Semester	Course Code	Title of the Paper	Credits	Teaching hours/week	Semester End Exam.		Internal Assessment		Total Max. marks
					Duration	Max. marks	Duration	Max. marks	
IV	HCT 4.1	Statistical Mechanics	4	4	3 hrs	80	1 hr	20	100
	HCT 4.2	Quantum Mechanics-II	4	4	3 hrs	80	1 hr	20	100
	SCT 4.1	Solid State Physics II/ Materials Physics II/ Semiconductor Physics and devices	4	4	3 hrs	80	1 hr	20	100
	SCT 4.2	Nuclear Physics II/ Energy Physics II/ Biophysics II	4	4	3 hrs	80	1 hr	20	100
	HCP 4.1/4.2	Practical 4.1	4	2	4 hrs	80	4 hrs	20	100
	SCP 4.1/4.2	Practical 4.2	2	2	4 hrs	40	4 hrs	10	50
	HCMP 4.3	Project	6	6	--	120*	2 hrs	30	150
Total			**24**			**480**		**120**	**600**

*(72 marks for project report + 48 marks for Viva-Voce)

In the beginning of the Semester-IV, the Department will notify the actual soft core courses that it wants to offer depending on the availability of staff and facility. Accordingly, the students will be allotted soft core course.

M Sc SEM-IV
Paper HCT4.1: STATISTICAL MECHANICS

Preamble: This paper pertains to the study of thermodynamics and statistical concepts, distinguishing features of classical and quantum statistics, irreversible phenomena and fluctuation theory.

Unit I [16 hours]

Basic Thermodynamical and Statistical Concepts: The laws of thermodynamics and their implications, thermodynamic potentials, Maxwell's relations and their applications, phase space, ensembles, Ergodic hypothesis and Liouville's theorem. Probability, probability distribution and the most probable distribution, partition functions, microcanonical, canonical and grand canonical ensembles, thermodynamic potentials and the partition functions.

Unit II [16 hours]

Classical Statistics: Partition function of a system of particles, the translational partition function, Gibbs paradox and Boltzmann equipartition theorem, rotational and vibrational partition functions, Einstein relation and electronic partition function. The various partition functions and the corresponding thermodynamic potentials. Maxwell-Boltzmann distribution and its physical applications.

Unit III [16 hours]

Quantum statistics: the symmetry and anti symmetry of the wave functions, Bosons and Fermions, Bose- Einstein and Fermi-Dirac distributions, ideal Bose and Fermi gases- their properties at high and temperatures and densities. Bose –Einstein condensation, blackbody radiation and photons, phonons and specific heat of solids.

Unit IV [16 hours]

Fluctuations: Fluctuations in canonical, grand canonical and microcanonical ensembles, Brownian motion and Langevin equation, random walk, diffusion and the Einstein relation for mobility. Fockker-Plank equation. Johnson noise and shot noise.

Irreversible Thermodynamics: Onsager reciprocity relations, thermoelectric phenomena, non-equilibrium phenomena in liquid helium-fountain effect. Gibbs entropy for non-equilibrium states, the entropy and information.

References

1. Statistical Mechanics: K Huang. (Wiley Eastern.)
2. Statistical Mechanics and Properties of Matter: E S R Gopal. (Macmillan.)
3. Elementary Statistical Physics: C Kittel. (John Wiley.)
4. Fundamentals of Statistical and Thermal Physics: F Reif (Mc Graw Hall.)
5. An Introduction to Statistical Physics: W G V Roser. (John Wiley.)
6. Thermodynamics of Irreversible Processes: S R de Groot.
7. Statistical Physics: L D Landau and E M Lifshitz (Pergamon)

M Sc SEM-IV

Paper HCT4.2: QUANTUM MECHANICS -II

Preamble: This course is an advanced course. The student, after getting the exposure of introductory quantum mechanics in the earlier semester will be taught the advanced topics in quantum mechanics.

Unit I [16 hours]

Time-dependent phenomena: perturbation theory for time evolution, first and second order transition amplitudes and their physical significance, application of first order theory: constant perturbation, wide and closely spaced levels-Fermi's golden rule, scattering by a potential, harmonic perturbation: interactions of an atom with electromagnetic radiation, dipole transitions and selection rules; spontaneous and induced emission, Einstein A and B coefficients, Sudden approximation.

Unit II [16 hours]

Identical particles and spin: Indistinguishability of identical particles, symmetry of wave function and spin, Bosons and Fermions. Pauli exclusion principle, singlet and triplet states of He atom and exchange integral, spin angular momentum, Pauli matrices.

Angular momentum: Angular momentum operators, commutation relations, eigen values and eigenvectors, matrix representation, orbital angular momentum. Addition of angular momenta, Clebsch-Gordon coefficients for simple cases.

Unit III [16 hours]

Symmetry Principles: symmetry and conservation laws, symmetry and degeneracy. space-time symmetries, displacement in space- conservation of linear momentum, displacement in time – conservation of energy, rotation in space–conservation of angular momentum, space inversion–parity, time reversal invariance.

Relativistic Wave equations: Schrodinger's relativistic equation: free particle, electromagnetic potentials, separation of equations, energy level in a Coulomb field, Dirac's relativistic equation: free particle equation, Dirac matrices, free particle solutions, charge and current densities, electromagnetic potentials. Dirac's equation for central field: spin angular momentum, approximate reduction, spin orbit energy. separation of the equation, the Hydrogen atom, classification of energy levels and negative energy states.

Unit IV [16 hours]

Quantization of wave fields: classical and quantum field equations; co –ordinates of the field, classical Lagrangian equation, functional derivative; Hamilton's equations, quantum equations for the field; quantization of non-relativistic Schrodinger wave equation: classical Lagrangian and Hamiltonian equations, second quantization.

References

1. Quantum Mechanics: L I Schiff (McGraw-Hill, 1968)
2. Quantum Mechanics: F. Schwab1 (Narosa, 1992).
3. A Text book of Quantum Mechanics: P M Mathews & K Venkateshan (TMH, 1994)
4. Quantum Mechanics: V. K. Thankappan (Wiley Eastern, 1980)
5. Quantum Mechanics: B K Agarwal and Hariprakash (Prentice-Hall, 1997)
6. Quantum Mechanics: Theory and Applications: A K Ghatak &S Loknathan [MacMillan India Ltd., 1984]
7. Quantum Mechanics : G Arulkhas, PHI Learning Private Lte.,(2nd Edn.), 2013.

M Sc SEM-IV
Paper SCT4.1: SOLID STATE PHYSICS -II

Preamble: This is an advanced course in solid state physics. Charge and heat transport phenomena in metals, semiconductors is crucial to understand the nature of materials and their response to electrical, magnetic etc. stimulus. Ferroelectric materials are materials of choice for high energy storage. Arriving at the room temperature superconductivity is a challenge.

Unit I [16 hours]

Transport properties

Metals: Boltzmann equation, electrical conductivity, calculation of relaxation time, impurity scattering, ideal resistance, general transport coefficients, thermal conductivity, thermoelectric effects, lattice conduction, phonon drag.

Semiconductors: Thermal conductivity, thermoelectric and magnetic effects, hot electron and energy relaxation times. High frequency conductivity. Acoustic and optical (polar and non polar) scattering by electrons.

Unit II [16 hours]

Dielectric and ferroelectric properties

Dielectric: Macroscopic description of static dielectric constant, electronic, ionic and orientational polarization, Lorentz field and its derivation, dielectric constant of solids, complex dielectric constant and dielectric losses. Debye's equations, theory of electronic polarization and optical absorption.

Ferroelectricity: General properties and classification of ferroelectrics, dipole theory and its drawbacks, thermodynamics of ferroelectric transitions (qualitative), ferroelectric domains.

Unit III [16 hours]

Magnetic properties

Classification of magnetic materials, diamagnetism: origin of diamagnetism, Langevin classical theory. Paramagnetism: origin of paramagnetism, review of classical theory, quantum theory (quantitative).

Ferromagnetism: concept of domains, thickness of Bloch wall, molecular field concept, Weiss theory, Heisenberg exchange interaction, Ising model, spin waves dispersion relation (one dimensional case), quantization of spin waves, concept of magnons and thermal excitation of magnons, Bloch $T^{3/2}$ law for magnetization.

Antiferromagnetism: Two sub-lattice model (quantitative description). Ferrimagnetism: ferrimagnetism in iron garnets.

Unit IV [16 hours]

Superconductivity: Review of basic properties, classification into type I and type II. Energy gap and its temperature dependence. Super current and critical currents.

London's equations (derivation), penetration depth. Cooper pairs, coherence length. Instability of Fermi surface and cooper pairs. BCS theory and comparison with experimental results. Ground state energy of superconductor. Quantization of magnetic flux. Josephson effects (AC and DC) and applications

High T_c materials: Structure and properties, some applications.

References

1. Principle of the theory of solids: J.M. Ziman (Cambridge University Press)
2. Introduction to Solid State Physics: C. Kittel (Wiley Eastern)
3. Solid State Physics: A.J. Dekkar (Prentice Hall Inc)
4. The physical principles of Solids: A.H. Morish
5. Introduction to Superconductivity: M. Tinkham (McGraw-Hill, Int. Edition)
6. Semiconductor Physics: P.S. Kireev (MIR Publishers)
7. Solid State Science: K. Seeger (Springer Verlag)

M Sc SEM-IV
Paper SCT4.1: MATERIALS PHYSICS -II

Preamble: This is an advanced course in materials physics. It covers materials like glasses, ceramics, polymers which are integral to mankind. Dielectric, ferroelectric and magnetic properties are studied. Special materials such as ferrites, liquid crystals and nano materials are also studied.

Unit I [16 hours]

Elastic properties: Atomic model of elastic behavior, Modulus as a parameter in design, Spring-Dashpot model for viscoelastic behavior. Plastic deformation: tensile stress-strain curve, plastic deformation by slip, shear strength of perfect and real crystals, mechanism of creep, creep resistant materials. Fracture of materials: ductile and brittle fracture, fatigue fracture, fracture toughness, ductile-brittle transition, methods of protection against fracture.

Unit II [16 hours]

Glasses, Ceramics and Polymers

Glasses: Glass forming constituents, structure of glasses, glass transition, types of glasses. Optical, electrical properties of glasses.

Ceramics: Classification and their structures, polymorphism; mechanical and thermal properties; Application of ceramics.

Polymers: Polymers, basic concepts, mechanisms of polymerization, structure and properties of polymers. Molecular weight of polymers. Electrical and optical properties.

Unit III [16 hours]

Dielectric, ferroelectric and magnetic properties: Ideas of static dielectric constant, loss, polarization, types of polarization; lorentz field, dielectric break down. Complex dielectric constant, applications of dielectrics.

Ferroelectrics and their properties. Types of ferroelectrics. Dipole theory of ferroelectricity, their objections. Ferroelectric domains. Relaxor ferroelectrics.

Magnetic materials; dia, para, ferro, antiferro and ferrimagnetism. Weiss theory of ferromagnetism, domains.

Unit IV [16 Hours]

Special materials:

Ferrites: Classification, soft and hard ferrites, Structure of ferrites, cation distribution, Mossbauer spectroscopic technique to determine cation distribution. B-H hysteresis loop, retentivity, coercieve field, saturation magnetization. Application of ferrites.

Liquid crystals: Classification, structure, optical and dielectric properties. Ferroelectric, anti ferroelectric and polymeric liquid crystals. Liquid crystal display.

Nano materials: Classification, structure, properties. Carbon nano tubes, Quantum dots, quantum wires. Synthesis of nano materials; Sol-Gel.

References

1. Elements of Materials Science and Engg, L.H. van Vleck, Addison-Wesley, 6th edition.
2. Materials Science and Engineering, V. Raghvan, Printice Hall of India, 3rd edition.
3. Materials Science and Processes: S. K Hazra Chaudary,Indian Distr Co., 1977.
4. Introduction to Ceramics, W.D. Kingery John Wiley
5. Polymer Science, V. R Gowarikar, N. V Vishwanathan, Wiley Eastern (1986).
6. Solid State Physics, A J Dekkar, Prentice-Hall, Inc.
7. Advances in Ferrites, V.R. K. Murthy and B, Vishwanath, Narosa Pub.
8. Liquid crystals, S. Chandrasekhar, Cambridge Univ Press, 2nd edition.
9. Principles of Polymer Science, P. Bahadur & N V Sastry, Narosa, 2002.

M Sc SEM-IV
Paper SCT4.1: SEMICONDUCTOR PHYSICS AND DEVICES

Preamble: This course is on semiconductors, semiconductor devices and amorphous semiconductors.

Unit I [16 hours]

Introduction to semiconductors: Crystal structure and bonding in typical semi conductors, band structures of some semi-conductors; electron and hole statistics; density-of-states, extrinsic and intrinsic semi-conductors; non- degenerate and degenerate semi-conductors.

Transport in Semiconductors:

Electrical conductivity, magneto-resistance and Hall effect, thermoelectric properties, experimental determination, types of scattering mechanisms (qualitative).

Unit II [16 hours]

Charge carrier recombination: continuity equation, life time, recombination mechanism, diffusion and drift of non- equilibrium carriers; Schokley- Hayney experiment.

Contact phenomena: Debye length, work function, contact potential, metal-metal, metal-semiconductor and metal-semiconductor-insulator contacts, two-dimensional solids and Stark effect.

Unit III [16 hours]

Devices: P-N Junction. Theory of rectification, junction transistor and amplification, breakdown in junctions; Tunnel & Zener diodes and their breakdown mechanisms; F.E.T; Semi-conductor diode laser; Microwave devices; Radiation detectors, (Photo-determinations, I.R. detectors, Photovoltaic device); The semi-conductor lamp (L.E.D.);

Solar cells: Fabrication and application to energy conversion

Unit IV [16 hours]

Amorphous Semiconductors: Types of amorphous semiconductors, preparation methods, band structure, electrical properties, optical properties and thermal properties, Applications: Switching and Xerography.

References

1. The principles of Magnetism : A. H. Morrish.
2. Introduction to magnetic resonance : A Carrington and A.D. Mclachlan.
3. Introduction to Ligand field theory : B. N. Figgis.
4. Solid State Physics by Ashcroft and Mermin.
5. Elementary Solid state Physics : M. Ali Omar.
6. Semi-conductor Physics : P. S. Kireev.

M Sc SEM-IV

Paper SCT4.2: NUCLEAR PHYSICS -II

Preamble: This course is an advanced course in nuclear physics. Heavy ion physics, special features of heavy ion reactions, nuclear reactions are introduced, Different types of particle detectors and radiation safety aspects are introduced.

Unit I [16 hours]

Formal theory of nuclear reactions: Nuclear reactions, general formalism and cross sections. Principle of detailed balance. Resonance reactions, Breit-Wigner formula for 1=0, level widths and strength functions.

Statistical model: Statistical theory of nuclear reactions, evaporation probability and cross sections for specific reaction. Experimental results.

Optical model: Optical potentials and optical model parameters. Optical model at low energy, Kapur-pierls dispersion formula for potential scattering&experimental results.

Unit II [16 hours]

Direct reactions: Transfer reactions. Theory of stripping and pickup reaction. Plane wave Born approximation and qualitative consideration of distorted wave Born approximation.

Heavy ion Physics: Special features of heavy ion reactions. Qualitative treatment of remote electromagnetic interaction- Coulomb excitations; close encounters, grazing collisions and particle transfer. Direct and head on collision, compound nucleus and quasi molecule formation.

Unit III [16 hours]

Particle detectors and accelerators: Gas filled ionization detectors: Current mode and pulse mode operation; proportional counter, position sensitive ionization chamber and multi-wire proportional counter. Semiconductor detectors: Semiconductor P-N junction as a detector. Type of semiconductor detectors; surface barrier, Si(Li), Ge(Li) and high purity germanium detectors. Pelletron accelerator.

Radiation protection: Dose units, estimation and measurement of dose from beta, gamma and neutron sources. Dosimeters. Biological effects of ionizing radiation. Radiation protection, tolerance limits of exposure to radiation and late effects of radiation. Radiation shielding.

Unit IV [16 hours]

Neutron diffraction: classification of neutrons in terms of energy, bound and free atom cross section, coherent and incoherent cross sections, neutron diffraction from single crystals and powders, advantages of neutron diffraction over X-ray diffraction. Refractive index of neutrons and mirror reflection of cold neutrons. Neutron interferometer and its application.

Nuclear techniques: Basic principles, instrumentation and application of positron annihilation spectroscopy, x-ray fluorescence, proton induced x-ray emission, Rutherford back scattering.

References

1. Nuclear Radiation Detectors: Kapoor and Ramamurthy.
2. Radiation Detection and Measurement : G F Knoll.
3. Measurement and detection of radiation : Nicholas Tsonlfanidis.
4. Physics of Nuclei and Particles : Marmier and Sheldon (Academic Press)
5. Introduction to Experimental Nuclear Physics : Singru.
6. Nuclear Physics : R R Roy and B P Nigam (Wiley Eastern)
7. Nuclear Physics : D C Tayal (Himalaya)
8. Atomic and Nuclear Physics : S N Ghoshal (S. Chand)
9. Neutron Diffraction: G F Bacon.

M Sc SEM-IV
Paper SCT4.2: ENERGY PHYSICS -II

Preamble: This course is an advanced course in energy physics. Nuclear fusion and fission energies are dealt with.

Unit I [16 hours]

Nuclear Fission Energy: Fission chain reaction, neutrons and their classification in terms of energy, energetics of neutron induced fission and four factor formula. Diffusion of neutrons (Qualitative discussions): Diffusion coefficient, diffusion equation and diffusion length. Slowing down of neutrons: Energy loss of neutrons in elastic scattering, mean energy loss and average logarithmic energy decrement. Slowing down power, slowing down density and lethargy. Continuous slowing model and Fermi age theory.

Unit II [16 hours]

Nuclear reactors: Fission reactors condition for criticality, bare homogenous reactor, geometrical and material buckling. Critical size for bare homogenous cylindrical and rectangular assemblies. Power reactors: Gas cooled and graphite moderated reactors, pressurised water reactor, heavy water moderated reactor and fast breeder reactors.

Unit III [16 hours]

Nuclear Fusion Energy: Controlled fusion reaction cycle in hydrogen plasma, reaction cross sections and reaction rates. Ignition temperature, Lawson’s criterion, radiation loss and kinetics of fusion reaction. Transport coefficient in plasma. Confinement of plasma: Pinch effect, dynamics of pinched plasma, instabilities of plasma and plasma stabilization, linear and toroidal pinched plasma. Tokomak and stellarator fusion reactors. Laser derived fusion reactor and power generation.

Unit IV [16 hours]

Wind, geothermal and Electrochemical Energy: Energy in the wind. Horizontal and vertical axis wind mills. Sources of geothermal energy and its utilisation working and efficiency of photochemical cells.

Bioenergy: Bio conversion and mechanism of photosynthesis, microbial and plant photosynthesis. Bio-mass systems, assessment, conversion, utilisation and conversion. Types of conversion of Bio-mass, anaerobic conversion and Bio-gas generation, enzymatic conversion and liquid fuel production.

References

1. Renewable Energy : B Sorenson.
2. Principles of Energy Conversion : A W Culp.
3. Introduction to Nuclear Reactor Theory : J K Lamarsh.
4. Introduction to Nuclear Reactor Theory : Isbin.
5. Elementary Nuclear Reactor Theory : Gladstone and Edlund.
6. Nuclear Energy and Energy Policies : S S Penner.
7. Nuclear Power Engineering : D K Singhai.
8. Plasma Physics : R A Cairns.
9. Non-conventional Energy Sources : G D Rai.

M Sc SEM-IV
Paper SCT4.2: BIOPHYSICS -II

Preamble: This is an advanced course in biophysics. Biophysical methods are discussed. Radiation and medical biophysics and bioinformatics are dealt with.

Unit I [16 hours]

Molecular biophysics: Molecular interactions and bonds. Biophysical organization; Molecular recognition processes; structure and function of biomolecules-Carbohydrates, and Lipids; Structure of nucleic acids; conformational polymorphism in nucleic acids. Structure of proteins; polyptides and protein conformation.

Unit II [16 hours]

Biophysical methods: Principle, working and applications of ultracenterifugation, electrophoretic and chromatographic techniques. Optical electron and Atomic Force Microscopy. Principles of absorption and fluorescence spectroscopy, optical rotary dispersion and circular dichroism. X-ray spectrometer and structure analysis. Nuclear Magnetic Resonance and Electron Spin Resonance spectrometers. Radiotracer techniques.

Unit III [16 hours]

Radiation biophysics: Interaction of radiation with matter; radiation detection, measurement and dose estimation; Biological effects of ionizing radiations- effects at the molecular, cellular and tissue levels; genetic effects. Biological effects of nonionizing radiations. Radiation hazards and safety standards for radiation protection.

Unit IV [16 Hours]

Medical biophysics: Diagnostic and therapeutic uses of ionizing radiations- Nuclear medicine. Medical uses of nonionizing radiation- Photomedicine; physiological and therapeutic uses of heat radiation. Biosensors: Medical expert systems-principle, working, and applications; Endoscopic, Ultrasonic, Fluoroscopic and Tomographic techniques.

Bioinformatics: Information Computers-Data bases-Bimolecular, sequence and structure databases. Sequence analysis of proteins and nucleic acids. Genome project.

References

1. An introduction to Biophysics: C Sybesma (Academic,1977).
2. Biophysics: V Pattabhi and N Gautham, (Narosa,2002).
3. Essentials of Biophysics: P Narayan, (New Age,2001).
4. Molecular Biophysics: R B Setlow and E C Polland, (Addition Wesey, 1962).
5. Biophysics: W Hoppe, W Lohmann, H. Markl, H Ziegler, (Springer Verlag, 1983).
6. Biophysical Principle of Structure and Function: F M Snell, Shulman, R P Spensor and Moos, (Addison Wesley, 1965).
7. Principles of Protein Structure: G E Schultz and R H Shirmer, (Springer.1969).
8. Principles of nucleic acid structures: W. Saenger, (Springer Verlag, 1984).
9. Radiation Biophysics: E L Alpen, (Prentice-Hall, N J, 1990).
10. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Eds A D Baxevanis & B F Francis (John Wiley, 1998).

M Sc SEM-IV
Paper HCMP4.3: PROJECT

Compulsorily each student has to carry out a project work under the supervision of a staff member. The topic for project work can be of theoretical or experimental or computational in nature. A group of students under a staff member can work on a single topic for project. However, each student has to submit his/her own independently written original project report and face examination independently. Maximum of six credits are given for the project work. On completion of the project work and at the end of the Semester IV, a project report (certified by both supervisor and Chairman/Head of the Department) based on the project work carried out must be submitted to the Department. Project work will be valued for maximum of 150 marks (project report 72 marks,Viva-Voce 48 marks and Internal Assessment 30 marks).

M Sc SEM-IV
PRACTICAL COURSES

HCP 4.1/4.2 : Optics and Electronics	
Optics: 1. Wavelength of laser beam by single slit diffraction method. 2. Wavelength of laser beam by diffraction due to engraving on vernier calipers. 3. Velocity of light by Kerr cell method. 4. Determination of numerical aperture by an optical fibre. Assignments/ Computations	Electronics: 5. RC coupled transistor CE amplifier. 6. Fixed voltage regulation using IC 7812 or 7912 7. Variable voltage regulation using IC 723 or 8085 8. Study of counters and shift registers 9. D/A converter. Assignments/ Computations
SCP 4.1/4.2 : Nuclear Physics and Solid State Physics	
Nuclear Physics: 1. Spectral response analysis of solid state detector. 2. Study of coincidence circuits. 3. Study of Bremsstrahlung radiation 4. Analysis of n-p and p-p scattering parameters. 5. Nuclear structure analysis. 6. Analysis of beta spectrum by multi channel analyzer. 7. Study of solar panels. 8. Positron annihilation and angular correlation of annihilation photons. 9. Analysis of nuclear reaction cross section. Assignments/ Computations	Solid State Physics: 10. Dielectric constant of PZT. 11. Hall effect in semiconductors. 12. Electron Spin Resosnance. 13.Four probe method to study resistivity variation with temperature of a semiconductor. 14. Study of lattice dynamics. 15. B-H hysteresis loop tracer. Assignments/Computations.

Note: New experiments shall be added to the list as and when developed.

QUESTION PAPER PATTERN FOR INTERNAL ASSESSMENT TESTS AND SEMESTER END EXAMINATIONS

IA Test 1 for theory courses (Hard core, Soft core & Open electives)

There shall be three questions of 10 marks each. Students will have to answer any two questions.

Example: Question 1 has to be drawn from Unit 1. Question 2 has to be drawn from Unit 2. Question 3 consisting of two parts (a) and (b) has to be drawn from both the Units 1 & 2.

Duration of the test is one hour. Maximum marks 20.

IA Test 2 for theory courses (Hard core, Soft core & Open electives)

There shall be three questions of 10 marks each. Students will have to answer any two questions.

Example: Question 1 has to be drawn from Unit 3. Question 2 has to be drawn from Unit 4. Question 3 consisting of two parts (a) and (b) has to be drawn from both the Units 3 & 4.

Duration of the test is one hour. Maximum marks 20.

Average of the marks secured in two internal assessment tests will be taken as the final awarded marks in the internal assessment test of the respective subject.

Practical Internal Assessment Test

1. There shall be one Internal Assessment test in each of the practical courses for 20 marks. In the practical test, the students may be asked to perform the experiment or analyse the data or work out a computation or answer few questions orally etc. The methodology to be followed in the given practical test will be decided by the Department and that would be uniformly applied to all the students in that semester.

Duration of the practical test is 1 or 1½ hour. Maximum marks 20

Semester End Examinations

Question paper Pattern for theory courses (Hard core, Soft core and Open Electives)

There shall be 8 questions of 15 marks each (two questions from each unit). Students will have to answer four questions. There shall be internal choice in each unit.

Example:

Questions 1 & 2 must be from Unit 1. Students will answer either Question 1 or Question 2.

Questions 3 & 4 must be from Unit 2. Students will answer either Question 3 or Question 4.

Questions 5 & 6 must be from Unit 3. Students will answer either Question 5 or Question 6.

Questions 7 & 8 must be from Unit 3. Students will answer either Question 7 or Question 8.

Further, there shall be four questions of 10 marks each. One question from each unit must be drawn. Students will have to answer two questions.

Example:

Question 9 must be drawn from Unit 1.

Question 10 must be drawn from Unit 2.

Question 11 must be drawn from Unit 3.

Question 12 must be drawn from Unit 4.

Duration: 3 hours Max. marks : 80 [=(15x4) + (10x2)]