DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

REVISED SYLLABUS FOR M.Sc (PHYSICS)

III SEMESTER

With effect from the academic year 2018 -2019 onwards

S.No	Paper code	Paper	Paper title
1.	P301T	Paper I	Modern Optics
2	P302T	Paper II	Advanced solid state physics
Solid state physics (SSP)			
3	P303T/SSP	Paper III	Band Theory & electrical Properties
4	P304A/T/SSP	Paper IVA	Physics of phonons and structural phase transitions
5	P304B/T/SSP	Paper IVB	Crystal Physics and physical properties

Practical

35	P305P	Paper V	General Physics lab-I (Common to all specializations)
36	P306P	Paper VI	General Physics lab-II (Common to all specializations)
37	P307P	Paper VII	Special Lab - I
38	P308P	Paper VIII	Special Lab - II

Details of credits and marks	
Number instruction hours per each theory paper per week	4
Maximum marks for each theory paper	100(80 semester exam + 20 internal evaluation)
Number of credits for each theory paper	4
Number instruction hours per each practical paper per week	16 (3 x 5 + 1 Tutorial)
Maximum Marks per each practical paper	50
Number credits per each practical paper	2
Total Credits per semester	24

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - Semester-III Syllabus

(For the batch admitted from 2018-2019 onwards)

P–301T

Paper – I: Core (Common for all Specializations)

MODERN OPTICS

Unit I: Principles of Lasers: Emission and absorption of Radiation –Einstein Relations, pumping Mechanisms – Optical feedback - Laser Rate equations for two, three and four level lasers, pumping threshold conditions, Laser modes of rectangular cavity –Properties of Laser beams.

Unit II: Laser Systems: Classification of laser systems –Gas, Liquid and Solid Lasers-Gas lasers and Energy level schemes: He- Ne, Argon, CO_2 Gas lasers, EXCIMER lasers- Applications. Solid State lasers: Ruby, Neodymium, Nd-YAG lasers –Dye lasers- Applications
Semiconductor lasers: Ga-As lasers and applications.

Unit III: Holography: Basic Principles of Holography- Recording of amplitude and phase- The recording medium-Reconstruction of original wave front- Image formation by wave front reconstruction- Gabor Hologram- Limitations of Gabor Hologram-Off axis Hologram- Fourier transform Holograms- Volume Holograms, Applications of Holograms- Spatial frequency filtering.

Unit IV: Fourier and Non-Linear Optics: Fourier optics- Thin lens as phase transformation – Thickness function- Various types of lenses- Fourier transforming properties of lenses –Object placed in front of the lens- Object placed behind the lens.

Non-Linear Optics-Harmonic generation- Second harmonic generation- Phase matching condition- Optical mixing- Parametric generation of light –Self focusing of light.

Recommended Books:

1. Opto Electronics- An Introduction–Wilson & JFB Hawkes 2nd Edition.
2. Introduction to Fourier optics –J.W. Goodman
3. Lasers and Non-Linear optics –B.B. Laud
4. Optical Electronics –Ghatak and Thayagarajan.
5. Principles of Lasers –O. Svelto
6. Laser fundamentals Silfvast Cambridge

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M.Sc. (Physics) - Semester-III Syllabus
(For the batch admitted from 2018-2019 onwards)

P – 302T

Paper –II: Core (Common for all Specializations)

ADVANCED SOLID STATE PHYSICS

Unit I: Electronic Properties: Introduction to band theory of solids. Fermi surface and Brillouin zones. Construction of Fermi surfaces. Extended, periodic and reduced zone schemes. Fermi surfaces in simple cubic, bcc and fcc lattices. Effect of electric and magnetic fields on Fermi surfaces. Anomalous and skin effects. De Haas-van Alphen effect.

Unit II: Dielectrics and Ferroelectrics: Macroscopic description of the static dielectric constant. Concept of local field. The electronic, ionic and orientational polarizabilities. Measurement of dielectric constant of a solid. Clausius-Mosotti relation. Behavior of dielectrics in an alternating field, elementary ideas on dipole relaxation. Classification of ferroelectrics- Ba TiO_3 and KDP. Theory of ferroelectrics, Spontaneous polarization and ferroelectric hysteresis.

Unit III: Magnetic Properties: Diamagnetism - Langevin's theory and quantum theory. Origin of permanent magnetic moment, Theories of paramagnetism, Paramagnetic cooling. Spontaneous magnetization Weiss theory of spontaneous magnetization. Nature and origin of Weiss molecular field, Heisenberg exchange interaction. Ferromagnetic domains and hysteresis. The Bloch wall, Neel's theory of anti-ferromagnetism. Ferrimagnetism, ferrites and their applications (basic concepts only)

Unit IV: Superconductivity: Occurrence of superconductivity. Experimental observations – persistent currents, effect of magnetic field, Meissner effect, Type I and type II superconductors. Isotope effect, entropy, heat capacity and thermal conductivity. Energy gap. Microwave and infrared absorption.

Theoretical explanations:-penetration depth, Coherence length London equations, Cooper pairs and elements of BCS theory. Giaver tunneling, Josephson effects (Basic ideas only). Elements of high temperature superconductors (basic concepts). Applications of superconductors.

Recommended Books:

1. Solid State Physics --A.J.Deckker
2. Introduction to Solid State Physics --Kittel
3. Solid State Physics --R.L.Singhal
4. Elements of Solid State Physics --J.P.Srivastava
5. Solid State Physics --M.A.Wahab

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - III Semester Syllabus

(For the batch admitted from 2018-2019 onwards)

P – 303/T /SSP

Paper –III

BAND THEORY AND ELECTRICAL PROPERTIES

Unit I : Band Theory Of Solids : Brillouin zones.- Brillouin zones in one, two and three dimensions., Density of states, Extended, reduced and periodic zone schemes; Nearly free electron model, Tight binding approximation and its application to simple cubic lattice, Calculation of energy bands- Cellular method, APW method, Pseudo potential method, OPW method.

Unit II : Fermi Surface : Introduction, Characteristics of Fermi Surface, Construction of Fermi surface, Fermi surface and Brillouin zones, Dynamics of an electron in electric field; Dynamics of an electron in magnetic field –Cyclotron frequency, Cyclotron mass, Onsager-Lifshitz quantization condition, Cyclotron resonance, Energy levels and density of states in magnetic field, de-Haas van Alphen effect.

Unit III : Transport Phenomenon In Metals: The Boltzmann transport equation, Electrical conductivity, Definition and experimental features – The Drude Lorentz theory, The Sommerfeld theory- Calculation of the relaxation time, The electrical conductivity at low temperatures, Matheissen's rule, Thermal conductivity, Wiedemann-Franz law, Hall-effect.

Unit IV : Electrical Transport Properties of Insulators : Hopping conduction; Temperature variation of electrical conductivity; Seebeck coefficient; Polarons- small polaron band conduction; large polaron band conduction; small polaron hopping conduction; Mott transitions; Ionic Conductivity; Superionic Conductivity- structure, defects and conductivity.

Recommended books

1. Principles of the theory Solids – Ziman
2. Solid state Physics - Singhal
3. Solid state Physics – H.C. Gupta
4. Elementary SolidState Physics – M.Ali Omar
5. SolidState Physics – M.A. Waheb
6. SolidState Physics – Kachava,
7. Principles of the solid state – H.V. Keer

G.Pulla Reddy Degree & PG College, Hyderabad

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - III Semester Syllabus

(For the batch admitted from 2018-2019 onwards)

P – 304A/T/SSP

Paper – IV A

PHYSICS OF PHONONS AND STRUCTURAL PHASE TRANSITIONS

Unit I : Phonon Physics : Theoretical background of lattice vibrations – Phonons and their properties – Crystal momentum – Conservation – Neutron diffraction from phonons – Experimental verification of dispersion relations – Thermal conductivity – Role of phonons – Thermal conductivity – Normal and Umklapp processes – Photon –Phonon interaction – TO and LO phonons – Liddane – Sach – Teller's (LST) relation – Applications – Infrared measurements, Raman effect – Theory of polaritons – Experimental measurement.

Unit II : Diffusion in solids : Solid state diffusion, Diffusion mechanisms, Self-diffusion, Impurity diffusion coefficient, Fick's second law, Diffusion coefficient, Experimental determination of diffusion coefficient, Various methods, Random walk diffusion, Diffusion in a simple cubic structure, Diffusion under external field, Nernst-Einstein relation, Kirkendall shift. Ionic conductivity, Ionic conductivity of alkali halides and effect of divalent impurities on ionic conductivity.

Unit III : Ferroelectricity and structural phase transitions : Introduction to ferroelectricity and phase transitions, The free energy expression to summarize characteristics of ferroelectrics, Soft modes in ferroelectrics, Structural phase transitions, Comparison with experiments, Symmetry of low temperature phases, Microscopic model of soft modes, Optical properties of ferroelectrics, other related properties including pyroelectricity, Piezoelectricity, Ferroelasticity and Antiferroelectricity.

Unit IV : Superconductivity : Instability of Fermi Sea and Cooper pairs, BCS ground state, manifestation of energy gap; consequence of BCS theory and comparison with experimental results, Quantization of magnetic flux, Giaever tunneling, Josephson effect – Phase coherence, D.C. and A.C. Josephson effects, Superconducting quantum interference devices (SQUIDS). Discovery of the phenomenon of High Temperature Superconductivity; Discovery of various types of HTSC materials, viz; - Y-, Bi-, Tl and Hg based materials. Preparation of HTSC materials by the solid state reaction method and their fundamental physical properties (Elementary treatment only)

Recommended Books

1. Solid state physics G.Burns;
2. Intermediate theory of crystalline solids – Animalu
3. Solid state physics – H.Ibach and H.Luth,
4. Solid state physics – Christ,
5. Solid state physics – Kachava
6. Solid State Physics - Dekker
7. Solid State Physics --Wahab.

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY

M.Sc. (Physics) - III Semester Syllabus

(For the batch admitted from 2018-2019 onwards)

P – 304B/T/SSP

Paper – IV B

CRYSTAL PHYSICS AND PHYSICAL PROPERTIES

Unit I : Elements of group theory : Introduction to crystallographic point groups, the five platonic solids, procedure for symmetry classification of molecules, class , matrix notation for geometrical transformations, matrix representation of point groups , reducible and irreducible representations, great orthogonality theorem and its consequences, Character tables for C_{2v} and C_{3v} point groups, Mullikan symbolism, Symmetry species.

Unit II : Elements of Ligand field theory and Electronic spectra: Concept of ligand field and crystal field. Free ion configurations- terms and states. Derivation of free ion terms for d_1 and d_2 configuration. Energy ordering of terms- Hund's rules. Strength of crystal fields, Crystal field potentials for O_h and T_d fields. Meaning of Dq. Construction of ligand field energy level diagrams- effect of weak crystal fields on terms. Splitting due to lower symmetries Electronic spectra of d_1 and d_9 systems.

Unit III : Crystal symmetry and physical properties : Development of theoretical formalism, tensors, Physical property and its tensorial representation . Quotient theorem, Symmetry in crystals - point groups and space groups, Crystal classes. Neumann's Principle. Fumi's method determining symmetry of physical properties, Pyroelectricity and crystal Symmetry, Dielectric constant and Crystal symmetry –triclinic, monoclinic, orthorhombic and cubic systems; Piezoelectricity and crystal symmetry- triclinic, monoclinic and cubic systems, Piezoelectricity in quartz. Elasticity and crystal symmetry – triclinic, monoclinic, orthorhombic and cubic systems .

Unit IV : Surface science : Introduction, Crystal shape and bond densities, Preparation clean surfaces, Low energy electron diffraction (LEED), Structure of surfaces, Examples of surface reconstruction, Interaction of gases with surfaces, Chemisorptions and co-adsorption, Photoelectron spectroscopy(PES), UPS, XPS, ESCA, Synchrotron radiation, Auger electron spectroscopy(AES), Electron Energy Loss spectroscopy (EELS), Extended X-ray absorption fine structure (EXAFS)

Recommended books

1. Chemical applications of group theory F.A. Cotton
2. Spectroscopy of molecules Veera Reddy
3. Ligand field theory B.N. Figgs
4. Physical properties of crystals J.F.Nye;
5. Physics of crystals S.Bhagavantam and S.Radhakrishna,
6. Solid State Physics G. Burns

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REVISED SYLLABUS FOR M.Sc. (PHYSICS)

IV SEMESTER

With effect from the academic year 2018 -2019 onwards

S.No	Paper code	Paper	Paper title
1.	P401T	Paper I	Nuclear Physics
2	P402T	Paper II	Spectroscopy
Solid State Physics(SSP)			
3	P403T/SSP	Paper III	Optical Phenomena in solids
4	P404A/T/SSP	Paper IVA	Resonance Phenomena in solids
5	P404B/T/SSP	Paper IVB	Studies on reduced dimensionality in solids

Practical

35	P405P	Paper V	General Physics Lab – I (Common to all specializations)
36	P406P	Paper VI	General Physics Lab – II (Common to all specializations)
37	P407P	Paper VII	Special Lab-I
38	P408P	Paper VIII	Special Lab-II

Details of credits and marks	
Number instruction hours per each theory paper per week	4
Maximum marks for each theory paper	100(80 semester exam + 20 internal evaluation)
Number of credits for each theory paper	4
Number instruction hours per each practical paper per week	16 (3 x 5 + 1 Tutorial)
Maximum Marks per each practical paper	50
Number credits per each practical paper	2
Total Credits per semester	24

DEPARTMENT OF PHYSICS, OSMANIA UNIVERSITY
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(For the batch admitted from 2018-2019 onwards)

P 401T

Paper - I Core (Common for all Specializations)

NUCLEAR PHYSICS

Unit I:
Nuclear Force And Nuclear Models: Systematics of nuclear force-strength, range, charge independence; Deuteron problem and its contribution to the definition of the Nuclear force. Exchange force theories- Majoranna, Bartlett, Heisenberg and Yukawa.

The liquid drop model, the semi empirical mass formula and its applications, The Shell model, states based on square well potential and harmonic oscillator potential Predictions-spins and parities of nuclear ground states, magnetic moments, electric quadruple moments

Unit II:
Nuclear Decay Processes: α-decay, Gamow's theory, fine structure of α-spectrum, alpha decay, systematics, neutrino of hypothesis, Fermi's theory of β-decay, Fermi-Curie plot, angular momentum, selection rules for β-decay, -decay, Multi-pole radiation, selection rules.

Unit III:
Nuclear Radiation Detection: Interaction of charged particles with matter, Bohr's theory, Bethe's formula. Range-energy relation. Stopping power. Measurements of range and stopping power. Interaction of gamma rays with matter-Photoelectric effect, Compton Effect and pair production. gamma ray detection using gas, scintillation and solid state detectors

Unit IV:
Nuclear Reactions: Classification of nuclear reactions, Kinematics and Q-value of reactions. Basic theory of direct nuclear reactions-Born approximation, stripping and pick-up reactions, characteristics, cross-sections, examples and applications. Compound nucleus formation. Theory of Fission and fusion reactions. Nuclear structure information from nuclear reactions.

Particle Physics: Elementary Particles Classification and their Quantum Numbers (Charge, Spin, iso-spin etc). Fundamental Forces, Conservation of Parity, Strangeness and Lepton and Baryon numbers, Quark model.

Recommended Books:

1. Concepts of Nuclear Physics; B.L.Cohen (TMH)
2. Introductory Nuclear Physics: Kenneth S.Krane (Wiley)
3. Nuclear and Particle Physics: Blin-Stoyle (Chapman and Hall)
4. Nuclear Physics; I.Kaplan (Narosa 2002)
5. Introductory Nuclear Physics: W.Wong
6. Introductory Nuclear Physics: S.B.Patel
7. Nuclear Physics: Tayal

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M.Sc. (Physics) - Semester-IV Syllabus
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P 402T

Paper –II Core (Common for all Specializations)

SPECTROSCOPY

Unit I

Atomic Spectra: Different series in alkali spectra (main features), Ritz combination principle, Terms for equivalent & non-equivalent electron atom, Term values in alkali spectra and quantum defect, L-S and j-j coupling; Energy levels and spectra; Spectroscopic terms.

Spin-Orbit interaction, doublet structure in alkali spectra, selection rules, intensity rules, alkali-like spectra, Lamb shift, many electron atoms, isotope shift; hyperfine splitting of spectral lines, selection rules. Lande interval rule

Unit II

Molecular Spectra: Types of Molecular spectra, Regions of the Spectrums, Salient features of rotational spectra, rotational spectra of diatomic molecule as a rigid rotator, Energy levels and spectra of a non-rigid diatomic molecule, effect of isotopic substitution on rotational spectra, salient features of Vibrational-Rotational spectra, vibrating diatomic molecule as a harmonic oscillator and as anharmonic oscillator. Diatomic molecule as rigid rotator and harmonic oscillator diatomic molecule as a non-rigid rotator and anharmonic oscillator

Unit III:

Raman and Infrared (IR) Spectra: Raman effect and its salient features, classical and quantum theory of Raman effect, normal vibrations of CO_2 and H_2O molecules, vibrational and rotational Raman spectra, Infrared spectroscopy; infrared spectroscopy –basic concept of IR spectroscopy –IR spectrophotometer –Principle and Instrumentation –FTIR principle and working –interpretation of data from Raman and IR spectroscopy.

Unit IV:

Nuclear Magnetic Resonance (NMR) and Electron Spin Resonance (ESR) Spectroscopy: Nuclear spin and magnetic moment, origin of nuclear magnetic resonance (NMR) spectra, Theory of NMR spectra, relaxation process –Bloch equations –chemical shift, experimental study of NMR spectroscopy, Experimental technique, ESR spectroscopy, origin and resonance condition –quantum theory –design of ESR spectrometer –hyperfine structure of ESR absorptions, fine structure in ESR spectra, ESR instrumentation, Applications of ESR.

Books Recommended

1. Elements of Spectroscopy - Gupta, Kumar, Sharma
2. Atomic Spectra & Atomic Structure - Gerhard Hertzberg
3. Introduction to Molecular Spectroscopy - G.M.Barrow
4. Molecular Spectroscopy - J.D.Graybeal
5. Atomic and Molecular Spectroscopy - Raj Kumar
6. Molecular Structure & Spectroscopy - G.Aruldhas
7. Introduction to Atomic Spectra - H.E.white
8. Fundamentals of Molecular Spectroscopy - C.N. Banwell and EM Mc Cash
9. Spectra of Diatomic Molecules - Herzberg
10. Spectroscopy Vol. I, II, III - Walker and Straughen
11. Principles of Magnetic Resonance - C.P.Slitcher
12. Electron Spin Resonance: Their Applications - Wertz and Bolton

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P 403T/SSP

Paper – III

OPTICAL PHENOMENA IN SOLIDS

Unit I : Optical Properties Of Solids: Introduction, Relation between dielectric and optical properties (macroscopic theory), Kramer-Kronig relations, Absorption of electromagnetic radiation, Photon-Phonon transitions, Inter band transitions, Direct and indirect band gap semiconductors - Absorption coefficients.
Optical Band Transitions: Frenkel and Wannier excitons and their absorption, Imperfections - exciton absorption below the band gap, Intra-band transitions - Absorption and reflection in metals, Hagen-Rubens relation, Raman, Brillouin and Rayleigh scattering, Magneto-optic effects: Faraday effect.

Unit II: Luminescence
General considerations of luminescence, exciton, absorption and emission processes of luminescence, Configuration coordinate diagram, Energy level diagram, radiative and non radiative processes, Decay mechanisms, Effect of doping and efficiency, Energy transfer and charge transfer, Different kinds of luminescence, Electro luminescence, Photoluminescence and Thermo-luminescence, Defects and color centers, Different kinds of color centers in the context of luminescence in alkali halides, Thallium activated alkali halides, Zinc sulphide phosphors.

Unit III : Photo-detectors
Photoconductors-dc and ac photo conductors, gain & band width, noise in photo conductors, junction photo diodes, PIN diodes, quantum efficiency & frequency response – hetero junction photo diodes, avalanche photo diodes, noise performance of avalanche photo diodes – comparison of avalanche and PIN diodes.

Unit IV : Photo-voltaics
Photovoltaic effect, Types of interfaces, homo junction, hetero junction and Schottky barrier- Choice of semiconductor materials for fabrication of homo junction solar cells, equivalent circuit of a solar cell, Solar cell output parameters – Fill factor, conversion efficiency, quantum efficiency, effect of series and shunt resistance on the efficiency of solar cells, Variation of open-circuit voltage and short circuit current with intensity of incident light, effect of temperature on I-V characteristics. .

References:

1. Solar cells – Charles E. Backus, IEEE Press.
2. Fundamentals of Solar cells, Farenbruch and Bube.
3. Principles of theory of solids – Ziman, Vikas Publishing House, New Delhi.
4. Solid State Physics – G. Burns
5. Luminescence and Luminescent Materials – Blasse
6. Solid State Physics – Dekker.
7. Optoelectronic devices _ P. Bhattacharya
8. Physics of semiconductor devices – S. M. Sze.
9. Elementary solid state physics – M. Ali Omar

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P404A/T/SSP

Paper – IVA

RESONANCE PHENOMENON IN SOLIDS

Unit I : Magnetism In Solids

Ferromagnetism - Ferromagnetic coupling, Theory of spin waves, magnons in Ferro magnets; Bloch $T^{3/2}$ law, **Anti-ferromagnetism** – Molecular field theory, susceptibility and Neel temperature; **Ferrimagnetism** – susceptibility variation with temperature, Neel's theory, **Ferrites** - Structure, properties and applications; Novel magnetic materials – GMR/ CMR materials.

Unit II : Nuclear Magnetic Resonance

Nuclear magnetic resonance (NMR), Basic principles of NMR, Resonance condition, Spin-lattice and Spin-spin relaxation mechanisms, Bloch's equations and complex susceptibility, Chemical shift, Bloch diagram of NMR spectrometer, Analysis of the spectra, Applications of NMR.

Unit III : Electron Spin Resonance

Principle of Electron spin resonance , Nuclear hyperfine interaction, crystal field theory, splitting of energy levels for octahedral and tetrahedral fields in transition metals; rare earth and actinide ions, Experimental details of Electron spin resonance spectrometer; Analysis of ESR spectra.
Elements of Nuclear Quadrupole Resonance (NQR), construction and working of NQR spectrometer

Unit IV : Mossbauer Effect

Resonance fluorescence/Natural and Doppler broadening of lines, Qualitative theory of recoil less gamma ray emission, Mossbauer effect, Temperature dependence of recoilless process, Debye-Waller factor, Experimental study, Mossbauer spectroscopy, Quantum mechanical theory of Mossbauer effect, Isomer shift, Magnetic hyperfine interactions, Electric quadrupole interactions, Applications of Mossbauer effect.

Recommended books

1. Elementary theory of solid state Physics -- J.P. Srivastava.
2. Mossbauer effect- Principles and applications – G.K.Wertheim,
3. Mossbauer spectroscopy – N.N.Greenwood and T.C.Gibb,
4. Solid State Physics – Singhal;
5. Horizons of Physics, Vol. I, --Wiley Eastern Publishers

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P 404B/T/SSP

Paper – IV B

STUDIES ON REDUCED DIMENSIONALITY IN SOLIDS

Unit I
Two Dimensional Solids - Quantum-Well Device Structures
A review of quantum mechanics - infinite deep rectangular potential well, Basic concepts of artificial structures; Introduction to Semiconductor hetero-junction super lattices, Properties of semiconductor super lattices - Optical absorption, Resonance tunneling, Negative differential conductivity, Modulation doped hetero-junction super lattices, n-i-p-i structures, Inversion layers in MOSFETS and MODFETS, Metallic super lattices and their preparation, characterization and properties.

Unit II
One and Zero Dimensional Solids
Definitions, Zero-dimensional systems, Fullerenes, Quantum dots and their optical and electronic properties; One-dimensional systems: one-dimensional metals, Peirls distortion, conjugated polymers, Nano-tubules, Quantum wires (elementary treatment only)

Unit III
Preparation of Thin Films
Vacuum evaporation: Types of evaporation sources – Resistive heating, electron beam evaporation, two source evaporation – Flash evaporation – Laser ablation, Epitaxial deposition: Vapor-phase epitaxy, Liquid-phase epitaxy, molecular bean epitaxy- Thickness distribution of evaporated films (Point and Ring sources). Sputtering : Glow discharge, dc and RF sputtering, Reactive sputtering, magnetron sputtering, Ion beam deposition. Chemical methods: Chemical Vapor deposition (CVD), Plasma chemical vapor deposition(PCVD), Metal organic chemical vapor deposition (MOCVD).

Unit IV
Insulator Thin Films
Metal insulator contact-Mott-Gurney contact- Schottky contact- Conduction in insulator films-Schottky emission-Poole-Frenkel emission-Thermally activated hopping-Direct tunneling-Space charge limited current-Photo conduction-Photovoltaic effect-Voltage controlled negative resistance-Experimental techniques for photo conduction.

Recommended Books:

1. Fundamentals of thin films - Goswamy
2. Thin films - K.L.Chopra
3. Semiconductor Devices - Physics and Technology - S.M.Sze
4. Hand book of nanostructred materials and nanotechnology
   (Vol. 1-4) Ed. By Hari Singh Nalwa
5. Nano crystalline materials – H. Gleiter
6. Nanophase materials - R.W. Seigel
7. Solid State Physics – G.Burns
8. Physics and Chemistry of Solids - S.R.Elliott
9. Non-Conventional energy sources, B.H. Khan, Tata Mc Graw-Hill, 2006
10. Non-Conventional energy sources, G.D. Rai, Khanna Publishers, 4th Edn, 2000.