NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.Y.B.Sc. (PHYSICS)

SYLLABUS FROM JUNE,1994

I

Paper-I Section-I

MATHEMATICS FOR PHYSICS

Chapter-I : Vector Analysis :-

Physical significance of gradient of scalar field, Divergence and Curl of a vector field, line integral, surface integral and volume integral. Gauss's Theorem, Stoke's theorem, Greens 1st and 2nd theorems and Green's theorem in plane (Their statements, proofs and problems)

(10 Marks)

Chapter-II: Curvilinear Co-ordinates :-

Introduction to cartesian (X,Y,Z), Spherical polar (r, θ, ϕ) and cylindrical (ρ, ϕ, z) Co-ord. systems and transformation equations. General curvilinear Co-ord. systems. Co-ordinate surfaces, Co-ord. lines. length element, Surface element and volume element in curvilinear Co-ord. system, Metric Co-efficients.

Orthogenal curvilinear Co-ord. system, expression for gradient, divergence, Laplacian and Curl. special cases of the above for cartesian, Spherical polar and cylindrical co-ord. systems. (12 Marks).

Chapter-III:- Differential equations and Special functions :-

Introduction to partial differential equations Frequently occuring partial differential equations in Physics(It is expected that nature diffequation such as its degree, order, linears and homogenity should be discuss with examples). Method of seperation of variables (Wave equation and Laplace equation in cartesian, spherical polar and cylindrical co-ord. system) Singular points, Fuch's theorem. (Statement only)Frobenius method-method of series soln. Series soln. of linear simple hormonic oscillator equations, Legendre, Hermite and Bessel differential equations.

Generating function for legendre polinorgals Pn(x), Hermite Hn(x) and Bessel function of 1st kind Jn(x), their properties and basic recurrence relations from generating function only; and their graphical rreprentation. (16 Marks)

CHAPTER-IV : Special Theory of Relativity :-

Newotonian relativity, Absolute space, Absolute time

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Gallian transformations. Michelson-Merley expt. Postulates of special theory of relativity Lorentz transformations, length contraction, time dilation, relativity of simultaneity, variation of mass with velocity, mass-energy relation addition of velocities, energymementum relation $E^2 = C^2P^2 + M^2C^2$

(12 Marks)

Reference Books :

1) Mathematical Physics :- Joshi,Wagh, Mandke and Agashe (G.Y. Rane Prakashan, Pune).

2) Mathematics for Physics :- Bhat, Panat, Ogale. (Surichar Prakashan).

3) Mathematical Methods for Physicists :- Arfken Academic Press.

4) Mathematical Methods :- Boas (Join Wiley and Sons).

5) Vector Analysis :- Spiegel (Schaum Series).

6) Applied Mathematics for Engineers and Physicists :- L.A. Pipe Pipes (Mc.Graw Hill)

7) Mathematical Physics :- Rajput Gupta.

8) Special Relativity :- A French. (E.L.B.S. Publication)

9) Special Relativity :- Resnick.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.Y.B.Sc. (PHYSICS)

PAPER I Section-II

CLASSICAL ELECTRODYNAMICS

1. Electrostatics : (18 Marks)

Electrostatics field in Vaccum :- Electrostatic field and potential. Potential produced by continuous charge distribution, electric field and potential due to electric dipole.

Gauss's Law :- Gauss's law and its applications to the fields produced by some charge distribution such as (i) Charged sphere (ii) Charged infinite sheet. (iii) Infinite long charged uniform wire.

Boundary Value Problems in electrostatics :- Poisson's equation, laplace equation, Boundary conditions and uniqueness theorem. Solutions of Laplace equations in cartesian and spherical polar Co-ordinate system, Methods of electrical images for (i) a point charge near a conducting grounded infinite plane. (ii) a grounded conducting Sphere,
Electrostatics in dielectrics :- Polar and non-polar atoms and molecules, polarisation, dielectrics, Concept of displacement vector and polarisation vector, susceptibility, permitivity, dielectric constant Boundary conditions at the interface of the two dielectrics.. Paralled plate condenser with dielectrics.

2. Magnetostatics :- (16 Marks)

Lorentz force, Biot sawart law, Magnetic induction due to a uniform current carrying wire. Helmoltz coil, Ampere circuital law & its applications. Magnetic induction, Magnetisation, intensity of magnetic field, magnetic vector potential, Relation between $\bar{B}$, $\bar{H}$,$\bar{M}$, Magnetic sucscoptibility, Relative permiability, Hysteresis, Betentivity, Chercivity, hysteresis loss. Axial magnetic field of solenid.

3. Electrodynamics :- (16 Marks.)

Faradsy's laws of induction in integral and differential form, modified ampere's circuital law. Maxwell's equations in differential and integral forms. Wave equations in free space solution of wave equation for plane wave in free space. Poynting vector electromagnetic energy. Reflection and refraction of plane wave from non-conducting boundaries (Normal incidance only).

Reference Books:+

1) Foundation of electromagnetic field - by Reitz and Milford.
2) Electrodynamics - by Gupta, Singh, Kuwar.
3) Electrodynamics - By B.B. Laud.
4) Electricity and Magnetism - Kip.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.Y.B.Sc. (PHYSICS)

Paper-II Section-I

ATOMIC AND MOLECULAR PHYSICS

1. Vector atom model :-

Quantum numbers, Physical interpretation of Quantum numbers, electron spin.,Spin-orbit intraction, doublet splitting, spectral terms, Pauli's exclusion principle. Spectra of single valance electron system, (sodium), selection rules.

(12 Marks)

2. Two valance electron system :-

Spectra of two valance electron system, Spin-spin and orbit orbit intractions, LS and jj coupling schemes, singlet - triplet separations, lande interval rule, intensity relations.

(10 Marks).

3. Magnetic field effect :-

Magnetic dipole moment, Larmor precession, Zeeman effect - (Normal and anomulous), Paschen-Back effect for single valance electron system. (8 Marks)

4. X-ray Spectra :-

Origin of X-rays, characteristics X-ray spectra, absorption X-ray spectra, Energy levels (Cadmium), Moseleys law, regular doublets irregular doublets, and their laws.

(8 Marks)

5. Molecular Spectra :-

Regions of electromagnetic spectrum, Classification of molecular spectra, rotation spectra of diatomic molecules, rotational energy levels of rigid and non-rigid diatomic molecules, Vibrational spectra of diatomic molecules, vibrational energy levels of harmonic and anharmonic oscillations.

Raman spectra :- Raman effect, experimental set up and explanation of Raman effect. (14 Marks)

REFERENCE BOOKS :-

1) Introduction to atomic spectra - H.E. White.
2) Molecular spectra - By Banwell.
3) Spectra of diatomic molecules - By G. Hersberg.
4) Perspectives of Modern Physics - By A. Beiser.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.Y.B.Sc. (PHYSICS)

Paper-II Section-II

II

NUCLEAR PHYSICS.

1. Nucleus :- Constituents, Charge, mass, size and shape of nucleus. Nomanclature of nuclei, Binding energy and packing fraction. Nuclear magnetic dipole moment and electric Quadrupole moment (Brief idea only)

(5 Marks)

2. Nuclear forces and Models :- Saturation and short-range nuclear forces charge symmetry and charge independance of Nuclear forces, spin dependance of nuclear forces. Idea of nuclear ~~for~~ as force / Tensor force. The shell 2 model. The qualitative discussion of evergy level diagram ground state spin parity the liquid drop model.

(10 Marks)

3. Radioactivity :- Law of radioactive decay, Half life mean life specific activity, partial radioactive decay, successive disintegration (different types of equilibria), Applications of radioactivity (Medicinal, Biological). Units of radioactivity such as Rohtgen & quary.

(8 Marks).

4. Nuclear Reactions :- Theories of nuclear reactions based on nuclear models, Conservation laws, Q-value of equation, exoergic and endoergic nuclear reactions, Threshold energy in endoergic reactions, Basic idea of nuclear reactions, cross section.

(8 Marks)

5. Nuclear Energy :- Nuclear fusion, Energy available from fusion, Nuclear fission, Explaination on the basis of liquid-drop model, Energy available from fission, Controlled chain reactions, nuclear reactors (Hetero-geneous, Swimming Pool).

(8 Marks)

6. Nuclear Detectors :- G.M. Counter, Scientillation counter

(5 Marks)

7. Nuclear Particle Accelerators :- Van-de-Graaf generator, cyclotron, Betatron.

(6 Marks)

REFERENCE BOOKS :-

1) The atomic Nucleus :- R.D. Evans.
2) Nuclear Physics :- D.C. Tayal.
3) Nuclear Physics :- Irving Kaplan.
4) Perspectives of modern Physics :- Beiser.

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5) Introduction to Nuclear Physics :-Herald Enge.

6) Basic Nuclear Physics :- B.N. Shrivastava.

7) Modern Physics - Mani & Meheta.

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T.Y.B.Sc. (PHYSICS)

Paper-III Section-I

SOLID STATE PHYSICS

1. The Crystal structures :-

Classification of solids (Crystalline, Amorphous and Poly crystalline, Space lattice, The basis and crystal structure, Translational vectors, Symmentry operations, Two and three dimensional lattice types, Miller indices, Interplaner distances, some crystal structures (SC,BCC, FCC,Diamond, HCP Nacl) Primitive translational vectors for SC,BCC,FCC. The reciprocal lattice and its properties.

(12 Marks)

2. Diffraction of X-rays by crystals :-

Crystals as grating for X-rays, Bragg's diffraction condition, Bragg's law in reciprocal lattice, Ewald's construction, X-ray diffraction methods (Laue and powder methdd) Analysis of cubic crystal by powder method. (8 Marks)

3. Cohesive energy and Bonding in solids :-

Cohesive energy and formation of molecules, Ionic bond and medulung energy, Medulung constant for NaCl, Covalent bond, Molecular bond, Metalic bond, Atomic and ionic radii.

(8 Marks)

4. Lattice Vibrations and thermal properties :-

Lattice heat capacity, classical theory of sp.heat, Einstein's theory of sp.heat, Vibrational modes of a 1-D monoatomic lattice and its sp.heat, Debye's model.

(9 Marks)

5. The Free electron theory of metals :-

Drude - Lorentz theory, Ohm's law electrical and thermal conductivity, Sommerfeld model, Density of states, Free electron gas in 3-D (Fermi energy). (6 Marks)

6. Band Theory of Solids :-

Early free electron model and origin of energy gap.' Bloch theorem (Statement only), Kroning and Penny Model, Brillouin Zones

(1-D and 2-D), Distinction between metals, semiconductors and insulators. Concept of hole, and Hall effect.

(7 Marks).

REFERENCE BOOKS :-

1. Elementary solid state Physics ! C Kittle (John Wiley and sons
2. Solid State Physics - A.J. Dekker (MacMillan India Ltd.)
3. Introduction to solids - Azaroff.
4. Solid State Physics. - S.L. Gupta, V.Kumar (K.Nath & Co.)

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T.Y.B.Sc. (PHYSICS)

Paper-III Section-II

ELEMENTS OF MATERIALS SCIENCE

Chapter-1 :- Introduction to selected characteristics of Materials. Mechanical behaviour (determation, strenght, toughness) Thermal characteristics (heat capacity, thermal expansion, thermal Conductivity), Response to electric fields (Conductivity, dielectric behaviour). Structure properties processing relation ship.

(4 Marks)

Chapter-2:- Atomic disorder in Materials (Teacher needs to review crystal structure and chemical bonding aspects which are are covered in solid state Physics (Paper-III, Section-I. Impurities in solids, solid solutions in metals (substitutional and interstitial), imperfections in crystals (points detect line detect) surfaces and grain boundaries, grain boundary area and size. Non-crystalline materials and liquids, Glasses and Phases. Atomic vibrations (Thermal expansion and thermal energy distribution). Atomic diffusion (diffusivity and diffusivity versus temperature)

(8 Marks)

Chapter-3:- Single phase metals (Teacher needs to review electrical conductivity in metals and semiconductors which are covered in solid state Physics (Paper-III, Section-I) Single-phase alloys (Properties, microstructures). plastic deformation (Slip systems, resolved shear stresses, solution hardening). Properties of plastically defermed metals (Strain hardening), recrystallization (Temperature, hotworking & cold working

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Fracture (Transition temperature, fatigue)

(10 Marks)

Chapter-4:- Molecular Phases :-

Giant molecules (molecular size and lengths). Linear polymers (addition and condensation polymerization), molecular irregularities (steriosomers), polar group, glass temperature in polymers, Three dimensional polymers (Thermosets, crosslinting, branching).

(8 Marks)

Chapter-5 :- Ceramic Materials :-

Ceramic phases, ceramic crystals (Axstructures), Electromagnetic behaviour of ceramics (Dielectrics, Semiconductors, Piezo-electrics, Magnetic ceramics (soft and hard magnets), mechanical behaviour of ceramics (hardness, notch sensitivity use of non-ductile materials).

The topic is to be developed purely in a descriptive manner (as is done in the recommend text book)

(8 Marks)

Chapter-6:- Phase Diagrams :-

Qualitative phase relationships (solution versus mixtures, solubility limits, eutectics), phase diagrams (freizing ranges, isothermal cuts), phase composition (Single phase areas, two phase areas, eutectic reactions), phase quntities (Single phase areas, two phase areas), Materials balance. (8 Marks)

Chapter-7:- Processing of Materials

Processing of Lalloys, ceramics and synthesis of single crystals. (4 Marks)

TEXT BOOK :

Elements of Materials Science and Engineering - by L.H. Van Vlack (Fouth Ed.)

(also, TMH - Elements of Materials Science - Raghavan)

Publishers :-

Addison-Wesley publishing Co., World student series edition-I available. The following chapters (and sub-sections) from the above mentioned.

Text book :-

Chapter-1 = (1.1, 1.2,1.3,1.4)

Chapter-4 = (4.1,4.2,4.4,4.5,4.6,4.7)

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Chapter-6 = (6.1,6.3,6.4,6.5,6.6,6.7)
Chapter-7 = (7.1,7.2,7.3,7.4)
Chapter-8 = (8.1,8.2,8.6)
Chapter-9 = (9.1,9.2,9.3,9.4)

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T.Y.B.Sc. (PHYSICS)

Paper-IV, Section-I

IV

CLASSICAL MECHANICS

1. Newton's laws
Applications of Newton's laws of motion to charged particles under constant electric field, Constant magnetic field, and crossed electric and magnetic fields 1 to each other.

Rocket motion under action of gravity centre of man motion,

Mechanics of system of particles :- Conservation of linear and angular momentum of system of particles, Relation between angular momentum about any point and about centre of mass. Discuss similar relation for kinetic energy also.
(8 Marks)

2. Motion in Central Force Field :- Equivalet one body problem, General features of motion like constancy of angular momentum,

Motion in an inverse square law of force, Qualitative discussion of orbit, Equation of orbit, Kepler's laws.
(8 Marks)

3. and Scattering of particles :- Elastic and inelastic Collision, Lab C.M. System of Co-ordinates, Differential and total cross-section, Impact parameter, Ruther ford's scattering. Relation of cross-section between C.M. and Lab. frame.
(10 Marks)

4. Lagragian and Hamiltanian Formulation :- Constrains, generalised Co-ordinates D'Alembert's principle, Lagragian equations from D'Alembert's principle, General expression for Kinetic energy.

Conservation laws, Cyclic Co-ordinates. Hamiltonian and Hamilton's equations of motion.

Applications of Hamiltonian and Lagragian equations motion - Simple pendulum, Linear Hormonic oscillator, projectile motions, Compound pendulum etc. (16 Marks)

5. Moving Co-ordinate system :- Rotating Co-ordinate system. Derivation of

$$\frac{d}{dt}_{fix} = \frac{d}{dt}_{rot} + wx$$ is excepted.

cont..5

Corioli's force, freely falling body in rotating frame

(8 Marks)

REFERENCE BOOKS :-

1) Classical Mechanics - Panat, Bhat, Ogale.
2) Classical Mechanics - Goldstein.
3) Classical Mechanics - Takwale and Puranik.
4) Classical Mechanics - Gupta Kumar.
5) Principle of Mechanics - Synge and Griffiths.
6) Classical Mechanics - N.S. Rana, P.S. Joag.

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T.Y.B.Sc. (PHYSICS)

PAPER-IV, SECTION-II

QUANTUM MECHANICS

Unit.1 :- Origin of quantum mechanics. Wave-particle quality. Phase velocity, group velocity. Discussion of Uncertainty principle and its applications. Different forms of uncertainty principle (Statement only)

(6 Marks)

Unit.2 :- Physical interpretation of wave functions. Formulation of time dependent and time independent wave equation (one-two and three dimension) Boundary condition. Energy values and eigen function Expectation Values, Ehrenfest theorem. Probability density, probability current density.

(12 Marks)

Unit.3 :- Application of Schrodinger wave equation to particle in box (one,two and three dimensional cases) Potential step, potential barrier, particle in potential well in finite depth. Harmonic oscillator in one dimension only.

(12 Marks)

Unit.4:- Operators (P,E,H,L).Hermitian operator and its properties. Commutators, Commutation algebra. Commutation relation for angular momentum operators. Parity operator.

(10 Marks)

Unit.5:* Schrodinger equation for Hydrogen atom. Separation in radial and angular parts. Solution of radial Schrodinger equation, Energy eigen values. Signifinance of Quantum numbers n,l,ml,ms.

(10 Marks)

*Qualitative discussion of solution.

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REFERENCE BOOKS :-

1) Quantum Mechanics - Chatwal, Anand.
2) Quantum Mechanics - Powell, Creasmann.
3) Quantum Mechanic - S.L. Gupta and V. Kumar.
4) Quantum Mechanics - Satya Prakash.
5) A Text books of Quantum Mechanics - P.M. Mathew, K.Venkateshwar.
6) Perspectives of Modern Physics. - Arthur, Beiser.

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T.Y.B.Sc. (PHYSICS)

PAPER-V SECTION-I

ELECTRONICS-II

Chapter-I :- Semiconductor Devices :-

(The following devices should be studied as regards to construction, Characteristics, Parameteres).
JFET, FET as a V.V.R., SCR and SCR as power controlled device, UJT and UJT as relation Oscillator.

(8 Marks)

Chapter-II:- Power Supplies :-

Block diagram of unregulated power supply, its short comings Block diagram of regulated power supply. Series regulated Power supply. Study of line and load regulation.

(4 Marks)

Chapter-III :- Amplifiers :-

a) Review of classification of amplifiers, Graphical analysis of transformer coupled and impedance compled amplifiers. (3 Marks)

b) Class B push-pull amplifier Idea of cross over distortion. (2 Marks)

c) Different configurations of differential amplifier, Circuit and operation of Common mode and differential mode, need of constant current source, CMRR.

(4 Marks)

d) Operational Amplifier :- Inverting and non-inverting configuration, concept of virtual ground, and offsetnull Application of Op-amp as adder, subtractor, integrator, study of IC-741, (Pin configuration and parameters using mannual)

(8 Marks)

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Chapter-IV :- a) Feed back in amplifiers :- Basic four types of feedback circuits, current shunt feedback and voltage reries feed back. (5 Marks)

b) Relaxation Oscillator :- Multivibrators (Astable, Monostable, Bistable) using transistors. (3 Marks)

Chapter-V :- Digital Electronics.

a) Binary numbers, interconvertion of binary and decimal numbers. (2 Marks)

b) Logic systems, positive and Negative logic, study of logic gates :- OR, AND,NOT,NOR, AND,EX-OR (symbols and truth table). (3 Marks)

c) De-Morgans theorems and their use for interconvertion of gates.

d) Digital IC's-7400, 7402,7406,7408, (Function and their configuration). (2 Marks)

Chapter-VI:- Modulation and Detection. Concept of AM,FM, and Phase modulation and detection. Theory of amplitude modulation, Modulated class-C amplifiers, Diode detector. (4 Marks)

REFERENCE BOOKS :-

1) Integrated Electronics - Millman - Kalkias.
2) Electronics Fundamentals and application - John D.Royder (4th Edition)
3) Basic Electronics - Thereja. (C. Chand Publication)
4) Digital Electronics, Principles, and application - Malvino and Leach.
5) Electronics for Scientists and Engineers - Brophy.
6) Electronics devices and circuits - Descrete and integrated - Y.N. Bapat.
7) Electronic devices and Circuits (an introduction) - Allen Mottershed.

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2.2 Single and dual slope Integration.
2.3 Counter and servo type.
2.4 Parallel type.

III. D to A Converter
3.1 Variable resistor network.
3.2 Binary ladder. (9 Marks)

Unit.5 I. Signal Transmission
1.1 Modulation, Amplitude, frequency phase & pulsewidth
1.2 Multiplexing - Time division and frequency divison multiplexing.
1.3 Digital signal processing - digital filters, fast forier transformation.
(6 Marks)

Unit.5.II. Input and Output devices.
2.1 Self balancing potentiometer.
2.2 X-Y recorder.
2.3 Magnetic recorder.
2.4 LEDs and LCDs. (6 Marks)

REFERENCE BOOKS :-

1. Instrumention measurement and analysis -
by B.C. Nakra and K.K. Chaudhary.
Tata Mc.Graw - Hill publishing company limited, New Delhi.

2. Instrumentation Devices and systems
by C.S. Rangan, G.R. Sharma, V.S. Mani,
Tata McGraw Hill Publishing dehli.

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T.Y.B.Sc (PHYSICS)

Paper-V, Section-II

STATISTICAL PHYSICS AND THERMODYNAMICS

1. Random walk problem and Bionomial distributions :-
Elementary statistical concepts and examples, Random Walk problem in one dimension, General discussion of mean values, Calculation of mean values for the random walk problem, probability distribution for large N,
Gaussian probability distribution,
Probability distributions involving several variables.
(Art.No. 1-1 to 1.7. F Reif.) (6 Marks)

2. Statistical Formulation :-
Specification of the state of the system (Classical as well as quantum), Phase-space, statistical ensemble, accessible states, postulate of equal apriori probability, Behaviour of density of states of a system (Art No. 2.1 to 2.5 F Reif)
(8 Marks)

3. Statistical Thermodynamics :- equilibrium conditions and constraint, distribution of energy between systems in equilli-briums, approach to thermal equillibrium, Statistical calcula-tion of thermodynamic quantities. (Art Nos. 3.1,3.3,3.4,3.12 F. Reif)
(6 Marks)

4. Microcanonical and canonical ensembles :- Simple applications of Canonical ensembles such as, paramagnetism and molecule in ideal gas, system with specified mean energy, Calculation of mean values in a canonical ensemble. Partition function and its Connection to free energy. Planck's formula as derived from partition function and its limiting cases (Rayleigh Jeans, Wein's law) (Art. No. 6.1 to 6.6 F Reif)
(8 Marks)

5. Simple applications of Statistical Mechanics :-
Partition functions and their properties, equipartition theorem Maxwells velocity distribution. (Art No. 7.1, 7.5, 7.9)
(6 Marks)

6. Thermodynamics :- Basic ideas of free energy, entropy, ethalpy, Gibbs free energy, Maxwell's relations and their appli-cations first and Second Tds equations, expression for $c_p - c_v$ ratio of heat Capacities, Joule Thomson effect, production of law temperature by using joule Thompeon effect, Porous plug experiment.
(16 Marks)

REFERENCE BOOKS :-

1. Fundamentals of Statistical and thermal Physics - by F, Reif.

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2) Heat and thermodynamics - by Zemansky.
3) Treatise of Heat - by Saha and Srivastav.
4) Heat and thermodynamics - Brijlal and Subramanian.
5) Statistical Physics - by B.B. Land.

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T.Y.B.Sc. (PHYSICS)

Paper-VI Section-I

TECHNICAL ELECTRONICS (OPTIONAL COURSE)

I) Components :- Construction of resistors, capacitors, Working voltages, Current range values, limitation, Merits and De-merits of different types. Digital and linear IC's (741, 555, 7400, 7402).

Electromagnetic Relay, its construction and working, construction of Choke and different types of chokes. Transformer - step up and step-down, turns ratio, officiency, different losses and designing of transformer. (18 Marks)

II) Printed Circuit Board :- Idea of Printed circuit Board (PCB), different steps for making PCB, Principle of Photo lithography. (10 Marks)

III) Instrument study :-

a) A good quality Multimeter (Simpson-260)
b) Cathod - Ray - Oscilloscope (C.R.O.) 15 MHz), Its functional block diagram, front panel controls.
c) An AF Oscillator.
d) A Public address system. (16 Marks)

IV) Power Supplies :- Thermal design considerations. (6 Marks)

REFERENCE BOOKS :-

1) Basic Electronics - B.L. Thereja.
2) Electronic Measurement - Termann and Petit.
3) Understanding Electronic Component - E.J. Waters.
4) Guide to P.C.B. - G.J. King.
5) Electronic Fundamental - Ryder.

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.Y.B.Sc. (PHYSICS)

Paper-VI, Section-II

(a) TECHNICAL ELECTRONICS (OPTIONAL COURSE)

Unit.I :- Transducers :-

i) General :- Transducers, Active and passive transducers, Required features.

ii) Electrical Transducers :-

a) Temp. sensors :- Resistance Thermometer, Thermister, Thermocouple, Semiconductor diode temp. sensors, Quartz Thermometer.

b) Pressure and displacements transducers :- Based on principle of (i) Variable Resistance (Strain Gauge)
(ii) Variable Industunce (LVDT)
(iii) Piezo electric effect.

c) Optoelectronic Transducers :- Based on principle of (i) Photoelectric effect (Photo tube)
(ii) Photoconductive effect (LDR)
(iii) Photo voltaic effect (Solar Cell).

(12 Marks)

Unit.II :-Operational Amplifier :-

i) General :- Negative feedback and its effect on Op-amp characteristics frequency response of Op-amp.

ii) Processing applications :- Active filters (1st order low and High pass filters), Rectifier circuits (Iddal half wave rectifier and absolute value full wave rectifier circuits), Phase sensitive detection.

iii) Instrumention amplifiers :- Voltage substractors, High input impedence differential amplifier configurations with adjustable gain.

iv) Computation circuits. Logaritlmic and antilogrothmic amplifier (Multiplier and Divider ckts.)

(14 Marks)

Unit.III :- Data Converders :-

i) A to D Convertors :- V to F Convertor Voltage to time Convertor (Single slope and Dual slope Convertors)

ii) D to A Convertors : Importance of D to A Convertors in instrumentation, basic blocks of D to A Convertors Basic D to A convertor ckts using :- a) Binary weighted Resistance. b) R - 2 R Network.

iii) Multiplexer and Demultiple (Digital)

a) Encoder :- Encoding and Encoding matrix to transform

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Decimal to BCD.

b) Multiplexer :- Multiplexing principle, Multiplexer ckts using logic Gates (4-1 line)

c) Decoder :- Decoding, BCD to Decimal.

d) Demultiplexer :- Demultiplexing, conversion of Decoders to Demultiplexer. (12 Marks)

Unit.IV :- Digital Instrumention.

Basic Building Blocks of Digital measurement system Block diagram and working DFM and DVM. (8 Marks)

Unit.V :- Medical Instruments.

Biopotential, Block diagram of ECG and its operation, types of electrodes. (4 Marks)

Reference books :-

1) Transducers and display systems :- B.S.Sonde.
2) Operational Amplifier :- G.B. Clyton.
3) Integrated Circuit :- Botkar.
4) Integrated Circuit :- Mullman and Kalkies
5) Data Converters :- B.S.Sonde.
6) Electronics for Scientists :- Malmstadt and Enke.

Additional Reference Book :-

1)Medical Instrumention, application and design by J.C. Wobster.
2) Introduction to Bio-Medical electronics by Joseph-Du-Bovy, McGraw Hill.
3) Electronics Practical by - S.P. Singh.

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T.Y.B.Sc. (PHYSICS)

(b) PAPER-VI :- AIR CONDITIONING AND REFRIGERATION-I
(Optional Course)

I) Heat and thermodynamics :- 1st and 2nd law of thermodynamics, entrophy, carnot cycle, efficiency.- (5 Marks)

II) Methods of Refrigeration :-
Ice refrigeration, evaporative refrigeration, Refrigeration, by expansion of air, refrigeration by throttling of a gas, vapour refrigeration system. Unit of refrigeration.
(5 Marks)

III) Air Refrigeration system :-
Reversed carnot's cycle as most efficient refrigerator, Bell coleman air refrigerator, advantages and disadvantages of air refrigeration system.
(6 Marks)

IV) Vapour Refrigeration Systems :-
Vapour compression refrigerator, T-S and P-H diagram for vapour compression refrigeration system, C.O.P. from T-S chart, presentation of all processes on P-H and T-S chart, Advantages and disadvantages of vapour compression refrigeration system over air compression refrigeration system, performance of a simple vapour compression refrigeration cycle.
(10 Marks)

V) Absorption Refrigeration System :-
Basic Absorption system, actual ammonia absorption system, Electrolux refrigerater and C.O.P. of the system. Actual electrolux refrigerator, salt soln, cycle absorption refrigeration, comparison between compression and absorption refrigeration system.
(7 Marks)

VI) Refrigerants :-
Classification of refrigerants, required properties of an ideal refrigerant, important refrigerants, Secondary refrigerants.
(3 Marks)

VII) Refrigeration Equipments :-
Compressors, condensors, evapertors, expansion devices.
(14 Marks)

TEXT BOOKS :-

1) A course in Refrigeration and Air Conditioning.
S. Donkundwar, Dhampatrai and Sons, Delhi.

REFERENCES :-

1) Principles of Refrigerations,
Roy J. Dossat, John Wiley and Sons Inc.(1961)

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NORTH MAHARASHTRA UNIVERSITY, JALGAON

T.Y.B.Sc. (PHYSICS)

PAPER-IV (OPTIONAL)

SPACE PHYSICS AND METEOROLOGY

Chapter-1 :- Equation of state of moist air, Adiabatic process of saturated air, Stable and Unstable states, Adiabatic Charts, Potential temperature, Virtual temperature, lifting Condensation level, Mixing. (8 Marks)

Chapter-2 :- Condensation and Precipitation processes, nuclear, formation and growth of cloud droplets, The ice-crystal process (Bergeron process), Capture process (Colescence process), Types of clouds (Classification with respect to altitude only). Thunder storm clouds, Atmospheric electricity. (9 Marks)

Chapter-3 :- Atmospheric circulation, Scales of Atmospheric motions, Equation of motion of rotating earth, Coriolis force, Buys-Ballot law, Major features of General Circulation inthe Atmosphere, Jet streams, Inter Tropical Convergence zone (ITCZ), Monsoon. (9 Marks)

Chapter-4 :- Air pollution, Aerosols, Pollutants, Sources of pollution, Temperature inversion and pollution, Green house effect, Green House gases, Predicted future climate change. (8 Marks)

Chapter-5 :- Application of Laser in atmospheric studies, Use of computers, Radar and Weather satellite for weather studies. (8 Marks).

Chapter-6 :- Physics of Plasma :- Properties, Plasma temperatures, Debye Schielding, Natural and Artificial plasma, Reflection of Radiowaves in the ionosphrere. (8 Marks)

REFERENCE BOOKS :-

1) Atmosphere, Weather and Climate - by R.G. Barry and R.J. Chorlet.
2) Introduction to meteorology - by Sveno Petterssen.
3) Introduction to Climatology for tropics - by J.O. Ayoade.
4) Introduction to Atmosphere - Reihl.

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T.Y.B.Sc. (PHYSICS)

PAPER-V, SECTION-I

INSTRUMENTATION-II

Unit-I 1.: Introduction

1.1 Functional elements of a measurement System.

1.2 Classification of Instruments.

1.3 Applications of Instrument system.

II Static performance characteristics of Instruments.

2.1 Resolution, Threshold. Sensitivity, Hysteresis, Drift, Back-lash (Definations only)

2.2 Impedence, loading and matching.

III. Dynamic performance characteristics of Instruments.

3.1 Introduction.

3.2 Formulation of system equation.

3.3 Dynamic response (Only Introductory remark)

3.4 Compensation - first and second order .

(8 Marks)

Unit.2 I:-Transducer elements :

1.1 Classification of Transducers.

1.2 Analog transducer - Electromechanical, Potentiometric, Piezoelectric, Optoelectrical.

1.3 Digital Transducer - Frequency domain, digital encoder, vibrating string. (7 Marks)

Unit.3. I :- Generators :

1.1 Waveform generators.
(Sine, triangular, square, Sawtooth & Staircase).

II. Processing

2.1 Phase sensitive detector.

2.2 Absolute value circuits.

2.3 Peak detector.

2.4 Sample and hold circuit.

2.5 Log amplifier circuit.

2.6 V to F and F to V converters.

III. Signal Analysis.

3.1 Classification of signals.

3.2 Method of Analysis. (14 Marks)

Unit.4. I Data Aquisition system.

1.1. Introduction.

1.2 Single chanel data Aquisition system.

II.A to D Converter

2.1 Sucessive approximation.

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2) Refrigeration and air conditioning -
by Jorden and Prinstley.

AIR CONDITIONING AND REFRIGERATION-II

I) Heat transfer and insulation :-
Condution through slab, conduction through pipe, conduction through hallow spheres, convection, combined conduction and convection, applications of fins, mean temperature difference, overall heat transfer co-efficient, evaporative condenser, cooling towers, (8 Periods)

II) Air conditioning (Psychrometry) :-
Introduction, meaning of air conditioning Psychrometry and its properties, Psychrometric relations, psychrometric chart, Psychrometric processes, air conditioning systems.
(8 Periods)

III) Cooling load calculations and Different heat sources, conduction heat load, radiation load of some occupants equipments load, in filteration air load, miscellaneous heat sources, fresh air load cooling coils and dehumidifying air washers.
(5 Periods)

IV) Airconditioning Equipment :-
Air conditioning and air filters, humidifiers, dehumidifiers fans and blowers, grills and resistors.
(4 Periods)

V) Control systems :-
Basic principle of control systems, temperature controlling elements, humidity controlling elements, actuating elements pre heat and humidification control systems, cooling dehumidification reheat control system, face and by-pass control system.
(8 Periods)

TEXT BOOK :-

1) A course in Refrigeration and Air conditioning
S. Domkundwar,
Dhampatrai and Sons, Delhi.

REFERENCE BOOKS :-

1) Principle of Refrigeration,
by Roy J.Dossat, Hohn Wiley and Sons Inc. (1961).
2) Refrigeration and air conditioning
by Jorden and Prinstley.

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T.Y.B.Sc. (PHYSICS)

Paper-VI (OPTIONAL COURSE)

C) BASIC MICROPROCESSOR AND PROGRAMMING (FIRST TERM)

1) Number systems (Binary, BCD and Hex), Code conversion, logic functions (AND, OR , NOT,NAND, NOR, XOR), De-Morgans theorems, Flip-flops, (R-S, D,J,K,J-K m/s flip-flop), level clocked and edge triggered flip-flop, Counters (4-bit binary, up-down), Different modes of decade counter, General introduction to registers, multiplexers, demultiplexer, decoders, encoders. (18 Marks)

2) Classification of memories (Introduction). Semiconductor memories :- RAM (Static and dynamic), ROM,PROM, EPROM, EAROM, Memory capacity, Memory addressing. (8 Marks)

3) Digital Computer (Block Digram). Introduction to lagge, mini and micro computers. (4 Marks)

4) Architecture of 8085 microprocessor :- Block diagram - Address, data and control bus, Accumilator, Temp. Register, ALU and Flags, Instruction register and decoder, Timing and control section, CPU register, Stack, stock printer, program counter. Addres buffer and address data buffer. Interrupt control, Serial I/O Pinout diagram of 8085 and description of lach pin. (18 Marks)

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C) Paper-VI Optional Course (Second Term)
MICROPROCESSOR AND PROGRAMMING

1) Programming languages, high level language, low level language (Advantages, disadvantages) compiler, Assembler, hex loader. (4 Marks)

2) Instruction set of 8085 :- Computer instruction formates, addressing method for 8085, Type of instructions. Assembler delimeters and Assembler directives (pseudi - Operation) (18 Marks)

3) Introduction to flow-charts, Simple arithmatic programs, loops and arrays, sub routines. (16 Marks)

4) I/O Operations :- Programmed I/O, Restart instructions, interrupt circuits, interrupt instructions, serial I/P and serial O/P. (8 Marks)

5) The 8255 Programmable peripheral interface - Block diagram, Pin diagram, different modes. (4 Marks)

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Reference for Section-I and Section-II

1) Digital Compute Electronics - Malvino.
2) Principles of Digital Electronics - Malvino-Leach.
3) Introduction to Microprocessor, Software, Hardware, Programming - L.A. Laventhal.
4) Microprocessor - Architecture, programming and application with 8085/8080 - Gaonkar.
5) 8085/8080 Assembly language Programming - L.A. Lavanthal.

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T.Y.B.Sc. (PHYSICS)

Paper-VI (OPTIONAL COURSE)

D. COMPUTER PROGRAMMING-I (FORTRAN-77)

Section-I

I. Introduction

1. Introduction to Computing machines (Generations and types of Computers), Block diagram of a digital Computer. (4 Marks)

2. Binary system for digital computer, Conversion of decimal number to binary number and vice-versa, Binary addition and subtraction. (2 Marks)

3. Languages :- Lower level languages (Machine languages, Assembly language), Various Higher level language (FORTRAN, COBOL, BASIC etc.) and their applications. (3 Marks)

II. FORTRAN Fundamentals -1 :-

1. Character set, FORTRAN constants and variables, Arithmetic operators Hierarchy of arithmetic operators, Evaluation of Arithmetic of expressions. (4 Marks)

2. Types of fortran statements, (Declarative, executable, nonexecutable), Arithmetic replacement statement, Algorithms and Flowcharts. (5 Marks)

3. Types of Input, output statements, Format specifications and seperators (IW,FW. d, wX, wlt, Aw, slash, etc.) (8 Marks)

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III. FORTRAN Fundamentals - 2

1. Transfer of control statements, unconditional GO TO, computed GO TO, Relational operators, Logical IF statement, Arithmetic IF statement, Block IF statement. (8 Marks)
2. DO Loops, CONTINUE statement. (4 Marks)
3. Subscripted variables, DIMENTION statement, Implied DO Loop. (6 Marks)

IV. Programmes.

Various FORTRAN programmes based on the syllabus mentioned above. (6 Marks)

REFERENCE BOOKS :-

1) Computer Fundamental - V.Rajaraman.
2) FORTRAN-77 - Davis and Hoffmann.
3) FORTRAN-77 - Ramkumar.
4) FORTRAN-77 - V.Rajaraman.

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D. Paper-VI COMPUTER PROGRAMMING-II (Numerical Methods)

Section-II

I) Sub programmes :-

1) Arithmetic statement function.
2) FUNCTION Sub programme.
3) SUBROVTINE Sub programme.
4) Additional Fortran Feature - COMMON statement, DATA statement etc. (15 Marks)

II. Errors :- Types of errors :- Intial errors, Rounding errors, Truncation errors, propogation of errors. (5 Marks)

III. Interpolation :- Difference tables, Newton's forward differenc interpolation formula. (5 Marks)

IV. Numerical Intepration :- 1) Trapezoidal rule, 2) Simpson's 1/3 rule. (7 Marks)

V. Solution of algebraic equations :- 1) Bisectim methods, 2) Regula-False method, 3) Newton-Raphson method. (8 Marks)

VI. System of linear equations :- 1) Gauss-elimination method, 2) Triangularitation of matrix. (10 Marks)

REFERENCE BOOKS :+

1) Computer Orientated numerical methods - V.Rajaraman.
2) Computer oriented numerical methods - Shastri.
3) Numerical Analysis - Lipschuttz and Poe.

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NORTH MAHARASHTRA UNIVERSITY, JAIGAON.

T.Y.B.Sc. (Physics)

Paper-VI (Optional Course) Section:- I

e) VACUUM TECHNOLOGY

Expected background :-

Gas pressure and equation of state, molecules velocities, mean free path, gaseous diffusion, thermal conductivity and viscosity of gases (Derivations are not to be expected) (6 Marks)

I. Fundamental Concideration of Vacuum Practice.

Atmosphere and vacuum, range of vacuum, different units of vacuum, vacuum circuits, impedance Conductance, flow through pipes, pumping speed of vacuum pumps. (12 Marks)

II. Vacuum Pumps

Rotary pump, roots pump, diffusion pumps - principle, Construction and actual working, Ultimate pressure attainable, factors on which the optimum performance of the pump depend and pump characteristic. (16 Marks)

III. Vacuum gauges

U- tube manometer, Mcleod gauge, thermal conductivity gauge thermocouple pirani, semiconductor gauge. Ionisation gauges - Hot cathod, cold cathod gauge, Bayard - Alpert gauges. (16 Marks)

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Paper - VI (Optional Course) Section - II

e) VACUUM TECHNOLOGY

I. Vacuum materials and Components

Adsorption, Absorption, desorption, diffusion and penetsation of gases through solid surfaces. Vapour pressure of different materials.

Desired propertier of materials used for fabrication of vacuum system and its components. (6 Marks)

II. Vacuum Seals

Permament seals:- Welding, brazing, soldering, metal to metal seal, metal to glass seals, Adhesive seals(Wax, araldite etc.)

Demountable seals:- (Joints), flanges, couplings, rubber and metal gaskets 'O' rings.

Feed throughs:- Electrical and motion feed through Wilson seal, bellow feed through, magnetic retator etc.

Valves:- Ranghing and the line valves - Diaphrm valve, high vacuum, vacuum valves - butterfly, flap, air admittance, Baffle, needle valves. (10 Marks)

III. Principles of leak detection

Real and virtual leaks, leak detection metnods - over - pressure method - bubble method, Sniffer technique (halide torch) low - pressure method - blocking (Sealing), Tesla Coil, Search gas spray, halogen leak detector, organic vapour and gas probe with suitable

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pressure gauge as a detector. (6Marks)

IV. Ultra - high Vacuum pump

Sorption, molecular drag pump (turbo molecular pump) - Ion pump getter pump, titanium sublimation pump, Cryogenic pump. (12 Marks)

V. Vacuum system fabrication

i) General Consideration of designing.

ii) High - Vacuum system (rotary diffusion system)

iii) UHV System - Clean Vapous free Vacuum system.

(10 Marks)

VI. Applications of Vacuum in Research and Industry

Discussion on the vacuum evaporation, thermionic valves, lamps industry, discharge lamps, X-ray tubes, CR tubes, and other valves.

Heating of materials in Vacuum :- Industion heating electron beam heating. (10 Marks)

Refrence Books :-

1) Introduction to the theory and practice of high vacuum Technology :- L. Ward and J.P.Bunn, Butterworths, 1967

2) High - Vacuum Techniques :- J.Yarwood. Chapman and Hall, 1967.

3) High Vacuum Engineering :- A.E..Barrington Prentice Hall.

4) Scientific foundations of Vacuum Techniques :- S. Dushman and J.M.Lafferly. John Willey and sons, 1962.

5) Design and Construction of small Vacuum systems :- G.W.Green.

6) Vacuum Sealing techniques :- A.Roth.