NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (Solid state physics and Crystal growth)

PHY 302 Solid State Physics - I

(W.e.f. from June, 1993)

1> Formation of crystals : Crystal growth :

Velocity of growth, Theories of growth, Mechanism of growth, Twining Growth twins, Deformation twins, Transformation twins, Growth in the solid state, Recrystallization, Martensite transformation. ...6 Periods

2> Transformation in crystals :

Elements of thermodynamics- Introduction: Free energy calculation. Equilibrium transformations- Ist and IInd order transformations, order-disposer transitions, Transformations in complex structures. Equillibrium diagrams- The phase rule, Solid solutions, Complex diagrams, Kinetics of transformations. ...6 Periods

3> Mechanical properties of crystals :

Classification of properties, Properties of engineering importances, Anisotrophy in crystals, Preferred orientation in polycrystalline aggregates, Elastic deformation , Single crystal, polycrystalline aggregates, Plastic deformation, Slip in angle crystals, Mechanics of deformation fracture. ...8 Periods

4> Imperfections in atomic packings :

Types of imperfections, Discovery of imperfections, classification of imperfections, Point defects, Frankel defects, Disordered crystals, Line defects, Large angle boundries, Small angle boundries, Stacking faults. ...8 Periods

5> Shear strength of single crystals :

Slip, Dislocations, Burgers vectors, stress field of dislocations, Low angle green boundries, dislocation densities, dislocation multiplication and slip, dislocations and crystal growth, Whiskers. ...7 Periods

6> <u>X-ray, electron and Neutron diffraction in crystals</u> :

Emission of X-rays, absorption of X-rays, The geometry of diffraction, The intensity of the diffractedbeam, X-ray diffraction methods, The uses of X-ray diffraction techniques, Electronic diffraction neutron diffraction, Zeolities.   ...<u>5 Periods</u>

<u>REFERENCES</u> :

1. Introduction to solids   - L.V.Azaroff

2. Solid state physics   - A.J.Dekker

3. Introduction to solid state physics   - C.Kittle

4. The physics of Engineering solids   - T.S.Hutchison,D.C.Baird

5.Dislocation   - Hull

6. X-ray diffraction procedures   (Accde. Press)

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5> Vibrational Spectra :

Vibrations of a single particle, vibrations of two particles connected by a spring (classical), Harmonic oscillator, vibrational energies of diatomic molecules, interaction of radiation with vibrating molecules, vibrational spectra of diatomic molecules, anharmonic oscillator, deduction of molecular properties from vibrational spectra of diatomic molecules. (5 Periods, 8 mks)

6> Rotation-Vibration Spectra :

Diatomic vibrating rotator coupling of rotation and vibration, rotation-vibration spectra, selection rules and transitions for the vibrating rotator, intensities in rotation and vibration spectrum, Parallel and perpendicular bands of Linear molecules, Isotope effect-vibration, rotation. (5 Periods, 8 mks)

7> Electronic Spectra of Diatomic Molecules :

Electronic energy, potential energy curves, stable and unstable molecular states, vibrational structure of electronic transitions, general formula, graphical representation, isotope effect, rotational structure of electronic spectra, the branches of band, band head formation, shading of bands : Fortrat diagram, isotope effect, intensities in electronic bands-vibrational structure-Fanck condon principle, obsorption and emission, Intensity distribution in the rotational structure, $^1\Sigma - ^1\Sigma$ transition.

(7 Periods, 12 mks)

REFERENCES :

1. Atomic Spectra   — White
   (For topics 1 to 3)

2. Introduction to Molecular Spectroscopy   — C.M.Barrow
   Mc Graw Hill, International Edition
   (For topics 4 to 6).

3. Spectra of diatomic molecules   — Hersberg
   (For topic 7)

4. Atomic structure and chemical bond   — Manas Chanda
   Mc Graw Hill

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

PHY-301   M.Sc. (PHYSICS) PHY 301

Atomic and Molecular Physics

(W.e.f. from June, 1993)

1> Atom model for two valence electrons :

ll coupling, ss coupling, LS coupling, Pauli exclusion principle, coupling schemes for two electrons, factors for LS coupling, Lande interval rule, jj coupling branching rule, selection rule, intensity relations. Magnetic moment of the atom, Zeeman effect, intensity rules, calculation of Zeeman pattern, Paschen back effect LS and jj coupling and Paschen back effect, Breits scheme for derivation of spectral terms, Paulis exclusion principle.   (10 Periods. 18 mks)

2> Complex spectra :

Displacement law, alteration law of multiplicities, vector model for three more valence electrons, Lande interval rule, inverted terms, Hund's rule.

Zeeman effect and magnetic quantum numbers in complex spectra magnetic energy and Lande g factor, Paschen back effect in complex spectra.   (8 Periods. 12 mks)

3> Hyperfine structure :

Introduction, hyperfine structure and Lande interval rule, nuclear interaction with one valence electron, hyperfine struction of two or more valence electrons, Zeeman effect in hyperfine structure, Back Goudsmit effect in hyperfine structure.   (6 Periods. 10 mks)

4> Pure Rotation Spectra :

Rotation of a linear system (classical and quantum mechanical), rigid rotator, rotational energy levels and their populations, interaction of radiation with rotating molecules, rotational spectra of rigid rotators, selection rules for linear molecules, determination of moment of inertia and bond length from rotational spectra, relative intensities of spectral lines, Stark effect in molecular rotational spectra, molecular rotation-nuclear spin coupling.

(7 Periods. 12 mks)

Any one of the following (Course PHY 403) :-

PHY 403 A :   Crystal growth and their characterization

PHY 403 B :   Microprocessor

PHY 403 C :   Numerical methods and Computer Programming

PHY 404   :   Special Laboratory - II

PHY 405   :   Project

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (SOLID STATE PHYSICS)

Semester-wise distribution of Cources = (W.e.f. June,1993)

Sem. :- I

PHY 101   :   Methods of Mathematical Physics

PHY 102   :   Quantum Mechanics

PHY 103   :   Classical Mechanics

PHY 104   :   Electronics (Wave-shaping and Circuit design)

PHY 105   :   General Laboratory - I

Sem. :- II

PHY 201   :   Statistical Mechanics

PHY 202   :   Solid State Physics

PHY 203   :   Electrodynamics

PHY 204   :   Digital Electronics

PHY 205   :   General Laboratory - II

Sem. :- III

PHY 301   :   Atomic and Molecular Physics

PHY 302   :   Solid state physics - I

Any one of the following (Course PHY 303) :-

PHY 303 A :   Physics of Semiconductor Devices

PHY 303 B :   Microwave Electronics

PHY 303 C :   Vacuum tech. and thin film physics

PHY 304   :   Special Laboratory - I

PHY 305   :   Project

Note : At end of the IIIrd Sem. assessment of PHY 305 Project Course for the first half (out of 20 marks) must be submitted to the University office.

Sem. :- IV

PHY 401   :   Nuclear Physics

PHY 402   :   Solid state physics - II

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (Physics) PHY 404

List of experiments (W.e.f. from June, 1993)

Special Lab.- II (Microprocessor and Computer Programming)

Note :- At least SIX experiments from each group

Group A : Microprocessor

i> Read two digit hexadecimal number through keyboard and convert it into binary form.

ii> Read string through keyboard which is terminated by any specified character and reverse the string.

iii> Write a program for four digit hexadecimal counter.The counting should stop and resume by pressing any key.

iv> Temperature measurement by using ADC.

v> Read data through thumbwheel switches and display it on moniter and 7 segment display.

vi> Write a program for controlling relay switches, provide delay of one second.

vii> Average the given set or data and display the result in decimal form.

viii> Microprocessor controlling function generator (Square,Traingular and Ramp)

ix> Steeper motor speed control using microprocessor.

x> Interfacing of eight bit ADC with microprocessor.

Group B : Computer programming (FORTRAN 77)

i> To solve a third order equation using one of following method.
   a> Successive appreximation
   b> Newton Raphson method
   c> Falsi position method

ii> To integrate the given function by using Trapezoidal or Simpson rule.

iii> Interpolation using Lagranges interpolation formula. (Fitting fourth order formula)

iv> To find the solution of simultaneous linear equations by using Gauss elimination method or Gauss seidal method.

v> To solve second order differential equation by using one of the following method.
   a> Euler´s method
   b> Euler´s modifide method
   c> Runge-Kutta method

vi> Draw a flow chart and write a programme to calculate sine/cosine function by using Tayler´s series and compare with Library function.

vii> Find the inverse of matrix using Jacobi method.

REFERENCES :

1> Solar energy thermal processes - J.A.Duffie and W.A.Beckman

     (Wiley Interscience Publication, 1974)

2> Solar Energy Conversion.

     (An Introductory course)

 Editors:-

   A.E. Dixon and J.D. Leslie

     (Pergaman press)

3> Solar energy (Principles of thermal collection and storage)

    - S.P. Sukhatme

    (T M H , New Delhi)

4> Sun power

    - J.C. Mveigh

    (Pergaman press, 1983)

5> Solar energy engineering

    - A.A.M. Sayigh

    (Academic press, 1977)

6> Principles of solar engineering

    - F. Kreith and J.F. Kreider

    (McGraw Hill, 1978)

M.Sc. (Physics) (W.e.f. from June, 1993)

PHY 403 C Solar Energy

1> Importance of solar energy, World's production and reserves of commercial energy sources, India's production and reserves, energy alternatives.

2> Nature of solar radiation, sun as a fusion reactor, spectral distribution of solar radiation, seasonal variation in the solar radiation, measurement of global and diffuse solar radiation, various routes for converting solar energy into different forms.

3> Solar thermal devices :

Basic principles, different types of solar collectors, energy balance equation, heat-losses and efficiency of the solar collector. Solar cooker, domestic hot water systems, Industrial hot water system, solar dryers solar pond, solar distillation solar furnace, solar refrigeration, solar power generation.

4> Flat plate collectors :

Theory of flat plate collectors, energy balance equation, evaluation of heat losses and efficiency of solar collectors.

5> Selective coating for solar thermal devices :

Ideal characteristics of selective coating, different types of selective coating, material and techniques for making selective absorbers. effect of selective coating on the efficiency of solar thermal collectors.

6> Soalr collectors :

Point focus, line focus, soalr concentrators, cylindrical, paraboloid, compound paraboloid type solar concentrators, Fresnel lens. Theory of solar concentrators and their efficiency. Applications of solar concentrators.

7> Storage of solar energy :

Thermal storage, Electrical storage, Chemical storage, Hydro storage.

NORTH MAHARASTRA UNIVERSITY, JALGAON

M.Sc(PHYSICS) (W.e.f. from June, 1993)

PHY 403 B

Vaccum Technology and Thin Film Physics

1. Various ranges of vaccum, conductance,impodance,speed,pump-down time
and thin relations.   (2 periods)

2. Pumps and Gauges for H.V. and U.H.V. : Rotary Diffisuion, Getter
pumps,Evapouration, sputtenation Molecular drug,Cryogonic and orgitron
pump.   (6 periods)

3. Method of producing thin films: Different methods chemicals CVD,
Vaccum evaporation and sputtering. Parameters governing thin films
different types of sources, Working of Hig-vaccume systems, Theory of
Cosine law of omission.

4. Thickness measurenments: Optical interferences techniques, Multiple
beam interforometry, Tolcksky technique,Gravimatric method.

                                             (5 periods)

5. Monitoring of film thickness: Quarts crystal monitor, optiical
thickness monitor.   (3 periods)

6. Nucleation: Thermal accomodation coefficients, capilarity model,
sperical cap and disc. Atimatic model and Comparison, varios states of
growth.

7. Mechanical properties:Adhesion and its measuremets with various
methods, stress measurements with various methods. (4 periods)

8. Electrical properties:- Boltzman equation, Fuch-Sondhemir theory,
TCR and its variation, Resustance variation of very thin films, Hall
effect.   (5 periods)

9. Optical properties, Reflaction,Refraction,Fresnels coefficients,
Complex refractive index, Ellipsometry Reflecting and antireflecting
films.   (5 periods)

REFERENCE BOOK:-

1. Hand Book of Thin film technology :-   Maissel and Glang.
2. Vaccum Deposition of Thin Films   :- L. Holand.

M.Sc. (PHYSICS) PHY 403 : $\langle A \rangle$

Radio communication and T.V.

(W.e.f. from June, 1993)

1> Modulationn and transmitters :

Theory of amplitude, frequency and phase modulation, AM and FM modulation system, vestigial side band filters and modulation pulse modulation, block diagram of transmitter and its function, T.V.scanning synchronization of pulses, vision signal mixing , composite video signal,T.V.camera tubes, vidiocon image orthicon,m plubicon, use of frequency multipliers and duplixer, nesative polavity in T.V. transmission, information content capacity

2> Detection and Reception :

Demodulation of FM,Block diagram of T.V. recevier, tuner and mixer stage, IF amplifier, detection and video amplifier, sunc pulse seperation deflection-circuits.

3> Propagation :

Nomenclature of upper atomsphere, ionorphere grounds and space wave propagation,tropospheric and ionospheric propagation, effect of ertth's curvature,fading,duct propagations, reflection in ionosphere, MUP, critical frequencies of differen layers.

4> Antenna :

Characteristics of antenna system, wire aerials, arrays, Yagi with design,Rhobatic aerial. loop aerials pattern multiplication.

5> T.V.Communication System :

Micowave links,satellite communication.

REFERENCES:

1. Electronics(fundamentals and applications)   - Ryder

        * 4 th Edition *

2. Antenna Engineering   - Kraiss

3. Basic Television   - Anil maini

4. Basic Television   - Grob

5. Antennas   - Prasad

6. Electronics and Radio Engineering   - Terman

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7> Inturrupts :

Need of Inturrupts; study of hardware and software Inturrupts, study of Inturrups controller (IC 8259)   (2 Lectures)

8> Introduction to 8086, 80386 and 80286 in brief   (2 Lectures)

REFERENCES :

1) Microprocessor Fundamentals (Schaum's series)

                                        - Roger L. Kokhein (M.G.H.)

2) Introduction to Microprocesser Softwar, hardware, programming by

                                        - L.A.Leventhal (M.G.H.)

3) 8080/8085 Assembly language programming

                                        - L.A.Leventhal (M.G.H.)

4) Microprocessor Architecture .Programming and application

                                        - Ramesh Goankar (WEL Bombay.)

5) MC5 85 Users manual Inter Corp. USA.

6) Introduction to microprocesser

          (3 rd Ed.)   - A.PMathur (TMG)

7) Introduction to micorprocessor

          (Vol. 1 & 2)   - Adam Osborn (MGH)

8) Data manual for Microprocessor family Intel Corpusa

9) Introduction to micorprocessor   - Khambate

10) Microprocessor and its applications   - B.Ram

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (PHYSICS) PHY 402

Microprocessor

(W.e.f. from June, 1993)

1> Introduction to Microcomputor :

Memories, Microprocessor (C.P.U.), I/O devices,   (2 Lectures)

2> Memory devices :

A) Biportar, Unipolar memeries, Random access memory (RAM) Read only momory (ROM,PROM,EPROM.)

B) Study ofmemory chips : 2174,2716   (6 Lectures)

3> Architecture of 8085 :

Detail block diagram with pin configuration   (3 Lectures)

4> Instruction set of 8085 :

A) i) Instruction types

ii) Classification of instruction

iii) Addressing modes

iv) Instruction set of 8085.

B) Programming- simple programs use of subroutine   (12 Lectures)

5> Interfacing memory and I/O devices :

Introduction

i) Address space partitioning, address deceding   .

ii) Momory Interfacing

iii) Lata transfer schemes........

a) Programmed date transfer,

Synchronous   transfer, Asynchronoces transfer,   Interrupt driven data transfer, Intrurrupts in 8085.

b) Direct memory access data transfer: DMA transfer in an 8085 bassed system   (5 Lectures)

6> Study of interfacing devices :

i) Programmatice peripheral interface (Ic 8255)

ii) Programmable interval timer (IC 8253) with programming.

iii) Keyboard ontroller and display controller (IC 8279)

(7 Lectures)

5> Elementary Particals :

Classification on the basis of type of interaction,quantum numbers, Isospin,strangeness,parity,Decay of elementry particles.Conservation laws and symmentry properties of elementry particles,Quark model.

(5 Periods. 10 mks)

6> Cosmic Rays :

Origin of cosmic Rays, primary and secondary radiations,cosmic ray showers, Geomagnetic effects,absorption of cosmic rays.

(4 Periods. 8 Mks)

REFERENCES :

1) Atomic Nucleus   - R.D.Evans.

2) Nuclear Physics   - D.G.Tayal.

3) An Introduction to Nuclear Physics   - Bhide,Joshi.

4) Concepts of Nuclear Physics   - B.L.Cohen.

5) Basic Nuclear Physics   - B.N.Srivastava.

6) Introduction to Nuclear Physics   - Herald Enge.

7) Introduction to Nuclear Physics   - David Halliday.

8) Elements of Nuclear Physics   - M.L.Pandya and Yadav.

9) Nuclear Physics   - Irving Kaplan.

10) Nuclear Physics   - Alex E.S.Green.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (PHYSICS) PHY 401

Nuclear Physics

(W.e.f. from June, 1993)

1> Nuclear Structure :

Nuclear masses and binding energies,Defination of seperation energy,
Basic principles of mass spectroscopy, Neir's and Robert's mass
spectroscopes, Bainbridge's and Jordon's mass spectroscopes.

Size of the nucleus, determination of radius by electron scattering
method and by Coloumb energy difference method.

Nucleaur angular momentum and magnetic dipole moments, Electric
quadrupole moment (classical derivation only),Quadrupole interaction
energy.   (10 Periods, 20 mks)

2> The Nuclear Two -Body Problem :

The Deuteron, ground state of the deuteron (Simple theory).

Nucleon-Nucleon Scattering : Phase shift analysis,scattering length,
effective range,Coherent scattering by hydrogen molecule (Ortho and
para hydrogen) Born approximation.   (10 Periods, 20 Mks)

3> Nuclear Reactors :

Brief revision of fission chain reation, General reactor design,
Nuclear reactor types,research reactor (Heterogeneous) Power reactor
(Fast breeder reactor), reactors in India (Apsara,Cirus,Purnima)

                                                  (6 Periods, 12 Mks)

4> Nuclear Particle Accelarators :

The Principle of phase stability, synchro-cyclotron, Microtron,
electron-synchrotron or Bevatron.   (5 Periods, 10 Mks)

M.Sc. (Physics) PHY 304

List of experiments (W.e.f from June, 1993)

Special Lab.- I

Note :- At least SIX experiments from each group

Group A:

    i) Wave shaping circuits.
    ii) Instrumentation amplifier.
    iii) PAM, PWM, PPM using IC - 555.
    iv) S M P S of 5 Volt and 1 Amp.
    v) Inductance Simulation.
    vi) Phase detection using PLL.
    vii) Optocoupler using IC -741,LED and Phototransistor.
    viii) DC to DC Converter.
    ix) Programmable UJT Oscillator.
    x) Study of filters.(band reject and Notch filter)
    xi) To study the performance of microwave components.
    xii) To study horn antenna characteristics.
    xiii) Susceptibility of $MnSO_4$ by using Guoy's method.
    xiv) To study Fraunhoffer diffraction by He-Ne laser.
    xv) To determine the pumping speed of rotary pump.
    xvi) Study of phase diagrams by direct cooling curves.
    xvii) Study of dielectric behaviour of $BaTiO_3$ sample.

Group B:

    i) Shift register IC - 7495.
    ii) UP/DOWN counter IC - 74192.
    iii) Digital multiplexing (F-1 and F-2 generated by timer IC-555.)
    iv) Conversion of temperature to digital signal using temperature transducer (AD 590) and 8-bit ADC.
    v) Half and Full substractor.
    vi) 1 : 10 line multiplexing.
    vii) Study of J-K master slave flip-flop.
    viii) Design, build and test a code converter circuit.
    ix) To study the parity generation (odd and even) and parity checking using proper circuit.
    x) To study core-loss in transformer.
    xi) To study Klystron characteristics.
    xii) Thin film deposition by evaporation method.
    xiii) Measurement of thickness of thin film.
    xiv) study of power distribution within laser beam and determine the laser beam quality.
    xv) Study of flat-plate collector.
    xvi) Measurements of Ultrasonic velocity in liquids.
    xvii) Study of the dispersion relation for the monoatomic lattice and diatomic lattice.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc(PHYSICS)

PHY 3Ø3 C (W.e.f. from June, 1993)

Laser and Their Application

1. Charecteristics of Laser light. Light waves, monochromaticity, Directionality, Brightness, Interference, the laser speekly pattern, Coherence, polarization.

2. Basic Laser Principle : The Active medium, the automatic basis fpr laser action Laser pumping, creating a population inversion Optical Feedback the Laser resonator.

3. The Laser output and its modification. Absorption and emission lineshape,Brocadenning lasermodes Optical resonance, pump rate, gain oscillations, power output , gain saturation. Selection of laser emission linesintracavity elements. Q-switching and mode locking.

4. Laser exposition(Type of Laser)

Gas lasers, Doped-Insulator Lasers, Semiconductor lasers, Dye lasers, extending the range. Design features and operating charecteristics.

5. Application of Laser:-(Brief review) Holography.

civil engineering, medicine and surgery, High power laser application A power primer, material processing , laser Fusion.

REFERENCE BOOKS:-

1. An Introduction to lasers and their applications D C O shea, W-Russell and W.T. Rhodes(1977) Addision-Wesley Pyble.Col.

2. Laser Application to optics and sepectroscopy. Vol. 1, II,S.F. Jaco Bs. M. Sargent at. al. (1973).

3. Laser Application- Ed. Monte Ross, Vol. III (1977).

By Academic press.

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5. MICROWAVE Semiconductor Devices:-

Microwave transistors:Principle, operation microwave charecteristics, current gain cutoff frequency, power gain

Varactor diode: Principle, opearation use of varector diode for frequency multiplication.

microwave Tunnel diode. principle of operation, microwave field effect Transistors. FETS,JFSTS,MESFETS principle of operation microwave charactoristics,drain current out off frequency.

(6 period, 12 marks)

REFERENCE BOKKS:

1. Foundation of microwave engineering – Collin R. E.
2. Introduction to microwaves – Atwater
3. Introduction to microwave – Wheeler
4. Microwave semiconductor devices and their circuit application. – Watson
5. Microwave circuits and elements – M.L.Sisodia
6. Electromagnetic fields and waves – Jorden
7. Microwave – K.C.Gupta.
8. Electronic communication – Sangeeva Gupta

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1. ELECTROMAGNETIC FILED AND WAVE EQUATIONS:

Intruduction to microwave freqencies. Coparison betweeen Radio and microwave frequency aspects. Electron motion in electric, magnetic and electromagnetic field. Electric and magnetic wave equations. Uniform plane wave. Plane wave propogation in free space poor conductor good conductor. Boundry conditions. Plan wave reflection normal incidence only. Pointing theorem. (10 periods. 20 Marks)

2. MICROWAVE TRANSMISSION LINE AND WAVEGUIDE:

Transmission line equation and their solution-open and terminated transmission lines. Line impedences. Line admittance. reflaction coefficient, transmission coeficient. Standing wave ratio. Smith chart. Single stub matching double stube matching.

Wave duides:-Rectangular, circular, Rectangular waveguides solutions of wave equation in rectangular co-ordinates TE and TM modes in rectangular waveguide power transmission. Power losses and excitation modes in rectangular waveguid. (10 periods. 20 marks)
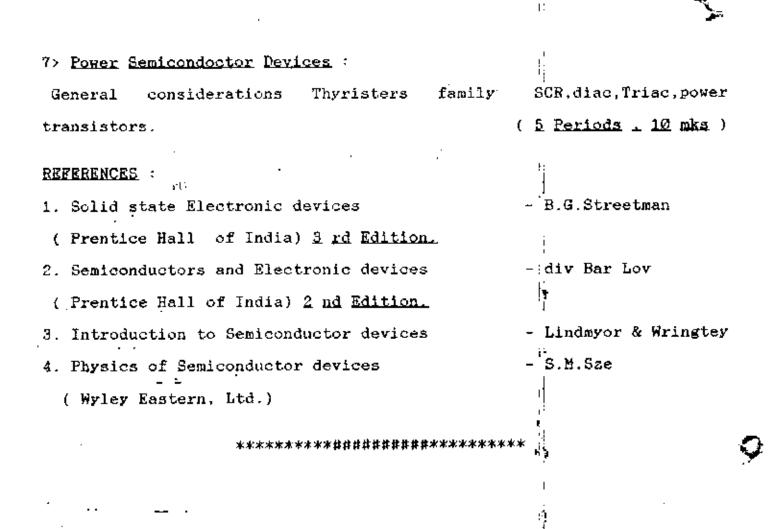
3. MICROWAVE COMPONENTS:

Rectangular cavity resonator circular cavity resonator of cavity resonator re-ontract caities. E-flame (Series tee) H-plane (Shunt fee), magic tee (Hubrid tee) wave guide corners bends and twists Direectional conplers, two hole difectional couplers, Mocrowave circulars isolators. Hybrid couplers. (8 periods. 16 marks)

4. MICROWAVE GENERATORS:

Klystrons, Velocity modulation, bumching process, output power and beam loading efficienty of klysteren.

Reflax Klystron Velocity modulation. Power output efficiency electonic admittance.

Travelling wave Tube: Construction operation

7> <u>Power Semicondoctor Devices</u> :

General   considerations   Thyristers   family   SCR,diac,Triac,power

transistors.   (<u>5 Periods . 10 mks</u>)

<u>REFERENCES</u> :

1. Solid state Electronic devices   - B.G.Streetman

 (Prentice Hall of India) <u>3 rd Edition.</u>

2. Semiconductors and Electronic devices   - div Bar Lov

 (Prentice Hall of India) <u>2 nd Edition.</u>

3. Introduction to Semiconductor devices   - Lindmyor & Wringtey

4. Physics of Semiconductor devices   - S.M.Sze

   (Wyley Eastern, Ltd.)

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Physics of Semiconductor Devices

(W.e.f. from June, 1993)

1> Introduction to Semicondutors :

Types of semiconductors-Elemental compounds, properties of Silicon,Germanium and Galium arsenide Semiuconductors, Direct indirect semiconductors, charge carriers Mobility and Majority carriers, Excess carriers and life time, Diffusion of carriers and Eisteins relation Intrinsic somiconductors and position of Fermi level, degenerate and non degemerate semiconductors carrier concentration in non degenerate and degenerate cases,current transport internal fielded to non uniform doping.   (10 Periods. 20 mks)

2> Measurement of Electrical Parameters of Semiconductors :

Resistivity (Four Probe method) Mobility, carrier-concentration, carried types, by Hall effct Hayne-Shockly experiment for measurement of mobility of minority carries.   (6 Periods. 12 mks)

3> Semiconductor Diodes :

Tunnel diode, degenerate semi-conductor, principle of operations,circuit applications.

Varactors diode,capacitance of p- n junction, Princple of operation, equivalent circuit application, rectifierdiodes dependance of current and voltage specifications, switching diodes.

Zener diodes- reverse bias breakdown Avalenche and Zener breakdown, device designfor particular breakdown voltage.'   (7 Periods. 14 mks)

4> Bipolar Junction Transisters :

Ebers Moll Expressions switching characteristics, transient and A.C.conditions secondary.   (4 Periods. 8 mks)

5> Field Effect Transistors :

Metal semiconductor, FET metal Insulator, semiconductor, Ideal MOS capacitor,surface fieldeffect transistors.   (4 Periods. 8 mks)

6> Opto Electronic Devices :

Solar cells photodetectors   (4 Periods. 8 mks)

M.Sc(PHYSICS) (W.e.f. from June, 1993)

PHY 302

NUMERICAL METHODS AND COMPUTER PROGRAMMING

1. COMPUTER PROGRAMMING:

A)   FORTRAN-77: Charector set , Constants,Variables. Expressions (Arithmatics, Relational and Logical), Assignment statements, Input statement, output statement,control statements(GO TO, If, DO Loops)

(12 periods)

B)   Subprogramme : -FUNCTION, SUBROUTINE Subprogram, Common statemet equivalanic statemt.   (7 periods.)

2. NUMERICAL METHODS IN FORTRAN:

In the following topic on numerical methods,students are expected to be able to write programs, subprogrsms or programs segments as well as perform numerical calculations using electronics calculators and mathematical tables.

a)Inerative methods for solution of Algebric equations-

Derivation of formula for successive Bisection, Newton Rapson method Regula false and their comparison.   (6 periods)

b) Integration - Traperoidal, simpson 1/3, Simpson 3/8 Rules DErivation and Applications.

c) Interpolation:-Linear interpolation, Langrages Interpolation.

(4 periods)

d) Solution of Simulataneous equation - Guass Elimination method pivoting all conditioned equations in Guass-Seidal Iterative method.

(5 periods)

REFERENCE BOOK:

1.Programming with FORTRAN - Lipsehutz (Seaum series,MC Graw Hill pub)

2. Computer Programming in FORTRAN-77   :- Davis

3. Computer programming in FORTRAN-77   : Ramkumar

4. Computer programming in FORTRAN-77   : V. Rajaraman

5. Computer oriented numerical methos   : V. Rajaraman

6. Introductory methods of Numerical
   Analysis   : S.S. Sastry.

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5> Vibrational Spectra :

Vibrations of a single particle, vibrations of two particles connected by a spring (classical), Harmonic oscillator, vibrational energies of diatomic molecules, interaction of radiation with vibrating molecules, vibrational spectra of diatomic molecules, anharmonic oscillator, deduction of molecular properties from vibrational spectra of diatomic molecules. (5 Periods, 8 mks)

6> Rotation-Vibration Spectra :

Diatomic vibrating rotator coupling of rotation and vibration, rotation-vibration spectra, selection rules and transitions for the vibrating rotator, intensities in rotation and vibration spectrum, Parallel and perpendicular bands of Linear molecules, Isotope effect-vibration, rotation. (5 Periods, 8 mks)

7> Electronic Spectra of Diatomic Molecules :

Electronic energy, potential energy curves, stable and unstable molecular states, vibrational structure of electronic transitions, general formula, graphical representation, isotope effect, rotational structure of electronic spectra, the branches of band, band head formation, shading of bands : Fortrat diagram, isotope effect, intensities in electronic bands-vibrational structure-Fanck condon principle, obsorption and emission, Intensity distribution in the rotational structure, $^1\Sigma - ^1\Sigma$ transition. (7 Periods, 12 mks)

REFERENCES :

1. Atomic Spectra   - White
   (For topics 1 to 3)

2. Introduction to Molecular Spectroscopy   - C.M.Barrow
   Mc Graw Hill, International Edition
   (For topics 4 to 6)

3. Spectra of diatomic molecules   - Hersberg
   (For topic 7)

4. Atomic structure and chemical bond   - Manas Chanda
   Mc Graw Hill

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PHY-301   M.Sc. (PHYSICS) PHY 301

Atomic and Molecular Physics

(W.e.f. from June, 1993)

1> Atom model for two valence electrons :

ll coupling, ss coupling, LS coupling, Pauli exclusion principle, coupling schemes for two electrons, factors for LS coupling, Lande interval rule, jj coupling branching rule, selection rule, intensity relations. Magnetic moment of the atom, Zeeman effect, intensity rules, calculation of Zeeman pattern, Paschen back effect LS and jj coupling and Paschen back effect, Breits scheme for derivation of spectral terms, Paulis exclusion principle.   (10 Periods, 18 mks)

2> Complex spectra :

Displacement law, alteration law of multiplicities, vector model for three more valence electrons, Lande interval rule, inverted terms, Hund's rule.

Zeeman effect and magnetic quantum numbers in complex spectra magnetic energy and Lande g factor, Paschen back effect in complex spectra.
(8 Periods, 12 mks)

3> Hyperfine structure :

Introduction, hyperfine structure and Lande interval rule, nuclear interaction with one valence electron, hyperfine struction of two or more valence electrons, Zeeman effect in hyperfine structure, Back Goudsmit effect in hyperfine structure.   (6 Periods, 10 mks)

4> Pure Rotation Spectra :

Rotation of a linear system (classical and quantum mechanical), rigid rotator, rotational energy levels and their populations, interaction of radiation with rotating molecules, rotational spectra of rigid rotators, selection rules for linear molecules, determination of moment of inertia and bond length from rotational spectra, relative intensities of spectral lines, Stark effect in molecular rotational spectra, molecular rotation-nuclear spin coupling.

(7 Periods, 12 mks)

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (PHYSICS)

Semester-wise distribution of Cources - (w.e.f. June.1993)

Sem. :- I

PHY 101 : Methods of Mathematical Physics

PHY 102 : Quantum Mechanics

PHY 103 : Classical Mechanics

PHY 104 : Electronics (Wave-shaping and Circuit design)

PHY 105 : General Laboratory - I

Sem. :- II

PHY 201 : Statistical Mechanics

PHY 202 : Solid State Physics

PHY 203 : Electrodynamics

PHY 204 : Digital Electronics

PHY 205 : General Laboratory - II

Sem. :- III

PHY 301 : Atomic and Molecular Physics

PHY 302 : Numarical methods and Computer Programming

Any one of the following (Course PHY 303) :-

PHY 303 A : Physics of Semiconductor Devices

PHY 303 B : Microwave Electronics

PHY 303 C : Lasers and their applications

PHY 304 : Special Laboratory - I

PHY 305 : Project

Note : At end of the IIIrd Sem. assessment of PHY 305 Project Course for the first half (out of 20 marks) must be submitted to the University office.

Sem. :- IV

PHY 401 : Nuclear Physics

PHY 402 : Microprocessor

Any one of the following (Course PHY 403) :-

PHY 403 A : Radio communication and T.V. system

PHY 403 B : Vacuum technology and thin film physics

PHY 403 C : Solar energy

PHY 404 : Special Laboratory - II

PHY 405 : Project

M.Sc. (PHYSICS) PHY 303 A

Physics of Semiconductor Devices

(W.e.f. from June, 1993)

1> Introduction to Semicondutors :

Types of semiconductors-Elemental compounds, properties of Silicon, Germanium and Galium arsenide Semiuconductors, Direct indirect semiconductors, charge carriers Mobility and Majority carriers, Excess carriers and life time, Diffusion of carriers and Eisteins relation Intrinsic somiconductors and position of Fermi level, degenerate and non degemerate semiconductors carrier concentration in non degenerate and degenerate cases, current transport internal fielded to non uniform doping.   (10 Periods, 20 mks)

2> Measurement of Electrical Parameters of Semiconductors :

Resistivity (Four Probe method) Mobility, carrier-concentration, carried types, by Hall effct Hayne-Shockly experiment for measurement of mobility of minority carries.   (6 Periods, 12 mks)

3> Semiconductor Diodes :

Tunnel diode, degenerate semi-conductor, principle of operations, circuit applications.

Varactors diode, capacitance of p- n junction, Princple of operation, equivalent circuit application, rectifierdiodes dependance of current and voltage specifications, switching diodes.

Zener diodes- reverse bias breakdown Avalenche and Zener breakdown, device designfor particular breakdown voltage.   (7 Periods. 14 mks)

4> Bipolar Junction Transisters :

Ebers Moll Expressions switching characteristics, transient and A.C.conditions secondary.   (4 Periods. 8 mks)

5> Field Effect Transistors :

Metal semiconductor, FET metal Insulator, semiconductor, Ideal MOS capacitor, surface fieldeffect transistors.   (4 Periods. 8 mks)

6> Opto Electronic Devices :

Solar cells photodetectors   (4 Periods. 8 mks)

7> <u>Power Semiconductor Devices</u> :

General   considerations   Thyristers   family   SCR,diac,Triac,power
transistors.   (<u>5 Periods</u> . <u>10 mks</u>)

<u>REFERENCES</u> :

1. Solid state Electronic devices   - B.G.Streetman

   (Prentice Hall of India) <u>3 rd Edition.</u>

2. Semiconductors and Electronic devices   - div Bar Lov

   (Prentice Hall of India) <u>2 nd Edition.</u>

3. Introduction to Semiconductor devices   - Lindmyor & Wringtey

4. Physics of Semiconductor devices   - S.M.Sze

   (Wyley Eastern, Ltd.)

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MICROWAVE ELECTRONICS

1. ELECTROMAGNETIC FILED AND WAVE EQUATIONS:

Intruduction to microwave freqencies. Coparison betweeen Radio and microwave frequency aspects.Electron motion in electric, magnetic and electromagnetic field. Electric and magnetic wave equations. Uniform plane wave. Plane wave propogation in free space poor conductor good conductor.Boundry conditions.Plan wave reflection normal incidence only.Pointing theorem.   (10 periods. 20 Marks)

2. MICROWAVE TRANSMISSION LINE AND WAVEGUIDE:

Transmission line equation and their solution-open and terminated transmission lines. Line impedences. Line admittance. reflaction coefficient,transmission coeficient.Standing wave ratio. Smith chart.Single stub matching double stube matching.

Wave duides:-Rectangular,circular,Rectangular waveguides solutions of wave equation in rectangular co-ordinates TE and TM modes in rectangular waveguide power transmission. Power losses and excitation modes in rectangular waveguid. (10 periods. 20 marks)

3.MICROWAVE COMPONENTS:

Rectangular cavity resonator circular cavity resonator of cavity resonator re-ontract caities. E-flame (Series tee) H-plane (Shunt fee), magic tee (Hubrid tee) wave guide corners bends and twists Direectional conplers, two hole difectional couplers, Mocrowave circulars isolators. Hybrid couplers.   (8 periods. 16 marks)

4.MICROWAVE GENERATORS:

Klystrons, Velocity modulation, bumching process, output power and beam loading efficienty of klysteren.

Reflax Klystron Velocity modulation. Power output efficiency electonic admittance.

Travelling wave Tube:Construction operation.

5. MICROWAVE Semiconductor Devices:-

Microwave transistors:Principle, operation microwave charecteristics, current gain cutoff frequency, power gain

Varactor diode: Principle, opearation use of varector diode for frequency multiplication.

microwave Tunnel diode. principle of operation, microwave field effect Transistors. FETS,JFSTS,MESFETS principle of operation microwave charactoristics,drain current out off frequency.

(6 period. 12 marks)

REFERENCE BOKKS:

1. Foundation of microwave engineering - Collin R. E.

2. Introduction to microwaves   - Atwater

3. Introduction to microwave   - Wheeler

4. Microwave semiconductor devices
   and their circuit application.   - Watson

5. Microwave circuits and elements   - M.L.Sisodia

6. Electromagnetic fields and waves - Jorden

7. Microwave   - K.C.Gupta.

8. Electronic communication   - Sangeeva Gupta

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Vaccum Technology and Thin Film Physics

1. Various ranges of vaccum, conductance, impodance, speed, pump-down time and thin relations.   (2 periods)

2. Pumps and Gauges for H.V. and U.H.V. : Rotary Diffisuion, Getter pumps, Evapouration, sputtenation Molecular drug, Cryogonic and orgitron pump.   (6 periods)

3. Method of producing thin films: Different methods chemicals CVD, Vaccum evaporation and sputtering. Parameters governing thin films different types of sources, Working of Hig-vaccume systems, Theory of Cosine law of omission.

4. Thickness measurenments: Optical interferences techniques, Multiple beam interforometry, Tolcksky technique, Gravimatric method.

(5 periods)

5. Monitoring of film thickness: Quarts crystal monitor, optiical thickness monitor.   (3 periods)

6. Nucleation: Thermal accomodation coefficients, capilarity model, sperical cap and disc. Atimatic model and Comparison, varios states of growth.

7. Mechanical properties; Adhesion and its measuremets with various methods, stress measurements with various methods. (4 periods)

8. Electrical properties:- Boltzman equation, Fuch-Sondhemir theory, TCR and its variation, Resustance variation of very thin films, Hall effect.   (5 periods)

9. Optical properties, Reflaction, Refraction, Fresnels coefficients, Complex refractive index, Ellipsometry Reflecting and antireflecting films.   (5 periods)

REFERENCE BOOK:-

1. Hand Book of Thin film technology   :-   Maissel and Glang.
2. Vaccum Deposition of Thin Films   :- L. Holand.

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc.(Solid state physics)

List of experiments PHY 304

Spl. Lab.-1 (W.e.f. From June, 1993)

(15 Experiments :- 3 Hours duration each)

X-rays :

Analyse an X-ray power photograph for a substance having crystal lattice.

i> SC ,ii> BCC and iii> FCC and determine the (hkl) indices of reflections recorded. Hence determine lattice constant and volume of unit cell.

Microwave :

1> Study of different microwave components :

Slotted section probe, tunable crystal detector, Klystron tube, attenuators, frequency meters, directional couplers, circulators and horn antenna.

2> Detection of relationship between frequency f, wavelength in free space and wavelength in a wave guide by using a microwave bench.

3> Measurement of dielectric constant of various solids and liquids at room temperature by using a microwave bench.

Crystal defects :

1> Study of defects in calcite crystals by chemical etching technique and density of dislocation by using an optical microscope.

2> To study ionic conductivity of solids at various temperatures (Alkali halides), using two probe method.

Magnetic Resonance :

Study of electron spin resonance in combined static and r.f.magnetic fields of a paramagnetic material.

Nuclear Radiations :

1> To determine "Plateau range", "Plateau slope" and "Variation in counts with distance" for a given G.M.Counter.

2> To study absorption of beta rays in aluminium, measurement of range.

Alloys :

1> To construct equlibrium phase diagram of a series of Lead-Antimony alloy system of varying composition and to measure the eutoctic temperature by preparing Pb-Sb alloys.

2> To prepare a series of Nickel-Copper alloys and to measure the curie temperature of the alloys for different percentages of nickel content.

Thermo Gravimetric Analysis (TGA) :

Thero gravimetric analysis (TGA) of $NiSO_4$, $6H_2O$ crystals.

Absorption Phenomenon :

To study absorption in Zeolites.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (PHYSICS) PHY 401

Nuclear Physics

(W.e.f. from June, 1993)

1> Nuclear Structure :

Nuclear masses and binding energies,Defination of seperation energy,

Basic principles of mass spectroscopy, Neir's and Robert's mass

spectroscopes, Bainbridge's and Jordon's mass spectroscopes.

Size of the nucleus, determination of radius by electron scattering

method and by Coloumb energy difference method.

Nucleaur angular momentum and magnetic dipole moments, Electric

quadrupole moment (classical derivation only),Quadrupole interaction

energy.   (10 Periods, 20 mks)

2> The Nuclear Two -Body Problem :

The Deuteron, ground state of the deuteron (Simple theory).

Nucleon-Nucleon Scattering : Phase shift analysis,scattering length,

effective range,Coherent scattering by hydrogen molecule (Ortho and

para hydrogen) Born approximation.   (10 Periods, 20 Mks)

3> Nuclear Reactors :

Brief revision of fission chain reation, General reactor design,

Nuclear reactor types,research reactor (Heterogeneous) Power reactor

(Fast breeder reactor), reactors in India (Apsara,Cirus,Purnima)

                                                 (6 Periods, 12 Mks)

4> Nuclear Particle Accelarators :

The Principle of phase stability, synchro-cyclotron, Microtron,

electron-synchrotron or Bevatron.   (5 Periods, 10 Mks)

5> Elementary Particals :

Classification on the basis of type of interaction,quantum numbers, Isospin,strangeness,parity,Decay of elementry particles.Conservation laws and symmentry properties of elementry particles,Quark model.

(5 Periods, 10 mks)

6> Cosmic Rays :

Origin of cosmic Rays, primary and secondary radiations,cosmic ray showers, Geomagnetic effects,absorption of cosmic rays.

(4 Periods, 8 Mks)

REFERENCES :

1) Atomic Nucleus   - R.D.Evans.

2) Nuclear Physics   - D.G.Tayal.

3) An Introduction to Nuclear Physics   - Bhide,Joshi.

4) Concepts of Nuclear Physics   - B.L.Cohen.

5) Basic Nuclear Physics   - B.N.Srivastava.

6) Introduction to Nuclear Physics   - Herald Enge.

7) Introduction to Nuclear Physics   - David Halliday.

8) Elements of Nuclear Physics   - M.L.Pandya and Yadav.

9) Nuclear Physics   - Irving Kaplan.

10) Nuclear Physics   - Alex E.S.Green.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (Solid state physics and Crystal growth)

PHY 402 Solid State Physics - II

(W.e.f. from June,1993)

1> Properties of semiconductors :

Band theory : Energy bands, Intrinsic semiconductors, Extrinsic semiconductors conductivity. Electron and holes, The temperature dependence of minority carriers and Hall effect.

Optical properties : Absorption spectrum, photoconductivity, photovoltaic effect, junction properties.

Metal : Metal junctions, metal semiconductor junction, MIS structure, P-N junction, Transistors.   ...**10 Periods**

2> Structure of semiconductor :

The elements : Dimond structure, Graphite structure, complex structure, intermetallic compounds. General properties : III-V compounds, II-VI compounds, Silicon carbide. Sulfides : Wurtzite and halite types, Binary sulfides, Complex sulfides Oxides, Binary Oxides, Complex Oxides.   ...**10 Periods**

3> Luminescence :

Excitation and emission, Decay mechanisms, Thallium-activited alkali halides, The sulfide phosphors, Types of luminescence.   ...**5 Periods**

4> Ferrimagnetism :

Introduction, The structure of ferrites, The saturation magnetization, Elements of Neel's theory.   ...**3 Periods**

5> Principle of LASER and MASER action :

The nature of spontaneous and stimulated emission, The master cavity, Pumping in the optical MASER, The two level, Three level and Four level optical MASER, The ruby optical MASER, The semiconductor optical MASER, The solid state detector, Ruby LASER, Applications of LASER in medicine

and crystallography.

Mossbeaur effect : Instrumentation,Relativity and Mossbeaur effect, Atomic motion and chemical application. Introduction Recoilles resonance-absorption. ...6 **Periods**

6> **Radiation damage in solids** :

Damage by neutron radiation, Irradiation by heavy charged particles, Irradiation by fast electrons,Irradiation by Gammarays. ...3 **Periods**

7> **Photoconductivity** :

Historical survey, photoconducting materials,Electronic transitions in photoconductors, Absorption and excitation, Trapping and capture, Recombination, Life time, photoconductivity,capture cross-section, simple model of a photoconductor, Excitation, absorption, excitation across the gap trapping and it's effects.

REFERENCES :

1. Introduction to solids   - L.V.Azaroff
2. Solid state physics   - A.J.Dekker
3. Introduction to solid state physics   - C.Kittle
4. The physics of Engineering solids   - T.S.Hutchison,D.C.Baird
5. Solid state physics   - R.L.Singhal
6. Fundamentals of solid state physics   - Saxena, Gupta
7. Dislocation   - Hull and Read
8. Mossbeaur effect   - G.K.Wertheim
9. Crystal growth and characterization   - R.Ueda, J.B.Mullin
10. Semiconductor physics   - Shieger
11. Essentials for solar cell   - N.P. Singh (New Delhi)
12. Semiconductor physics   - T.S.Moss
13. Introduction to Mossbear effect   - V.G.Bhide
14. Semiconductor physics   - S.M.Zea

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NORTH MAHARASHTRA UNIVERSITY,JALGAON

M.Sc. (Solid state physics and Crystal growth)

Growth of crystal and their characterization

PHY 403 A (W.e.f. from June,1993)

1> Importance of growing single crystals and their uses :

Thermodynamic principles and crystal growth equilibria.Theory of crystal growth ,revision, nucleation from solution, melt and vapour.

2> Solution growth : .

Growth from water solution,growth by Gel method, growth by Flux, Hydrothermal growth,growth from flux, growth by electrodeposition.

3> Grwth from melt :

Czcharalski crystal pulling techniques, Bridgmann-Stockbarget technique, Zone melting method, Detailed study of growth and silicon and germanium single crystals.

4> Vapour growth :

The various methods of vapour growth. (Viz. CVD,Epitaxial growth etc.) and growth kinetics.

5> Introduction to liquid crystals, their classification, properties, uses and limitations of each type.

6> Characterization of crystals :

a. Identify classical gravimetric and volumetric analysis.

b. Major constituents.

c. Minor constituents.

d. Mapping (Electrical and dielectric properties).

e. X-ray power diffraction techniques.

f. Election microscopic techniques (TEM, SEM).

g. Etching studies (Chemical etching thermal and hydrothermal etching).

h. Characterization of crystal surfaces by optical microscopy.

REFERENCES :

1. Crystal growth and characterization   - R.Ueda, J.B.Mulling

2. Crystal growth theory and techniques   - Ed. C.H.L.Goodman

3. Short course on solid state phy. Vol.   - Vol.I Ed.F.C.Auluk

4. Art and science of growing crystals   - J.J.Gillman

5. Fundamentals of crystal growth   - Dr. Franz A.Rosenberg

6. Dislocations   - Hull and Read

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. (PHYSICS) PHY 403 (B)

Microprocessor

(W.e.f. from June, 1993)

1> Introduction to Microcomputor :

Memories, Microprocessor (C.P.U.), I/O devices,　　　　(2 Lectures)

2> Memory devices :

A) Biportar, Unipolar memeries, Random access memory (RAM) Read only momory (ROM,PROM,EPROM.)

B) Study ofmemory chips : 2174,2716　　　　(6 Lectures)

3> Architecture of 8085 :

Detail block diagram with pin configuration　　　　(3 Lectures)

4> Instruction set of 8085 :

A) i) Instruction types

   ii) Classification of instruction

 iii) Addressing modes

  iv) Instruction set of 8085.

B) Programming- simple programs use of subroutine　　　　(12 Lectures)

5> Interfacing memory and I/O devices :

Introduction

 i) Address space partitioning, address deceding

 ii) Momory Interfacing

 iii) Lata transfer schemes........

     a) Programmed date transfer,

        Synchronous transfer, Asynchronoces transfer, Interrupt driven data transfer, Intrurrupts in 8085.

     b) Direct memory access data transfer: DMA transfer in an 8085 bassed system　　　　(5 Lectures)

6> Study of interfacing devices :

 i) Programmatice peripheral interface (Ic 8255)

 ii) Programmable interval timer (IC 8253) with programming.

 iii) Keyboard ontroller and display controller (IC 8279)

　　　　(7 Lectures)

7> Inturrupts :

   Need of Inturrupts; study of hardware and software Inturrupts, study
of Inturrups controller (IC 8259)   (2 Lectures)
8> Introduction to 8086, 80386 and 80286 in brief   (2 Lectures)
REFERENCES :

1) Microprocessor Fundamentals (Schaum's series)

                                   - Roger L. Kokhein (M.G.H.)
2)   Introduction to Microprocesser Softwar, hardware, programming by
                                   - L.A.Leventhal (M.G.H.)
3) 8080/8085 Assembly language programming

                                   - L.A.Leventhal (M.G.H.)
4) Microprocessor Architecture .Programming and application

                                   - Ramesh Goankar (WEL Bombay.)
5) MC5 85 Users manual Inter Corp. USA.

6) Introduction to microprocesser
          (3 rd Ed.)   - A.PMathur (TMG)
7) Introduction to micorprocessor
          (Vol. 1 & 2)   - Adam Osborn (MGH)
8) Data manual for Microprocessor family Intel Corpusa

9) Introduction to micorprocessor   - Khambate

10) Microprocessor and its applications   - B.Ram

NORTH MAHARASTRA UNIVERSITY, JALGAON

M.Sc(PHYSICS) (W.e.f. from June, 1993)

PHY 403 (C)

NUMERICAL METHODS AND COMPUTER PROGRAMMING

1.COMPUTER PROGRAMMING:

A)   FORTRAN-77:   Charector set , Constants,Variables.   Expressions (Arithmatics, Relational and Logical), Assignment statements, Input statement, output statement,control statements(GO TO, If, DO Loops)

(12 periods)

B) Subprogramme : -FUNCTION, SUBROUTINE Subprogram, Common statemet equivalanic statemt.   (7 periods.)

2.NUMERICAL METHODS IN FORTRAN:

In the following topic on numerical methods,students are expected to be able to write programs, subprogrsms or programs segments as well as perform numerical calculations using electronics calculators   and mathematical tables.

a)Inerative methods for solution of Algebric equations-

Derivation of formula for successive Bisection, Newton Rapson method Regula false and their comparison.   (6 periods)

b) Integration - Traperoidal, simpson 1/3, Simpson 3/8 Rules DErivation and Applications.

c) Interpolation:-Linear interpolation, Langrages Interpolation.

(4 periods)

d) Solution of Simulataneous equation - Guass Elimination method pivoting all conditioned equations in Guass-Seidal Iterative method.

(5 periods)

REFERENCE BOOK:

1.Programming with FORTRAN - Lipsehutz (Seaum series,MC Graw Hill pub)

2. Computer Programming in FORTRAN-77   :- Davis

3. Computer programming in FORTRAN-77   : Ramkumar

4. Computer programming in FORTRAN-77   : V. Rajaraman

5. Computer oriented numerical methos   : V. Rajaraman

6. Introductory methods of Numerical
   Analysis   : S.S. Sastry.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc.(Solid state physics)

List of experiments (W.e.f. from June, 1993)

Spl. Lab - 2 PHY 404

(15 Experiments :- 3 Hours duration each)

Magnetism :

1> To study variation of capacitance and power factor with temperature in ferroelectric sample.(Barrium titanate)

2> To study variation of dc channel resistance of a field effect transistor (BFW 10) with external magnetic field.

3> To determine the paramagnetic molar susceptibility and hence magnetic moment and number of unpaired electronics in pottassium ferricyanide $K_3 Fe (CN)_6$ by Guoy method.

4> To study variation of suceptibility of a magnetic slat with temperature.

5> To study Faraday effect and to determine Vardet's constant of a magnetic material.

Electrical properties :

1> To determine electrical conductivity of a semiconducting material.

2> To determine energy gap of a semiconducting speciman.

3> To determine energy gap in the band structure of Indian Antimonide from the given IR spectrum.

4> To study characteristics of NTC and PTC materials by varying their temperature and to determine temperature co-efficient of resistance.

Thin films :

1> To prepare cadmium sulphide photosensitive thinfilm by chemical bath deposition technique.

2> To determine step hight on mica-cleavage by multiple beam interferometry.

3> To prepare thin films of semiconducting materials by flash evaporation technique and to measure resistivity by two probe/ four probe method.

4> To prepare thin films of photosensitive materials by solution growth technique and to study their photoconductivity.

Hall measurement : (For semiconductors)

To measure Hall co-efficient, the number of charge carriers per unit volume and the carrier mobility in P-type and N-type semiconducting samples and compare the results.

Superconductors :

To study theorotical aspects and preparation of superconductors.

Low temperature :

Effect of change in temperature down to liquid nitrogen temperature upon the break down potential of a voltage reference diode.

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N O R T H   M A H A R A S H T R A   U N I V E R S I T Y.

J A L G A O N - 425 001.

M.Sc. (MATHEMATICS)
(Part II)
SYLLABUS FROM JUNE,1993

COURSES FOR SEMESTER III and IV

SEMESTER - III

Compulsory Courses.

MT : 301	–	Functional Analysis.
MT : 302	–	Field Theory.
MT : 303	–	Fluid Mechanics.
MT : 304	–	Commutative Algebra.

Optional Courses (Any one)

MT : 305	–	Graph Theory.
MT : 306	–	Mathematical Modelling.

SEMESTER - IV

Compulsory Courses.

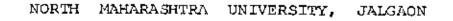|			
MT : 401	–	Real and Complex Analysis.
MT : 402	–	Advanced functional Analysis.
MT : 403	–	Solid Mechanics.
MT : 404	–	Algebraic Topology.

Optional Courses (Any one)

MT : 405	–	Algebraic Geometry.
MT : 406	–	Number Theory.

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dbs./-

NORTH MAHARASHTRA UNIVERSITY, JALGAON

M.Sc. II (MATHEMATIC) SYLLABUS (From June,1993)

MT 301 :- FUNCTIONAL ANALYSIS

1. BANACH SPACES :- Definition and examples. Construction of
   new normed linear spaces. Convexity of the unit sphere of
   a normed linear spaces. Linear transformations. Finite
   limensional normed Linear spaces. The Hahn-Banach (Spaces)
   theorem. The natural imbedding. The open mapping theorem.
   The closed graph theorem. Banach-Steinhauss theorem.

2. HILBERT SPACES :- Definition and examples. Schwarz's
   inequality. Projection theorem. Orthogonal Sets. Bessel's
   inequality. Parseval identity. Gram-Schmidt orthogonaliza-
   tion process. The conjugate space, Operators and their
   adjoints on a Hilbert space. Self-adjoint operators. Normal
   and unitory operators. projection operators.

3. Finite dimensional spectral theory, the spectral theorem.

   Prescribed Book :-

   1) G.F.Simmons : Introduction to topology and Modern
                    Analysis. (McGraw - Hill book company)

RECOMMENDED BOOKS :

1, B.V. Limaye :- Functional Analysis (Wiley-Eastern)

2. Lusternik, L.A. :- Elements of functional Analysis
   and Sobolev V.J.   Hindustan Publishing Corporation
                       (Friedrick Ungart)

3. Fried man A :- Foundations of Modern Analysis.
                       (Holt Reinhart, Winston)

4. Bachman G. and Narici L. :- Functional Analysis
                       (Academic Press).

5. Berberian S.K. :- Functional Analysis and Operator Theory
                       (Springer)

6. Brown A.L. :- Elements of Functional Analysis.
                       (Van Nostrand)

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MT 302 :- FIELD THEORY

Algebraic extensions, Spliting field, Algebraic closure. Separable and Inseparable extensions. Normal extensions. Perfect fields finite fields.

Galois extensions. Fundamental theorem. Roots of Unity Solvability by radicals. Transcrendental extensions. Transcentental base.

Prescribed Book

1. N.S. Gopalkrishnan :- University Algebra (Wiley-Eastern).

RECOMMENDED BOOKS :

1. N.Jacobson :- Basic Algebra Vol.1
   (Hindustan Publishing Corporation).
2. M.Nagata :- Theory of fields (Marcel-Dekker).

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MT 303 :- FLUID MECHANICS

1. Inviscid Fluid, Stream Lines, Path Lines and stream tubes, Density, Pressure, Hydrodynamic pressure, Bernoulli's theorem. Lagrangian and Eulerian methos.

2. Vorticity, Circulation, Irrotational motion, Equation of Continuity, Rate of change of Linear momentum, Euler's Dynamical equations. Boundary Conditions, Velocity potential, pressure equation. Impulsive motion, Acyclic and cyclic irrotational motion, Kinetic energy of an infinie mass of liquid.

3. Motion in two dimensions, stream function, Rankine's method, complex potential, Complex Velocity Stagnation point, the Circle theorem, Streaming motion past a sphere, cavitation, Flows past a moving sphere, Blasius theorem,

4. Circulation about a cylinder, Aerofoil, theorem of Kutta and Jaukowski, Two dimensional sources and sinks. Combination of sources and streams. Doublets. The method of images. Images system for a source outside a Circular cylinder.

5. Axisymmetrical fluid motion, Stoke's stream function. Stoke's Viscosity law. Navier - stoke's equations, Reynold's number.

RECOMMENDED BOOK :

1. Theoretical Hydrodynamics :- L.M. Milne-Thomson
                                (Mac Millan Publishing Company)

REFERENCE BOOK

1. Advanced Fluid Dynamics :- Roy Singhania and Grewal
                        (S.Chand and Comp. New Delhi).

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MT 304 :- Commutative Algebra

Revision of fundamental concepts in Rings and Modules.
Nil radical, Jacobson radical, Operations on ideals Nakayami
Lemma Extensions and contraction.

Exact sequences, Tensor product of modules, Exactness
properties of tensor product. Rings and modules of fractions.
Local properties. Extended and contracted ideals in ring of
fractions.

Integral dependence, The going up theorem. Integrally
closed integral domains, The going down theorem. Valuation
ring.

Primary decomposition in Noetherian rings, Artin rings.

Discrete valuation ring and Dedekind domains.

RECOMMENDED BOOKS

1. Introduction to commutative Algebra
    by Atiyah M.F. and I.G. Mac Donald.

2. Commutative Algebra by N.S. Gopalkrishnan.

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MT 305 :- Graph Theory

1) Graphs, Adjacency and Incidence, Complete graph, Regular
   graph, Bipartite Graph, Isomorphism of Graphs, Matrices &
   Graphs, Degree sequences.

2) Subgraphs, Induced subgraphs, Complement of a graph. The
   Ramsey nubers, Union and sum of graphs. Connected and
   disconnected graphs, product of graphs, Line graphs.

3) Walks, Path, trail, and cycle (Circuit), Connectivity,
   Menger's Theorem (Both forms), Halls Marriage problem,

Blocks, Weighted graph, Shortest path algorithm.

4. Trees, Centres, Spanning trees, Fundamental cycle
    Fundamental cutset. Labelled trees, spanning tree algorithm.

5. Eulerian graph, Chinese Postman Problem, Hamiltonian graph.
    The Travelling salesman problem.

6. Planarity and Coloring, Coluouring of planar graphs, The
    Four colour Theorem, Chromatic polynomials.

7. Directed graphs, Connected digraph, Directdd trees,
    Eulerian digraph, Tournaments, Flows & Networks. Max-flow
    Min-Cut theorem.

PRESCRIBED BOOK :

    1. N.S. Bhave &   : Elements of Graph Theory
       T.T. Raghunathan   Gaaj Prakashan,

RECOMMENDED BOOKS :

    1. Narsingh Deo   : Graph Theory with applications to
                          engineering and Computer Science
                          (Prentice Hall of India.)

    2. Frank Harary   : Graph Theory
                          Narosa Publishing House.

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MT 306 MATHEMATICAL MODELLING :

1. Mathematical Modelling :- Need, Technique, Classification
    and Simple illustrations, Mathematical modelling through
    geometry, algebra, trignometry and calculus. Limitations
    of Mathematical modelling.

2. Mathematical Modelling through ordinary differential
    equations, Linear and non-linear growth and decay models.
    Compartment models. Mathematical modelling in Dynamics
    and geometric problems.

3. Mathematical modelling through systems of ordinary differential
    equations of the first order, Mathematical modelling in
    population, dynamic epidemics, Compartment models in economics
    medicine, battles, international trade dynamics.

4. Mathematical Modelling through partial differential equations,
    Model for traffic flow on a highway, Mathematical modelling
    in terms of wave equation.

Prescribed Books

1. Mathematical Modelling :- J.N. Kappor,

   Wiley Estern Ltd.

MT 401 : REAL AND COMPLEX ANALYSIS

1. Complex Measures :-

   Total Variation, Absolute Continuity, Lebesgue decomposition
   theorem. Randon-Nikodym theorem and its consequences, Hahn
   decomposition theorem. Bounded linear functions on L^p

2. (Knowledge of elementary properties of holomorphic
   functions to be assumed). Poisson Integral. Harnack's
   theorem. Harmonic function.
   Schwarz reflection principle.

3. Statement of Schwarz's lemma and study of its consequences.
   Phragmen Lindel of theorem. Hausdorff- Young theorem.

4. Normal families, Riemann Mapping theorem, The family of
   Univalent functions.
   Weierstrass Factorization theorem. Mittag-Leffler theorem.
   Jensen's formula. Muntz-Szasz theorem. Natural boundary.
   Ostroswski theorem. Hadamard theorem. Monodromy theorem.
   Picard's theorem.

Prescribed Books

1. W.Rudin - Real and Complex Analysis (Tata McGraw Hill)

2. J.B. Conway : Functions of one complex variable
   (Springer - Verlag Graduate Tect)

RECOMMENDED BOOKS :

1. L.V. Ahlfors :- Complex Analysis (McGraw Hill)

2. R.A. Silverman :- Complex Analysis (Houghton, Hifflen Co.)

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MT 402 ADVANCED FUNCTIONAL ANALYSIS

1. TVS, Separation properties, Linear mappings, finite
   dimensional spaces, metrization, Boundedness and Continaty,
   Seminorms and local convexity, quotient spaces, Weak

topologies, Weak convergence, Reflexive Banach Spaces, Compact convex sets.

2. Fixed point theorems & their applications. Banach contraction principle and its generalization, Schauder's fixed point theorem, Application of Banach Contraction Principle. Browber's fixed pt. them.

3. Strickly convex Normed linear space, Uniformly convex space, Best approximation, Approximation, Approximately Compact sets, proximinal set, Boundedly compact sets, Normal structure, Weakly compact sets, Best simultaneous approximation.

4. Banach Algebras :- Preliminaries, Invertibility in Banach algebra with unity, Resolvent and spectrum, Gelfand representation theorem,

5. C^*- Algebras :- Preliminaries, Commutative C^* - algebra, Gelfand Naimary representation theorems.

PRESCRIBED BOOKS

1. W. Radin :- Functional Analysis (Tata McGraw Hill)
2. G.F. Simmons :- Introduction to topology & Modern Analysis (McGraw-Hill book Company)

RECOMMENDED BOOKS

1. A.H. Siddiqi :- Functional Analysis with applications (Tata-McGraw Hill)
2. Gottfried Kothe :- Topolagical Veater spaces-I (Springer Verlag)
3. A.R. Robertson and :- Topological vecter spaces
   W.J. Robertson (Combridge University Press)
4. S.K. Berberian :- Functional Analysis and operater Theory (Springer).

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MT 403 SOLID MECHANICS

1. Stress, Complementory property of sheer, Equations of equilibrium, strain components, Compatibility.

2. One dimensional stress distribution, Three dimensional Hooke's law for isotropic materials.

3. Stress Variations for plane stress, principal stresses and principal axes, Mohr's Circle. Equations for plane strain, properties.

4. Sheer Force, Axial force and Bending moment formulation of sheer and Bending moment equations, Differential equations for equilibrium.

5. Pure Bending of Symmetric beems, Normal stress, Sheer stress in transverselly loaded beams, stress concentrations for bending.

6. Deffection of Symmetric beems, statically indeterminate beems, superpositions methods.

7. Three dimensional formulation for stresses, Tensor invariants, Tensor notation, Equations for strain and properties.

REFERENCE BOOKS

1. Solid Mechanics :- S.A.M. Kazimi
Tata McGraw Hill Company.

RECOMMENDED BOOKS

1. Introduction to solid Mechanics :- Irving H.Shames,
(Prentice Hall of India
Pvt.Ltd. New Delhi-11000)

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MT 404 (ALGEBRAIC TOPOLOGY)

Geometric Complexes, Polyhedra, Orientation Simplicial homology of polyhedra, Examples of homology groups, Euler-Poincare formula, Pseudomanifolds, Homology of S^2.

Simplicial appoximation, Brouwer's fixed point theorem and related results.

Homology of maps, Fundamental groups, Covering homotopy for S^1, Relation between first homology and fundamental group

PRESCRIBED BOOK

    1. F.H.Croom : Basic Concept of Algebraic Topology
                    (Springer under graduate Text).

RECOMMENDED BOOK :

    1. Mayer J. :-   _Algebraic Topology (Prentice-Hall).

    2. I.M.Singar and J.A. Thorpe :- Lecture Notes on
                    elementary topology and differential
                    geometry (Springer Verlag).

    3. E.H.Spanier :- Algebraic Topology
               (Tata McGraw Hill).

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MT : 405 ALGEBRAIC GEOMETRY

Affine space, Affine algebraic sets, Irreducible components fo an algebraic set. Hilbert Nullstellensatz, Affine variety coordinate ring, polynomial maps, Rational functions.

Affine plane curves, multiple points and tangent lines. Intersection number.

Projective space, projective algebraic set, Projective variety,

Projective plane curve, Bezcout's Theorem, Max Noether's fundamental theorem and its applications.

RECOMMENDED BOOK

    1) Algebraic Courves :- As introduction to Algebraic
                Geometry.
                By Willaim Fulton.

    2) Algebraic Geometry by Hartshorne.

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MT 406 NUMBER THEORY

1. Revision :- Divisibility, g.c.d., l.c.m., prime numbers,
The fundamental theorem of arithmetic, The Euclidean algor
The g.c.d. of more than two numbers.

2. Arithmetic function and Direchlft multiplication. The Mo
function Υ-;(x) The Euler function ϕ(x). The Dir

Product of arithmetic functions, Dirichlet inverses and the Mobius inversion formula. The Mangoldt function $\Lambda(n)$, Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function $\lambda(n)$, The divisor function $\sigma(n)$, Generalized convolutions.

• Congruences : Congruences, Residue classes and complete residue systems. Linear congruences, Reduced residue systems and Euler Fermat theorem, Polynomial congruences modulo p, Lagrange's theorem and its applications. The chinese remainder theorem and its applications, Polynomial congruences with prime power moduli.

4. Quadratic Residues and Quadratic Reciprocity law :-

   Quadratic residues, Legendre's symbol and its properties, Evaluation of $(\frac{1}{p})$ and $(\frac{2}{p})$ Gauss lemma, The quadratic reciprocity law and its applications, The Jacobi symbol.

5. Primitive Roots :- The exponent of a number modulo m primitive roots, Primitive roots and reduced residue systems, The non existence of primitive roots and mod 2^n for $n \geq 3$. The existence of Primitive roots mod p, and p^n and p^{2n} for add primes p and $n \not\geq 1$. The non-existence of primitive roots in the remaining cases. The number of primitive roots mod m. The primitive roots and quadratic residues. The Index calculus.

PRESCRIBED BOOKS :

   1. T.M. Apostol :- Introduction to Analytic Number Theory (Springer International student Edition)

RECOMMENDED BOOKS

   1. Ivan Niven and   :- An Introduction to the theory of
      H.S.Zuckerman   numbers (Wiley Eastern University
                            Edition).

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