Josephson effect. **16 Hrs**

Books Recommended:

1. Charles Kittel, Introduction to Solid State Physics, 8th edition, John Willey & sons, Inc., New York, 2012
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, 2009.
4. V.Raghavan, Materials Science and Engineering, 3rd Edition, Prentice Hall India, New Delhi 2001.
5. S.O. Pillai, Solid State Physics, 7th Edition, New Age International, New Delhi, 2015.

Books for Reference:

1. A.J.Dekker, Solid State physics, 1st Edition, Macmillan India Ltd., New Delhi, 2000.
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, 1st Edition, Pearson education, Addison – Wesley 2001.

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 **(10 x 2 = 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
- One choice of any two questions can be a problem
- 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 AND MICROCONTROLLER 8051

Teaching Hours: 60 **Credits: 4**
Course Code: 14SP18/3C/MPC **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

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 Timer 8253/54 – 8251Serial Communication Interface – 8279 Programmable Keyboard/Display Interface. **12 Hrs**

Unit III: Microcontroller 8051

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 Largest Number – Interfacing DAC and 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 and 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.
4. V.Vijayendran, Fundamentals of Microprocessor 8085 , Architecture, Programming and Interfacing, 2nd Edition, Viswanathan Pvt. Ltd., Chennai, 2004.

Books for Reference:

1. I. Scott MacKenzie, The 8051 microcontroller, 4th Edition, illustrated, Pearson Prentice Hall, 2007, Digitized 19 Aug 2009.
2. Muhammad Ali Mazidi, Rolin D. McKinlay, Janice G. Mazidi, The 8051 Microcontroller: A Systems Approach, Pearson Education, 2012.
3. Aditya P.Mathur, Introduction to Microprocessor, 3rd Edition, Tata McGrawHill Pub.Co., Ltd., New Delhi.
4. B.Ram, Fundamentals of Microprocessors and Microcomputers, 4th revised and Enlarged edition, Dhanpat Rai Publications, New Delhi, 2005.
5. A.Nagoor Kani, Microprocessor and its applications, 1st Edition, RBA Pub., Chennai.

Online Sources:

1. www.onesmartclick.com/engineering/microprocessor.html
2. https://en.wikipedia.org/wiki/Intel_8085
3. http://shodhganga.inflibnet.ac.in/bitstream/10603/70026/9/09_chapter%203.pdf
4. https://www.slideshare.net/yayavaram/basics-of-peripheral-devices-and-working
5. https://en.wikibooks.org/wiki/Embedded_Systems/8051_Microcontroller
6. https://www.electronicshub.org/8051-microcontroller-introduction/

Question Paper Template

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

Part – A **(10 x 2 = 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: **14SP18/3C/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: 60 **Credits: 3**
Course Code: 14SP18/3E3/CMC **L T P: 2 2 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 and programs.

Course Outline:

Unit I: Solutions for Transcendental and Simultaneous Equations

Roots of transcendental equations–Bisection method, Newton-Raphson method, Iteration method, Regula–Falsi method

Solution of simultaneous linear equations – Gauss Elimination – Gauss Seidal – matrix inversion – eigen values and eigen vectors - Power and Jacobi methods.

12 Hrs

Unit II: 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.

12 Hrs

Unit III: Differentiation, Integration and Solution of Differential Equations

Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's rules – Error estimates – Numerical solutions of ordinary differential equations – Euler's method - Runge Kutta second and fourth order. **12 Hrs**

Unit IV: Fundamental Concepts of C Programming

basic structure of C program – character set – C tokens – keywords and identifiers - constants – variables - data types – declarations – assigning values to variables - operators – types of operators – arithmetic expressions and their evaluation – precedence of arithmetic operators – type conversions – formatted inputs and outputs

12 Hrs

Unit V: Loops, Arrays and Functions

Decision making and branching: types of IF statements – Switch statement – GOTO statement – Decision making and looping : WHILE, DO and FOR statements – jump in loops.

Arrays – one, two and multi dimensional arrays – character arrays – declaring and initializing – string handling functions.

user defined functions – definition – return values and their types – function calls and declaration – nesting of functions – recursion. **12 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 **(10 x 2 = 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: 14SP18/3E/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 – Inverse Square Law– 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. **12 Hrs**

UNIT II: The Camera and its types

Light Sensitive Films and Sensors – Digital Camera – Types of Cameras – Beginner's Cameras – Advanced Compacts - Single Lens Reflex (SLR) Cameras – Manual SLR's - Automatic SLR's - Accessories. **12 Hrs**

UNIT III: Creative use of camera controls

Aperture - Effective and Relative aperture - F numbers – Circles of Confusion - Depth of field– Depth of focus– practical significance – Shutters –selection of shutter speeds and subject movements – Filters –Performance - types of filters – Correction –Contrast-Special. **12 Hrs**

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 . **12 Hr**

UNIT V: Digital Image - Post Production Editing

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. **12 Hrs**

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 3 – COMPUTING SKILLS

Teaching Hours: 30 **Credits: 2**

Course Code: PG18/3S/CPS

Course Outline:

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: 14SP18/4C/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 – Problems – 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 – Problems - Nuclear Reaction cross-section and partial wave analysis – Problems – 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 – Problems **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 – Massless Bosons – Leptons – Mesons – CP violation in neutral K-meson decay – Baryons – Hyperons – Eight fold way – SU(2) and SU(3) multiplets – Gell-Mann-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.
4. M.L. Pandya, R.P.S. Yadav, Elements of Nuclear Physics, 7th Edition, Reprint 2010, Kedarnath Ramnath, Meerut, Delhi.1995.

Books for Reference:

1. R.R.Roy and B.P.Nigam, Nuclear Physics, Ist US Edition, New Age International, 1967.
2. S. N. Ghoshal, Nuclear Physics, 1st Edition (Reprint 2013), S.Chand & Co. Ltd., New Delhi. 1994
3. I. Kaplan, Nuclear Physics, 2nd Edition, Narosa, New Delhi, 1989.
4. D. Griffiths, Introduction to Elementary Particles, 2nd Edition, Harper and Row, NY 1987.

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 **(10 x 2 = 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
- One choice of any two questions can be a problem
- 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: 14SP18/4C/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: 14SP18/4C/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 Chebyshev 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

NANO SCIENCE AND NANO TECHNOLOGY

Teaching Hours: 75 **Credits: 3**
Course Code: 14SP18/4E4/NST **L T P: 3 2 0**

Objectives:

- To familiarize the students with basics of nano structured material and equip them towards research in this field.

Course Outline:

Unit I: Introduction to Nanoscience

Basics of Nanoscience – Idea of Band Structure – Density of States: Zero dimensional - One Dimensional - Two Dimensional & Three dimensional – Quantum Confinement – quantum well – wire - dot. **15 Hrs**

Unit II: Properties of Nanomaterials

Mechanical-Thermal- Electrical – Optical – Structural Properties - Factors affecting Particle size – Size dependent properties – Determination Particle Size – Increase in width of XRD peaks of nanoparticles. **15 Hrs**

Unit III: Methods of Synthesis

Physical Method – Solid state reaction – High energy Ball milling – Sputtering – MBE – Laser ablation – Chemical Method – Sol-gel method – Hydrothermal method – CVD – Biological Method- Green Synthesis. **15 Hrs**

Unit IV: General Characterization Techniques

X- Ray Diffraction studies – Bragg's law – Particle size – Scherrer's equation - UV – Vis- NIR – Spectroscopy – Determination of Band gap - Photoluminescence (PL) studies –SEM, AFM, VSM – Principle- Instrumentation- Application **15 Hrs**

Unit V: Application of Nanomaterials.

Introduction to Nanoelectronics – Quantum electronic devices – Nanostructure as single electron transistor - Energy – Solar cells – OLED, OFET- Medical Applications – Imaging of Cancer cells – Biological tags – targeted nano drug delivery system – Carbon Nanotubes – Field emission – Fuel cells and Display devices **15 Hrs**

Books Recommended:

1. Introduction to Nanoscience and Nanotechnology, K.K. Chattopadhyay, A.N. Banerjees, Fifth edition, PHI Learning Private edition, 2012.
2. Nano Materials, B. Viswanathan, second edition, Narosa Publishing house, 2011.
3. Structure and Properties of solid state materials, B. Viswanathan, 2nd edition , Alpha science international, 2006.
4. Nano – the essentials, T. Pradeep, Tata McGraw – Hill publishing company, 2007.
5. Nanotechnolgy : Principles and Practicals, S. K. Kulkarni, Capital Publishing co.

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 **(10 x 2 = 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

X- RAY CRYSTALLOGRAPHY

Teaching Hours: 75 **Credits: 3**
Course Code: 14SP18/4E5/XRC **LTP: 3 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

Crystal- crystal systems -Crystal Axes -Unit Cell – Space Lattices – Bravais Lattice – Symmetry Operations- Point Groups- Space Groups- Screw Axis- Glide Plane – Equivalent Positions **15 Hrs**

UNIT II: Diffraction of X-rays

Reciprocal lattice – role and construction - diffraction and Fourier transforms - production of X-rays –Laue equations – Bragg's law – Ewald's sphere – diffraction methods- Laue diffraction – powder diffraction – atomic scattering factor – structure factor –Friedel's law – systematic absences. **15 Hrs**

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. **15 Hrs**

UNIT IV: Data collection techniques

Four Circle Diffractometer - CCD Detector –Image Plates – data reduction: extinction, Lorentz –polarization and absorption corrections- determination of thermal & scale factors – Wilson's plot. **15 Hrs**

Unit V: Crystal Structure Refinement & Analysis

Structure Refinement – Successive Fourier Synthesis – Least squares refinement - residual factor - locating hydrogen atoms- structural analysis- bond lengths – bond angles – torsion angles – conformational analysis – conformation of rings – Vander Waal's Interactions – hydrogen bonds –crystal packing. **15 Hrs**

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.
6. A. R. Verma; O. N. Srivastava, Crystallography Applied to Solid State Physics. New Age International (1991).

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 **(10 x 2 = 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 4 – 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.