Semester VII
B. Sc. B. Ed. (CBCS) Semester- VII
GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)
Semester VII
PHY 401: PHYSICS: QUANTUM MECHANICS AND STATISTICAL PHYSICS

Time: 3 Hours   Max. Marks: 100
Credits-   4   Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

 ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

 iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives: The student teacher will be able to:
- Describe the limitation of classical mechanics and requirement of Quantum mechanics.
- Understand the fundamental aspects of Quantum mechanics followed by its application.
- Apply the Statistical principles to various physical phenomena.
- Solve the problems related to Quantum mechanics and Statistical mechanics.
- Establish the link between theory and experiments.

Course Contents

Unit I:
 Origin of the quantum theory- Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Ritz combination principle in spectra, stability of an atom, Planck's radiation law, Einstein's explanation of photoelectric effect, Bohr's quantization of angular momentum and its application to hydrogen atom, limitations of Bohr's theory.

Unit II:
 Wave-particle duality and uncertainty principle, de Broglie's hypothesis for matter waves, the concept of wave and group velocities, evidence for diffraction and interference of 'particles', experimental demonstration of matter waves, Consequence of de Broglie's concepts, quantisation in hydrogen atom, energies of a particle in a box, wave packets, Heisenberg's uncertainty relation for p and x, its extension to energy and time.

Consequence of the uncertainty relation: gamma ray microscope, diffraction at a slit, particle in a box, position of electron in a Bohr orbit.

Quantum Mechanics: Schrodinger's equation, Postulates of quantum mechanics, operators, expectation values, transition probabilities.

Unit III:

Applications of quantum mechanics to particle in one dimensional and three dimensional box, harmonic oscillator, reflection at a step potential, transmission across a potential barrier.

Hydrogen atom: natural occurrence of n, l and m quantum numbers, the related physical quantities, comparison with Bohr's theory, Wave functions, Probabilistic interpretation.

Unit IV:

Statistical Physics

The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a-priori probabilities, probability distribution and its narrowing with increase in number of particles, The expressions for average properties, Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states.

Some universal laws: The mu space representation, division of mu space into energy sheets and into phase cells of arbitrary size, application to one-dimensional harmonic oscillator and free particles, Equilibrium between two systems in thermal contact, bridge with macroscopic physics, Probability and entropy, Boltzmann entropy relation, Statistical interpretation of second law of thermodynamics, Boltzmann canonical distribution law and its applications, rigorous form of equipartition of energy, Partition function and its applications, Saha's ionization formula. Maxwell distribution of speeds in an ideal gas, Distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values, Doppler broadening of spectral lines. Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator, Indistinguishability of particles and its consequences, Bose-Einstein and Fermi-Dirac conditions, applications to liquid helium, free electrons in a metal and photons in blackbody chamber, Fermi level and Fermi energy.

Suggested Readings:

1. D.J. Griffith, Introduction to Quantum Mechanics (Pearson Education, 2015)
2. A.K. Ghatak and S. Loknathan, Quantum Mechanics- Theory and Application (Macmillan India Ltd. Delhi)
3. H.C. Verma, Quantum Physics (TBS, 2012)
4. H.S. Mani and G.K. Mehta, Introduction to Modern Physics, (Affiliated East West Press Pvt. Ltd. New Delhi, 1998)
5. B. Laud, Introduction of Statistical Mechanics (Macmillan 1981).
6. F. Reif, Statistical Physics (Mcgraw-Hill, 1988).

7. K. Huang, Statistical Physics (Wiley Eastern, 1988).

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	Marks
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

All the following experiments are to be done. Few more experiments may be set at the institutional level.

1. To find out the reverse recovery time of given diodes.
2. To study RC transmission line at 50 Hz and to draw curve showing the variation of magnitude and phase of the voltage along the RC ladder network.
3. To study the Gaussian distribution law.
4. To study the Poisson's distribution law.
5. To determine the value of Planck's constant by photo cell. (Photo electric effect).
6. To determine the value of Planck's constant by solar cell.

GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)
Semester VII
CHM 401: CHEMISTRY: ADVANCE CHEMISTRY-I

Time: 3 Hours   Max. Marks: 100
Credits- 4   Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives: Students Teachers will be able to
- Understand the Spectroscopic methods that are used to study the molecules.
- Predict the appearance of a molecule's vibrational spectra as a function of symmetry and uses in detailed organic structure analysis
- Evaluate the utility of UV/VIS spectroscopy as a qualitative and quantitative method.
- Determine the vibrations for a triatomic molecule and identify whether they are infrared-active.
- Determine whether the molecular vibrations of a tri-atomic molecule are Raman active.
- Explain the difference between Stokes and anti-Stokes lines in a Raman spectrum.

Course Contents

Unit I: Spectroscopy-I (Theoretical Principle)
Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.
- **Rotational Spectrum:** Diatomic molecules, Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.
- **Vibrational Spectrum:** Infrared spectrum: energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect

of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

- **Raman Spectrum**: Concept of polarisability, pure rotational and pure vibrationl Raman spectra of diatomic molecules, selection rules,σ,π- and n M.O., their energy levels and the respective transitions.

Unit II: Separation Techniques

Solvent Extraction: distribution Coefficient, distribution ratio, solvent extraction of metals, multiple batch extraction, counters current distribution – Chromatographic Techniques: classification, theory of chromatographic separation, distribution coefficient, retention, sorption, efficiency and resolution - Column, ion exchange, paper, TLC & HPTLC: techniques and application.

Unit III: Electronic Spectrum

Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Frank-Condon principles.Qualitative description of σ, π- and n M.O., their energy levels and the respective transitions.

Unit IV: Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples).

Suggested Readings:

1. Mahendra R. Awode, Quantum Chemistry S. Chand Publishing.
2. A. K. Chandra, Introductory Quantum Chemistry, Tata McGraw-Hill Education
3. Peter Atkins Julio de Paula, Atkins' Physical Chemistry Oxford University Press.
4. Robert J. Silbey, Robert A. Alberty , Moungi G. Bawendi, Physical Chemistry 4th Edition, Wiley
5. Colin N. Banwell, Fundamentals of Molecular & Spectroscopy, Tata McGraw-Hill Education
6. Walter S. Struve, Fundamentals of Molecular Spectroscopy, Wiley

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

Inorganic Chemistry: Estimations

a. Quantitative estimation of one metal volumetrically from a given mixture.
b. To estimate magnesium volumetrically from a mixture containing Ba^{2+} and Mg^{2+} Ions/ Zn^{2+} and Mg^{2+} ions.
c. To estimate copper iodometrically from a given mixture containing Pb^{2+} and Cu^{2+} ions.
d. Estimation of Glucose with the help of Fehling's solution.
e. Determination of Total hardness of water.

Colorimetry

- To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

Conductometry

- To determine normality and gms/lit of xNHCl and also determine specific conductance by conductometry.
- To determine normality and gms/lit of the mixture of $HCl+CH_3COOH$ by Conductometry.
- To determine the normality of weak acid by Conductometry.

GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)
Semester VII
ZOO 401: ZOOLOGY: EVOLUTION AND PALAEONTOLOGY

Time: 3 Hours   Max. Marks: 100
Credits- 4   Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives:
To enable students to understand and comprehend origin of life and theories of evolution; to understand the evolution from the evidences.

Course Contents

Unit I: Origin of Life &its Theories
- Origin of life (Abiogenesis and biogenesis)
    a. Evidence in favour of evolution: from morphology, comparative anatomy, embryology and Paleontology.
- Molecular basis of evolution
- Theories of evolution:
    1. Lamarckism, inheritance of acquired characters and Neo-Lamarckism.
    2. Darwinism, theory of natural selection and Neo Darwinism.
    3. Mutation theory of Hugo de Vries.
    4. Weismann theory of germplasm
    5. Recapitulation theory

Unit II: Evolution
- Variation: Kinds, sources of variation, origin of new mutations.
- Isolation: Definition, mechanism and role of isolation in evolution.
- Adaptation: Introduction, kinds (structural, physiological and protective) of animal associations, divergent evolution, convergent evolution, evolutionary significances of adaption.

Unit III: Evolution Changes

- Origin of species: Concept of species/subspecies/sibling. Specie, Factors causing genetic divergence in the population of species, genetic drifts, Bottle Neck effect founder's effect.
- Mimicry and protective coloration: Definition, kinds, condition necessary for mimicry, significance.
- Zoogeographical distribution of animals, geological time scale, origin and evolution of amphibian, reptiles, birds and mammals.

Unit IV:
- Introduction, formation, kinds, determination of age of fossil and its significance.
- Dinosaurs, fossil evidence & reasons for extinction of dinosaurs.
- Evolution of man: Time of origin, compelling causes, ancestor of man, evolution from apes and evolutionary trends.

Suggested Readings:
1. Evolutionary Biology by B.S. Tomar& S.P. Singh – (Rastogi Publications, 2008)
2. The origin of life by K. John – (Reinhold Publishing Corpn)
3. The evolution of Man by G.W. Lasker – (Holt,Rinehart&Winston)
4. Organic Evolution by R.S. Lull – (MacMillan)
5. Organic evolution – V.B. Rastogi
6. Animal Taxonomy and Evolution, VS Pawar Hindi Edition, College book centre, Chaura Rasta, Jaipur
7. Mammalian Endrocrinology and Animal Behavior, VS Pawar, Hindi Edition, College book centre, Chaura Rasta Jaipur

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

Course Content:
1. Study of vestigial organs, models of dinosaurs, living fossils.
2. Study of teeth and skulls of horse, elephant and man.
3. Study of five animals for mimicry.
4. Study of various types of beaks of local birds.
5. Study of various types of feet of local birds.
6. Evolution of Man (Chart / Model).
7. Evolution of Horse (Chart / Model).
8. Zoogeographical distribution of animals in India and World.

GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)
Semester VII
BOT 401: BOTANY: PLANT ANATOMY AND ECOLOGY

Time: 3 Hours   Max. Marks: 100
Credits-   4   Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.

iv) All questions will carry equal marks.

Objectives: After completion of this course the student teachers will be able to:
  • Understand the development, organization and functions of tissues inplants;
  • Understand the histological complexity inplants;
  • Understand the dynamics of environment and its delicatebalance;
  • Understand the influence of human beings on quality ofenvironment.

Course Content:
Unit I: Tissue & Tissue System : Root & Shoot Organisation
  • Types of Tissue and Tissue System, basic body plan of a flowering plant.
  • The root system: The root apical meristem and its organisation; differentiation of primary and secondary tissues and their roles; structural modifications for storage, respiration, reproduction and for interaction with microbes.
  • The shoot system: The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial and sympodial growth; canopy architecture.

Unit II: Organization of Xylem & Phloem tissues
  • Cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem: structure, function relationships; periderm
  • Leaf: Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; stomatal types and trichomes; senescence and abscission.

Unit III: Ecology & Environment
- Ecological Factors: Brief account of edaphic, climatic, physiographic and biotic factors and their ecologicalimportance.
- Ecosystem : Structure, abiotic and biotic components, bio-energetic approach, food chain, food web, ecological pyramids, bio-geo-chemical cycles of carbon, nitrogen and phosphorus.
- Community ecology:Community characteristics, frequency, density, cover, life forms.
- Plant succession: General features, events in succession, brief account of xerarch succession.

Unit IV: Environmental Adaptations
- Morphological, anatomical and physiological adaptations of plants to environment – hydrophytes, xerophytes,halophytes.
- Biodiversity: General account, types and characteristics, biodiversity conservation efforts, WCU, Red databook, brief account of Intellectual Property Rights (IPR) and patentlaws.
- Environmental pollution – a brief account of causes, effects and remedies of air, water, soil, radioactive and noisepollution.

Suggested Readings:
1. Esau, K., 1977, Anatomy of Seed Plants, 2nd Ed., John Wiley & Sons, NewYork.
2. Fahn, A. 1974, Plant Anatomy 2nd Ed., Pergamon Press, Oxford.
3. Mouseth J.D.,1988, Plant Anatomy. The Benjamin/cummings Publishing Co. Inc., California,USA.
4. Singh V., P.C.Pande& D K Jain 2006, Angiosperms, RastogiPublications,Meerut.
5. Vashishta, P.C. A Text book of Plant Anatomy, PredeepPublications,Jullandar.
6. Gangulee S.C. &Kar.1980, College Botany Vol.I, Central Book Agency,Calcutta.
7. Sharma, P.D., 2006, Environmental biology, RastogiPublications,Meerut.
8. Mitra, J.N., An Introduction to Systematic Botany and Ecology, World Press,Calcutta.
9. Odum, E.P. 1983, Basic Ecology, Saunders,Philadelphia.
10. Kormondy, E.J. 1996, Concepts of Ecology, Viva Books Pvt. Ltd., NewDelhi.
11. Misra, R. 1968, Ecology Work Book, Oxford &IBH, NewDelhi.
12. Moore P.W. and S.B.Chapman, 1986, Methods in Plant Ecology, Blackwell Scientific Publications.
13. Krebs, C.J.1989, Ecological Methodology, Harper and Row, NewYork.

Practicals

Distribution of Marks for End Semester Practical Examination	
Activity	**Marks**
Experiments	10
Viva Voce	5
Record	5
Total Marks	**20**

All the following experiments are to be done. Few more experiments may be set at the institutional level.

- Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides).
- Anomalous secondary growth in *Boerhaavia, Nyctanthes* and *Dracaena*
- Anatomy of leaf and peel mount for stomatal types/trichomes.
- Anatomy of the root-primary and secondary structure
- To determine the minimum size of quadrate by species area curve method.
- To determine the minimum number of quadrate to be laid down in field under study.
- To study the vegetation structure through profile diagram.
- To determine moisture content and water holding capacity of different types of soil.
- To determine the dust holding capacity of different types to leaves.

GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)
Semester VII
MTH 401: MATHEMATICS: NUMBER THEORY AND THEORY OF EQUATIONS

Time: 3 Hours   Max. Marks: 100
Credits-   4   Theory: 80, Internal: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.

ii) Q.No. 1 will be compulsory and will carry 16 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.

iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.

iv) All questions will carry equal marks.

Objectives:
At the end of the semester learners will be able to understand basic principles, formulae and procedures of number theory and theory of equations and apply them in problem solving situations.

Unit I:
Division Algorithm, Prime and Composite numbers, proving the existence and uniqueness of GCD and the Euclidean Algorithm, Fundamental theorem of Arithmetic, the least common multiple, congruences, linear congruences,

Unit II:
Sigma function, Tau function, Phi function, Wilson's theorem, simultaneous congruences, theorem of Euler- Fermat and Lagrange.

Unit III:
Continued fractions, Relation between roots and coefficients**,** symmetric functions, Transformations, Reciprocal equations, Descarte's rule of signs, Multiple roots

Unit IV:
Solving cubic equation by Cardon's method, Solving quartic Equations by Descarte's method and Ferrari's method.

Suggested Readings:
1. Elementary Number Theory by David M. Burton.
2. Theory of Equations by Uspensky, Mc. Graw Hill Book Co. Ltd.
3. Elementary Number Theorywith Applications by Thomas Koshy.

GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)
IV: Engagement with the field (EF)
Semester VII

EFSI 401: SCHOOL INTERNSHIP

Credits: 14P   **Marks: 300**

Contact hours : 14 weeks

Distribution of Marks for the School Internship		
Activity	**Max. Marks**	**Min. Marks**
Classroom Teaching (two Pedagogy courses)	200	100
Critisism Lessons (four lessons in total)	40	20
Reflective Journal (two Pedagogy courses)	10	5
Observation Records • Ten lessons of school teacher • Ten lessons of peer	5+5 =10	5
Achivement test-development, Administration and Analysis	10	5
Case Study / Action Research	10	5
Detailed Record of any two activities organized by the student teacher	10	5
Learning Resource in two teaching subjects	10	5
Total	**300**	**150**

Objectives of the course: On the completion of the course the student teachers will be able to:

- Observe the classes of regular teachers and peers and learn about teaching learning process and classroom management.
- Develop skill in planning and teaching in actual classroom environment.
- Reflect, learn to adapt and modify their teaching for attaining learning outcomes of students.
- Maintain a Reflective Journal.
- Acquire skill in conducting Action Research/ Case Study.
- Inculcate organizational and managerial skills in various school activities.
- Create and maintain resources for teaching and learning in internship schools.
- Work with the community in the interest of the learner and their learning outcomes.

Internship Tasks:

The student teachers will perform the following in the school attached to her/him.

(a) Delivery of lessons

- The student teachers will deliver a minimum of 40 lessons including two criticism lessons (one at the end of 9th week and the other during the last week of the teaching assignment) in each Pedagogy course. In total they will teach 80

lessons in two Pedagogy courses (Preferably 20 lessons for Upper Primary classes and 20 for Secondary classes in each Pedagogy course).

- The student teachers will visualize details of teaching learning sequences, keeping all considerations in view. They will also involve themselves in discussion, reflection, reconsideration and consolidation after each lesson as well as at the end of the unit.

(b) Practicum

- Preparation, administration and analysis of achievement tests in two Pedagogy courses.
- Conducting Action Research / Case Study.
- Observing ten lessons of a regular teacher and ten lessons of peers in each Pedagogy course and preparing an Observation Record.
- Preparing and using teaching aids in each Pedagogy course.
- Writing a Reflective Journal.
- Organising any two co curricular activities and reporting.
- Preparing a suggestive comprehensive plan of action for improvement of some aspects of the school, where they have been teaching during Internship.
- Reporting on activities conducted with the community.

Any other activity given under Suggested School Activities can be studied after consultation with the Faculty, in charge of learning to function as a teacher (School Internship).

Suggested School Activities:

- Organising cultural, literary, sports and games activities
- Framing of time table
- Organising Morning Assembly
- Maintenance of school discipline
- Maintenance of school records, library and laboratories
- Providing Guidance and Counseling services
- Studying the role of community in school improvement
- School Mapping
- Water Resource Management in schools
- Mass awareness of social evils and taboos
- Organising educational fair, exhibition, club activities, nature study and field trip. (Any other activity/ activities decided by the Institute)

Post Internship Tasks:

- Post Internship is organized for a day mainly for reflection and review of internship programme as a whole, to facilitate the understanding of the effectiveness of various activities undertaken during the internship. The tasks include the following.
- Seeking reactions from students, teachers, Heads and teachers of cooperating schools and supervisors of the Institute.

- Exhibition of the Teaching Learning Material used by the student teachers during the internship.
- Any other activity decided by the Institute.
- Inviting suggestions for improving the programme.

Modes of Learning Engagement:

- Internship tasks will be carried out as a part of the 'in-school' practice. A mentor/cooperating teacher and supervisor of the Institute will guide the student teacher periodically.
- Student teachers will observe at least 10 lessons of regular classroom teacher and 10 lessons of their peers.
- Adequate classroom contact hours - a minimum of 40 lessons including two criticism lessons in each Pedagogy course preferably 20 lessons for Upper Primary classes (VI-VIII and 20 lessons for Secondary classes (IX and X) for subject based teaching – learning will be under taken in consultation with the school authorities.
- A Reflective Journal will be maintained by the student teacher in which she/he records her/his experiences, observations and reflections on classroom experiences.
- A portfolio will be maintained by the student teachers which includes lesson plans, resources used, assessment tools, student observations and other records.
- Student teachers will always work in liaison with the regular teachers in the schools involving themselves in all the school activities and conducting at least two activities.
- The Institute in consultation with the schools will prepare the details of the internship programme for each of the schools.