NORTH MAHARASHTRA UNIVERSITY,
JALGAON

PROGRAMME: T.Y.B.Sc. Physics

Syllabus

for

T.Y.B.Sc. Physics

(W. E. From June 2004)

OBJECTIVES OF THE PROGRAMME

The objectives of this programme are to develop the following skills amongst the students which would in long run benefit the country, scientific world and the individual.

- To develop keen interest in scientific field.
- To integrate Information Communication Technology with basic concepts of Physics to promote relevant education and training.
- To develop the skills of formulation and analysis of the Physical phenomena.
- To develop scientific attitude and curiosity to know the 'cause and effect' behind natural calamities/ phenomena and to re-examine them consciously to uncover the truth.
- To train the students to perform experiments confidently, to represent the observations, to analyse and interpret the results and to conclude.
- To inculcate scientific mind through open ended experiments.
- To develop the qualities of adaptability, innovation and dynamism amongst the students.

Important Instructions:

1. The T.Y.B.Sc. Physics students who have offered 'Electronics Science' at F.Y.B.Sc. and /or at S.Y.B.Sc. as one of the subjects will have to offer Instrumentation-II' instead of 'Electronics-II'.
2. The T.Y.B.Sc. Physics students who have offered 'Computer Science' at F.Y.B.Sc. and/ or at S.Y.B.Sc. as one of the subjects will have to offer 'Statistical Physics & Thermodynamics' instead of 'Programming Using 'C' Language'.
3. A well equipped computer laboratory with at least 10 computers is necessary for T.Y.B.Sc. students offering 'Programming Using 'C' Language'.
4. Two tutorials (~~one per term~~) and ~~one~~ two seminar should be conducted for each course in addition to regular teaching schedule.
5. Educational /Industrial tour is compulsory for T.Y.B.Sc. Physics students. A report of the tour should be submitted to concerned Head of the department.
6. Faculty members are advised to make use of 'compact disks' related to concepts from Physics (to clarify the topics from syllabus) and computers as teaching aids so as to ingrain the basic ideas of Physics.
7. Students are advised to borrow scientific information (published worldwide) from scientific websites on Internet.

Structure of the programme:

Theory/ Practical	No. of papers	No. of periods/ Paper/ week	Total periods/Term /Section	Marks/ Section	Marks/ Paper	Total marks
Theory	6	4	52*	50	100	600
Practicals	2	4	52	50	100	200
Project	1	4	52	50	100	100
Total						900

*Excluding tutorials and seminars

Details of the programme:

Paper	Section I	Section II
I	Mathematical Physics	Electrodynamics
II	Classical Mechanics	Quantum Mechanics
III	Atomic &Molecular Physics	Nuclear Physics
IV	Electronics II / Instrumentation-II*	Programming Using 'C' Language / Statistical Physics &Thermodynamics
V	Solid State Physics	Elements of Material Science
VI	Any one of the following Optional Courses (A) Technical Electronics I (B) Refrigeration and Air Conditioning I (C) Microprocessor I (D) Vacuum Technology I	Extension of a course from section I (A) Technical Electronics II (B) Refrigeration and Air Conditioning II (C) Microprocessor II (D) Vacuum Technology II
VII	Practical Course I (8-Experiments)	Practical Course I (8-Experiments)
VIII	Practical Course II (8-Experiments)	Practical Course II (8-Experiments)
IX	Practical Course III: Project Work (A weightage of 16 Experiments.) (Note: Start the project work at the beginning of the first term.)	

NORTH MAHARASHTRA UNIVERSITY, JALGAON

Syllabus for T.Y.B.Sc. Physics
(W.E.From June 2004)

Paper-I : Mathematical Physics and Electromagetics

Section-I Mathematical Physics

Unit 1: Vector Analysis

Gauss's divergence theorem, Stoke's theorem, Green's 1st and 2nd theorem, Green's theorem in the plane. (Their statements, proofs and problems) (6 P, 6 M)

Unit 2 : Curvilinear Co-ordinates

Introduction to cartesian (x,y,z), spherical polar (r, θ,ϕ), cylindrical co-ordinate system (ρ, ϕ, z), co-ordinate systems and their transformation equations.

General curvilinear co-ordinate system, co-ordiante surfaces, co-ordinate lines, length elements, surface element and volume element. Metric co-efficient (Scale factor). Orthogonal curvilinear co-ordinate system. Proofs of orthogonality of spherical polar and cylindrical co-ordinate systems.

Expressions for gradient, divergence, curl and Laplacian in curvilinear co-ordinate system and in spherical polar and cylindrical co-ordinate systems (13P, 12 M.)

Unit 3 : Differential Equations

Degree,order, linearity and homogenity of partial differential equation. Method of seperation of variables (Wave equation, laplace's equation in Cartesian, spherical polar and cylindrical co-ordinate system) Singular points, Singular points of Legendre differential equation and Hermite differential equation. Fuch's theorem (statement only). Frobenius method of series solution. Series solution of linear simple harmonic oscillator. (15P ,14M)

Unit 4 : Special functions

Generating functions for Legendre polynomial, Pn (x), Hermite polynomial Hn (x), Bessel functions of first kind Jn (x).

Proofs of following properties :

i) $(n+1)P_{n+1}(x)= (2n+1) \times P_n(x) - nP_{n-1}(x)$

ii) $Pn(x)=P'_{n+1}(x) - 2xP'_n(x) + P'_{n-1}(x)$

iii) $H_{n+1}(x) = 2 x H_n(x) - 2n H_{n-1}(x)$

iv) $2n H_{n-1}(x) = H'_n(x)$

v) $J_{n+1}(x) + J_{n-1}(x) = 2n/x \, . \, J_n(x)$

vi) $J_{n-1}(x) - J_{n+1}(x) = 2J'_n(x)$

(8P ,8M)

Unit 5: Special theory of Relativity

Newtonian relativity, Absolute space, Absolute time, Gallilean transformations, Michelson-Morley experiment, postulates of special theory of relativity, Lorentz's transformtion equations, length contraction, time dilation, relativity of simultaneity, variation of mass with velocity, addition of velocities, mass-energy relation, energy momentum relation, $E^2 = P^2 C^2 + m^2_0 c^4$. (10 P ,10 M)

Total 52 periods , 50 marks

References:

1. Mathematical Physics : B.S. Rajput, Pragati Prakashan, 14th Eds., 1999.
2. Mathematical Physics : B.D. Gupta, Vikas Publishing House Pvt. Ltd.
3. Mathematical Physics : P.K.Chattopadhyay,Wiley Eastern Limited, New Delhi, 1990.
4. Mathematical Methods for Physics : G.Arfken,Academic Press, 1985.
5. Vector Analysis : Murray R. Spiegal, Schaum's series, Tata McGraw Hill Publishing Com. Ltd ,New Delhi,1987.
6. Mathematical Methods for Physicists : G.B. Arfken and Hans J. Weber, Prism Books Pvt. Ltd, Bangalore (Fourth Edition) , 1995.
7. Mathematical methods in the Physical Sciences : Mary.L.Boas, John Wiley & Sons, Inc. (IInd edition)
8. Mathematical Physics : A.K.Ghatak, I.C.Goyal, S.J.Chua, MacMillan India Ltd, 1995.

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Paper-I : Mathematical Physics and Electromagetics

Section- II Electromagetics

Unit 1: Electrostatics

Electrostatic field in vacuum, Electrostatic field and potential, Potential produced by continuous charge distribution, Electrostatic field and potential due to electric dipole.

Gauss's Law. Gauss law and its applications to the field produced by some charge distribution such as i) charged sphere ii) charged infinite sheet iii) Infinite long uniformly charged wire. (10 P ,10 M.)

Unit 2: Boundry value problems in electrostatics

Poisson's equation, Laplace equation. Boundary conditions for E and D. Solution of laplace equations in Cartesian and spherical polar co-ordinate system. Method of electrical images i) a point charge near a conducting grounded infinite plane. ii) a grounded conducting sphere. (8 P, 8 M)

Unit 3: Magnetostatics

Lorentz force, Biot-Savart law. Magnetic induction due to a wire carrying uniform current, Helmoltz coil, Axial magnetic field of solenoid, Ampere Circuital law and its application for straight wire carrying current, current loop. Magnetic Induction, Magnetization, Intensity of magnetic field, Magnetic vector potential, Relation between B, H and M, Magnetic susceptibility, Relative permeability, Magnetic circuit winding with and without air gap. (17 P, 16M)

Unit 4: Electrodynamics

Faraday's law of induction in differential and integral form, Modified Amperes Circuital law. Maxwells equation in differential and integral form, wave equation in free space, Solution of wave equation for plane wave in free space. Poynting vector and Electromgnetic energy. Reflection and refraction of plane wave from non-conducting boundaries (Normal incident). (17 P ,16M)

Total 52 periods , 50 marks

References :

1. Foundation of electromagnetic field : John R. Reitz and Frederick J. Milford, Robert W. Christy, 'Narosa Publishing House', New Delhi (3rd Edition)
2. Electrodynamics :Dr. S.L. Gupta, Dr. V. Kumar, Dr. S.P. Singh, 'Pragati Prakashan', Meerut (16th Eds.,2001)
3. Electromagnetics : B.B.Laud, 'Wiley Eastern Ltd', New Delhi (2nd Eds.)
4. Fundamentals Electricity and Magnetism : Aurther F. Kip, 'McGraw Hill Kogakusha Ltd, (2nd Eds.)

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Paper-II: Classical And Quantum Mechanics

Section – I Classical Mechanics:

Unit 1: Introduction : What is classical mechanics ? The place of classical mechanics in Physics and some basic definitions, A brief history of the development of mechanics up to Newton, Newton's laws of motion (law of intertia, law of causality, law of reciprocity, law of superposition), limitations of Newton's laws. (P6,M6)

Unit 2: Constrained Motions in Cartesian co-ordinates: Introduction, constraints and their classification, examples of contraints, Pinciple of virtual work, The basic problem with the contraint forces, Lagrange's equations of motion of the first kind, Gibb'- Appell's principle of least constraint, D' Alembert's principle-(conditions for vanishing virtual work. (P10,M8)

Unit 3: Lagrangian formulation: (in generalized co-ordinates) Introduction, generalized co-ordinates and degrees of freedom, Lagrange's equations of motion of the second kind, properties of kinetic energy function T, theorem on total energy, important properties of Lagrangian, Linear generalized potentials, generalized momenta and energy, Gauge function for Lagrangian, invariance of the Euler-Lagrange's equations of motion under generalized co-ordinate transformations, cyclic or ignorable co-ordinates, integrals of motion, concept of symmetry-(homogeneity and isotropy),invariance under Galilean transformations, Lagrangian for free particle motion. (P16,M16)

Unit 4: Rotating frames of reference : Introduction,Inertial forces in the rotating frame, Electromagnetic analogy of the inertial forces, Effects of coriolis force (flow of river, formation of cyclones, trade winds and tropical winds, guided missiles, effect in atomic nuclei, planetary atmospheres), Foucault's pendulum. (P8,M8)

Unit 5: Central force: Introduction, Definitions and properties of the central force, Two body central force problem, stability of orbits, conditions for closure, Kepler's problem and conditions for nature of orbits, orbits of artificial satellites. The basic Physics of tides (tidal bulge, tidal forces on the earth due to the moon, two tides a day, relative tidal heights due to the Moon and the Sun) (P12,M12)

Total 52 periods , 50 marks

References:

1. Classical Mechanics : N.C.Rana, P.S.Joag. Tata McGraw Hill, New Delhi, 1991

2. Classical Mechanics : Herbert Goldstein, Indian Book Company, New Delhi.
3. Introduction to Classical Mechanics : R.G.Takwale and P.S.Puranic, Tata McGraw Hill,1991
4. Classical Mechanics: Y.R.Wahmare ,Prentice Hall of India.1990.

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Paper–II Classical And Quantum Mechanics

Section-II Quantum Mechanics

Unit 1.
(Review of Schrodinger's Time dependent and steady-state equations). Probability density and probability current density (derivation of equation), probability current for free particle, Expectation values, eigen values and eigen functions; correspondence principle, correspondence between the motion of a wave packet and the motion of classical particle. (P10,M10)

Unit 2
Applications of quantum mechanics: (1-D problems) Boundary conditions, potential step, potential barrier, rectangular potential well, Linear Harmonic oscillator : recursion formula, energy levels, wave functions, concept of parity of wave function, degeneracy (idea). (P14,M14)

Unit 3. (3-D problems)
Rigid Rotator with free axis (up to energy level diagram), Schrodinger's equation for hydrogen atom in spherical polar co-ordinates), Solution of R, θ, Φ equations, quantum numbers- total quantum number, orbital quantum number, magnetic quantum number, spin quantum number. Significance of each quantum number. (P14,M12)

Unit 4.
Operator forms of – x, p, H, L , commutators, commutation algebra, commutation relations:

$[x , p_x] = i\hbar$

$[x^n , p_x] = ni\hbar\, x^{n-1}$

$[H , p] = 0$

$[L_x , x] = [L_y , y] = [L_z , z] = 0$

$[L_x , y] = i\hbar z \qquad [L_z , z] = -i\hbar y$ ..... and so on.

$[L_x , p_x] = [L_y , p_y] = [L_z , p_z] = 0$

$[L_x , p_y] = i\hbar p_z \;, \qquad [L_x , p_z] = -i\hbar p_y, \quad [L_x , L_y] = i\hbar L_z$

$[L^2 , L_x] = [L^2 , L_y] = [L^2 , L_z] = 0.$

Ladder operators L+ and L-
Commutation relations of Lx with L+ and L-. (P14,M14)

Total 52 periods , 50 marks

References:

1. Quantum Mechanics :L.I. Schiff , McGraw Hill Pub.,1968.
2. Quantum Mechanics : John L. Powell and Bernd Crasemann, Narosa Pub. House, 5th Print, 1994.
3. Perspectives of Modern Physics : Arthur Beiser, 'McGraw Hill Kogakusha Ltd, Tokyo.
4. Quantum Mechanics : G.R.Chatwal and S.K. Ananda, Himalaya Pub. House.
5. Fundamentals of Quantum Mechanics : Y.R.Waghamare,Wheeler Publishing,1996.

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T. Y. B.Sc. Physics

Paper-III :Atomic, Molecular and Nuclear Physics

SECTION –I Atomic & Molecular Physics

Unit 1. Vector Atom model
(Revision of Bohr-Sommerfield theory)
Quantum numbers, Physical interpretation of quantum numbers, electron spin, spin orbit interaction, spectral terms, spectra of single valence electron system(sodium), doublet splitting, selection rule, Pauli's exclusion principle. (P8, M8)

Unit 2. Two valence electron system :
spin-spin & orbit-orbit interactions, LS & jj coupling schemes, Spectra of two valence electron system-(Helium), singlet-triplet separations, Lande interval rule. (P10,M10)

Unit 3. Zeeman & Paschen – Back effects :
Magnetic dipole moment, Larmor precession, Normal and Anomalous Zeeman effect and Paschen-Back effect for single valence electron system. (P.8,M8)

Unit 4. X-ray spectra :
Origin of X-rays, characteristic X-ray spectra (with relative intensity curves), absorption of X-ray spectra, energy levels of Cadmium, regular and irregular doublets and their laws, Moseley's Law & its applications. (P10,M8)

Unit 5. Molecular Spectra :

Regions of electromagnetic spectrum, classification of molecular spectra, rotation spectra of diatomic molecules, rotational energy levels of rigid diatomic molecules, vibrational spectra of diatomic molecules, vibrational energy levels of harmonic oscillations.

Raman spectra- Raman effect, experimental setup and explanation of Raman effect, explanation of Stoke's and antistoke's lines in Raman spectra. (P16,M16)

Total 52 periods , 50 marks

References:

1. Introduction to Atomic spectra: H.E.White, McGraw Book Company, Inc.
2. Fundamentals of Molecular spectroscopy : C.N. Banwell, Tata McGraw Hill, 3rd Eds.
3. Spectra of Diatomic molecules : G.Herzberg, D.Van Nastrand Company, Inc., New York.
4. Perspectives of Modern Physics : Arthur Beiser, 'McGraw Hill Kogakusha Ltd, Tokyo.
5. Atomic spectra & Molecular spectra : Raj Kumar, Kedar Nath Ram Nath Prakashan.

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Paper-III :Atomic,Molecular and Nuclear Physics

SECTION-II Nuclear Physics

Unit 1. Nucleus and Nuclear Forces

Constituents, charge, mass, shape and size of nucleus, Nomenclature of nuclei, Binding energy, packing fraction, Nuclear magnetic dipole moment. Saturation and short range of nuclear forces, charge symmetry and charge independence, Spin-dependence of nuclear forces. (P10,M10)

Unit 2. Radioactivity

(Revision of law of radioactive decay) Half life, mean life, specific activity, partial radioactive decay, successive disintegration, Agricultural, Biological and Medical applications. (P7,M8)

Unit 3. Nuclear Models

Single particle shell model : Introduction, Evidence for shell model, theory of nuclear shell potential. Nuclear spins and parities, limitations of shell model. Liquid drop model : Introduction, Assumptions, Semi-empirical mass formula . (P6,M6)

Unit 4. Nuclear Reactions

Theories of nuclear reactions, conservation laws, Q-value equation, Energetics of exorgic reactions, Energetics of endoergic reactions. Threshold energy. (P7,M6)

Unit 5. Nuclear Energy :

Nuclear fission, explanation on the basis of liquid drop model, Energy available from fission – estimation of energy from masses of fission fragments and Binding energy. Nuclear chain reaction, Basic principle of atomic bomb, Nuclear fusion, Nuclear reactor : Basic principle, classification, constituent parts, Heterogeneous reactor, swimming pool reactor. (P12,M12)

Unit 6. Nuclear Detectors and Accelerators :

Types of detectors, Geiger-Mueller counter, Scintillation counter, classification of accelerators, Linear resonance accelerator, Cyclotron, Betatron. (P10,M8)

Total 52 periods , 50 marks

References:

1. The Atomic Nucleus :R.D.Evans, McGraw Hill Book Company.
2. Nuclear Physics : D.C.Tayal, Himalaya Publishing House, Bombay
3. Nuclear Physics : Irving Kaplan, Narosa Publishing House, New Delhi
4. Basic Nuclear Physics and Cosmic Rays : B.N. Srivastava, Pragati Prakashan, Meerut

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T.Y.B.Sc. Physics

Paper- IV: Electronics II / Instrumentation II & Programming in 'C' / Statistical Physics and Thermodynamics.

Section-I Electronics II

Unit 1: Semiconducting Devices

Construction, working principle, characteristics and parameters of: (i) FET , (ii) UJT (iii) SCR.) Introduction to MOSFET

Applications:

1. i) FET as VVR, ii) FET as an amplifier
2. i) UJT as a switch, ii) UJT as a relaxation oscillator
3. i) SCR as a switch, ii) SCR as a power control device.

(12 P,10M)

Unit 2 : Power Supplies :

Block diagram of unregulated and regulated power supply, their merits and demerits. Series regulated power supply, line regulation, load regulation. Study of monolithic voltage regulators: IC 723. Three terminal ICs- 78 xx & 79 xx (Discuss only with Block diagram). (8P,8M)

Unit 3 : Amplifier :

a) Differential Amplifier :

Black box concept, Basic circuit of differential amplifier, different configuration of differential amplifier, C.M.R.R, Need of constant current source. (5P,4M)

b) Operational amplifier (IC 741) :

Basic block diagram, symbol & pin connections, parameters of ideal and practical op-amp. , Concept of virtual ground, Inverting and Non inverting amplifier with gain expression, off-set null.

Applications of Op-Amp.:

Adder, Substractor, Integrator, Diffrentiator, Comparator & Wein Bridge Oscillator. (9P,8M)

Unit 4 : Digital Electronics :

(Revision of R.S., J-K & T. Flip Flops.)

(a) Counters: Four bit Asynchronous (ripple), Synchronous (parallel), MOD 3, MOD 5 and Decade counters along with block diagram. (6P,6M)

(b) Data Processing circuits:

Multiplexer (4 to 1 line) , Demultiplexer (1 to 4 line) Encoder, Decoder. (4P,4M)

(c) Internal diagram of IC 555 (Timer) and its application as a astable multivibrator (2P,4M)

Unit 5. Modulation and Demodulation :

Concept of A.M., F.M & Phase modulation, comparison between A.M. & F.M. Theory of A.M., modulation index, Importance of modulation index, modulated class C amplifier, Linear envelope diode detector. (6P,6M)

Total 52 periods , 50 marks

References:

1. Electronic Devices and Circuits : Jacob Milliman and Christos C. Halkies, Tata McGraw Hill Pub. Co. Ltd, New Delhi
2. Electronic Devices and Circuits : Allen Mottershed, Prentice Hall Of India Pvt. Ltd., New Delhi
3. Integrated Circuits : K.R.Botkar, Khanna Publishers, Delhi
4. Operational Amplifier : G.B.Clayton, Butterworth & Co. Ltd., London

5. Op-Amp. And Linear Integrated circuits : Ramakant A.Gayakwad, Prentice Hall Of India Pvt. Ltd., New Delhi, 3rd Eds. 1993
6. Electronics principle : Albert Paul Malvino, Tata McGraw Hill Pub. Co. Ltd., New Delhi
7. Principles of Electronics : V.K.Mehta, S. Chand & Co. Ltd., New Delhi
8. Digital principles and Applications : A.P. Malvino & D.P. Leach, McGraw Hill International Eds.
9. Basic Electronics : D. C. Tayal, Himalaya Publishing House.

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Paper- IV: Electronics II / Instrumentation II & Programming in 'C'/ Statistical Physics and Thermodynamics

Section-I Instrumentation-II

Unit 1 :

Introduction to Instrumentations :

Functional elements of measurement system.

Classification of instruments (Types only).

Static performance characteristics of instruments :

Define the following static parameters:

Resolution, Threshold, Hysteresis, Backlash Drift.

Impedance loading and matching.

Dynamic characteristics of instruments.

Introduction

Formation of system equations.

Compensation- First and second order systems . (12P,12 M)

Unit 2 :

Transducer Elements :

Classfication of transducers.

Basic requirements of a transducer.

Study of following analog transducers strain-gauge, LVDT, Potentiometric, Piezo-electric and opto-electrical.

Digital transducers -- Frequency domain and vibrating string. (10P,10M)

Unit 3:

A.C.Bridges :

Introduction

General equation for bridge balance.

General form of an A. C. bridge

Measurement of self-inductance :
- Maxwell's Inductance Bridge
- Anderson's Bridge.

Measurement of mutual inductance:
- Carry Foster Bridge(Heydeweiller's)
- Campbell's Bridge. (10P,10M)

Unit 4 :

Data Acquisition system.
- Introduction
- Single channel Data Acquisition system.

Digital to analog converters
- Binary weighted
- R-2R Ladder.

Analog to digital converters
- Successive approximation method.
- Single and dual slope integration. (10P,10M)

Unit 5 : Input – Output Devices and Displays
- Strip chart recorder
- Null type recorder
- X-Y recorder
- Magnetic tape recorder
- Light emitting diodes and Liquid crystal displays. (10P,8M)

Total 52 periods , 50 marks

References:

1. Intrumentation Measurement and Analysis : B. C. Nakra & K. K. Chaudhry, Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Instrumentation: Devices and System : C.S. Rangan, G.R. Sarma, V.S.V. Mani, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 2nd Eds.
3. Electrical and Electronics measurement and Instrumentation : A.K.Sawhney, Dhanpat Rai & Sons, Delhi
4. Electronic Instrumentation and measurement techniques : William D. Cooper & A.D. Helfrick, Prentice Hall India Pvt. Ltd., New Delhi
5. Electronics measurement : U.A. Bakshi, Technical Publications, Pune.

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Paper- IV: Electronics / Instrumentation II & Programming Using 'C'/ Statistical Physics and Thermodynamics.

SECTION –II: Programming Using 'C'

Unit 1 : Introduction to 'C'
Types of programming languages, Introduction to C: History , features of 'C'.Constants, Variables and Data types Character set, constants, variables, keywords, Data types, Declaration of variables. (8P,8M)

Unit 2 : Expressions and Operators
Arithmetic operators and modes of arithmetic expressions. Assignment operators, assignment statement, increment and decrement operators, Relational operators, Logical operators, logical expression, Preprocessor directives. (8P,6M)

Unit 3: Input and output in C
Character I/O getch() , putch(), unformatted and formatted I/O: scanf(), printf ( ) (P6,M6)

Unit 4: Control structures
If statement, If-else statement, nested if statement. (P6,M6)

Unit 5: Loop control
go to statement, switch statement, break statement, continue statement while loop, do-while loop, for loop (P7,M8)

Unit 6: Arrays
One dimensional, two dimensional arrays, Introduction to multi dimensional arrays. (P6,M5)

Unit 7: Functions
Defining a functions, Assessing a function, passing argument to a function, Recursion functions. (P6,M5)

Unit 8: Pointer, Structure, Union
Concepts, Use , declaration. (P5,M6)

Total 52 periods , 50 marks

References:

1. Let us C : Yashwant Kanitkar, BPB Publications
2. Computer programming in C : V.Rajaraman Prentice Hall India Pvt. Ltd., New Delhi
3. Programming in ANSI C : E.Balagurusamy, Tata McGraw Hill Pub. Co. Ltd. New Delhi
4. Programming in C : Stephen G.Kochan, CBS Publications.

5. The C programming language : Kerningham and Ritchie, Prentice Hall India Pvt. Ltd., New Delhi
6. Programming with C (2nd Ed.) : Byron S. Gottfried, Tata McGraw Hill Pub. Co. Ltd. New Delhi

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Paper- IV: Electronics / Instrumentation II & Programming Using 'C' / Statistical Physics and Thermodynamics.

SECTION–II Statistical Physics and Thermodynamics

Unit 1:Random Walk Problem And Binomial Distribution

Elementary statistical concepts and examples, Random walk problem in one dimension, General discussion of main values, Calculation of mean values for the random walk problem, Probability distribution for large N. Gaussian probability distribution, Probability distributions involving several variables. (P8,M6)

Unit 2: Statistical Formulation :
Specification of the state of the system, (Classical as well as quantum), Phase-space, Statistical ensemble, Accessible states, Postulates of equal a priori probability, Behavior of density of states of a system. (P8,M8)

Unit 3: Statistical Thermodynamics :
Equilibrium conditions and constraint, Distribution of energy between systems in equilibrium, Approach to thermal equilibrium. Statistical calculation of thermodynamic quantities. (P6,M6)

Unit 4: Micro canonical and Canonical Ensemble :
Simple application of canonical ensembles such as, paramagnetism and molecule in ideal gas, System with specified mean energy, Calculation of mean energy in a canonical ensemble, Partition functions and their properties, Partition function and its connection to free energy, Equipartition theorem, Maxwell velocity distribution only. (P16,M14)

Unit 5: Thermodynamics:
Basic idea of free energy , Entropy, enthalpy, Gibb's free energy, Maxwell's relations and their applications. First and second Tds equations. Expression for Cp-Cv, Ratio of heat capacities, Joule-Thomson effect, Production of low temperature by using Joule-Thompson effect, Porous plug experiment. (P14,M16)

Total Periods 52, Total Marks 50

References :

1 Fundamentals of Statistical and Thermal Physics :F. Reif., McGraw Hill Co. Ltd

4. Heat and Thermodynamics: M.W.,Zeemansky & R.H. Dittman, McGraw Hill Co., Inc, 7th Eds.
5. Treatise on Heat : M.N. Saha and B.N. Srivastava, Indian Press, Allahabad
6. Heat and Thermodynamics: Brijlal and N. Subrahmanyam, S. Chand & Co. Ltd., New Delhi
7. Elementary Statistical Mechanics : Dr. S.L. Gupta & Dr. V. Kumar, Pragati Prakashan, Meerut, 13th Eds, 1996.
8. Statistical Physics : B.B.Laud, New Age International Publishers.

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T.Y.B.Sc. Physics

Paper-V : Solid State Physics and Elements of Material Science

SECTION –I Solid State Physics

Unit 1 : The Crystal Structure

Classification of solids (crystalline, amorphous and polycrystalline), space lattice. The basis and crystal structure. Translational vectors, symmetry operations, Two and three dimensional lattice types, Miller indices, Interplanner distances. Some crystal structures (SC, BCC, FCC) CsCl, NaCl Co-ordination number. Packing fraction, Primitive translational vectors for SC,BCC, FCC The reciprocal lattice and its properties. (P13,M12)

Unit 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. Brillouin zones (1-D and 2-D). First brillouin zone for simple cubic lattices, X-ray diffraction methods (Laue, rotation method and powder). Analysis of cubic crystal by powder method. (P10,M10)

Unit 3 : Cohesive Energy and Bonding in Solids

Cohesive energy and formulation of molecules, Ionic bond and Madelung energy, Madelung constant for NaCl, Covalenet bond, Molecular bond, Metallic bond, Atomic and Ionic radii. (P8,M8)

Unit 4 : Lattice Vibrations and Thermal Properties

Lattice heat capacity, Classical theory of specific heat, Einestein's theory of specific heat, Vibrational modes of a 1-D monoatomic lattice, Debye's model. (P10,M8)

Unit 5 : The Free electron Theory of Metals

de-Lorentz theory, Ohm's law, Electrical and thermal conductivity, Summerfield model. Density of Free electron gas 1-D and 3-D, Fermi energy. (P6M6)

Unit 6 : Band Theory of solids

Energy Band formation and origin of energy gap, Bloch theorem (statement only), Krong-Penney model effective mass of an electron. Distinction between metals, semiconductors and insulators, concept of hole. (P5,M6)

Total Periods 52 Marks 50

Reference:

1. Introduction to Solid State Physics : C. Kittle, Wiley Eastern Ltd, 5th Eds.
2. Solid State Physics : A. J. Dekker, Macmillan India Ltd., Madras.
3. Introduction to Solids : L.V. Azaroff, Tata MacGraw Hill Co. Ltd, New Delhi.
4. Solid State Physics : S. L. Gupta, V. Kumar.
5. Solid State Physics : S. L. Kakani and C. Hemrajan.
6. Solid State Physics : C. M. Kachhava.
7. Solid State Physics : R. L. Singhal, KedarNath Ram Nath & Co.,Meerut, 7th Eds. 2002.
8. Fundamentals of Solid State Physics: B.S. Saxena , R.C. Gupta, P.N. Saxena, Pragati Prakashan, Meerut

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Paper-V : Solid State Physics and Elements of Material Science

SECTION –II Elements of Material Science

Unit 1 : Classification of Materials

Classification of materials, selection of material, structure of materials, Modern material need. Structural properties, relationship in materials. (P6,M6)

Unit 2 : Properties of Materials

A) Mechanical properties :

Mechanical fundamentals – Stress, strain, isotropic and anisotropic. Hook's Law and modulus of materials. Poisson relation, stress strain relation. Important properties – Strength, ductility, toughness stiffness, malleability, plasticity, hardness brittleness, creep, fatigue.

B) Electrical properties :

Resistivity, conductivity, ionic conductivity, factors affecting conductivity. Other electrical characteristics such as ferro-electricity and piezo electricity.

C) Thermal properties :

Heat capacity, thermal expansion, thermal conductivity. (P12,M10)

Unit 3 : Diffusion in solid materials

Concept of diffusion, atomic theory of diffusion, Fick's 1st and 2nd law of diffusion. Self diffusion, diffusivity, dependence of diffusivity on temperature. (P6,M7)

Unit 4 : Defects in Materials :

Imperfection and type of imperfections. Point defects : Schottky defect, Frenkel defects, disorder in crystals.

Line defects : Dislocation and type of dislocation. (P8,M8)

Unit 5 : Solid solutions:

Solid solutions in metals, Rules of solid solubility, Solution hardening, work hardening, Annealing, recovery, recrystalisation, cold working of metals, Hot working of metals, comparision between cold and hot working. (P5,M6)

Unit 6 : Phase-diagram:

Basic concepts: construction of phase diagram, phase rule and application. Lever-rule and application and interpretation of phase-diagram. Single component system, study of phase-diagram for complete solid solution. (P12,M10)

Unit 7: Polymeric Material : Basic concepts of polymers, Size and molecular weight of polymers, Structure of polymers, properties of polymers, application of polymers. (P3,M3)

Total Periods 52, Marks 50

References :

1. Elements of Material Science and Engineering : L.H.Van Vlack., Addition Western Pub. Co.
2. First course in Material Science and Engineering : V.Raghavan, Prentice Hall Of India Pvt. Ltd., New Delhi.
3. Material Science and Metallurgy : V.D.Kodgire.
4. Material Science and Process : S.K.Hajra, Choudhari, Indian Book Distribution Co.
5. Material Science and Engineering : W.D.Callister Jr..W.
6. Introduction to Material Science for Engineers. : J.F.Shackelford, Macmillan Publishing Company.

7. Diffusion in Solids : M.W.Schewon, McGraw Hill, 1963.
8. Physical Metallurgy Part 1 & II: Edited by R.W. Cahn & H. Hassan, North Holland, 1983.

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T.Y.B.Sc. Physics

Paper-VI :Optional Courses-A,B.C.D

Paper-VI: (A) Technical Electronics I & II

Section I: Technical Electronics I

Unit I : Components and Devices
Resistors, capacitors, Inductors : (Types, constructions, and specifications).
Transformers: Principle, Types (single phase power transformer; Auto, Isolation, AF,RF,IF)
Relays: Principle, construction and working of EM relay, types of relays (list only).
Display devices : Seven Segment Display, LCD. (P14, M14)
Unit II: Printed Circuit Board
Idea of PCB, functions and advantages, Basic and conducting material, Different steps for making PCB, principle of photo lithography. (P8,M8)
Unit III: Transducers
Definition, classification.
Electrical Transducers: Thermister, Thermocouple, pressure and Displacement transducers. Strain gauges, LVDT, Piezoelectric transducer, Optoelectronic transducer : LDR.
Chemical Sensors : Gas sensors, Radio active sensor, pH-cell. (P14,M12)
Unit IV : Data Converters
D to A converters: Importance, Resistive divider network, Binary ladder network.
A to D converters : Voltage to frequency, voltage to time (single and dual slope). (P 8,M6)
Unit V : Audio Amplifiers and their sub systems
Introduction, Hi-fi sound, stereophony, Quadra phony, Dolby A system, Dolby B system Graphic equalizer (circuit expected). (P 8,M10)

Total 52 periods , 50 marks

Section II: Technical Electronics II

Unit I: P. A. System: Basic requirements, Block diagram, Different types of microphone and loudspeaker. Installation planning.
Magnetic tape recorder: Block diagram (record and play mode)
C. D. Player: Block diagram, optical assembly for reading C.D. (P10,M8)
Unit II: Modern Home appliances:
Microwave oven : Operating principle, block diagram, features.
Remote Control: Operating principle, block diagram, features.
Washing Machine: Operating principle, block diagram, features Fuzzy logic (Idea only)
Facsimiles (Fax): Operating principle, block diagram, features, fax standards.
Cordless Phone: Operating principle, block diagram of base unit, block diagram of handset features.
Electronic Weighing System: Principle, block diagram, features. (P14,M14)
Unit III: Medical Instruments: Pre requisites of Bio-electronics (Bio-potential, types of electrodes, Cardio vascular system.) ECG (principle, block diagram & feature) (P10,M10)
Unit IV: Measuring Instruments (Analog and Digital):

1. Analogue Multimeter (Simpson 260)
2. Cathode ray oscilloscope (Block diagram, front panel controls)
3. Function Generator (Block diagram & features)
4. DFM-Frequency mode only (Block diagram & features)
5. DVM- Ramp type only (Block diagram & features)
6. Digital LCR Meter (Block diagram & features). (P18,M18)

Total 52 periods , 50 marks

References:

1. Electronic Measurements : U.A.Bakshi, V.V.Bakshi, Technical Publications, Pune
2. Modern Electronic Instruments & Measurement Techniques : Albert D. Helfrick, William D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi
3. A course in Electrical & Electronic Measurements & Instrumentation : A. K. Sawhney, Dhanpat Rai & Sons.
4. Instrumentation Devices & system (2nd Edition) : C. S. Rangan, G. R. Sarma, V. S. V. Mani, Tata McGraw Hill Pvt. Ltd, New Delhi
5. Instrumentation Measurement & analysis : B.C.Nakra, K.K.Chaudhry, Tata McGraw Hill Pvt Ltd., New Delhi.
6. Components and Devices technology : A.B. Gogate, P.C Rao, D.V. Sutrave , Nirali Prakashan

7. Consumer Electronics : J. S. Chitode, Technical Publications, Pune
8. Basic Electronics : B. Grob, McGraw Hill Book Co. New York, 5th Eds.
9. Understanding Electronic components : F.J.Water, D. B. Taraporevala Sons & Co. Pvt. Ltd., Bombay.
10. Transducers & Display System : B. S. Sonde, Tata McGraw Hill Pub. Co. Ltd., New Delhi
11. Data Converters : B. S. Sonde, Tata McGraw Hill Pub. Co. Ltd., New Delhi
12. Introduction to Bio-Medical Electronics : Joseph-Du-Bary, McGraw Hill Co. Ltd.
13. Medical Instrumentation Application & Design : J. C. Wobster.
14. Biomedical Instrumentation & Measurements : Lesline Cromwell, Fred J Weibell, Pretice Hall Of India Pvt Ltd, New Delhi.
15. Audio and Video Engineering Systems : R.G. Gupta, Tata McGraw Hill Co. Ltd, New Delhi

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T.Y.B.Sc. Physics

Paper VI: (B) Refrigeration &Air conditioning I & II

Section 1 : Refrigeration & Air conditioning I.

Unit.1 Methods of Refrigeration

Ice refrigeration, Evaporative refrigeration, Refrigeration by expansion of air, refrigeration by throttling of a gas, vapour refrigeration system, Units of refrigeration, work developing and work absorbing systems, concept of C.O.P. and E.P.R. (6P,6M)

Unit. 2 Air refrigeration system

Basic elements of air refrigeration system, flow diagram of working, Carnot cycle as most efficient refrigerator, C.O.P. & its dependence on source and sink temperature, Bell-Coleman air refrigerator , Advantages and disadvantages of air refrigeration system. (8P,7M)

Unit. 3 Vapour refrigeration system

Vapour compression refrigeration, study the effect of suction and delivery pressure, condensing temperature and vapourisation temperature, construction of various lines on T- Φ Chart, P-H diagram for vapour compression refrigeration, Advantages and disadvantages of vapour compression refrigeration system over air compression refrigeration system (10P,10M)

Unit. 4 Absorption refrigeration system

Simple absorption system, practical ammonia absorption system, Electrolux refrigerator, C.O.P. of absorption refrigeration system, Domestic electrolux refrigerator, salt solution absorption refrigeration system, Advantages of absorption refrigeration system over vapour compression refrigeration system.

(9 P, 9 M)

Unit. 5 Refrigerant

Classification of refrigerants, Desirable thermodynamic, Physical and Safe working properties of an ideal refrigerant, important refrigerants, Refrigerant nomenclature, selection of refrigerant

(5P,4M)

Unit 6 Refrigeration equipments

* Compressors : Function,Types,study of hermetically sealed compressor, Effect of evaporator and condensing temperature on performance parameter of reciprocal compressor.

* Condensers : Function, Air cooled & water coolers condensers and evaporative condensers.

* Evaporators: Function, Primary and secondary evaporators, study of flooded evaporator, Dry expansion evaporator, study of coolers, classification of evaporators as per the mode of air circulation (Natural cooled, Forced cooled evaporator). Classification of evaporators as per design of evaporator (Double pipe, shell & coil and shell & tube).

*Expansion Devices : Function, Automatic expansion valve, Thermostatic expansion valve, solenoid valves.

(14 P,14M)

Total periods 52, Total Marks 50.

Section II : Refrigeration & Air conditioning II.

Unit. 1 .Heat Transfer

Introduction, conduction through slab, pipe, and hollow sphere, convection, Expression for heat transfer coefficient, combined conduction and convection, Applications of fins, means temperature difference, over-all heat transfer coefficient.

(10P,10M)

Unit. 2, Air Conditioning (Psychrometry)

Introduction, meaning of air conditioning, Psychrometry and psychrometric charts, Psychrometric processes, Summer and winter air conditioning systems.

(10P,10M)

Unit. 3.A) Different heat load sources

Conduction heat load, Radiation load of Sun, occupant's load, Equipment load, Infiltration air load, miscellaneous heat sources, fresh air load, and load calculations.

(10P,8M)

B) Cooling coils and Dehumidifying air washers, cooling Towers, Evaporative condensers. (6P,6M)

Unit.4. Air conditioning Equipments :-

Air cleaning and air filters, Humidifiers, Dehumidifiers, fans and blowers, Grills and resistors. (5P,6M)

Unit.5. Control Systems:

Introduction, purpose, Elements of basic control system, Basic principle of working of control system, Temperature control elements, Humidity control elements, Actuating elements, Pre-heat and humidification control system, cooling dehumidification and Reheat control, face and Bypass control system. (11P,10M)

Total Periods 52 Total Marks 50

References:

1. A course in Refrigeration & Air Conditioning : S. Domkundwar, Dhanpat Rai & Sons. (Text book), 3rd Eds.
2. Refrigeration and Air Conditioning : Jordon and Prister. Prentice Hall of India.
3. Principles of Air Conditioning : Patel & Mehata ,Allied Publishers India.
4. Air Conditioning and Refrigeration: Raber and Hutchinson, John Wiley & Sons.

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T.Y.B.Sc. Physics

Paper-VI: (C) Microprocessor and Assembly language programming I & II

Section I: Microprocessor and Assembly language programming I

Unit I: Fundamentals of digital systems:

Counters, 4-bit ripple counter, Up down counter, shift register (SICO, SIPO, PISO, PIPO, left shift, right shift). Multiplexer (16 to line), Demultiplexer (1 to 16 line), Encoder, Decoder. (P16,M16)

Unit II: Fundamentals of computer (Revision)

Block diagram of computer, Address bus, Databus control bus, High level language, Low level language, assembler, compiler, interpreter. (P6,M6)

Unit III: Architecture of 8085 microprocessor

Architecture of Intel 8085 microprocessor, Pin diagram of 8085 (Function of each pin is expected) Reference-2 (P8,M8)

Unit IV: Instruction set of microprocessor 8085
Addressing modes for 8085, types of instructions, Instruction set of 8085. (P22,20M)
Reference-4

Total Periods 52 Total Marks 50

Section II: Microprocessor and Assembly language programming-II

Unit V: Assembly language programming:
Arithmetic programs: 8-bit addition, 8-bit subtraction, decimal addition of two 8-bit numbers, 8-bit decimal subtraction, Two's complement of 16-bit number, shifting of a 16-bit number left by two bits, square root from lookup table. Largest/ Smallest number from a series of number, 8-bit multiplication. Code conversion: ASCII code, Hex to ASCII conversion, Decimal to 7-segment conversion, BCD to binary conversion. References 1and 4. (P22,M20)

Unit VI: Interfacing of memory and peripheral devices
Address space partitioning, memory mapped I/o scheme, I/o mapped I/o scheme, memory interfacing, I/o interfacing.
Data transfer schemes: Programmed data transfer, Direct memory access (DMA) data transfer, synchronous, asynchronous and interrupt driven data transfer scheme. Reference-1. (P10,M10)

Unit VII: Programmable peripheral Interface (8255)
Architecture of Intel 8255, pin diagram, function of each pin, control word, mode 0, mode1 and mode 2.Reference-3 (P8,M8)

Unit VIII: study of sample projects:
i) A digital stop watch.
ii)A digital thermometer.
(The study of hardware and flow chart is expected)Reference-4 (P12,M-12)

Total Periods 52 Total Marks 50

References:

1. Fundamentals of Microprocessor and Micro computers : Badri Ram, Dhanpat Rai & Sons, Delhi.
2. Digital Computer Electronics : Albert Paul Malvino, Tata McGraw Hill Pub. Pvt Co. Ltd, New Delhi
3. Microprocessor Architecture, Programming and Applications with 8085/8080A : Ramesh S Gaonkar, New Age International (P) Ltd Publisher, New Delhi.
4. 8080A/8085 Assembly Language Programming : Lance A. Leventhal, Osborne/McGraw Hill, Berkeley, California.

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Paper- VI (D): Vacuum Technology I&II

Section –I: Vacuum Technology I

Unit I Expected background:

Basic assumptions of kinetic theory; Gas pressure and equation of state, Molecular velocity distribution law and expressions of constants involved in it, Mean free path, Gaseous diffusion, Thermal conductivity and Viscosity of gases. (P6,M6)

Unit II Fundamental consideration of vacuum practice:

Atmosphere and vacuum, Throughput and speed; Different units of vacuum measurements; Ranges of vacuum, Vacuum circuits; Impedance and Conductance; Gas flow mechanism through pipes, Pumping Speed of vacuum pumps. (P12,M12)

Unit III Production of Vacuum:

Mechanical oil sealed rotary pumps – The rotating vane type – The sliding vane type pumps, Vapour pumps (Oil diffusion pump) – Working, principle, construction details, actual working, Ultimate pressure attainable and factors on which the optimum performance of the pumps depends and pump characteristics. (P14,M12)

Unit IV Ultrahigh Vacuum Pumps:

Molecular drag pump (Turbo molecular pump), Sorption pump, Ion pump, Getter pump, Getter-Ion pumps; Titanium sublimation pump and Cryogenic pump. (P8,M8)

Unit V Pressure Measurement devices (Vacuum Gauges):

U-tube manometer, Mc-Leod gauge, Thermal conductivity gauges - thermocouple, pirani and semiconductor gauges, Ionization gauges - Hot cathode and cold cathode gauge and Bayard-Alpert gauge. (P12,M12)

Section-II : Vacuum Technology II

Unit VI Vacuum materials and components:

Adsorption, absorption, desorption, diffusion and penetration of gases and vapours through solid surfaces. Vapour pressure of different materials, Outgassing. Desired properties of materials used for fabrication of vacuum system and its components. (P8,M8)

Unit VII Vacuum Seals:

Permanent seals (joints) – Welding, brazing, soldering, Metal-to-Metal seal, Metal to glass seal; Adhesive seals (Wax, Araldite)

Demountable seals (joints): - Couplings, flanges, Rubber and Metal gaskets, 'O' rings.

Feedthrough's: - Electrical and motion feedthrough, Wilson seal, Bellow feedthrough, Magnetic rotator etc.
Valves: - Diaphram valve, Sliding valve, Baffle valve, Butterfly valve, gate valve, Air- admittance, Needle valve. (P13,M12)

Unit VIII Vacuum System Fabrication:

i). General consideration of designing

ii). Construction of High vacuum system [Combination of rotary & Oil diffusion] and it's operational procedure.

iii).Ultra-high vacuum system and it's operational procedure. (P10,M10)

Unit IX Principle of Leak detection:

Real and virtual leak; Leak detection methods - over-pressure method - bubble method, Sniffer technique (halide torch), Low pressure method - blocking (sealing method), Tesla Coil, Search gas spray. Halogen leak detector- Organic vapour and gas probe with suitable pressure gauge as a detector. (P13,M12)

Unit X Application of Vacuum Technology In Research and Industry. (State applications only)

Thin Films Research – Vacuum deposition coating by evaporation, Aluminization of mirrors, Decorative coating, corrosion Resistance coatings, optical coatings, Micro-circuit coating, Electron microscopy specimens.
Lamp Industry: - Various filaments lamps, Discharge tubes, X-ray tubes, electron tubes (Various electron tubes)
Vacuum Metallurgy: Vacuum degassing static, progressive and stream degassing.
Vacuum Induction Melting, Simulation of outer space environment .(P8,M8)

Total Periods 52 Total Marks 50

References:

1. Introduction to theory and practice of high vacuum technology : L. Ward, J. B. Bunn, Butter Worths 1967.
2. High vacuum Technology : J. Yarwood, Champan and Hall, 1967.
3. High vacuum engineering : A. E. Barringlon, Prentice Hall of India.
4. Scientific foundation of vacuum techniques : S. Dushman and J. M. Lafferty, John Willery and Sons, 1962.
5. Design and construction of small vacuum system : G. W. Green.
6. Vacuum Sealings Techniques : A Roth.

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Practical Course I

Section I : Carry out any Eight experiments

1. Resonance Pendulum.
2. S.T.by Quinke's method.
3. Y & η by Searl's method.
4. To determine the Coefficient of viscosity by rotating cylinder method.
5. S.T.by soap bubble method.
6. Bifilar suspension(with stop watch)
7. To determine Stefan's constant
8. To determine Thermal conductivity of metal by Forbe's method.
9. To determine Thermal conductivity of rubber by rubber tubing method.
10. Jolly's steam calorimeter
11. Velocity of sound by phase shift method.
12. Study of directional characteristics of unidirectional microphone.
13. Y by Koenig's method.
14. Determination of velocity of sound using Ultrosonic Interferometer.
15. Frequency of A.C. /Tuning Fork by Sroboscope.

Section II : Carry out any Eight experiments

1. 'μ' by total internal reflection.
2. Resolving power of grating.
3. Determination of cardinal points of a given lens system by Searle's Goniometer.
4. To estimate temp. of sodium flame.
5. Determination of unknown wavelength of a given source by LLyod's single mirror.
6. 'λ' by Michelson's interferometer.
7. To study the characteristics of thermistor.
8. Platinum resistance thermometer.
9. To study oscillatory charge and discharge of a condenser through an inductance and resistance.
10. Electromagnetic pendulum.
11. e/m using Thomson's method.
12. Restivity of thin film /(Semiconductor) by four probe method.
13. To study the Doppler effect.
14. Dffraction by straight edge/cylindrical obstacle.
15. Determination of Planck constant using photocell.

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Practical Course II

Section I : Group [A]

Programming in C (Any four)

1. To find largest and smallest from given list of numbers.
2. To find factorial of given number.
3. To generate list of prime numbers within a given range.
4. To find roots of quadratic equations.
5. To find sum of series (Sine/cosine)
6. To find multiplication matrix of given two matrix.
7. To calculate electric bill using ' else-if '.

OR

Section I : Group [A]

Statistical Physics and Thermodynamics, Solid state physics , Material Science (Any four)

1. Ionic conductivity of NaCl.
2. Measurement of resistivity of material by two probemethod.
3. Determination of Curie temperature of ferrite
4. Measurement of susceptibility by Gauy's method.
5. G.M.Counter (Plateau region)
6. Determination of Hall constant using Hall effect.
7. Specific heat of graphite at different temperatures.

Section I : Group [B]

Electronics II and Instrumentation II

Electronics II (Any four)

1. To study characteristics of SCR .
2. Sensitivity of CRO & Lissajous figure.
3. Built & test ERPS using transistor.
4. Study of RC/LC filter (High pass & Low pass)
5. To study characteristics of UJT./ UJT as relaxation oscillator.
6. Study of NAND/NOR gate as an universal gate (using IC).
7. To design and build FET as VVR.
8. 4 to 1 line Multiplexer (Using IC 7400 &7420)
9. Wein bridge oscillator using IC 741.

OR

Instrumentation II (Any four)

1. Measurement of self inductance using Maxwell's Inductance Bridge / Anderson's Bridge.
2. Measurement of mutual inductance using Carry Foster's Bridge.
3. Instrumentation Amplifier.
4. Measurement of displacement using LVDT.
5. To design and build Crystal Oscillator.
6. To determine Input impedance, Output impedance, CMRR of a given OP AMP.
7. Binary weighted DAC converter/ DAC (R-2R ladder) using OP AMP.

Practical Course II

Section II : (Optional Course)

(A) Technical Electronics

Carry out any Eight experiments

1. To make two PCBs
   i] Using discrete components. (Single stage transistor amplifier, astable multivibrater using transistor)
   ii] Using IC component (Op-amp as a adder).
2. To study Op-amp as adder.

3. Astable multivibrater using IC 555.
4. Thermister as a Thermometer (using IC 741)
5. To study characteristics of LDR.
6. DAC (R-2R ladder, without op-amp)
7. Study of IC 7490 and its different modulus (Mod 2 , Mod 5)
8. Half wave and full wave precision rectifier (using Op-amp)
9. Triangular – square wave generator (using op-amp)
10. Study of CRO & its use to find parameters of a pulse (rise time, fall time, duration and amplitude)
11. Study of PA system (series & parallel connections of two speakers)
12. Study of OP AMP as an 'adder' & a 'subtractor'.
13. Study of OP AMP as 'differentiator' & an ' integrator'.
14. Study of strain gauges.
15. Designing & fabrication of transformer.

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Section II:(Optional Course)

(B) Refrigeration & Air conditioning.
Carry out any Eight experiments

1. Study of tools required for refrigeration system.
2. Gas filling in the given system.
3. Oil testing & oil charging in the compressor.
4. Study of water cooler.
5. Study of window type air conditioner.
6. Study of chilling plant.
7. Leakage testing of given refrigeration system.
8. Study of refrigerator.
9. To determine coefficient of performance by using chilling plant.

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Section II:(Optional Course)

(C) Microprocessor & Assembly language programming I & II.
Carry out any Eight experiments

1. 8-bit decimal addition/subtraction.
2. Find largest/smallest number from series of 8-bit numbers.
3. Find square root from look up table.
4. Conversion of Hex to ASCII code.

5. 8-bit binary multiplication.
6. up-down counter (4-bit)
7. Multipliexer / Demultiplexer using IC.
8. Hexadecimal/Decimal counter.
9. LED interface (Time delay generation)
10. Application of DAC (square/triangular sweep wave)
11. Interfacing of thumbwheel switch.
12. Study of shift register (using IC)

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Section II : (Optional Course)

(D) Vacuum Technology II

Carry out any Eight experiments.

1. To describe function of various parts of Rotary pump (with schematic diagram).
2. To describe the constructional details & working of vapour diffusion pump.
3. Study of McLeod gauge (Vaccu–stat)
4. To measure the pumping speed of vacuum system by steady state method.
5. To calibrate and study the function of Pirani gauge
6. To measure the pumping speed of a rotary vacuum system (use of Gaedes equation)
7. To evacuate a system with a rotary pump (measurement of vacuum with & without ballest using McLeod gauge)
8. Demonstration of oil diffusion pump and to evacuate the system and to measure the ultimate vacuum.
9. To study the effects of conductance of pumping speed of oil diffusion pumping module.
10. Deposition of metallic thin film.
11. To investigate the variation of pumping speed of vapour diffusion pumping module with the pressure in vacuum system.

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"Quality has a cost and one who ignores quality in higher education, does it at the cost of the country"