BHARATHIAR UNIVERSITY,COIMBATORE-641 046

B.Sc. PHYSICS WITH NANO TECHNOLOGY & COMPULSORY DIPLOMA IN INSTRUMENTATION

SCHEME OF EXAMINATIONS **(CBCS PATTERN)**

(For the students admitted during the academic year 2008-2009 and onwards)

Part	Study Components	Course Title	Ins. hrs / week	Exam				Credit
				Dur.Hr	CIA	Marks	Total Marks	
	Semester I							
I	Language-I		6	3	25	75	100	3
II	English-I		6	3	25	75	100	3
III	Core I – Heat and Thermo Dynamics		3	3	25	75	100	4
III	Core II – Mechanics, Properties of Matter and Sound		3	3	25	75	100	4
III	Major Practical I		3	-	-	-	-	-
III	Allied A - Mathematical Paper I * (or)		7	3	25	75	100	5
	Chemistry Theory I **		4	3	20	55	75	4
III	Allied Practical**		3	-	-	-	-	-
IV	Environmental Studies #		2	3	-	50	50	2
	Semester II							
I	Language-II		6	3	25	75	100	3
II	English-II		6	3	25	75	100	3
III	Core III – Electricity and Magnetism		6	3	25	75	100	4
III	Major Practical I		3	3	40	60	100	3
III	Allied A - Mathematical Paper II * (or)		7	3	25	75	100	5
	Chemistry Theory II **		4	3	20	55	75	4
III	Allied Practical**		3	3	20	30	50	2
IV	Value Education - Human Rights #		2	3	-	50	50	2
	Semester III							
I	Language-III		6	3	25	75	100	3
II	English-III		6	3	25	75	100	3
III	Core IV – Optics		4	3	25	75	100	4
III	Major Practical II		2	-	-	-	-	-
III	Allied B - Mathematical Paper I * (or)		7	3	25	75	100	5
	Chemistry Theory I **		4	3	20	55	75	4
III	Allied Practical**		3	-	-	-	-	-
IV	Skill Based Subject 1 (Diploma) Instrumentation I		3	3	25	75	100	3
IV	Tamil @ / Advanced Tamil# (OR) Non-major elective - I (Yoga for Human Excellence)# / Women's Rights #		2	3	75		75	2

	Semester IV						
I	Language-IV	6	3	25	75	100	3
II	English-IV	6	3	25	75	100	3
III	Core V – Atomic Physics and Nuclear Physics	4	3	25	75	100	4
III	Major Practical II	2	3	40	60	100	3
III	Allied A - Mathematical Paper II * (or)	7	3	25	75	100	5
	Chemistry Theory II **	4	3	20	55	75	4
III	Allied Practical**	3	3	20	30	50	2
IV	Skill based Subject 2 (Diploma) Instrumentation II	3	3	25	75	100	3
IV	Tamil @ /Advanced Tamil # (OR) Non-major elective -II (General Awareness #)	2	3	75		75	2
	Semester V						
III	Core VI – Mathematical Physics	5	3	25	75	100	4
III	Core VII – Applied Electronics	5	3	25	75	100	4
III	Core VIII – Solid State Physics	4	3	25	75	100	4
III	Core IX – Principles of Digital Electronics & Micro Processors	3	3	25	75	100	5
III	Major Practical III - Electronics Alone	2	-	-	-	-	-
III	Major Practical IV - Digital and Micro Processor	2	-	-	-	-	-
III	Elective –I	4	3	25	75	100	5
	Major Practical V - C and C++	2	-	-	-	-	-
IV	Skill based Subject 3 (Diploma) Instrumentation III	3	3	25	75	100	3
	Semester VI						
III	Core X – Quantum Mechanics and Relativity	4	3	25	75	100	4
III	Core XI - Principles of Programming concepts and C Programming	4	3	20	55	75	3
	Core XII - Object Oriented Programming with C++	4	3	20	55	75	3
III	Major Practical III - Electronics Alone	2	3	40	60	100	3
	Major Practical IV - Digital and Micro Processor	2	3	40	60	100	3
	Major Practical V - C and C++	2	3	20	30	50	1
III	Elective –II	4	3	25	75	100	5
III	Elective –III	5	3	25	75	100	5
IV	Skill based Subject 4 (Diploma Practical)	3	3	40	60	100	3
V	Extension Activities @	-	-	50	-	50	1
	Total					3800	140

* For subjects without practical ** For subjects with Practical

@ No University Examinations. Only Continuous Internal Assessment (CIA)

No Continuous Internal Assessment (CIA). Only University Examinations.

List of Elective papers (Colleges can choose any one of the paper as electives)		
Elective – I	**A**	Nano Mechnanics
	B	**$**
	C	**$**
Elective – II	**A**	Fundamentals of Nano Materials and its Characterization
	B	**$**
	C	**$**
Elective - III	**A**	Nanoscale Materials & Devices
	B	**$**
	C	**$**

$ - yet to be submitted

SEMESTER – I

CORE PAPER I HEAT AND THERMO DYNAMICS

No. of Credit Hours : 3 per week

Subject Description :

This paper presents the principle of heat and Thermo dynamics.

Goal:

To enable the students in order to learn the basic principles and concepts of Heat and Thermodynamics

Objectives

The aims is to provide the students

- To understand the principles of calorimetry
- understand the basic principle and laws of thermodynamics
- understand the concepts of entropy

UNIT I (9 hrs)

Calorimetry: C_p and C_v of a gas – Meyer's Relation – Experimental determination of C_v Jolly's Method – determination by Regnault's Method – Specific heat of gas by calendar Barnes method – Experimental Determination of Specific heat of liquid – Linear Expansion – Air wedge Method – Thermostat.

UNIT II (9 hrs)

Transmission of heat : Conduction – Co-efficient of the thermal conductivity – Cylindrical flow of heat – determination of thermal conductivity of rubber and bad conductor – Lee's disc method. Conduction – Radiation – Black body – Wein's Law - Rayleigh Jeans Law – Stefan's law – Experimental Determination of Stefan's constant – Mathematical derivation of Stephan's law

UNIT III (9 hrs)

Kinetic theory of gases: Equipartition of energy- ratio of specific heat capacities – Maxwell's law of distribution of molecular velocities – Experimental verification – equilibrium speed distribution of velocities. Mean free path – transport phenomena – diffusion – viscosity and thermal conduction of gases – Vander walls equation – relation between Vander Wall's constant and critical constants.

UNIT IV (9 hrs)

Laws of Thermodynamics: I Law – Isothermal and Adiabatic process – gas equation during an adiabatic process – Work done an adiabatic expansion of gas – equation of an adiabatic curve – isothermal processes – Determination of γ by clement and Desormes method – II law – Carnot's engine- Working efficiency – Carnot refrigerator – Carnot's Theorem.

UNIT V **(9 hrs)**

Concept of entropy: Change in entropy in reversibility and irreversibility process entropy of an ideal gas – temperature entropy diagram – increase of entropy in any irreversible process – Thermo dynamics functions – Maxwell's thermodynamics relations and applications – Joule – Kelvin effect (theory)- Claussius and Clapeyron equation.

Text Book

Thermal Physics, R. Murugesan, I Edi, 2002

Heat & Thermodynamics, Brijlal & N. Subramaniam

Reference Books

1. Heat and Thermodynamics – Sears & Semansky
2. Heat and Thermodynamics – D.S. Mathur, S. Chand & Co, Edi 2002.
3. Heat and Thermodynamics – Agarwal, Singhal, Sathyaprakash
4. Thermal Physics – H.C. Saxena and Agarwal

SEMESTER – I
CORE PAPER II MECHANICS, PROPERTIES OF MATTER AND SOUND

No. of Credit Hours: 3 per week

Subject Description:

This paper presents the principle of motion of rigid bodies, liquids and knowledge sound energy.

Goal:

To enable the students in order to learn the basic principles, theory and concepts of matters, sound and mechanics.

Objectives

To gain knowledge by the students in order to

- learn motion of bodies and sound waves
- acquire basic knowledge of mechanics, properties of matter and gravitation
- know how to apply the conservation of rotational motion

UNIT I **(9 hrs)**

Conservation Law – Impulse – Impact – Direct and oblique impact – Final velocity and loss of kinetic energy –Motion of a particle in a vertical circle – friction – Laws of friction – angle of friction – resultant reaction – cone of friction – Equilibrium of a body on a rough inclined plane to the horizontal and when the inclination in greater then the angle of friction.

UNIT II **(9 hrs)**

Motion of rigid body

Moment of inertia – Parallel and perpendicular axes theorem – M.I. of rectangular Laminar and triangular laminar – M. I of a solid sphere about all axes – Compound pendulum – torque and angular momentum – Relation – Kinetic rotation – conservation of angular momentum

UNIT III **(9 hrs)**

Gravitation: Kepler's Law of Planetary motion – Laws of gravitation – Boy's method for G – Gravitational potential – Gravitational field at a point due to spherical shell – Variation of 'g' with latitude altitude and depth.

Elasticity: Elastic modules – Poison's ratio – relation between theorem – Expression for bending moment – determination of Young's modular by uniform and non-uniform bending I section girders – Static Tension – Expression for couple per unit twist – Torsional oscillation.

UNIT IV **(9 hrs)**

Surface Tension: Definition and dimension of surface Tension – Excess of Pressure over curved surface – Variation of S.T. with temperature Jaeser's Experiment.

Viscosity: Definition – Rotation viscometer- viscosity of gases , Meyer's Modification of Poiseuille's formula – Rankine's method for viscosity of gas.

UNIT V **(9 hrs)**

Sound: Simple Harmonic vibration – Progressive waves – properties – Composition of two S.H.M. and beats – stationary waves – Properties Melde's Experiment for the frequency of electrically maintained tuning fork – Transverse and longitudinal modes – Ultrasonic – Properties and application.

Text Books

1. Properties of Matter – Brijlal. and N. Subramaniam - S Chand & Co
2. Text Book of Sound – Brijlal. and N. Subramaniam - S Chand & Co

Reference Books

1. Mechanics, Properties of matter and sound, Thermal Physics – R. Murugesan, Edi 2002.
2. University Physics – Sears Semansky and Ground
3. Text books of Sound - Ghosh
4. Elements of Properties of Matter – D.S. Mathur
5. Mechanics - B.S. Mathur, S. Chand and Co, Edi 2002.

SEMESTER – II
CORE PAPER III ELECTRICITY AND MAGNETISM

No. of Credit Hours: 6 per week

Subject Description:

This paper presents the basic principle of charged body, when they are in rest and also under motion. This paper gives the knowledge regarding the electrical energy and magnetic energy.

Goal:

To enable the students in order to learn the basic principles theory and concepts of electricity and magnetism.

Objective

To gain knowledge about the electrical energies in order to

- learn motion of charges
- acquire basic knowledge of magnetic properties
- know about the alternating current and its circuits
- get a depth of knowledge in electricity and magnetism

UNIT I (18 hrs)

Gauss theorem and its applications

Normal electric induction L Gauss theorem, application of guass theorem; electric intensity at a point immediately adjacent to a charged conductor; energy stored in unit volume of an electric field .

Capacitance and Capacitors

Spherical capacitor: Cylindrical capacitor, Force of attraction between charged plates of a capacitor l change in the capacitance – capacity of a parallel plate capacitor; effect of introducing a dielectric slab between the plates – Guard ring condenser polarization in dielectric materials.

UNIT II (18 hrs)

Magnetic Properties of materials

Electron theory of magnetism; dia, para, ferromagnetism; magnetic field B; magnetization M; magnetic field intensity H; magnetic susceptibility and magnetic permeability; magnetic materials and magnetization; magnetic hysterisis area of the hysterisis loop; determination of susceptibility : Guoy's method – magnetic circuits - comparison of magnetic with electrical circuits.

UNIT III (18 hrs)

Thermo Electricity : Seebeck effect: Laws of thermo e.m.f; Peltier effect; Peltier Co-efficient, determination of Peltier co-efficient a junction; thermo dynamical consideration of Peltier effect; Thomson effect; Thomson Co-efficient; e.m.f generated in a thermocouple taking both Peltier effect and Thomson effect in the metals; Thermo electric power; Application of thermodynamics to Thermocouple ; Thermoelectric diagrams and their uses.

UNIT IV **(18 hrs)**

Helmholtz equation of varying current

Growth and decay of current in an inductive – resistive circuit charging and discharging of a capacitor through a resistance; charging and diacharging of capacitor through an inductance – oscillatory circuits- Force on a current carrying conductor; Theory of Ballistic Galvanometer.

UNIT V **(18 hrs)**

Dynamics of charged particles

Charged particles in a uniform and constant electric field; Charged particles in an alternating electric field; Charging particles in a uniform and constant magnetic field; magnetic focusing ; charged particles in combined electric and magnetic field when the fields are parallel and are in mutually perpendicular direction.

A conducting rod moving through a uniform magnetic field – inductance in series – in parallel – self inductance of coaxial cylinders – self inductance of toroidal coil of rectangular cross section – circular cross section – Grassot fluxmeter – comparison with Ballistic galvanometer – rotating magnetic field.

Books for Study

1. Electricity and Magnetism – Brijlala and Subramaniam
2. Electricity and Magnetism – R. Murugesan

Books for Reference

1. Electricity and Magnetism – D.N. Vasudeva
2. Electricity and Magnetism – Nagarathanam and Lakshminarayanan
3. Fundamental of Electricity and Magnetism – B.D.Duggal and C.L. Chhabra
4. Mechanics – D.S. Mathur

CORE PRACTICAL I

Credit Hours : 3 hours per week

ANY FOURTEEN EXPERIMENTS ONLY
(EXAMINATION AT THE END OF SECOND SEMESTER)

1. Compound Pendulum.
2. Comparison of Viscosities – Capillary Flow Method
3. Young's Modulus – Non- Uniform bending – Pin and Microscope
4. Young's Modulus – Uniform bending – Optic lever
5. Rigidity modulus – Static Torsion – Scale and Telescope
6. Sonometer – Frequency of A.C.
7. Spectrometer – Refractive index of Solid Prism
8. Resonance Column – Velocity of Sound
9. Moment of magnet – Tan C Position
10. Characteristics of a Junction Diode
11. Spectrometer – (i.d) Curve

12. Air Wedge – Thickness of Wire
13. Field along the axis of a coil – Moment of a Magnet
14. Potentiometer – Specific Resistance of a wire
15. Potentiometer – Low range Ammeter Calibration
16. Young's Modulus – Cantilever – Depression – Scale and Telescope
17. Young's Modulus – Cantilever – Dynamic Method
18. Viscosity by Capillary flow method
19. Melde's Strings – Frequency of Vibrator.

SEMESTER - III
CORE PAPER IV OPTICS

No. of Credit Hours : 4 hours per week

Subject Description

To study the optical instrument objects in images propagation of light, nature and behaviour of light, vibration of light laser and as application

Goal and objectives

To provide a good foundation in optics
To provide a knowledge of the behaviour of light
To inspire interest for the knowledge of concepts

UNIT 1 - Geometrical Optics (12 hrs)

Aberrations-- Spherical aberrations in lens—coma—Astigmatism-- chromatic aberration-- dispersion by a prism-- Cauchy's dispersion formula-- dispersive power, achromatism in prism-- dispersion without deviation-- chromatic aberrations in a lens-- circle of least confusion, achromatic lens--condition for achromatism of two thin lenses separated by a finite distances.

Physical Optics

UNIT 2 Interference (12 hrs)

Fresnel's Biprism – Interference in thin films due to reflected light – Fringes due to wedge shaped thin film – Newton's rings – Refractive index of the Liquid – Michelson interferometer – Determination of a wave length of monochromatic light – difference in Wave length between two neighboring spectral lines – Fabry Perot Interferometer – Visibility of fringes – sharpness of fringes – Resolving Power

UNIT 3 Diffraction (12 hrs)

Fresnel's assumptions – rectilinear propagation of light – half period zone – Zone Plates – Action and Construction – comparison with a convex lens – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction at a Single light – Diffraction grating – Resolving power & Dispersive power of Grating.

UNIT 4 Polarization (12 hrs)

Double Refraction – Huygen's explanation --Optic axis in the plane of incidence inclined and parallel, perpendicular to the crystal surface – Production and Detection of Plane, Circularly and

Elliptically Polarized light – Optical Activity – Fresnel's explanation – Specific rotation – Half Shade Polarimeter.

UNIT 5 Quantum Optics (12 hrs)

Light quanta and their origin – Resonance radiation – Metastable states – Population Inverse – Optical pumping – Spontaneous and Stimulated emission – Einstein's coefficient – Ruby, He-Ne, CO_2 laser – Resonant cavities – elements of non linear optics – second harmonic generation – threshold condition for lasing – Stimulated Raman scattering.

Books for Study

1. A Text book of Optics Brijlal & Subramaniam
2. Modern Physic R Murugesan

Books for Reference

3. Optics and Spectroscopy R Murugesan
4. Optoelectronics Thiyagarajan

SEMESTER – III

DIPLOMA PAPER I INSTRUMENTATION I

Subject Description

To study the instrument with its principle and observe the method their functioning

Goal and objectives

- ✓ To provide a good foundation in measurements
- ✓ To provide a knowledge of the behaviour of instruments
- ✓ To inspire interest for the knowledge of concepts regarding measurements

UNIT 1 (9 hrs)

Basic Concept of Measurement

Introduction – System configuration – Problem Analysis – Basic Characteristics of measuring devices – Calibration

Transducers

Capacitive transducers – Piezoelectric transducers – Photoelectric effect – Photoconductive transducers – Ionization transducers – Hall effect transducers – Digital displacement transducer.

UNIT 2 (9 hrs)

Performance Characteristics of an Instrumentation system

Introduction – Generalized measurement – Zero order system – Second order system – Dead time element – Specification and testing of dynamic response.

UNIT 3 **(9 hrs)**

Pressure Measurement

Mechanical Pressure measurement devices – Bourdon tube Pressure gauge – The Bridgeman gauge – Dead weight tester – Low Pressure measurement – The Mc lead gauge – Pirani thermal conducting gauge- The Knudsen gauge.

Unit 4 **(9 hrs)**

Flow Measurement

Positive displacement methods – Flow Obstruction methods – Flow measurement by drag effects – Hot wire and Hot film anemometers – Magnetic flow meters – Flow visualization methods – The Shadow graph

Unit 5 **(9 hrs)**

Measurement of Temperature

Temperature scales – The ideal gas thermometer – temperature measurements by mechanical effects – temperature measurements – Thermisters – Thermoeletric effects – quartz crystal thermometer – liquid crystal thermography.

Book for Study

Unit 1 & 2: Instrumentation Devices and Systems –
C S Rangan, G R Sharma, V S V Mani TMH.
Unit 3 & 4: Experimental Methods for Engineers – Jacy P Hofman, TMH.
Unit 5 : Experimental methods for experiments by Jack P Holman

SEMESTER – IV

CORE PAPER V ATOMIC PHYSICS AND NUCLEAR PHYSICS

No. of credit hours : 4 hours per week

Subject Description

Analysis of Atom, modeled in various aspects, spectral lines subjected to magnetic fields, light inducing electron emission, X-rays and the nuclear concepts of the atom.

Goals and Objectives

- ✓ To provide a detailed study of atom
- ✓ To learn the impact of magnetic fields on spectra
- ✓ To learn the behaviour of nucleolus in various states
- ✓ To provide a knowledge of the application of observed theories

Unit 1 Magneto Optical Properties of Spectrum (12 Hrs)

Optical spectra – Fine Structure of the sodium D line – Zeeman effect – Experiments – Lorentz classical theory – Expression for Zeeman shift – Larmor's theorem precession – Quantum mechanical explanation – Anomalous Zeeman effect – Paschen Back effect – Stark effect –

Unit 2 Photoelectric Effect (12 Hrs)

Introduction – Richardson and Compton experiment – Relation between Photoelectric current and retarding potentials – Relation between Velocity of Photo electrons and the frequency of light – Laws of Photoelectric emission – Failure of electromagnetic theory – Einstein's Photo electric equation – Experimental verification – Millikan's Experiments – Photo electric cells – Photo emission cell – Photo Voltaic cell – Photo conductive cell – Applications of Photo electric cell.

Unit 3 X-ray Spectra (12 Hrs)

X-ray – Coolidge tubes – Properties – X-ray Spectra – Continuous and characteristics X-ray spectrum – Mosley's law (Statement, Explanation and Importance) – Compton effect – Expression for change of wave length - X-ray diffraction-Bragg's law - Bragg's spectrometer - Powder crystal method.

Unit 4 – Radioactivity (12 hrs)

Natural Radioactivity – Alpha, Beta and Gamma rays – Properties – Determination of e/m of Alpha particle – Determination of e/m of Beta particle – determination of Wavelength of Gamma rays (Dumond Spectrometer) – Laws of Radioactivity – Soddy-Fajan's displacement law – Law of Radioactive disintegration – Half life period – Mean life period (Definitions, Expression) – Units of Radioactivity – Artificial Radioactivity – Preparation of radio elements – Application of radio isotopes.

Unit 5 - Nuclear Fission and Fusion Reactions (12 hrs)

Nuclear fission – Energy released in Fission – Bohr and Wheelers theory of Nuclear fission – Chain reaction – Multiplication factor – Critical size – Natural Uranium and chain reactions – Atom Bomb – Nuclear reactor – Nuclear fusion – Source of Stellar energy – Carbon Nitrogen cycle – Proton - Proton cycle – Hydrogen bomb – Controlled thermo nuclear reactions.

Book for Study:

1. Modern Physics R Murugesan (S. Chand & Company)

Books for Reference

1. Modern Physics Sehgal Chopra Sehgal
2. Source book on Atomic Energy Galsstons (S)
3. Atomic Physics Rajam
4. Introduction to Atomic Spectra White (HE)
5. Nuclear Physics D C Tayal
6. Concept of Modern Physics Arthur Beiser
7. Introduction to Modern Physics F K Richtmyer Etal

SEMESTER – IV

DIPLOMA PAPER II INSTRUMENTATION II

No. of Credit Hours : 3 Hours

Subject Description

To study the instrument with its principle and observe the method their functioning

Goal and objectives

- ✓ To provide a good foundation in measurements
- ✓ To provide a knowledge of the behaviour of instruments
- ✓ To inspire interest for the knowledge of concepts regarding measurements

UNIT 1 **(9 Hrs)**

Temperature Measurement by Radiation:

Effects of heat transfer and temperature measurements – Transient response of thermal systems – Thermocouple compensation – Temperature measurement flow in high speed flow.

Thermal and transport property Measurement.

Thermal conductivity measurements – Thermal conductivity of liquids and gases – Gas diffusion – Calorimeter – Convection – heat transfer measurements – Humidity measurements – Heat flex meter – pH measurements.

UNIT 2 **(9 Hrs)**

Force, Torque and Strain Measurements

Introduction – Mass balance measurements – Elastic elements for force measurements – Torque measurement – Stress and Strain measurements – Electrical resistance – strain gauges – Temperature compensation.

UNIT 3 **(9 Hrs)**

Vibration

Random Vibration – Shock – Analyzing vibration sensing devices – Generalized second order system – Absolute displacement – Absolute velocity and acceleration vibrating sensing devices – Velocity transducer – Banded strain gauge accelerators – Piezo electric accelerometer.

UNIT 4 **(9 Hrs)**

Thermal and Nuclear Radiation Measurements

Introduction – Detection of thermal radiation – Measurement of emissivity – Reflectivity and Transmitting measurements – Solar radiation measurements – Detection of Nuclear radiation – The Geiger Muller counter – Ionization chamber – Photographic detection methods – Neutron detection – Statistics of counting.

UNIT 5 **(9 Hrs)**

Air Pollution Sampling and Measurements

Introduction – Units of pollution measurements – Air pollution standards – General air sampling – Train gas sampling techniques – Particulate sampling techniques – Sulpher dioxide measurements – Combustion products measurements – opacity measurements – odor measurements.

Books for Study:
Unit 1, 2, 4 to 5: Experimental methods for Experiments by Jack P Holman
Unit 3: Instrumentation Devices and Systems –
C S Rangan, G R Sharma, V S V Mani TMH.

CORE PRACTICAL – II
(Examination at the end of Fourth Semester)
Any Fourteen (14) Experiments only

1. Rigidity Modulus – Torsional Pendulum – With & Without symmetrical masses
2. Quincke's method – Surface Tension and Angle of Contact of Mercury
3. Specific heat capacity – Newton's law of cooling – Spherical calorimeter
4. Spectrometer – Hollow prism – Refractive index of the Prism
5. Determination of M_H and B_H
6. Zener diode - Characteristics
7. Spectrometer – (i – i') curve
8. Newton's rings – Refractive index of a lens
9. Reduction factors of a Tangent Galvanometer - BG
10. Comparison of Mutual Inductance - BG
11. Spectrometer – Grating – Minimum deviation & Normal Incidence
12. Young's Modulus – Koenig's Method – Non Uniform bending
13. Young's Modulus – Koenig's Method – Uniform bending
14. Spectrometer – Cauchy's constant
15. Spectrometer – Dispersive Power
16. Spectrometer – Narrow Angled Prism
17. Carey Foster's Bridge – Temperature Coefficient
18. Potentiometer – Reduction factor of T.G in Primary
19. Potentiometer – EMF of a thermocouple
20. B.G - Absolute Capacity
21. B.G – Determination of High Resistance

SEMESTER – V
CORE PAPER VI MATHEMATICAL PHYSICS

No. of credit hours : 5 per week

Subject Description :

This paper presents the fundamental of classical mechanics special functions and matrices which will be used for studies solving problems during research work.

Goal:

To enable the students to acquire the problem solving ability and to apply the equations for the situation of different physical problems.

Objectives

To acquire knowledge and apply it to various physical problems

- Various physical problems
- To apply the develop the problem solving ability.
- To motivate the students to apply matrices or solving problems in spectroscopy, nuclear physics etc.,
- To apply vectors to non-linear dynamics

UNIT 1 **(15 Hrs)**

Classical Mechanics - I

Constraints and Degrees of Freedom – Generalized coordinates – Generalized displacement – Velocity – Acceleration – Momentum – Force – Potential – D'Alembert's Principle – Lagrangians equation from D'Alembert's principle – Application of Lagrange's equation of motion to Linear Harmonic Oscillator, Simple Pendulum and Compound Pendulum.

UNIT 2 **(15 Hrs)**

Classical Mechanics – II

Phase Space – Hamiltonian function – Hamiltonian Principle – Hamilton's canonical equations of motion- Physical significance of H – Applications of Hamiltonian equations of motion to Simple Pendulum, Compound Pendulum and Linear Harmonic Oscillator.

UNIT 3 **(15 Hrs)**

Special Functions

Definition – The Beta function – Gamma function – Evaluation of Beta function – Other forms of Beta function – Evaluation of Gamma function – Other forms of Gamma function - Relation between Beta and Gamma functions – Problems.

UNIT4 **(15 Hrs)**

Matrices

Introduction – special types of Matrices – Transpose of a Matrix – The Conjugate of a Matrix – Conjugate Transpose of a Matrix – Symmetric and Anti symmetric – Hermitian and skew Hermitian – Orthogonal and Unitary Matrices – Properties – Characteristics equation – Roots and characteristics vector – Vector – Diagonalization of matrices – Cayley – Hamilton theorem – Problems

UNIT 5 **(15 Hrs)**

Vector Calculus

∇ Operator – Divergence – Second derivative of Vector functions or fields – The Laplacian Operator – Curl of a Vector – Line Integral – Line Integral of a Vector field around an infinitesimal rectangle – Curl of Conservative field – Surface Integral – Volume Integral (without problem) – Gauss's Divergence theorem and it's proof – Stoke's and its proof with simple problems.

Books for Study and Reference

1. Mathematical Physics B D Gupta
2. Mathematical Physics Rajput

3. Classical Mechanics — Gupta Kumar & Sharma
4. Mathematical Physics — K N Pillai
5. Mathematical Physics — Sathiya Prakash
6. Mathematical Physics — H K Dass
7. Mathematical Physics — Gupta Kumar & Sharma

SEMESTER – V
CORE PAPER VII APPLIED ELECTRONICS

No. of credit hours : 4 hours per week

Subject Description :

This paper presents the fundamentals of electronics and its theory which will be used for studies solving problems during research work.

Goal:

To enable the students to acquire the knowledge of electronics and to apply the principles for the situation of different physical problems.

Objectives

To acquire knowledge and apply it to

- Various electronics instruments
- To apply the development of the electronic instruments.
- To motivate the students to apply the principles of electronics in their day – to – day life.

UNIT 1 – Amplifiers (12 hrs)

Characteristics of an amplifier, Voltage amplifiers - Feed back amplifier- feed back and related terms- block diagram of a feed back amplifier-Transfer gain of an amplifier with feedback-Emitter follower circuit - an example of negative feedback.

UNIT 2 – Oscillators (12 hrs)

Introduction - Types of oscillators - Fundamental principle of oscillators - Concept of feedback oscillators - Hartley oscillators –Analysis - Colpitts oscillators –Analysis - Phase shift oscillators-Analysis - Wien bridge oscillator – Analysis.

UNIT 3 -- Solid state switching circuits (12 hrs)

Introduction - important terms - Collector leakage current - Saturation collector current - Switching transistors - Switching action transistor – OFF region – ON region – Active Region. Multivibrator – Types of multivibrator –Transistor Astable multivibrator – circuit details - Operations - ON or OFF time – transistor mono stable multivibrator -Circuit details – operations – transistor Bistable multivibrator - Circuit details – operations.

UNIT 4 -- Wave Shaping Circuits (12 hrs)

Differentiating circuit - Output waveforms - Integrating circuit – Output waveforms-Important applications of diodes – Clipping circuit – positive clipper – biased clipper – combinations

clipper – applications of clipper- Clamping Circuits-basic idea of a clamper-Positive clamber – Operations – negative clamper.

UNIT 5 -- Power Electronics (12 hrs)

Introduction - power electronics - The Triac – Construction - Operations – Characteristics - Applications. The Diac – Operations – Applications of Diac – Lamp dimmer heat control. Uni junction transistor – Constructions – Operations - equivalent circuit of UJT – Characteristics of UJT - advantages of UJT – UJT relaxations Oscillator - UJT over voltage detector.

Book for Study and Reference

1. Foundation of Electronics D Chattopadhyaya & R C Raksjti
2. Principles of Electronics V K Metha
3. Applied Electronics R S Sedha
4. Integrated Electronics Millman and Halkias
5. Electronics devises and Circuits Millman and Halkias.

SEMESTER – V
CORE PAPER VIII
SOLID STATE PHYSICS

No. of credit hours : 4 hours per week

Subject Description :

This paper presents the fundamentals of solids and its bond theory which will be used for studies solids, how they are formed.

Goal:

To enable the students to acquire the knowledge of electrons and their bonds with the external applied force as well as the interval attractive force.

Objectives

To acquire knowledge of

- Various bond theory
- And to know the method of forming different alloys, conducting materials.
- To motivate the students to apply the principles of bond theory in their research studies.

UNIT 1 (12 hrs)

Crystallography: Distinction between crystalline and amorphous solids – Different features of the crystal – Crystal lattice – Basis – Crystal structure – Unit cell – Number of lattice points per unit cell- Bravise lattices – Miller indices – Elements of Symmetry – Structure of KCl and NaCl crystal – Atomic Packing – Atomic radius –-Lattice constant and density- Crystal structure (sc; hcp; fcc;bcc.)

UNIT 2 **(12 hrs)**

Band theory of solids – Classification of solids – Basics of Bond theory – Optical properties of solids – Specific heat capacity of solids – Dulong and Pettit's law – Einstein's theory of specific heat of solids – Fermi levels .

UNIT 3 **(12 hrs)**

Free electron theory – Drude Lorentz theory – Explanation of Ohm's law – Electrical conductivity – Thermal conductivity – Wide-Mann and Franz ratio – Sommerfield model – Schotcky effect – Hall effect – Hall voltage and Hall coefficient – Mobility and Hall angle – Importance of Hall effect – Experimental determination of Hall coefficient.

UNIT 4 **(12 hrs)**

Magneto properties of materials – Dia Magnetism – Para Magnetism – Ferro Magnetism and Anti Ferro Magnetism – Magnetic fields properties due to circulating current in atoms – Langevin's theory of Dia magnetism – Langevin's theory of Para Magnetism – Weiss' theory of Ferro Magnetism.

UNIT 5 **(12 hrs)**

Dielectrics- Dielectric constant and displacement vector- Clausiss mossotti relation- Atomic or molecular polarizability – Types of polarizability -Super conductivity – Phenomena – magnetic properties – Super conductor – Meissner effect – Experimental facts – Isotopes effect – Thermodynamic effect.

Books for Study:

1. Solid State Physics Gupta and Kumar
2. Modern Physics R Murugesan

Books for Reference:

1. Introduction to Solid State Physics Charles Kittel
2. Solid State Physics A J Dekker

SEMESTER – V
CORE PAPER IX
PRINCIPLES OF DIGITAL ELECTRONICS AND MICRO PROCESSORS

No. of credit hours : 3 hours per week

Subject Description

This paper presents basic principles of digital electronics. This paper gives deep knowledge to the students regarding number system, arithmetic building blocks, memories and data processing circuits.

Goal

To enable the students to learn the basic principles, theory and concepts of number system memories and data processing circuits counters

Objectives

To give description for the students in order to

- Learn the logic circuits
- Acquire basic knowledge of binary addition
- Understand the action and application of counters
- Get a deep knowledge of various memories used in computer circuits

UNIT 1 - Arithmetic Circuits (9 hrs)

Binary addition - Binary Subtraction – Unsigned Binary numbers - sign magnitude numbers – 2's complement representation – 2's complement Arithmetic – Arithmetic building blocks – The Adder – Subtractor.

Flip – Flops:

RS flip flop – Clocked RS flip flop – D flip flop – Edge triggered D flip flop – JK flip flop – JK Master Slave flip flop – Schmitt trigger.

UNIT 2 - Shift Register and Counters (9 hrs)

Types – Serial In Serial Out – Serial In Parallel Out – Parallel In Serial Out – Parallel In Parallel Out – Ring counter – Asynchronous counter – Decoding gates – Synchronous counter – Mod 3 counter – Mod 5 counter – shift counter.

UNIT 3 - Semiconductor Memories (9 hrs)

Basic – Memory addressing – ROM's PROM's and EPROM's – RAM's – DRAM's – Dynamic RAM's.

D/A and A/D Conversion:

Variable – Resistor Network – Binary ladder – D/A converter – A/D converter – Simultaneous conversion – Counter method – continuous A/D conversion

Unit 4 - Microprocessor and Data Representation (9 hrs)

Basic concept – what is Microprocessor, 4, 8, 16, 32 – Organization of Microprocessor – Microprocessor Programming – Instruction – Machine and Mnemonic codes – Machine and Assembly Language Programming – High level Language programming – Timing diagram conventions.

Organization of 8085 – Data and Address buses addressing – The I/O devices – Register in 8085 – Instruction types – Classification of Instruction – Addressing modes – Programming the 8085 – The Programming process – machine language programming – Assembler Programming.

Unit 5 Semi Conductor Memories (9 hrs)

Introduction – Registers – Primary memory – Mass storage, cache – off line backup – memory chips – static and dynamic RAMs, ROMs and their versions characteristics of memories : Memory chip capacity and organization – memory size – combining the chips together with example electrical signals. Static RAM : Organisation of 6264 – Read and write cycle of 6264 – dynamic RAMS : Organisation of 51100 x – Read and write cycle of 51100 x RAS only fresh hidden fresh – Burst and distributed i.e., fresh – pseudo static ram and automatic refresh.

Books for Study:

1. Digital Principles and Applications – Albert Paul Malvino & Donald P Leach (Fourth Edition, TMH).
2. Introduction to Microprocessors by Aditya P Mathur (3rd Edition TMH).

Books for Reference:

1. Integrated Electronics – Millmann & Halkeias
2. Microprocessors by Goenkar - Microprocessors by K Ramachandran.

SEMESTER – V
DIPLOMA PAPER III INSTRUMENTATION III

No. of Credit Hours : 3 Hours per week

Subject Description

To study the instrument with its principle and observe the method their functioning

Goal and objectives

- ✓ To provide a good foundation in measurements
- ✓ To provide a knowledge of the behaviour of instruments
- ✓ To inspire interest for the knowledge of concepts regarding measurements

UNIT 1 **(9 hrs)**

Data Acquisition and Conversion

Introduction – Signal conditioning of the inputs – Single channel data acquisition systems – Multi channel data acquisition system – Data conversion – Digital of Analog converter – Analog to Digital converter – Multiplexer and Sampling hold circuits.

UNIT 2 **(9 hrs)**

Input – Output Devices and Displays

Introduction – Analog display and recorder – Graphic recorder – Optical oscillograph – self balancing potentiometer – X-Y recorder – Magnetic recorder – Digital input – output devices – Punched card-paper type – output equipments – Line printer – Digital tape recording – Disk files and floppy disk.

UNIT 3 **(9 hrs)**

Basic meter movements

Permanent magnetic moving coil movements – Practical PMMC movements – Taut band instrument – Electro dynamometer – Moving ion type instrument – Concentric vane repulsion type (Moving ion type) – Display devices: LED – LCD – Gas discharge Plasma displays – Sequential display using LED's – Line printer – Drum printer – dot matrix printer.

UNIT 4 **(9 hrs)**

Digital Instruments

Introduction – Digital Multi meter – Digital panel meters – Digital frequency meters – Digital measurement of time – Universal counter – Digital measurement of frequency – Digital tacho meter – Automation in digital instruments.

UNIT 5 **(9 hrs)**

Oscilloscope

Introduction – Basic principles – CRT features – Basic principles of signal displays – Block diagram of oscilloscope – Simple CRO – Vertical amplifier – Horizontal deflecting system – Delay line in triggered sweep – CRT connection – Dual beam CRO – Dual beam oscilloscope – Storage oscilloscope measurement of frequency, capacitance, inductance and Voltage.

Book for Study:

Unit 1& 2: Instrumentation Devices and Systems – C S Rangan, G R Sharma, V S V Mani TMH
Unit 3, 4 & 5: Electronic Instrumentation by H S Kalsi TMH

SEMESTER – VI
CORE PAPER X
QUANTUM MECHANICS AND RELATIVITY

No. of credit hours : 6 hours per week

Subject Description :

This paper presents the fundamentals of wave mechanics, Schrödinger's wave equation and its applications.

Goal:

To enable the students to acquire the problem solving ability and to apply the Schrödinger's wave equation for the situation of different physical problems.

Objectives

To acquire knowledge and apply it to

- Various physical problems
- To apply the develop the problem solving ability.
- To motivate the students to apply Schrödinger's equation or solving problems in wave mechanics, nuclear physics etc.,

UNIT 1- Wave Properties of Matter **(18 hrs)**

Introduction – Phase velocity and Group velocity – Analytical expression for a group of waves – Nature of De'Broglie relation – Derivation of the De'Broglie relation – Phase velocity of De'Broglie waves – Relation between the Phase velocity and the wavelength of De'Broglie wave – De'Broglie wavelength associated with a particle of mass M and kinetic energy – Verification of De'Broglie relation – Davission and Germer's experiments – G P Thomson's experiments.

UNIT 2 - Uncertainty Principle **(18 hrs)**

Introduction – Uncertainty Principle – Elementary proof between – Displacement and Momentum – Energy and Time – Physical Significance of Heisenberg's Uncertainty Principle – Illustration – Diffraction of electrons through a slit – Gamma ray microscope thought

experiment – Application – Non-existence of free electrons in the nucleus – Size and Energy in the ground state of Hydrogen atom

UNIT 3 - Schrödinger's Wave Equation (18 hrs)

Introduction – Wave function for a free particle – Schrödinger's One dimensional wave equation – Time-dependent and Time independent – Physical interpretation - Limitation – Normalization of wave function – Operators – Eigen function – Eigen Value – Eigen equation – Operator for Momentum, Kinetic Energy and Total Energy – Postulates of Quantum Mechanics – Orthogonality of Energy Eigen function – Proof – Probability current density – Ehruenfest's theorem – Statement and proof.

UNIT 4 - Spherical Symmetrical systems (18 hrs)

Three dimensional schrödinger's wave equation –Hydrogen atom – Wave equation for the Motion of a electron – Separation of variables – Azimuthal wave equation and its solution – Radial wave equation and it's solutions – Polar wave equation and its solution – Ground size of the Hydrogen atom.

UNIT 5 – Relativity (18 hrs)

Galilean Transformation equation – Ether Hypothesis – Michelson-Morley experiment – Explanation of the Negative results – special theory of Relativity – Lorentz transformation equation – Length contraction – Time dilation – Addition of Velocities – Variation of Mass with velocity – Mass energy equivalence.

Books for Study:

1. Quantum Mechanics S.P Singh and M.K Banda
2. Modern Physics R Murugesan

Books for Reference:

1. Quantum Mechanics Schiff
2. Introduction to Modern Physics F.K Richtmyer Etal

SEMESTER – VI
CORE PAPER XI
PRINCIPLES OF PROGRAMMING CONCEPTS AND C PROGRAMMING

Subject Description

This subject deals with the programming concepts of C language

Goal

To learn about C programming with various features

Objectives

On successful completion of this subject the student should have.

- Writing programming ability on scientific and mathematical problems
- It is very useful to the students in many ways like their higher studies and research etc., because of its versatility.

UNIT I **(12 hrs)**

Introduction – character sets – constants – keywords – and identifiers – variables – variables – data types – declaration of variables – assigning values to variables – defining symbolic constants.

UNIT II **(12 hrs)**

Arithmetic operators – relational operators – logical operators – assignment operators – increment and decrement operators – conditional operators – special operators – arithmetic expression – evaluation of expression. – precedence of arithmetic operators – some computer problems – type conversion in expression – operator precedence and associativity – mathematical functions.

UNIT III **(12 hrs)**

Reading and writing character – formatted input and output – decision making : IF statement : Simple IF – IF ELSE – Nesting of IF.. ELSE – ELSE. IF Ladder – Switch Statement – operator – go to statement – while .. do while – For loop – Jumps in loops – simple programs.

UNIT IV **(12 hrs)**

Arrays : Introduction – One dimensional array – declaration of array – Initiating on two and multidimensional arrays – declaring and initializing string variables – reading strings from terminal – writing strings on the screen – Arithmetic operations on characters – simple programs.

UNIT V **(12 hrs)**

Need for user defined functions – A multifunction program – RETURN values and their types – functions calls – category of functions – no arguments and no return values – simple programs.

Text Book

1. "Programming in ANSI C" by E. Balagurusamy, 3rd Edition

Reference Book

Programming in C by Ashok N. Kamthane First Indian Print 2004, Pearson.

SEMESTER – VI
CORE PAPER XII
OBJECT ORIENTED PROGRAMMING WITH C++

No of credit hours : 5 hours per week

Subject Description :

This subject deals with the programming concepts of object oriented programming using C++

Goal:

To learn about object oriented programming concepts with different features

Objectives

On successful completion of this subject the student should have

- ❖ Writing program ability on oops concepts like encapsulation, data abstraction, Inheritance, polymorphism and overloading etc.
- ❖ To implement various scientific and mathematical problems with minimum no. of lines.

UNIT I **(15 hrs)**

Software evolution – Procedure Oriented programming object oriented programming (oop) – Basic concepts benefits of OOP – Obejct oriented languages – Application of OOP – A simple C++ program – Structure of C++ program- Tokens – Key words- Identifiers and constants Basic data types – User defined Data Types – Derived data types – symbolic constants – Type compatibility – Declaration of variables – Dynamical Initialization of variables – Reference variables – Operators in C++ - Scope resolution operators.

UNIT II **(15 hrs)**

The main function – Function prototyping – call be reference – Inline functions – Default arguments – Function overloading – Math library functions - classes and objects.

UNIT III **(15 hrs)**

Constructors and destructors – operator over loading and type conversions

UNIT IV **(15 hrs)**

Inheritance : Extending classes – Pointers- Polymorphism – pointers to objects – this pointer pointers to derived classes.

UNIT V **(15 hrs)**

Virtual functions – pure virtual functions – Managing console I / o operators.

Text Book

1. "Object Oriented Programming with C++" by E. Balagurusamy, Second edition.
2. Programming with C++, John R. Hubbard, II Edition 2002, TMH Publications

CORE PRACTICAL – III– ELECTRONICS PRACTICAL
(EXAMINATION AT THE END OF SIXTH SEMESTER)
ANY SIXTEEN (16) EXPERIMENTS ONLY

1. Bistable Multivibrator
2. R.C. Coupled Amplifier – Transistor single stage
3. Hartley Oscillator – Solid State
4. Colpitt's Oscillator – Solid State
5. Tuned Plate Oscillator
6. Tuned Grid Oscillator
7. Astable Multivibrator
8. Series and Parallel resonance circuits
9. Differential Circuit and Integrating Circuit
10. Clipping and Clamping Circuits
11. Study of Solar Cell

12. Logic Gates – Discrete components
13. Emitter Follower
14. IC – Regulated Power Supply
15. Transistor – Regulated Power Supply
16. Dual Power Supply
17. Square wave generator using 555 IC
18. Study of LDR
19. UJT Characteristics
20. Bridge rectifier with voltage regulation
21. junction diode & Zener diode Characteristics

CORE PRACTICAL – IV DIGITAL AND MICROPROCESSOR (EXAMINATION AT THE END OF SIXTH SEMESTER) ANY SIXTEEN (16) EXPERIMENTS ONLY

1. Verification of Truth tables of IC gates: OR, AND, NOT, XOR, NOR and NAND.
2. NAND as universal building block- AND, OR, NOT
3. Verification of De Morgan's theorem.
4. Boolean Algebra –problem solving
5. Study of RS Flip-Flop.
6. Study of Shift –Registers –Serial in Parallel out.
7. Decade counter using 7490.
8. Half adder.
9. Full adder
10. Half Subtractor and Full Subtractor.
11. 4 BIT – Binary Adder & Subtractor using 7483.
12. Code converter (Binary to gray and vice versa) & Seven segment Decoder
13. Binary Counter using 7493.
14. Parity check logic.
15. Up/Down Counter using 74190
16. 8085 ALP for 8 bit Addition and Subtraction
17. 8085 ALP for One's Complement, Masking off most significant 4 bits and setting bits.
18. 8085 ALP for Two's compliment Addition and Subtraction
19. 8085 ALP for 8 Bit Multiplication and Division
20. 8085 ALP for finding the Biggest number element in the array and Sum of the elements in the Array

CORE PRACTICAL – V
C AND C++
ANY SIXTEEN (16) EXPERIMENTS ONLY

Programming in C

1. Find the number of Days elapsed between two dates.
2. Convert Integer in the range 1 to 100 in words.
3. Write a program that uses functions to compare two strings input by user. The Program should state whether the first string is less than, equal or greater than the second Strings.
4. Write a Program to compare two files printing the Character position where they equal and where they are differ.
5. Write a Program for Matrix addition
6. Write a Program for Matrix Multiplication.
7. Write a Program for Addition of Two times
8. Write a Program for find the Inverse of given Matrix
9. Write a Program for display the Multiplication table.

Programming in C++

1. To read any two number through the key board and to perform simple Arithmetic Operation (Use Do while loop)
2. To display the name of the day in a week, depending upon the number entered through the keyboard using Switch – case statement.
3. To read the elements of the given two matrix of m X n and to perform the Matrix addition
4. Write a Program for Matrix Multiplication table.
5. Write a Program to find the Inverse of Given m X n Matrix
6. Write a Program to find the Modulus of the Given Number
7. Write a Program to compare two files printing the character position where they are equal and where they are differ.

SEMESTER – VI
DIPLOMA PAPER IV
INSTRUMENTATION PRACTICAL
(Any Twelve)

1. Construction and Service of Power supply - 2, 4, 6 Volts
2. Regulated power supply construction and service - 5V& 12V
3. Dual power supply construction and service - (-12)-0- (+12)
1. Regulated power supply service - 5V& 12V
2. Dual power supply service - (-12)-0- (+12)
3. Servicing - Microscope
1. Servicing Telescope
4. Servicing - Spectrometer
5. Servicing -Galvanometer,
6. Servicing - Voltmeter
7. Servicing - Ammeter.
8. Servicing --UPS

9. Servicing ---Stop clock and Stop watch
10. Servicing ---Physical Balance
11. Servicing.—Mixie
12. Servicing.—Resistance box and Capacitance box
13. Servicing --- Signal Generators
14. Fixing and servicing a B.G.
15. Cutting, drilling, polishing and trimming.
16. Servicing.—Iron Box

SEMESTERS : V

ELECTIVE PAPER I – A NANOMECHANICS

Subject Description

This paper presents basic principles of nano materials. This paper gives deep knowledge to the students regarding the nano particles.

Goal

To enable the students to learn the basic principles, theory and concepts of nano mechanics.

Objectives

To give description for the students in order to

- Learn the size of the particles
- Acquire basic knowledge of atomic sizes.

UNIT I **(12 hrs)**

Crystal lattices- two – dimensional crystals – three dimensional crystals – crystal structure with basis – periodic functions – one dimensional fourier series – two and three dimensional fourier series the reciprocal lattice – reciprocal space lattice – examples – Bloch's theorem.

UNIT II **(12 hrs)**

Crystal theory of lattice – diatomic interaction potentials – boundary conditions in two and three dimension – normal models of the lattice – optical phonos – normal mode Hamiltonian – quantum operators for normal modes – connection to the classical continuum theory of solids

UNIT III **(12 hrs)**

The three atom chain – quantum mechanics and linear chain effect of temperature on the linear chain – specific heat for an atom chain – thermal expansion - quantum operator for the simple harmonic oscillators – quantum operators for the n atom chain.

UNIT IV **(12 hrs)**

Superposition – the stress tensor properties body forces – torques balance in the present of body forces – liners elastic response – orthorhombic materials – strain stress relation – polycrystalline materials.

UNIT V **(12 hrs)**

A simple fabrication sequence – radio frequency flexural resonators – non linear resonators – free – free resonators – the Mathieu oscillator – optical parametric resonators – mechanical electrometers – thermal conductance in nanostructure – coupling of electron transport and mechanical motion.

BOOKS FOR STUDY

1. Fundamentals of Nano Mechanics – Andrew Nn.cleland springer, 2003.

SEMESTER : VI
ELECTIVE PAPER II - A
FUNDAMENTALS OF NANO MATERIALS AND ITS CHARACTERIZATION

Subject Description

This paper presents basic principles of nano materials. This paper gives deep knowledge to the students regarding the nano particles.

Goal

To enable the students to learn the basic principles, theory and concepts of nano mechanics.

Objectives

To give description for the students in order to

- Learn the size of the particles
- Acquire basic knowledge of atomic sizes.

Unit 1. INTRODUCTION TO NANOTECHNOLOGY (12 hrs)

Definition of Nanoscale system – Feymann theory of Nanotechnology – types of nanotechnology – Molecular Nanotechnology – Molecualr and atomic size – Surface and dimensional space – opportunities at the Nanoscale.

Unit 2. NANO PROPERTIES (12 hrs)

Forces between atoms and molecules, particles and grain boundaries – Vander Waals and electrostatic forces between surface – Nano and Mesopores – size dependent variation in magnetic, electronic transport, resistivity, optical and etc – Misnomers and misconception of Nanotechnology.

Unit 3. QUANTUM CONFINEMENT (12 hrs)

Quantum confinement in one dimension – Quantum walls – Quantum confinement – In two dimensions – Quantum wires – Quantum confinement in three dimensions – Quantum dots – Super lattices band – Band offsets – Quantum dot layers.

Unit 4. SYNTHESIS OF NANOMATERIALS AND ITS CHARACTERIZATION (12 hrs)

Basic approaches of synthesis nanomaterials – Bottom up and top down process – fundamental of sol – gel process – Sol – Gel synthesis methods for oxides – Mechanical milling – thermal evaporation – XRD with Debye scherrer formula – SEM- TEM – FTIR – UV.

Unit 5. APPLICATION OF NANOMATERIALS (12 hrs)

Implications of Drug delivery – Polymeric Nanoparticles as Drug carriers and controlled release implant devices – Magnetic Data Storage – Magneto optics and magneto – optic recording – Nano Sensors – Physical sensor and chemical sensors.

REFERENCES:

1. Nanotechnology : Basic Science and Emergic Technologies – Mick Wilson, Kamli Kannangara, Geoff smith , Michelle Simmons, Burkhard Raguse, overseas press (2005)
2. Nanotechnology : A Gentle introduction to the next big idea, Mark A. Rather, Daniel Rather, Mark Rather, prentice Hall PTR; 1st edition (2002)
3. Robert W. Kel Sall, Mark Geoghenan, In W. Hamley, Nano Scale Science and technology, John Wiley and sons, 2005 ISBN 0470850868.
4. Recent advances I the liquid phase synthesis of inorganic nanoparticals Brain L. Cushing, Valdimir L. Kolesnichenko, Charles J. O* Connor, Chem Rev 104 (2004)3893- 3946.
5. Nano composite science and technology, Palical M. Ajayan, Linda S. Schadles, Paul V. Braues, Wiley – VCH Verlag WEileim (2003).
6. www.eng.vcedu/Ngbeaucag/calsses/XRD/Neutron_diffraction_atLNL.pdf
7. Nano particulates as Dring Carriers , Edited by Vladimir P. Torchilin, Imperiacal college press, North Einstein university, USA (2006), ISBN 1 – 86094 – 630 – 5.
8. Magnetic materials: Fundamental and device applications Nichola. Ann spaldin, Cambridge University press (2003) ISBN 0521016584.

SEMESTER : VI
ELECTIVE PAPER III - A
NANOSCALE MATERIALS & DEVICES

Subject Description :

This subject deals with the application material science.

Goal:

To learn about the application and uses of materials in day-to-day life.

Objectives

On successful completion of this subject the student should have

- The knowledge of applied science in practical life.
- To implement various scientific and mathematical problems with materials science.

Unit 1. SEMICONDUCTING NANOMATERIALS: (12 hrs)

Classification - Thermodynamics and kinetics of plane transformation – synthesis methods – micro structural stability – powder consolidation – physical, chemical. Mechanical properties – catalytic properties – present and potential applications for nano materials.

Unit 2. MAGNETIC NANOMATERIALS (12 hrs)

Particulate Nanomagnetis – Geomaterial nanomagnets – Fabrication techniques scaling-magnetic Data storage – Introduction – magnetic – media – properties – materials used – write Heads – Read Heads – Magentroresistance – General- In normal metals and in ferromagnetic materials – future of magnetic data storage.

Unit 3. NANO BIOTECHNOLOGY (12 hrs)

Natural nano composites – Introduction – natural nano composite materials biologically synthesized nano structures – biological device and synthetic nano composite – protein based nanostructure formation – biologically inspired nano composite nanotechnology in agriculture (fertilizers and pesticides)

Unit 4. NANO LITHOGRAPHY (12 hrs)

(i) Nano lithography techniques

Hug- Resolution E – beam Nanolithogrpahy- Resists exposure metrics – High resolution resists – proximity Effects – Direct warning

(ii) Proximal probe Nanolithography

STM – AEM – DIP pem nano lithography – resist imaging layers for proximal probes – Lang mum – Nano scratching

Unit 5. NANO ELECTRONICS (12 hrs)

Basic of Nano electronics – Features of Nano electrons- some physical fundamentals , Basic of information theory – the birth of electronics – The tool for micro and Nano fabrication – Basic of lithographic techniques for nano electronics.

Reference

1. Robert W. Kelsall, Mark Geohegan, Ian W. Hamlet, Nano Scale and Technology, John Wiley and sono, 2005 ISBN 0470850868
2. Ultra thin magnetic structure III – Fundamentals of nano magnetism Jac B1 and B. Heinrich , springer(2004) ISBN 3540219536.
3. Magnetic materials : fundamentals and device applications Nicola Ann Spaldin, Cambridge University press (2003) ISBN 0521016584
4. Bionanotechnology : Lenons from nature by: Davids Good Sell, Wiley – Liss (2004)
5. Nanobiotechnology: Protocols, Sadra J. Rosenthal, David W. Write. Series: methods in molecular. Biology (2005)
6. John N. Helbert “Hand books of VLSI microlithography” moyer publication, USA 2001.
7. James R. Sheats and Bruce W. Amith, “Microlithography Sciences and Technology” Marcell, Dekkar INC New York, 1998.
8. Nano electronics and Nanosystems : from transistors to molecular devices K. Goser, P. Glosekolter, J. Deinstall. Springer (2004).