SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
Post Graduate (PG) Programs under Faculty of Science
(Affiliated Colleges)
(w.e.f. Academic Year 2014-15)

SYLLABUS FOR M.Sc. PART-I EXAMINATION

M.Sc. PHYSICS
(SEMESTER PATTERN)
JUNE -2014

Draft Syllabus Prescribed for
M.Sc. Part-I and Part-II Examination in Physics
(Semester Pattern)

There shall be total four semesters (Two for M.Sc. Part-I and Two for M.Sc. Part-II). There shall be four theory papers (100 marks each) and Four practical papers (100 marks each) Annual pattern.

It is expected that the students should visit Research Laboratories and industrial establishments of repute.

M.Sc. Part – I First Semester

Paper No.	Title of the Theory Papers	credit
PH-01	Mathematical Physics	4
PH-02	Classical Mechanics	4
PH-03	Electronic Devices and Applications	4
PH-04	Atomic and Molecular Physics	4
PH-5 (Seminar)	(25 marks)	Credit: 1
	Title of the Practical Paper	
PH-06 Annual	General Physics Practical Course	4
PH-07 Annual	General Electronics Practical Course	4

M.Sc. Part – I Second Semester

Paper No.	Title of the Theory Papers	Credit
PH-08	Quantum Mechanics	4
PH-09	Statistical Mechanics	4
PH-10	Condensed Matter Physics	4
PH-11	Numerical Techniques	4
PH –12 (Seminar)	(25 marks)	Credit: 1
	Title of the Practical Paper	
PH-13 Annual	Solid State Physics Practical Course	4
PH-14 Annual	Spectroscopy & Numerical Techniques Practical Course	4

CHOICE BASED CREDIT SYSTEM (CBCS)
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Name of the Faculty	Total credits	Average credits per semester
Science	**100**	**25**

Note:

>Assessment shall consist of Continuous assessment **(CA)** and End of Semester Examination **(ESE).**

> **Weightage:** 75% for ESE & 25% for CA

> **Paper- (Elective):** Transfer of Credit as per Student choice

Tentative Distribution of Credits for PG under Science faculty:

Semester	Paper No	External (ESE)	Internal (CA)	Total
Sem. I	Paper-I (PH:01)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-II (PH:02)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-III(PH:03)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	*Paper-IV(PH:04) (Elective)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper –V (PH:05) (Seminar)	(25 marks)	Credit: 1(25 marks)	Credit: 1
	Total for Sem: I Credit: 17			**Credit: 17**
Sem. II	Paper-I (PH:08)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-II(PH:09)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper-III (PH:10)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	*Paper-IV (PH:11) (Elective)	(75 marks) (25 marks)	(2Test : 15 marks+ Assignments :10 marks)	Credit: 4 (100 marks)
	Paper –V (PH:12) (Seminar)	(25 marks)	Credit: 1(25 marks)	Credit: 1
	Total for Sem: I Credit: 17			**Credit: 17**
Lab Course Work (Annual Practical)	Lab Course Work – I (PH:06)	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Lab Course Work – II (PH:07)	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Lab Course Work- III (PH:13)	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Lab Course Work- IV (PH:14)	(75 marks)	(25 marks)	Credit: 4 (100 marks)
	Total for Lab Course work(Annual)			**Credit: 16**
	Total for M.Sc. I Year: Sem. I+ Sem. II + Lab Course work (Annual) Credit: 50			**Credit: 50**

Mathematical Physics

Paper: PH-01
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **Matrices and Vector Space:**

Definition, Algebra, Properties of matrices, Rank of matrix, Transformation, Inverse and trace of matrix, Characteristic root and characteristics vectors, Diagonalization of matrix, Linear dependence and independence of vectors, Inner product, Schmidt orthnormalization method.

Unit - II **Fourier Series:**

Fourier series, Evaluation of coefficients, Fourier cosine and sine series, Complex form of fourier series, Change to interval of fourier series, Applications of fourier series to; Square waves, Triangular waves, Saw-tooth waves, Full wave and Half wave rectifier.

Unit - III **Integral Transform:**

Fourier transform, Fourier cosine transform, Fourier sine transform, Fourier transform, Fourier transform of derivatives, Dirac delta function derivation, Laplace transform, Laplace transform of some functions, Properties of Laplace transform, Laplace transform of derivatives, Inverse Laplace transform, Applications of fourier and Laplace transform.

Unit - IV **Special Functions:**

Bessels differential equation, Some specific cases for $J_n(x)$, Generating function of $J_n(x)$, Orthoganility of $J_n(x)$ Legendre's differential equation, Generating function for $P_n(x)$, Specific cases for $P_n(x)$, Recurance relation for $P_n(x)$, Rodrigues formula for $P_n(x)$, Hermite differential equation, Specific cases for $H_n(x)$, Recurrence relation for $H_n(x)$, Orthogonality of $H_n(x)$, Rodrigues formula for $H_n(x)$.

Unit - V **Tensor Analysis:**

Introduction, Defination of tensor in three dimensions, Definition of tensors in four dimensions, Rank of tensors, Covariant and contra-varient tensors, Symmetric and anti-symmetric tensors, Algebraic operations of tensors: Sum and Difference, Direct product, Contraction, Extension of the Rank, Quotient Law, Reciprocal tensors, Relative and absolute tensors, Index notation and summation conversion, Invariant tensors: kronecker delta symbol, Epsinal tensor, Krutkov tensor.

Books:

1. Mathematical Method of Physics-Tulsidas and Sharma.
2. Mathematical Physics, B.S. Rajput and Yog Prakash (Pragati Prakashan)
3. Mathematical Physics, B.D. Gupta (Vikas Publishing House, New Delhi)
4. Mathematical Physics, Satya Prakash (S. Chand and Sons)
5. Mathematical Physics, S.L. Kakani (Himalaya Publishing House)
6. Mathematical Physics, Sisodia, Kachava, Khamesra (Dashora Ramesh Book Dept. Jaipur)
7. Advance Engineering Mathematics, Erwin Krezig.

Classical Mechanics

Paper: PH-02
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **Elementary Principles:** **(Periods 9)**

Introduction, Conservative and non conservative, Coordinate system, Degree's of freedom, Constraints; Classification of constraints, Virtual displacement and virtual work, D Alembert's principle, Newtonian mechanics for single and many particle system. (Various problems for all above) (Books 4, 1)

Unit - II **Lagrangian Formulation:** **(Periods 10)**

Largangian equation of motion, Variation technique, Kinetic energy in terms of generalized coordinates, Jacobi integral, Rayleigh's dissipation function, Symmetry properties and Conservation laws; Invariance of Lagrangian equations under Galilean Transformation; Variational Principle. (Various Problems on the above) (Books 4, 5)

Unit - III **Hamiltonian Formulation:** **(Periods 10)**

Hamiltonian equations of motion, Principle of least action, Hamilton's principle and its characteristics, Hamilton-Jocobi method, Canonical transformation, Generating function condition for canonical transformation, Definition of Poisson brackets, Poission's theorem and its properties, Jacobi identity. (Various problems for all above) (Books 3, 1)

Unit - IV **Central Force:** **(Periods 8)**

Two-body problem; The equation of motion and first integral, Equation of orbit, Kepler's laws, Kepler's problem and general analysis of orbit, Stability of orbit, Rutherford scattering, Laboratory and center of mass system, Differential scattering cross section, Viral theorem. (Books 3,4,1)

Unit - V **Rigid Body Dynamics:** **(Periods 8)**

Euler's angles, Inertial forces, Angulan momentum of rigid body, Euler's equation of rigid body, Free motion of rigid body. (Books 1,3,4)

Books:

1. Classical Mechanics, H.Goldstein (Addition Wesely Publication, 1980)
2. Classical Mechanics, N.C. Rana and P.S. Joag (Tata MeGraw Hill, 1991)
3. Classical Mechanics, J.C. Upadhaya (Himalaya Publishing House)
4. Classical Mechanics, Gupta, Kumar and Sharma (Pragati Prakashan)

5. Classical Mechanics, P.V. Panat and Joag (Tata MeGraw Hill)

Electronic Devices and Applications

Paper: PH-03
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **Special Purpose Diodes and Other Devices:** **(Periods 8)**

LED, Schottky, Varactor, Tunnel, Photo Diodes, Photoconductive cell, LCD (Liquid Crystal Display), Solar cell, Thermistor, SCR, UJT, Photo transistor. (Books 1)

Unit - II **Multivibrators:** **(Periods 7)**

Switching characteristics of transistor, Switchig times of transistor, Astable, Monostable and bistable multivibrators. Book 2)

Unit - III **Applications of OP-AMP:** **(Periods 10)**

Summing, Scaling and averaging amplifiers (Inverting), Instrumentation amplifier, Integrator, Differentiator, Comparator and Schmitt trigger.

Active filters and Oscillators: First order Low-pass Butterworth filter, Second order Law-pass Butterworth filter, First order High-pass Butterworth filter, Second order Highpass Butterworth filter, Square wave generator, Voltage Controlled Oscillator (VCO). (Book 3)

Unit - IV **Arithmetic Circuits:** **(Periods 8)**

Half adder, Full adder, Parallel binary adder. (Book 4)
Multiplexers, DeMultiplexers (Book 4)
Decoders, Encoders (Book 5)

Unit - V **Sequential Circuits and Data Converters:** **(Periods 12)**

Flip-Flops: 1 Bit Memory Cell, S-R, J-K, Race Around Condition, JK Master Slave, D-Type, T-Type. (Book 4)
Registers: SISO, SIPO, PISO and PIPO. (Book 6)
Counters: Asynchronous Counters, Synchronous Counter, Synchronous Counter Design.
Data Converters: D/A and A/D Converters (Book 4)

Books:

1) Electronics Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, 6th Edition, Prentice Hall of India Private Limited.
2) Handbook of Electronics, Gupta and Kumar.
3) Op-Amps and Linear Integrated Circuits, Ramakant A.Gayakwad, 4th Educatiom PHI Learning Private Limited.
4) Modern Digital Electronics, R.P. Jain, 4th Edition, Mc Graw Hill.
5) Digital Fundamentals Thomas L. Floyd, 10th Edition, Pearson.

6) Digital Principles and Applications, Donald P.Leach, Albert Poul Malvino, Goutam Saha, 7th Education Mc. Graw Hill.

Atomic and Molecular Physics

Paper: PH-04
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **The Atom Model for Two Valence Electrons: (Periods 10)**

Zeeman effect for two electrons, Intensity rules of Zeeman effect, Paschen-Back effect for two electons, Stark effect of hydrogen, Weak field stark effect in hydrogen, Strong field stark effect in hydrogen, Origin of hyperfine structure, Principles of resonance spectroscopy (ESR and NMR).

Unit - II **Molecular Physics: (Periods 10)**

Rotational spectra & diatomic molecular, Energy level factors affecting intensity of spectral lines, Spectra of non-rigid rotator, Microwave spectrometer, Isotopic substitution, Polyatomic molecules.

Unit - III **(Periods 8)**

Vibrational energy of diatomic molecule, Simple harmonic oscillator, Morse potential energy curve, Anharmonic oscillator, Molecule as a vibrating rotator, PQR branches, Born Oppenheimer approximation, IR spectrometer.

Unit - IV **Electronic Spectra: (Periods 8)**

Diatomic molecule, series and progressions, Frank-Condom principle, Reemission processes, Fluorescence and phosphorescence, dissociation energy, Birge sponer method for determining dissociation energy.

Unit - V **Raman Spectroscopy (Periods 9)**

Raman effect, Quantum theory of Raman effect, Classical theory of Raman effect, Polarizability ellipsoid.

Pure rotational Raman spectra of diatomic and polyatomic molecules, Fundamental modes of vibrations, Raman activity of vibrations.

Rule of mutual exclusion, nature of polarized light, structure determination from Raman and infrared spectroscopy, Technique and instrumentation.

Books:

1) Introduction of atomic spectra, White H.E.
2) Fundamentals of Molecular Spectroscopy, Banwell (TMH)
3) Spectroscopy Vol. I, II & III, B.P. Stranghen and Walker (Chapman and hall & John Viley & Sons, New York)

4) Introduction of Molecular Spectroscopy, G.M. Barrow.
5) Spectra diatomic molecules, G.Herzberg.
6) Modern Spectroscopy, J.M. Holias.
7) Molecular structure & spectroscopy, G.Aruldhas PHI Learning Pvt. Ltd.
8) Molecular Molecular, J.M. Brown, Oxford University Press.

General Physics Practical Course

Paper: PH-06
CREDIT:4
W.E.F.: June 2014

1. Determination of Plank's constant by photo cell.
2. Determination of Accoustic impedence (z) and adiabatic compressibility β and intermolecular free length (L_f) of a given liquid by ultrasonic interferometer.
3. Determination of h/e by photo cell.
4. e/m by helical method.
5. Platinum resistance thermometer.
6. Determination of specific heat of a given liquid by the method of cooling.
7. Determination of Poisson's ratio for rubber rube.
8. Verification of law of Malus.
9. Temperature to frequency conversion.
10. Thickness of a given mica sheat by Freshnel's bi prism.
11. Surface tension of a given liquid by stalegnometer.
12. *y*- by Cornu's fringes.
13. *e*- by Milikan oil drop method.
14. Characteristics of transformer.

General Electronics Laboratory Course

Paper: PH-07
CREDIT:4
W.E.F.: June 2014

1. CE – amplifier:

i) Design and build a single stage CE amplifier.
ii) Study its frequency response curve.
iii) Find its 3db bank width.

2. SCR– Characteristics:

i) Draw and construct the circuit for plotting SCR characteristics.
ii) From the graph find the value of holding current I_H and holding V_H.

3. UJT Characteristics:

i) Draw and construct the circuit for plotting SCR characteristics.
ii) From the graph note draw the value of pinch off voltage V_P and hence find intrinsic standoff ratio η.

4. FET Characteristics:

i) Draw and construct the circuit for plotting JFET characteristics.
ii) Plot its drain characteristics.
iii) Plot its trans conductance characteristics.
iv) From the characteristics find the values of r_d, g_m and μ.

5. Op-Amp:

i) Construct the circuit to study Op-Amp as an inverting amplifier.
ii) Verify the gain relation A $\mu = -R_f/R_1$ for various values of R_f & R_1 by giving dc i/p.
iii) By fixing R_f & R_1 study the frequency response of the circuit.
iv) From the graph find 3dB band width.

6. Op-Amp:

i) Construct the circuit to study Op-Amp as an non-inverting amplifier.
ii) Verify the gain relation A $\mu = 1+R_f/R_1$ for various values of R_f & R_1 by giving dc i/p.
iii) By fixing R_f & R_1 study the frequency response of the circuit.
iv) From the graph find 3dB-band width.

7. Op-Amp:

a) i) Construct the circuit to study Op-Amp as an adder.
ii) Study the circuit for different i/p voltages.

b) i) Construct the circuit to study Op-Amp as substractor.
ii) Study the response of circuit for different *i/p* voltages.
iii) Find error in actual *o/p* ad theoretical *o/p* ad comment.

8. Using IC 7400 construct:

i) And gate ii) OR gate iii) NOR gate

iv) NAND gate v) NOT gate

vi) Verify the truth table for every gate.

9.

i) Using IC 7476 verify the truth table for JK flip-flop.

ii) Construct T type flip flop and verify truth table.

iii) Construct D type flip-flop and verify truth table.

10. Using IC 7476:

Design a Mod-5 synchronous counter and study it.

11. Using IC 7476:

Design a Mod-16 up counter and study it.

12. i) Construct the circuit to study wave forms of function generator IC 566.

ii) By varying the control voltage study the response of circuit.

iii) Show modulated wave forms.

13. i) Design and construct the circuit for high pass filter using IC 741.

ii) Study the response of the circuit.

iii) From the graph find cutoff frequency.

14. i) Design and construct circuit for low pass filter using IC 714.

ii) Study the response of the circuit.

iii) From the graph find cutoff frequency.

15. i) Construct a R-2R ladder network by using IC 741 to study D/A converter.

ii) By giving different digital *i/p* study the response of the circuit.

iii) Comment on error in theoretical *o/p* and actual *o/p*.

16. i) Draw the circuit diagram to study the truth table for MUX and DeMUX.

ii) Verify the truth table.

Books for Practical Work:

1. University Practical Physics, D.C. Tayal (Himalaya Publishing House)
2. Lab Manual in Solid State Physics, Dr.Arun S.Nigvekar (University of Poona)
3. Experiments in Solid State Physics, D.B. Sirdeshmukh and K.G. Subhadra (Published by Authors Warangal).
4. Advanced Practical Physics, Chauhan and Singh.
5. Advance Practical Physics, Kumar and Madan Lal.
6. A Lab Manual of Physics, F.Tyler (Edward Arnold Publisher Ltd.)
7. Advanced Practical Physics Vol. I & Vol. II S.P. Singh (Pragati Prakashan)
8. Practical Physics, C.L. Arora (S.Chand & Co.)

Quantum Mechanics

Paper: PH-08
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **General Formalism of Quantum Mechanics I: (Periods 5)**

Physical Significance of wave function, Postulates of quantum mechanics, Quantum numbers, Physical Significance of Eigen function and Eigen value, Completeness of Eigen functions, Dirac delta function and its properties.

Unit - II **General Formalism of Quantum Mechanics II: (Periods 4)**

Linear vector space, Hilbert space, Ket and Bra notations, Linear operators, Commutation relation for position and momentum operator, Hermitian operators, Matrix representation of an operator, Unitary operator, Unitary transformations.

Unit - III **Angular Momentum: (Periods 12)**

Commutation relations for Spin, Orbital and total angular momentum and Ladder operators, Eigen values of L^2, L_Z, J^2, J_Z, J-, Angular momentum and rotations, Rotational symmetry and conservation of angular momentum, Reflection invariance and Parity, Addition of angular momentum – Clebsch Coefficient.

Unit - IV **Approximation Methods: (Periods 12)**

(a) **Time independent perturbation theory:** Non-degenerate case- First order perturbations, Second order perturbation, application for the He atom, Degenerate case-Stark effect.

(b) **Time dependent perturbation theory:** Zero order perturbation, First order perturbations, Second order perturbation, Fermi golden rule, Adiabatic and sudden approximation.

(c) **Variation Method:** The basic principle, Application to excited state, Linear variation function application to two electron atom problem.

(d) **WKB approximation:** The classical limit, One dimensional case, connection formulae, The turning point application to barrier poten.

Unit - V **Theory of Scattering and Symmetry in Quantum Mechanics: (Periods 12)**

Laboratory and Centre of Mass reference frames, Scattering amplitude, differential and total scattering cross section, Asymptotic form of scattering states, Relation between angles and cross sections in the laboratory and center of mass systems, Scattering by spherically symmetric potentials, Integral equation of scattering.

The Born approximation, Partial Waves and Phase shifts, Scattering by a perfectly rigid sphere and by square well potential, Complex potential and absorption.

Identical particles, symmetric and asymmetric wave factions and their construction for N particle system, Slater's determinant, Collision of identical particles (No Derivations)

Recommended Books:

1. Quantum Mechanics by G.Aruldhas (PHI Learning Private Limited) (Unit I to IV)
2. Quantum Mechanics by Suresh Chandra (CBS Publishers & Distributors) (Unit I to IV)
3. Quantum Mechanics by Gupta, Kumar, Sharma (Jai Prakash Nath & Co.Meerut) (Unit-V)
4. Quantum Mechanics by Satya Prakash

Other Reference Books:

1) Quantum mechanics - L.I. Schiff 2) Quantum mechanics – Ghatak and Loknathan

3) Quantum mechanics - A.P. Messiah 4) Modern Quantum mechanics – J.J. Sakurai
5) Quantum mechanics - Mathewas and Venkatesar 6) Quantum mechanics – V.K. Thankappan

Statistical Mechanics

Paper: PH-09
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **(Periods 8)**

a) **Fundamentals:** Macroscopic and microscopic state, Phase space, Ensemble and ensemble average, Liouville's theorem, Density matrix.

b) **Microcanonical Ensemble:** Mictrocanonical distribution; Equal a priori probability, Entropy, Entropy of perfect gas in a microcanonical ensemble, Gibbs paradox, Thermodynamic quantities in a microcanonical ensemble; Sackur-Tetrode formula.

Unit - II **(Periods 10)**

a) **Canonical Ensemble:** Canonical distribution, Canonical partition function, Maxwell distribution of velocities, Thermodynamic quantities in a canonical ensemble, Classical system in canonical ensemble, Gibbs paradox.

b) **Grand Canonical Ensemble:** Grand canonical distribution, Grand canonical partition function, Thermodynamic quantities in a grand canonical ensemble, Classical system in a grand canonical ensemble, Density and energy fluctuaions in a grand canonical ensemble.

Unit - III **(Periods 10)**

a) **Maxwell-Boltzmann System:** Maxwell-Boltzmann distribution, Maxwell-Boltzmann velocity distribution law, Thermodynamical quantities; Gibbs paradox, Ideal Boltzmann gas with internal motions, Monatomic ideal gas with internal motions, Diatomic ideal gas, Ideal paramagnetism.

b) **Fermi-Dirac Gas:** Weakly degenerate Fermi gas, Strongly degenerate Fermi gas, Thermionic emission, Statistical equilibrium in a white dwarf star.

Unit - IV **(Periods 8)**

a) **Bose-Einstein Gas:** Bose-Einstein gas at high temperature, Bose-Einstein gas at low temperature, Planck's radiation law, Debye model of solids (Phonons), Liquid He.

b) **Interacting System:** Van der walls equation, Critical constants of a real gas, Virial equation, Cluster expansion for a classical gas.

Unit - V **(Periods 9)**

a) **Phase Transitions:** First-order phase transitions, Equilibrium between two phases, Clapeyron-Clausius equation, Scaling hypothesis, Critical indices, Second-order phase transition, Ising model, Landau theory.

b) **Kinetic and Dynamical Theories of Gases:** Boltzmann transport equation, Mean free path, Transport properties, Fluctuations and thermodynamics properties, Brownian motion, Langevin theory.

Books:

1) Statistical Mechanics, R.K. Patharia (Pregamon Press Oxford)
2) Statistical Mechanics, J.K. Bhattacharjee (Allied Publishers Limited, New Delhi)
3) Fundamental of Statistical Mechanics and Thermal Physics, F. Reif (McGraw Hill International Editions)

4) Statistical Mechanics, S.K. Sinha, (Tata McGraw Hill Publishing Co. Ltd., New Delhi)
5) Fundamental of Statistical Mechanics, B.B. Loud (New Age International Publishers)
6) Statistical Mechanics, Eisener and Agrawal (Wiley Easter Ltd.)
7) Statistical Mechanics, K.Huang (Wiley Eastern Ltd.)

Condensed Matter Physics

Paper: PH-10
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **Crystal Structure and Imperfections: (Periods 10)**

Crystal lattice and crystal structure, Translation symmetry, Space lattice, Unit cell and primitive cell, Bravais lattice in two and three dimensions, Co-ordination number, Some important crystal structure: Simple cubic structure (SC), Body centered cubic (BCC) structure, Face centered cubic (FCC) structure, Hexagonal close packed (HCP) structure, Wigner-seitz cells, Miller indices, The spacing of a set of a crystal Planes.

Unit - II **X-ray Diffraction and Reciprocal Lattice: (Periods 10)**

Interaction X-rays with matter; X-ray diffraction according to Braggs law, Reciprocal lattice, Properties of reciprocal lattice to simple cubic (SC) lattice, Body centered cubic (BCC) lattice and face centered cubic (FCC) lattice, The Bragg condition and Ewald construction, Brillion zones for one dimensional lattice, Two dimensional square lattice, Simple cubic lattice, Body centered cubic (BCC) lattice, Face centered cubic (FCC) lattice, Atomic scattering factor, Geometrical structure factor, Laue method, Rotating crystal method and powder method.

Unit - III **Band Theory: (Periods 8)**

Electron motion in crystal (One dimensional), Bloch theorem, Kroning-penny model, The concept of effective mass, Concept of holes, Metals insulators and semiconductor, The nearly free electron model, Tight binding approximations, Wigner-seitz cellular method, Orthogonalised plane wave (OPW), pseudo potential method, Fermi surface:

Unit - IV **Superconductivity: (Periods 8)**

Introduction, Meissner effect, Critical temperature, Persistent current, The London theory, Type-I & II superconductors, Cooper pair, BCS theory, Flux quantization.

Unit - V **Magnetism: (Periods 9)**

Origin of Magnetic properties of material, Magnetic susceptibility, Classification of magnetic materials, Weiss molecular field theory of ferromagnetism, Heisenberg model, Curie Weiss law of susceptibility, Ferromagnetic domain and Hysteresis, Closure domains, The Bloch wall and Bloch wall energy, Antiferromagetism: two sublattice model, Neel temp, Susceptibility below Neel temperature, Ferrimagnetism: Structure of ferrites, Spin arrangement in Ferrite, Exchange interaction in Ferromagnets, Spain waves and magnons.

Books:

1) Elementary Solid State Physics, Omer Ali
2) Solid State Physics, C. Kittle

3) Introduction Solids, Azaroft
4) Solid State Physics, Ascrott and Mermin
5) Solid State Physics, Dekkar
6) Solid State Physics, Wahab
7) Solid State Physics, Ajay Kumar Saxena
8) Solid State Physics, S.O. Pillai

Numerical Techniques

Paper: PH-11
CREDIT:4
Periods: 45
W.E.F.: June 2014

Unit - I **Error Analysis:**

Introduction, Least squares fitting (Uncertainty in the measurements of y, Constants A,B), Covariance and correlations, the Binomial and Poisson distribution, the chi-squared test for a distribution.

Unit - II **Roots of Equation:**

Polynomial and transcendental equation, Limits for the roots of polynomial equation, Bisectional method, false position method, Newton Raphson method, Direct substitutation method, Synthetic division complex roots.

Unit - III **Numerical Integration and Solution of Differential Equation:**

Newton cotes formula, Trapezoidal rule, Simpson's 1/3 rule. Simpson's 3/8 rule, Gauss quadratic method, Taylor series method. Euler's method, 2^{nd} order Runge Kutta method, Predictor corrector method.

Unit - IV **Curve Fitting and Integration:**

Principle of least square feet, Fitting a straight line, Fitting a parabola, Cubic spline fitting, Linear interpolation, Difference Schemes, Newton's forward and backward interpolation formula.

Unit - V **Solution of Simultaneous Equations:**

Gaussian elimination methods, Pivotal condensation method, Gauss Jordan Elimination method, Matrix inversion method, Gauss-seidal iteration method.

Books:

1) Numerical Methods, Rajaraman
2) Introductory Method of Numerical Analysis, Sastry.
3) Numerical Computational Method, P.B. Patil, U.P. Verma (Narosa Publication New Delhi)
4) C Programming, Balguru Samy
5) Numerical Method and Computation, B.K. Bafna
6) Advanced Engeneering Mathematics by Ervin Kres Sing, John Willey and Sons. Inc.
7) Numerical Method for Scientiest and Engineers, H.M. Antia.
8) Introduction to error analysis, by JohnTaylor, University Science books USA.

Solid State Physics Practical Course

Paper: PH-13
CREDIT:4
W.E.F.: June 2014

1) Determination of specific heat of graphite at different temperatures.
2) Measurement of Resistivity of Germanium by four probe method.
3) Measurement of ionic conductivity of sodium chloride.
4) Study of magnetic properties of $MnSo_4$ by Guoy method.
5) Study of magnetic susceptibility in liquids.
6) Estimation of core loss and coercive force for a ferromagnetic core material of a transformer.
7) Measurement of Hall co-efficient of a given sample.
8) Energy band gap by using thermister.
9) Electrical conductivity of graphite rod.
10) Thermo e.m.f. and thermo electric power of a copper Iron thermo couple with temperature of hot junction using by LCRQ meter and function generator.
11) Dielectric constant of solid.
12) Energy band gap of semi conductor by four-probe method.

Spectroscopy and Numerical Techniques Practical Course Paper: PH-14

CREDIT:4

W.E.F. :- June 2014

1) Calibration of CDS and determine the unknown wavelength
2) Determination of Polarizability of a given liquid.
3) Calibration of Spectrometer by Talbot band/ Edser Butler plate.
4) Determination of Cauchy's Constants.
5) Verification of Beer's law.
6) Determination of thickness of plate /wavelength by Fabry Parrot etalon.
7) Michelson Interferometer determination of λ and $d\lambda$.
8) Hartman's dispersion formula.
9) Determination of wavelength of He-Ne laser beam by Michelson interferometer.
10) Write a program to find zeros of a polynomial equation by using Bisection method. Write the algorithm and draw flow chart. Get hard copy of the result.
11) Write a program to find the roots of given polynomial equation using Newton- Raphson method. Write the algorithm and draw flow chart. Get hard copy of the result.
12) Write a program to find integration of a given equation by using Simpson's 1/3 rule. Write the algorithm and draw flow chart. Get hard copy of the result.
13) Write a program to find integration of a given equation by using Trapezoidal rule. Write the algorithm and draw flow chart. Get hard copy of the result.

14) Write a program to find solution of a differential equation by using Taylor series method. Write the algorithm and draw flow chart. Get hard copy of the result.

15) Write a program to find solution of a differential equation by using Euler's method. Write the algorithm and draw flow chart. Get hard copy of the result.

16) Write a program for interpolation by using Newton's forward difference formula. Write the algorithm and draw flow chart. Get hard copy of the result.

17) Write a program for interpolation by using Newton's backward difference formula. Write the algorithm and draw flow chart. Get hard copy of the result.

Books for Practical Work:

1) University Practical Physics, D.C. Tayal (Himalaya Publishing House)
2) Lab Manual in Solid State Physics, Dr.Arun S.Nigvekar (University of Poona)
3) Experiments in Solid State Physics, D.B. Sirdeshmukh and K.G. Subhadra (Published by Author Warangal).
4) Advanced Practical Physics, Chauhan and Singh.
5) Advanced Practical Physics, Kumar and Madan Lal.
6) A Lab Manual of Physics, F.Tyler (Edward Anrold Publisher Ltd.)
7) Advanced Practical Physics Vol. I & Vol. II, S.P. Singh (Pragati Prakashan).
8) Practical Physics, C.I, Arora (S.Chand & Co.)

Swami Ramanand Teerth Marathwada
University, Nanded.
Paper setting Pattern
M. Sc. Physics Part I (CBCS)

Time :3 hours Maximum Marks :75 (3Credits)

Unit	Question No	Sections	Marks
I	1.	a	7
	OR	b	8
	1.	x	7
		y	8
II	2.	a	7
	OR	b	8
	2.	x	7
		y	8
III	3.	a	7
	OR	b	8
	3.	x	7
		y	8
IV	4.	a	7
	OR	b	8
	4.	x	7
		y	8
V	5.	a	7
	OR	b	8
	5.	x	7
		y	8