SCIENCE FACULTY

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS

FOR

T. Y. B. Sc.

PHYSICS

(With effect from June - 2017)

NORTH MAHARASHTRA UNIVERSITY, JALGAON
Class: T. Y. B. Sc.
Subject: Physics

The revised syllabus for T. Y. B. Sc. Physics prepared by different committees was discussed and finalized in the workshop for T. Y. B. Sc. Syllabi revision on 25th February 2017. The titles of the papers for T. Y. B. Sc. (Physics) are as given below;

Semester	Title of Course	Periods	Marks	
			Ext.	Int.
V	PHY 351: Mathematical Physics	60	60	40
	PHY-352: Classical Mechanics	60	60	40
	PHY- 353: Atomic and Molecular Physics	60	60	40
	PHY: 354(A): Electronics II or PHY-354(B): Instrumentation II	60	60	40
	PHY 355: Solid State Physics	60	60	40
	PHY 356(A): Technical Electronics- I or PHY 356 (B): Refrigeration and Air conditioning- I or PHY 356(C): Vacuum Technology-I or PHY: 356(D): Microprocessor-I or PHY 356(E): Programming in C+ + - I or PHY 356 (F): Solar Energy-I	60	60	40
	PHY 357: Practical Course-I	60	60	40
	PHY 358: Practical Course-II	60	60	40
	PHY 359: Project work-I	60	60	40

Semester	Title of Course	Periods	Marks	
			Ext.	Int.
VI	PHY 361: Classical Electrodynamics	60	60	40
	PHY 362: Quantum Mechanics	60	60	40
	PHY 363: Nuclear Physics	60	60	40
	PHY: 364: Statistical Mechanics and Thermodynamics	60	60	40
	PHY 365: Elements of Material Science	60	60	40
	PHY 366(A): Technical Electronics- II or PHY 366(B): Refrigeration and Air conditioning- II or PHY 366(C): Vacuum Technology-II or PHY: 366(D): Microprocessor-II or PHY 366(E): Programming in C+ + - II or PHY 366 (F): Solar Energy- II	60	60	40
	PHY 367: Practical Course – III	60	60	40
	PHY 368: Practical Course – IV	60	60	40
	PHY 369: Project work- II	60	60	40

Number of teaching days /year	180
Number of teaching days /term	90
Number of periods for theory course or practical course/ week	04

Number of teaching periods /term	52
Number of periods /term for test, seminars and tutorials	08
Total number of periods / term for course	**52 + 08 = 60**

PHY- 351: Mathematical Physics

Unit 1: Vector Analysis

Revision of gradient of scalar, divergence of vector, curl of vector, Gauss divergence theorem, Stoke's theorem, Green's 1st and 2nd theorem, Green's theorem in the plane. (Statements, proofs and problems) **(5P, 6M)**

Unit 2: Curvilinear Co-ordinates

Introduction to Cartesian (X, Y, Z), Spherical polar (r, θ, φ) and Cylindrical (ρ, φ, z) co-ordinate systems and their transformation equations, General Curvilinear Co-ordinate system, coordinate surfaces, length element and volume element, scale factors. Orthogonal Curvilinear Co-ordinates system, Proof of orthogonality of spherical polar and cylindrical co-ordinate systems. Expression for gradient, divergence, curl and Laplacian in spherical, polar and cylindrical co-ordinate systems. **(13P, 16M)**

Unit 3: Differential Equation

Degree, order, linearity and homogeneity of partial differential equation, Method of separation of variables in Cartesian, Spherical polar and Cylindrical co-ordinate system (Wave equation and Laplace's equation), Singular points, Singular points of Legendre and Hermite differential equation, Statement of Fuche's theorem, Frobenius method of series solution, series solution of linear simple harmonic oscillator. **(14P, 16M)**

Unit 4: Special Functions

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

Proof of following properties

1) $(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$.
2) $P_n(x) = P'_{n+1}(x) - 2x\,P'_n(x) + P'_{n-1}(x)$.
3) $H_{n+1}(x) = 2xH_n(x) - 2nH_{n-1}(x)$.
4) $H'_n(x) = 2nH_{n-1}(x)$.
5) $J_{n+1}(x) + J_{n-1}(x) = 2n/x\ J_n(x)$.
6) $J_{n-1}(x) - J_{n+1}(x) = 2\,J'_n(x)$. **(9P, 10M)**

Unit 5: Special Theory of Relativity

Newtonian relativity, absolute space, Galilean transformations, Michelson-Morley experiment, postulates of special theory of relativity, Lorent'z transformation equations, Length contraction, time dilation, relativity of simultaneity, variation of mass with velocity, addition of velocities, mass-energy relation, energy momentum relation. **(11P, 12M)**

(Total: 52 Periods, 60 Marks)

References:

1. Mathematical Physics: B.S. Rajput, Pragati Prakashan (19th Edition, 2007).
2. Mathematical Physics: B. D. Gupta.
3. Mathematical Methods for Physics: G. Arfken, Hens Weber (4th Edition, 1995).
4. Mathematical Methods in the Physical Science: Mary L. Boas.
5. Vector Analysis: Murray R. Spiegal, Schaum's series.

PHY- 352: Classical Mechanics

Unit- 1: Introduction to Classical Mechanics

Introduction of classical mechanics,Historical development of classical mechanics, Discussion on Newton's laws of motion, Limitations of Newton's law, Types of forces: Force of gravitation, Lorentz force, Hooks force, Frictional force, Fundamental forces of nature, Projectile motion in various medium, Rocket motion. **(10P, 12M)**

Unit- 2: Motion in Central Force Field

Concept of central force, Properties of central force, Reduction of two body problem into equivalent onebody problem, Motion in central force field, Generalfeatures of motion, Equation of anorbit, Orbits of artificial satellites,Deduction of Kepler's laws of planetary motion.

(14P, 16M)

Unit 3: Lagrangian Formulation

Types of constraints, degrees of freedom, Generalized coordinates, Concept of virtual displacement and virtual work, D'Alemberts principle Lagrange's equation from D'Alembert's principle, Properties of Lagrange's equation, Applications of Lagrange's equation (simple pendulum, linear simple harmonic oscillator, compound pendulum and Atwood'smachine)

(14P, 16M)

Unit 5: Hamiltonian Formulation

Cyclic coordinates, Phase space, Hamiltonian, Hamiltonian's canonical equation of motion, Physicalsignificance of Hamiltonian, Advantages of Hamiltonian approach, Applicationsof Hamilton's equation (simple pendulum, compound pendulum andlinear harmonicoscillator), Poisson Bracket: Definition and Properties. **(14P, 16M)**

(Total: 52 Periods, 60 Marks)

References:

1. Introduction to Classical Mechanics, R. G. Takawale, P. S. Puranik, TMH Publications Ltd.
2. Classical Mechanics, N. C. Rana, P. S. Joag, TMH Publications Ltd.
3. Principles of mechanics, J. L. Synge, B. A. Griffith, TMH Publications Ltd.
4. Classical Mechanics, Herbert Goldstein, Narosa Publishing House
5. Classical Mechanics by J.C. Upadhyaya, Himalaya Publishing House
6. Classical Mechanics: P. V.Panat, NarosaPublishing House
7. Classical Mechanics: Gupta, Kumar and Sharma, Pragati Publication (26^{th} edition)

PHY- 353: Atomic and Molecular Physics

Unit 1: Vector Atom Model

Quantum numbers, physical interpretation of quantum numbers, electron spin, Pauli's exclusion principle, Defination of L-S coupling, spin orbit interaction, spectral terms, selection rules, spectra of single valence electron system (sodium). **(8P, 10M)**

Unit 2: Two Valence Electron System

Spin-spin and orbit-orbit interaction, L-S & j-j coupling schemes, singlet triplet separations, s-p & p-d configuration in L-S coupling and j-j coupling, Lande interval rule. **(12P, 14M)**

Unit 3: Zeeman & Paschen Back effect

Magnetic dipole moment, Larmor precession, Zeeman Effect: Experimental set up, Normal & Anomalous Zeeman Effect for single valence electron system, Lande 'g' factor for single valence electron system (L-S and j- j coupling) for e.g., Helium spectrum, Paschen Back effect for single valence electron system. **(12P, 14M)**

Unit 4: X-ray spectra

Origin and nature of x-ray, Characteristic x-ray spectra, Moseley's law and its importance, energy level of cadmium, regular and Irregular doublets and their laws. **(8P, 10M)**

Unit 5: Molecular spectra

Regions of electromagnetic spectrum, classification of molecular spectra, rotational spectra of diatomic molecule, rotational energy levels of rigid diatomic molecule, vibrational spectra of diatomic molecule, vibrational energy levels of harmonic oscillations. Raman spectra – Experimental set up, explanation of stoke's and anti-stoke's lines. **(12 P, 12M)**

(Total: 52 Periods, 60 Marks)

References:

1. Introduction to Atomic Spectra: H E White, McGraw Book Company, Inc.
2. Fundamental of molecular spectroscopy: C N Banwell, Tata McGraw hill, 3rd edition.
3. Spectra of Diatomic Molecules: G Hertzberg, D Van Nastrand compony, Inc., NewYork.
4. Perspectives of Modern Physics: Arthur Beiser, McGraw Hill Kogakusha Ltd, Tokyo.
5. Atomic spectra and molecular spectra: Raj kumar, Kedarnath Ramnath Prakashan.

PHY- 354(A): Electronics- II

Unit 1: Semiconductor Devices

FET: Types (n-channel and p-channel), Constructional detail, electronic symbol, working principle and I-V Characteristics, FET parameters, Introduction to MOSFET, Applications: FET as a VVR, FET as an amplifier.

UJT: Constructional detail, Equivalent circuit, symbol, working principle and I-V Characteristics, Applications: UJT as a switch, UJT as a relaxation oscillator

SCR: Constructional detail, symbol, Equivalent circuit of SCR, working principle and I-V Characteristics, Transistor analogy and its working, Important terms (break over voltage, holding current, forward current rating), Applications: SCR as a switch, Controlled rectification using SCR. **(11P, 12M)**

Unit 2: DC Power Supplies

Block diagram of unregulated and regulated power Supply, their merits and demerits, Series regulated power supply, Voltage regulation (Load and Line). Study of Monolithic voltage regulators: Precision voltage regulator (IC 723), Three-terminal general purpose regulators ICs- 78xx and 79xx. **(7 P, 8M)**

Unit 3: Differential Amplifier

Introduction, black box concept, basic circuit of differential amplifier, Need of constant current source in differential amplifier, different configurations of differential amplifier, CMRR.

(5P, 6M)

Unit 4: Operational Amplifier and its applications:

Block diagram, Schematic symbol and Pin diagram of IC 741, Important terms of OPAMP such as Input impedance, output impedance, input offset voltage, open loop voltage gain, input bias current, slew rate. Ideal and practical parameters of Op-Amp, Concept of virtual ground, inverting and non-inverting amplifier with gain expressions, off-set null, frequency response of opamp, Applications : Adder, Substractor, Integrator, Differentiator, Comparator. **(10P, 14M)**

Unit 5: Digital Electronics

a) Counters: Types of counters (Asynchronous and Synchronous), 4-bit Asynchronous down counter (Serial counter), 3-bit Up-down counter, modulus of counter, mod-3 counter, mod-5 counter, and mod 10. **(9P, 8M)**

b) Data Processing circuits:

Multiplexer (2 to 1 & 4 to 1 line), De-multiplexer (1 to 2 & 1 to 4 line), Decoder, Encoder.

(5P, 6M)

c) Timer: - Functional block diagram of IC-555 (Timer), Pin configuration, Astable, Monostable and Bistable multivibrator using IC 555, Application: Square wave Generator **(5P, 6M)**

(Total: 52 Periods, 60 Marks)

References:

1. Principles of Electronics - V. K. Mehta
2. Basic Electronics: B. L. Thereja
3. Electronic Principles - A. P. Malvino
4. Electronic Devices & Circuits - Allen Mottershead
5. Digital Principles and Applications - Leach, Malvino
6. Modern Digital Electronics - R. P. Jain
7. Operational Amplifier - G. B. Clayton
8. Operational Amplifier & Linear Integrated Circuits - R. A. Gaikwad
9. Integrated Circuits - K. R. Botkar

PHY- 354(B): Instrumentation- II

Unit 1: Introduction to Instrumentation

Typical applications of instrument systems, Functional elements of measurement system, Brief description of the functional elements of the instruments-Transducer element, Signal conditioning element, Data presentation element, Classification of instruments- Deflection and Null type, Manually operated and automatic type, Analog and Digital types, Self-generating and power-operated types, Contacting and Non-contacting types, Dumb and intelligent type.

Definitions: Resolution, Threshold, Range and span, Hysteresis, Dead band, Backlash, Drift, Impedance loading and matching, Selection of the instrument.

Dynamic Characteristics of Instruments: Introduction, Formulation of system equations- Resistance transducer connected to display unit, Thermal element, U-tube manometer. **(14P, 17M)**

Unit 2: Transducer Elements

Introduction, Analog transducers- Electromechanical type, Potentiometric Resistance-type, Inductive type, Self-generating type, Non-self generating type, Capacitance type, Piezo-electric type, Resistance-strain gauges, Ionisation transducer, Opto-electric transducer, Digital transducers- Frequency domain transducers, Digital encoders, Optical encoders, Shaft encoder. **(12P, 13M)**

Unit 3: Intermediate Elements

Introduction, Data converters, Digital to analog converters- Binary weighted and R-2R ladder. Analog to digital converters - Successive approximation method, Single and dual slope integration type ADC. Data transmission elements-Electrical-type, Pneumatic-type, Position-type, Radio-Frequency type. **(13P, 15M)**

Unit 4: Data Presentation Elements

Indicating elements- Digital voltmeters, CRO,

Recorders- Strip chart, Galvanometer type, Null-type-Poetntometric, Bridge type, X-Y recorder, Magnetic Recorders, FM recording, Digital data recording.

Display elements- Classification of displays, Display devices- LED, LCD, Gas Discharge Plasma display, Dot matrix display, Electro luminescent display. **(13P, 15M)**

(Total: 52 Periods, 60 Marks)

References:

1. Instrumentation: Measurement and analysis - Nakra and Chaudhary
2. Instrumentation: Device and system - Rangan, Mani, Sharma
3. Electronic Instrumentation and Measurement Techniques - Helfrick and Cooper
4. Electronic Instrumentation – H.S. Kalsi
5. Electrical and Electronic Measurement & Instrumentation - A.K. Sawhney
6. Electronic Measurement- U.A. Bakshi

PHY- 355: Solid State Physics

Unit 1: The Crystal Structure

Classification of solids, Lattice, Basis & crystal structure, translational vector, Unit cell, Primitive unit cell, symmetry operations, Types of lattices (2D & 3D), Miller indices, Interplaner spacing, Number of atoms per unit cell, co- ordination number, atomic radius and packing fraction for SC, BCC and FCC structures, Study of CsCl, NaCl and ZnS structures, Concept of reciprocal lattice and its properties with proofs. **(12P, 14M)**

Unit 2: X-Ray Diffraction

Crystal as a grating for X-rays, Bragg's diffraction condition in direct lattice and reciprocal lattice, Ewald's construction, X-ray diffraction methods: Laue method, Rotating crystal method and Powder method, Analysis of cubic crystal by powder method, Brillouin zones (1D & 2D).

(10P, 12M)

Unit 3: Cohesive energy and Bonding in solids

Cohesive energy and formation of molecules, Definition of dissociation energy of molecule, Types of bonding, Ionic bond, Covalent bond, Molecular bond, Metallic bond and Hydrogen bond, Madelung energy, Madelung constant for one dimensional ionic crystal. **(10P, 10M)**

Unit 4: Lattice vibrations and Thermal Properties

Lattice heat capacity, Classical theory of specific heat, Einstein's theory of specific heat, Vibrational modes in one dimension monoatomic lattice, Debye's model of specific heat of solids, Limitations of Debye model. **(10P, 12M)**

Unit 5: Free electron theory of metals and Band theory of solids

Drude-Lorentz classical theory, Sommerfield's quantum theory: Free electron gas in 1-D and 3-D, Fermi level and fermi energy, Density of states, Formation of Energy band, Distinction between metals, semiconductors and insulators, Hall Effect, Hall co-efficient and mobility.

(10P, 12M)

(Total: 52 Periods, 60 Marks)

References:

1. Introduction to Solid State Physics: Charles Kittle.
2. Solid State Physics: A.J. Dekkar
3. Solid state Physics: R. L. Singhal
4. Solid State Physics: S.L. Gupta, V. Kumar.
5. Solid State Physics: S.L. Kakani, C. Hemrajan
6. Solid State Physics: C.M. Kachhava
7. Solid State Physics: R.L.Singhal, Kedar Nath, Ram Nath & Co.
8. Fundamentals of Solid State Physics: B.S. Saxena, R.C. Gupta, P.N. Saxena, Pragati Prakashan, Meerut
9. Concepts of Solid State Physics: J.N. Mandal, Pragati Prakashan, Meerut.
10. Solid State Physics: R. K. Puri and V. K. Babbar

PHY- 356(A): Technical Electronics- I

Unit 1: Components and devices

Resistors, Capacitors, Inductors (Types, construction and specification), Identification of resistor and capacitor values, Transformers: Types, (Single phase power transformer, auto transformer, isolation, AF, RF, IF), Switches, Types of switches, Relay: Types (list only), Electromagnetic relay: Principle, Construction and Working. [Ref. 1 to 5] **(10P, 12M)**

Unit 2: Optoelectronic Device

LED (Construction, Working & Applications), Multicolour LED, Seven Segment Display, Liquid Crystal Display (LCD), Photodiode (construction, Characteristics & applications), LDR, Introducion to phototransistor. [Ref. 2, 3 & 4] **(10P, 10M)**

Unit 3: Printed Circuit Board

Idea of PCB, advantages, copper clad, Etching processes, Different steps for making PCB, Precautions while making PCB, Principle of Photolithography (For PCB).[Ref.2,3 & 4] **(6P, 6M)**

Unit 4: Transducers I

Definition, Classification, Selection of transducer, Electrical transducer: Thermistor, Thermocouple, Pressure Transducer: Strain gauges (wire, foil, & semiconductor), Displacement transducer: LVDT. [Ref. 3, 4 & 10] **(8P, 10M)**

Unit 5: Data Converters

D to A Converters: Resistive divider network, Binary ladder network. A to D Converters: Successive approximation type, Voltage to Time (Single slope, Dual slope), Voltage to Frequency. [Ref. 7 & 8] **(8P, 10M)**

Unit 6: Measuring instruments

Cathode Ray Oscilloscope: Block diagram, Front Panel Control, Dual beam oscilloscope, measurement of voltage, current, frequency, phase using CRO, Function Generator: Block diagram and features, Digital Frequency meter (Frequency mode only): Block diagram & features, Digital Voltmeter (Ramp type only): Block diagram & features. [Ref.3, 4, 6 & 11]

(10P, 12M)

(Total: 52 Periods, 60 Marks)

References:

1. Basic Electronics: B. Grob McGraw Hill Book Co. New York,
2. A Textbook of Applied Electronics – R S Sedha, S Chand & Company, New Delhi.
3. Basic Electronics Solid state - B. L. Thereja, S Chand & Company, New Delhi.
4. Electronic Instrumentation – H S Kalsi, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Electronic components and materials: Principles, Manufacture and Maintenance- S. M. Dhir, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. Measurement and Instrumentation Principles: Alan S. Morris., Butterworth-Heinemann.
7. Transducers and display systems: B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
8. Digital principles and applications: A.P. Malvino and D. P. Leach. Tata McGraw-Hill.
9. Data Converters– B. S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
10. Modern Electronic Instruments and Measurement techniques- Albert D. Helfrick, Willam D. Cooper, Prentice Hall India Pvt. Ltd, New Delhi.
11. A course in electrical and electronic Measurements and Instruments: A. K. Sawhney, Dhanpat Rai and Sons.

PHY- 356(B): Refrigeration and Air conditioning-I

Unit 1: Air Refrigeration system: Introduction, Reversed Carnot cycle and as most efficient refrigerator, C.O.P. and its dependence on source and sink temperature, Bell-Coleman air refrigeration system, Advantages and disadvantages of air refrigeration system. (Ref. 1: Chapter - 3) **(8P, 10M)**

Unit 2: Vapour Refrigeration system i) Simple Vapour Compression Refrigeration system: Vapour compression refrigerator, Construction of various lines on T–S chart, P- H diagram for vapour compression refrigeration, Analysis of vapour compression system Advantages and disadvantages of vapour compression refrigeration over air refrigeration system. (Ref.1: Chapter -4)

ii) **Absorption Refrigeration system:** Introduction, Simple absorption system, Practical ammonia absorption system, C.O.P. of the absorption refrigeration system, Domestic Electrolux refrigerator, Advantages and disadvantages of absorption refrigeration over compression refrigeration system. (Ref. 1: Chapter -6) **(13P, 16M)**

Unit 3: Refrigerants Classification of refrigerants: primary and secondary refrigerants, Desirable thermodynamic, safe working and physical properties of refrigerants, important refrigerants, refrigerant nomenclature, selection of refrigerant. (Ref.1: Chapter -11) **(7P, 8M)**

Unit 4: Refrigeration equipments Compressors: Functions, Reciprocating compressor, Hermetically sealed compressor, Rotary compressor with sealing blade and eccentric motor. Condensers: Functions, Air cooled and water cooled condensers, Evaporative condensers, cooling towers. Evaporators: Functions, Primary and Secondary evaporators, flooded evaporators, Dry expansion systems, Shell & coil evaporators. Expansion Devices: Functions, Automatic expansion valve, Thermostatic expansion valve, Solenoid control valve, Low side and high side float valves. (Ref.1: Chapter -13) **(14P, 16M)**

Unit 5: Solar refrigeration Systems: Vapour Compression Refrigeration system using solar energy, Vapour absorption refrigeration system using solar energy, Solar refrigeration using a solid absorption cycle,Solar refrigerators sing Photovoltaic panels, (Ref.1: Chapter -28)

(10P, 10M)

(Total: 52 Periods, 60 Marks)

References:

1. A course in Refrigeration and Air –Conditioning: S.C. Arora & S. Domkundwar. Dhanpat Rai & Co. 7th Edition
2. Basic Refrigeration and Air –Conditioning: P.N. Ananthanarayanan , Tata Mcgraw Hill, New Delhi 3rd Edition
3. Principles of Refrigeration : Roy J Dossat , Pearson Education (Singapur) Ltd. 4th Edition.

PHY- 356(C): Vacuum Technology-I

Unit 1: Basics for Vacuum

Atmosphere and Vacuum, Gas pressure, Equations of ideal gas, Fundamental assumption of kinetic theory of gas, Mean free path, Gas diffusion, Viscosity of gas, Thermal conductivity, Adsorption, Absorption, Desorption. **(8P, 8M)**

Throughput and Speed, Different units of measurement of vacuum, Ranges of vacuum, Vacuum circuits: Impedance and Conductance, Mechanism of gas flow, pumping speed of vacuum pump. **(10P, 12M)**

Unit 2: High vacuum pumps

Rotating vane type rotary pump: principle, construction, working, ultimate pressure attainable, factors on which the optimum performance of the pump depends, pump characteristics. Oil diffusion vapour pump (single stage, multistage): principle, construction, working, ultimate pressure attainable, factors on which the optimum performance of the pump depends, pump characteristics. **(10P, 12M)**

Unit 3: Ultrahigh vacuum pumps

Turbomolecular pump, sorption pump, Ion pump, Getter pump, Cryogenic pump: principle, construction, working, ultimate pressure attainable. **(12P, 14M)**

Unit 4: Vacuum gauges

U-tube manometer, Mc-Leod gauge, Thermal conductivity gauges- Thermocouple gauge, Pirani gauge, Semiconductor gauge. Ionization gauges- Hot cathode and Cold cathode gauge and Bayard-Alpert gauge. **(12P, 14M)**

(Total: 52 Periods, 60 Marks)

References:

1. Introduction to Theory and Practical of High Vacuum Technology : L.Ward & J.P. Bunn, Butterworths.
2. High Vacuum Techniques : J. Yarwood.
3. Design and Construction of Vacuum systems : G.W. Green.
4. Vacuum Sealing Techniques : A. Roth
5. High Vacuum Engineering : A.E. Barrington.

PHY- 356(D): Microprocessor- I

Unit-1: Fundamentals of Microcomputer

Simple microcomputer architecture, Microcomputer operation, Address bus, Data bus, control bus, memory, semiconductor and magnetic memory, cache memory, RAM and ROM, High level and Low level language, Assembler, Compiler, Interpreter. **(14P, 18M)**

Unit-2: Architecture of 8085 Microprocessor

The 8085 pin diagram and function of each pin, Microprocessor communication and bus timings, Demultiplexing the bus AD7- AD0, Microprocessor Architecture and function of each block. Introduction to 8086(only pin functional diagram). **(12P, 16M)**

Unit-3: Instruction Set of 8085 Microprocessor

Study of addressing mode for 8085:- Implied addressing, Register addressing, Immediate addressing, Direct addressing, Register indirect addressing.

Instruction set:- Data transfer instructions, Arithmetic instructions, Logical instructions, Branching instructions, Stack, I/O and Machine controlled instructions. **(20P, 16M)**

Unit-4: Stack and Subroutines

Stack, subroutine, Restart, conditional call and return instructions. **(6P, 10M)**

(Total: 52 Periods, 60 Marks)

References:

1. Fundamentals of Microprocessors and Microcomputers – Badri Ram,DhanpatRai& Sons, Delhi.
2. Microprocessor Fundamentals – Roger L. Tokheim.
3. 8085 Assembly Language Programing – L. A. Leventhal.
4. Microprocessor Architecture programming and Applications 8080 & 8085 – Ramesh Gaonkar.
5. 8086 Microprocessor programming and Interfacing – Gibson.
6. Advanced Microprocessor and peripherals (Architecture, programming and interfacing) – A. K. Ray,

PHY- 356(E): Programming in C+ + - I

Unit 1: Elements of C++

What is C++?, applications of C++ ,comments, I/O streams, structure of C++program. **(6P, 9M)**

Unit 2: Variable & Expressions

Variables, tokens, keywords, identifiers and constants, basic data types, user defined data types & derived data types. Declaration and initialization of variables. **(10P, 11M)**

Unit 3: Operators in C++

Scope resolution operators, member dereferencing operator, memory management operators, manipulators, type cast operator, expressions and their types**.** **(10P, 14M)**

Unit 4: Control structure

If, if-else, else-if, switch, break, continue.

Loop structures: while, do while, for, nested for loop. **(9P, 10M)**

Unit 5: Functions in C++

Introduction, function prototyping, call by value & call by reference, Inline functions, reference arguments and default arguments. Math library functions. **(11P, 10M)**

Unit 6: Introduction to arrays, structures & union in C++

Definition, declaration, examples. **(6P, 6M)**

(Total: 52 Periods, 60 Marks)

References :

1. Master in C++ - K.R.Venugopal
2. C++ Programming - E.Balaguruswami
3. Turbo C++ Programming - Robert Lafore
4. C++ Programming - Yashwant Kanitkar.

PHY- 356 (F): Solar Energy-I

Unit 1: Introduction

Energy demand and energy resources, Fossil fuels, hydroelectric energy, nuclear energy: Utilization and limitations, Energy Alternatives, Indian energy scenario. **(10P, 12M)**

Unit 2: Solar Energy

Importance of solar energy, Solar radiations: Beam, diffuse and global radiation, characteristics of sun, Solar radiation outside the earth's surface, Solar radiation at the earth's surface. Spectral distribution of extra-terrestrial radiation, Instruments for measuring solar radiation, Pyranometer, Pyrheliometer. **(12P, 12M)**

Unit 3: Thermal Devices

Basic principle, different types of solar collectors, solar dryer, solar pond, solar distillation, solar concentrators: General Characteristics, Definition, Method of classification, Types of Concentrating Collectors Applications of solar concentrating collectors. **(10P, 12M)**

Unit 4: Flat Plate Collector

Construction, principle of operation, transmission of beam and diffuse radiation through the glass cover system, liquid and air flat plate collectors. Materials for flat plate collectors.

(10P, 12M)

Unit 5: Selective Coating

Selective coating, Ideal characteristics of selective coatings for various applications, Types of selective coatings, materials and techniques for making selective absorbers, Effect of elective coating on the efficiency of solar collectors. Production Methods of Coatings (any four).

(10P, 12M)

(Total: 52 Periods, 60 Marks)

References:

1. Solar Engineering and Thermal Processes – Duffie J. and W. Beckman (1991), John Willey and Sons Inc.
2. Solar Energy- Principles of Thermal Collection and Storage- Sukhatme S. P., Second Edition, Tata Mac Graw Hill Co. Ltd.
3. Solar Energy Fundamentals and Applications – Garg H. P. and Satyaprakash (2000), Tata Mc Graw Hill Co. Ltd.
4. Solar Power Engineering – Magal B. S. (1990), Tata Mac Graw Hill Co. Ltd.
5. Renewable Energy Sources and Conversion Technology – Bansal N. K., M. K. M. Meliss (1990), Tata Mac Graw Hill Co. Ltd.

PHY- 357: Practical Course-I

Perform any eight experiments:

1. Moment of Inertia by Bifilar suspension.
2. Y and η by Searl's method.
3. Y by Koenig's method.
4. Y by Newton's rings.
5. Searl's Goniometer.
6. Lloyd's single mirror.
7. Resolving power of grating.
8. To estimate temperature of Na flame.
9. Measurement of resistivity by four probe method.
10. Frequency of AC/ Tuning fork by stroboscope.
11. Variation of resistance of a filament of a bulb with its temperature.
12. Determination of velocity of sound using ultrasonic Interferometer.
13. Electromagnetic Pendulum.
14. Determination of circular aperture of LASER.

PHY- 358: Practical Course-II

Group A: Perform any four experiments (Solid state physics, Electronics,Instrumentation):

1. Hall effect.
2. Analysis of XRD pattern.
3. Measurement of resistivity by two probe method.
4. Characteristics of JFET.
5. UJT characteristics.
6. UJT as relaxation oscillator.
7. Study of RC/LC filter.
8. Wien bridge oscillator using IC-741
9. Measurement of self inductance using Maxwell's induction bridge.
10. Binary weighted DAC (R-2R ladder) using OP-AMP

Group B: Perform any four experiments from the following any one optional courses:

A) Technical Electronics:

1. To make two PCB's i) Using discrete components ii) Using IC components.
2. Thermister as a thermometer using IC 741.
3. To study characteristics of LDR.
4. DAC (R- 2R ladder, without OP- AMP).
5. Designing and fabrication of transformer.
6. Triangular, square wave generator using OP AMP.
7. LVDT.
8. V to F converter using IC-741.
9. V to T converter using IC-741.
10. Study of function generator.

B) Refrigeration and Air conditioning:

1. Study of different tools used in Refrigeration & Air Conditioning.
2. To carry out the following operations on Copper tube i) Cutting ii) Bending iii) Flaring.
3. Study of hermetically sealed compressor used in refrigeration systems.
4. To carry out Swaging and Brazing of Copper tubes.
5. Study of thermostatic switch, LP/HP cut out switch and filters used in Refrigeration and A.C. systems.
6. Leakage testing and charging of a refrigeration system

C) Vacuum technology:

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. To measure the pumping speed of vacuum system by steady state method.
4. Study of McLeod gauge (Vaccu-stat).
5. To calibrate & study the function of Pirani guage.
6. To evacuate a system with a rotary pump (measurement of vacuum with & without ballest using McLeod gauge).

D) Microprocessor:

1. Find square root from look up table.
2. Application of DAC (square/triangular sweep wave).
3. Up-down counter (4-bit).
4. Hexadecimal/decimal counter.
5. Multiplexer/Demultiplexer using IC.
6. Interfacing of thumbwheel switch.

E) Programming in C++:

1. Write a C++ program to display the string "T. Y. B. Sc. Physics"
2. Write a C++ program to make addition, subtraction, multiplication & division
3. Write a C++ program to demonstrate use of scope resolution operator
4. Write a C++ program to check whether given no. is palindrome or not
5. Write a C++ program to demonstrate use of inline function for finding maximum of two numbers
6. Write a C++ program to accept array elements as positive and negative nos. & only print positive nos. as output (use continue statement)
   e.g. {10, -20, 3, 5,-7}
   O/P: {10,3,5}
7. Write a C++ program to generate Fibonacci series upto 20 terms
   e.g. 1,1,2,3,5,8,…… (20 terms)
8. Write a C++ program to create following structure
   Roll-No. Stud-Name Class
   Enter at least five records

F) Solar Energy:

1. Study of Power versus load characteristics of Solar Photovoltaic panel
2. Study of Series combination of Solar Photovoltaic panels
3. Study of Parallel combination of Solar Photovoltaic panels
4. Study of Solar Lantern/ Street light
5. Determination of Calorific value of Coal/Cow dung

PHY- 359: Project – I

ASSESSMENT OF PROJECT- FIRST TERM:

Student should submit a Progress Report on the work done by him/her during the First Phase of the project i.e. on the topics :

1. Project Selection
2. Literature Search Strategy
3. Literature Review
4. Project Planning.

The student will have to give a seminar on the above topics.

The student must perform his project presentation by PPT on LCD projector.

PHY- 361: Classical Electrodynamics

Unit 1: Electrostatics

(Revision- Electrical charge, Coulomb's law, Electric field, Electrostatic potential), Principle of superposition, continuous charge distribution, Linear, surface and volume charge density, Flux of an electric field, statement of Gauss's law. Differential form of Gauss's law, Applications of Gauss's law- i) Electrical field outside the charged sphere ii) Electric field inside charged sphere iii) Electric field due to infinite sheet of charge. Electric dipole, Expression for potential and intensity. **(10 P, 12 M)**

Unit 2: Electrostatic field in dielectrics

Dielectric materials, polar and non polar molecules, polarization vector, Electric field vector at exterior point of dielectric medium, Electric displacement vector $\vec{D}$, Susceptibility, Permittivity, Dielectric constant, Relation between $\vec{D}, \vec{E}$ and $\vec{P}$, Boundary condition for $\vec{E}$ and $\vec{D}$, Dielectric sphere in uniform electric field, The method of electrical image for grounded plane and grounded conducting sphere (point charge near a grounded charged sphere, potential and intensity at a point M(r, θ). **(12 P, 16 M)**

Unit 3 Magnetostatics

Current density (J), Equation of continuity, Magnetic induction, Lorentz force on a point charge moving in a magnetic field, Biot and Savart's law, Magnetic induction due to a current flowing in a long straight wire, Magnetic induction due to a current carrying circular loop, Axial magnetic field of a solenoid, Magnetic forces between two current carrying loops, Ampere's circuital law and its applications for long cylindrical current carrying wire, co-axial cable. Magnetic vector potential $\vec{A}, \vec{B}, \vec{M}$ and $\vec{H}$, and relation between them, Magnetic susceptibility and permeability, Boundary conditions for $\vec{B}$ and $\vec{H}$. **(16 P, 16 M)**

Unit 4: Electrodynamics

Electromagnetic field, Faraday's law of induction in differential and integral form. Modified Ampere's law, Maxwell's equation in differential and integral form. Electromagnetic waves – solution of a plane wave in free space. Poynting vector in free space and electromagnetic energy. Reflection and refraction of a plane wave from non-conducting boundaries (Normal incidence only). **(14 P, 16 M)**

(Total: 52 Periods, 60 Marks)

References:

1) Electrodynamics: Dr. S. L. Gupta, Dr. V. Kumar, Dr. S.P. Singh, Pragati Prakashan (19th Edition, 2007).

2) Electromagnetic: B. B. Laud, Wiley aster Ltd., New Delhi (2nd Edition).

3) Foundation of Electromagnetic field: John R. Reitz and Fredrick J., Narossa Publishing House, New Delhi (3rd Edition).

4) Fundamental Electricity and magnetism: F. Kip, Mc Graw hill Kogakusha Ltd. (2nd Edition).

5) A text book of Classical Electrodynamics: Prof. M. K. Yeole, Dr. R.T. Chaudhari.

PHY- 362: Quantum Mechanics

Unit 1: The Schrodinger Equation

Wave function and its Physical interpretation, normalized and orthogonal wave functions, Formulation of time dependent and time independent Schrödinger equation (Steady state equation), Requirements of wave equation, Probability current density and equation of continuity, Solution of Schrodinger's equation, Energy eigen values and eigen functions, Expectation value – Ehrenfest's theorem. (Ref:1 & 2) **(14P, 14M)**

Unit 2: Applications of Schrödinger steady state equation

Particle in a rigid box (derivation of energy Eigen value and eigen functions), Particle in a non-rigid box, Step potential (Probability of reflection (R) and transmission (T)), Harmonic oscillator (one dimension). (Ref: 2,6,7) **(16P, 16M)**

Unit 3: Quantum theory of Hydrogen atom

Schrödinger equation in spherical polar co-ordinate system, Hydrogen atom-Solutions of R,Θ,Φ equations, Quantum numbers n, l m_l amd m_s. (Ref: 1) **(10P, 14M)**

Unit 4: Operators in Quantum

Hermitian operator, Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian), Commutator brackets, Commutator algebra, Commutator brackets using position, momentum and angular momentum operator, Commutation relations and Hamiltonian operator; Commutation rules for components of orbital angular momentum; Commutation relations of L^2 with components of orbital angular momentum; Commutation relation of components of orbital angular momentum with position operator, Raising and lowering angular momentum operator, Concept of parity, parity operator and its Eigen values.(Ref: 2 & 4)

(12P, 16M)

(Total: 52 Periods, 60 Marks)

References:

1. Perspectives of Modern physics : Arthur Beiser
2. Advance Quantum Mechanics: Satya Prakash, Kedarnath Ran Nath, Meerut
3. Quantum Mechanics: Gupta, Kumar, Sharma. Sultan Chand & Sons
4. Quantum Mechanics: Chatwal and Anand. Himalaya Publ. Co.
5. Quantum Mechanics: L.I.Schiff.
6. Quantum Mechanics: Powell and Crasemann, Addison-Wesley Pub. Co.
7. Introduction to Quantum Mechanics: D. Griffiths Published by Prentice Hall

PHY- 363: Nuclear Physics

Unit 1: Nucleus and Nuclear Forces

Nuclear compositions:- Constituents, charge, size, density, atomic mass of nucleus, nuclear magnetic moment, parity, classification of nuclei, mass defect and binding energy, stability of nuclei, packing fraction, Problems.

Nuclear forces: Nuclear force, features of nuclear forces, saturation and short range nuclear forces, charge symmetry and charge independence, spin dependence of nuclear force, Meson exchange theory of nuclear forces, Elementary particles (List only). **(10P, 12M)**

Unit 2: Radioactivity

Law of radioactive decay, half life, mean life, specific activity, partial radioactive decay, successive disintegration, Applications of radioactivity (Agricultural, Biological, Medical and industrial), Problems. **(07P, 08M)**

Unit 3: Nuclear Models

Types of nuclear models (List only), Single particle shell model**:** Introduction, Assumptions, Evidence of shell model, Theory of nuclear shell potential, nuclear spin and parities, limitations of shell model. Liquid drop model**:** Introduction, assumptions, semi-empirical mass formula. Limitations of Liquid drop model, Problems**.** **(08P, 09M)**

Unit 4: Nuclear Reactions

Introduction, Theories of nuclear reactions, conservation laws, Q-value equation, Energetic of exoergic reactions, Energetic of endoergic reactions, Threshold energy, Problems. **(08P, 09M)**

Unit 5: Nuclear Energy

Introduction, Nuclear fission, Explanation on the basis of liquid drop model, energy available from fission:- Estimation of energy from masses of fission fragments and from binding energy, Nuclear chain reaction, Nuclear Fusion.

Nuclear Reactor: Basic principle, classification, constituents parts, Heterogeneous reactor, Swimming pool reactor, Breeder reactor, Problems. **(12P, 14M)**

Unit 6: Nuclear Detectors and Accelerators

Types of detectors, Geiger-Mueller counter, Scintillation counter, Classification of accelerators**:** Cyclotron and Betatron.

(07P, 08M)

(Total: 52 Periods, 60 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.
5. Nuclear Physics: D.G. Tayal.
6. Concepts of Modern Physics – Arthur Beiser (5th Edition).
7. Atomic Physics: J.B. Rajam.
8. Introduction to Nuclear Physics: H.A. Enge (Addition Wesely Co.)

PHY- 364: Statistical Mechanics & Thermodynamics

Unit 1: Probability Distribution

Introduction to Statistical Mechanics, Basic concepts of probability, Probability distribution, Binomial distribution, Random walk problem in one dimension, Calculation of mean values for random walk problem, Probability distribution for large scale-N, Gaussian probability distribution. **(10P, 12M)**

Unit 2: Statistical Formulation

Specification of the state of the system, Macroscopic & Microscopic states, Statistical Ensembles and their classification, Phase Space, Volume in phase space, Division of phase space into cells, Accessible states, Postulate of equal a priori probability, Behaviour of density of states, Calculation of microstates of an ideal monatomic gas, Thermal and mechanical interactions.

(10 P, 12M)

Unit 3: Statistical Thermodynamics

Thermodynamic equilibrium, Constraints, Equilibrium conditions and constraints, Distribution of energy between systems in equilibrium, Boltzmann relation for entropy, Accessible states and first law of thermodynamics, Statistical calculations of thermodynamic quantities. **(08P, 10M)**

Unit 4: Ensembles and Partition function

Probability distribution for canonical ensembles, Applications of canonical distribution such as Curie's law of Paramagnetism & Maxwell's law of velocity distribution, system with mean specified energy, Calculation of mean values in canonical distribution, Partition function and its connection to free energy, Properties of partition function, Partition function of an ideal gas, Equipartition theorem. **(14P, 14M)**

Unit 5: Thermodynamics

Thermodynamic potentials, Maxwell's relations from thermodynamic potentials, First and second TdS equations, Ratio and difference of two specific heats, Energy equation, Joule Thomson effect (Throttling process). **(10P, 12M)**

(Total: 52 Periods, 60 Marks)

References:

1. Fundamental of Statistical & Thermal Physics: F. Reif (McGraw Hill)
2. Statistical and thermal physics: Lokanathan and Gambhir
3. Thermodynamics & Statistical Physics : Sharma & Sarkar (Himalaya Publishing House)
4. Fundamentals of Statistical Mechanics: B.B. Laud (New Age International Publishers)
5. Heat & Thermodynamics: M.W. Zemansky.
6. Statistical Mechanics: Gupta and Kumar

PHY- 365: Elements of Material Science

Unit 1: Introduction to materials

Classification of materials, Advanced materials, Materials of the future (Smart materials and Nano Materials)

Organic Materials (Polymers): Properties of polymer, Polymerization, Degree of polymerization, Linear polymers and their types, Vulcanization of rubber, Molecular weight, Molecular structure, Thermoplastic & Thermosetting Polymers. Advanced polymeric materials, Polymers additives.

(10P, 14M)

Unit 2: Properties of Materials

Mechanical Properties: Stress, strain (tensile, compressive and shear), strength, elasticity, plasticity, ductility, malleability, hardness, toughness, creep, fatigue, stiffness, Isotropy, Anisotropy, factor affecting the mechanical properties, (Grain size, temperature, exposure to atmosphere, Heat treatment and Carbon content).

Thermal Properties: Heat capacity, Thermal expansion, Thermal conductivity.

Electrical Properties: Conductivity, resistivity, dielectric strength, piezoelectricity. **(12P, 14M)**

Unit 3: Atomic disorder in materials

Solid solution: Types of solid solution (Interstitial and substitutional solid solution), Rules of solid solubility.

Imperfections (defects) in solids: (i) Point defects: vacancies, Frenkel defect, Schottky defect, (ii) Line defects (Dislocation): Edge dislocation, screw dislocation**,** (iii) Surface defects or interfacial defects and (iv) Volume defect.

Plastic deformation: Mechanism by slip system. **(12P, 14M)**

Unit 4: Diffusion of solid material

Atomic diffusion- Definition, Mechanism (Interstitial, vacancy diffusion), self diffusion in nickel, diffusivity, Fick's first law of diffusion, Fick's second law of diffusion, variation of diffusivity with temperature, factor that influence diffusion. **(08P, 08M)**

Unit 5: Phase Diagram

Phase diagram, Phase equilibrium, Construction of phase diagram, Gibb's Phase rule, classification of phase diagram (Unary Phase diagram, Binary Phase Diagram), Binary Phase Diagram for: i) Sugar-Water, ii) NaCl-water, Construction of phase diagram, Eulectic reaction, lever rule, Pb-Sn phase diagram**.** **(10P, 10M)**

(Total: Periods 52, Marks 60)

References:

1. Materials Science & Engineering An Introduction (6th Edition): By William D. Callister Wiley Student Edition, India.
2. Elements of Materials Science & Engineering: Van Vlack
3. First Course in Materials Science & Engineering: Raghavan.
4. Material Science: S. L. Kakani, Amit Kakani. New Age International Publishers

PHY- 366(A): Technical Electronics- II

Unit 1: Sound System

Microphones: characteristics, types (list only), carbon microphone and dynamic type microphone (principle, construction and working), Loud speakers: Characteristics, Dynamic (Moving coil type) speaker, Multiway speaker system (woofer and tweeter), Connection type of speakers (series, parallel and series-parallel type). [R1, R2, R9]. **(12P, 12M)**

Unit 2: Public address system

Block diagram of P.A. system and its explanation, requirements of P A system, typical P.A. Installation planning (Auditorium having large capacity, college sports), Volume control, Tone control and Mixer system, Concept of Hi –Fi system, Monophony, Stereophony, Quadra phony, Dolby A and Dolby B system, CD- Player: Block diagram of CD player and function of each block. [R1, R2, R9]. **(10P, 14M)**

Unit 3: Medical instruments.

Biopotential, Types of electrodes, ECG (principle, block diagram, features) Ultrasonography: working principle [R 3, 4, 5] **(8P, 8M)**

Unit 4: Transducer II

Peizo-electric Transducer, Optoelectronic transducers: LDR, Chemical sensors: PH sensor, Gas sensor (Fundamental aspects), Humidity sensor (Resistive). [R7, R8]. **(10P, 12M)**

Unit 5: Modern appliances

Remote control: Operating principle, block diagram, features

Microwave Oven: Operating principle, block diagram, features

Cellular phone: Operating principle, Block diagram, specifications, features, and functions performed;

Washing machine: Operating principle, block diagram, features, Fuzzy Logic (Idea only), Electronic weighing machine: Principle, Block diagram, features.

Electronic Weighing Systems - Operating principle, Block diagram, features. **(12P, 14M)**

(Total: 52 Periods, 60 Marks)

References:

1. Audio and Video Engineering System: R.G. Gupta, Tata McGraw-Hill Publishing Company Ltd, New Delhi.
2. Basic Electronics --B. L. Thereja
3. Introduction to Bio-medical Electronics: Joseph-Du-bary, McGraw Hill Co. Ltd.
4. Medical instrumentation Application and design- J. C. Wobster
5. Biomedical instruments and measurements – L. Cromwell, F. J. Weibell, Printice hall of India of India Pvt. Ltd, New Delhi.
6. Transducers and display systems: B.S. Sonde, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Solid state Gas sensors- edited by P. T. Moseley and B.C. Tofeld, Harwell, Adam Hilger and Philadelphia
8. Measurement and Instrumentation Principles- Alan S. Morris, Butterworth-Heinemann.
9. Consumer Electronics: J.S. Chintode, Technical Publication, Pune.

PHY- 366(B): Refrigeration and Air conditioning-II

Unit 1: Introduction to air conditioning:
Meaning of air conditioning, Five main factors of comfort air conditioning, Introduction to Heat Transfer Introduction, Conduction through slab, pipe, hollow sphere, Convection, Heat transfer by convection, combined conduction and convection heat transfer, Fins and their applications. (Ref. 1: Chapter -15) **(8P, 8M)**

Unit 2: Psychrometry and psychrometic properties, psychrometic relations: Dalton's law of partial pressure; relation between partial pressure & specific humidity; relation between degree of saturation & relative humidity, Types of psychrometers, Psychrometic processes, Bypass factor and its relation, Summer air conditioning systems for Hot & Dry; Hot & Humid outdoor conditions, Summer air conditioning with evaporative cooling, Winter air conditioning system for mild cold weather. (Ref. 1: Chapter -16) **(12P, 14M)**

Unit 3: Cooling load calculations & design of air conditioning systems Different heat sources, Heat flow due to conduction, Sun load, Occupants load, Equipment load, Infiltration load, Miscellaneous heat sources, Design aspects of air conditioning system, Cooling load and air quantities. (Ref. 1: Chapter -19) **(8P, 10M)**

Unit 4: Air Conditioning equipments Air Filters: Functions, Types, Wet filters, Electronic filters, Centrifugal dust collector. Cooling Coils: Bypass factor of multidepth coils. Humidifiers: Functions, Atomization type humidifiers, Impact type humidifiers, Pan & coil type humidifiers. Dehumidifiers: Functions, Refrigeration humidifiers, Spray type humidifiers, Dehumidifying air washers. Fans & Blowers: Functions, Axial flow fans, Centrifugal fans. Grills and Registers. (Ref. 1: Chapter -25) **(14P, 16M)**

Unit 5: Air Conditioning Control systems Basic elements of control systems, Temperature control elements: Bimetal type thermostat, Sealed bellow type thermostat, Electrical resistance and thermocouple type thermostat. Humidity Control Elements: Hair type humidostat, Absorption type thermostat, Water vapour recorder. Actuators: Relays Introduction to Transmission systems. Pre heat and humidification control systems, Cooling dehumidification and reheat control, Face and bypass control system. (Ref. 1: Chapter -26) **(10P, 12M)**

(Total: 52 Periods, 60 Marks)

References:

1. A course in Refrigeration and Air –Conditioning: S.C. Arora & S. Domkundwar. Dhanpat Rai & Co. 7th Edition
2. Basic Refrigeration and Air –Conditioning: P.N. Ananthanarayanan , Tata Mcgraw Hill, New Delhi

PHY- 366(C): Vacuum Technology-II

Unit 1: Vacuum materials and components

Diffusion and penetration of gases through solid surfaces, Vapour pressure of different materials, Outgassing of materials, Desired properties of materials used for fabrication of vacuum system. **(9P, 8M)**

(i) Vaccum Seals: (a) Permanent seals- Welding, Brazing, Soldering (b) Demountable seals- Waxes, Resins and Adhesives, Gaskets seal: Elastomer, metal. Feedthroughs: Electrical Feedthroughs, Motion Feedthroughs: Wilson seal, Bellows seal. **(9P, 10M)**

(ii) Valves: (a) Roughing and For-line valves: Disk valve, Ball valve. (b) High vacuum valves: Gate valve, disk valve, flap valve, Butter-fly valve. (c) Gas admittance valves: disk valve, Needle valve. **(9P, 12M)**

Unit 2: Leak detection

Real and Virtual leaks, Leak detection method: (a) Over pressure method- Bubble method, Halide torch, Sniffer technique. (b) Low pressure method- Blocking (sealing) method, Tesla coil, Halogen leak detector, Organic vapour and gas probe with suitable pressure gauge as detector. **(12P, 14M)**

Unit 3: Vacuum system fabrication

General consideration of designing, Construction of High vacuum system (Combination of Rotary and Oil diffusion pump), Its operational procedure, Construction of Ultrahigh vacuum system and its operational procedure. **(9P, 10M)**

Unit 4: Application of Vacuum Technology

Applications of Vacuum technology in Research and Industry. **(4P, 6M)**

(Total: 52 Periods, 60 Marks)

References:

1. Introduction to Theory and Practical of High Vacuum Technology : L.Ward & J.P. Bunn, Butterworths.
2. High Vacuum Techniques : J. Yarwood.
3. Design and Construction of Vacuum systems : G.W. Green.
4. Vacuum Sealing Techniques : A. Roth
5. High Vacuum Engineering : A.E. Barrington.

PHY- 366(D): Microprocessor- II

Unit 1: Assembly Language Programming

Arithmetic programs: 8- bit addition, 8- bit subtraction, Decimal addition and decimal subtraction of two 8 bit numbers, 8- bit multiplication, One's and two's complement of 16- bit numbers, Find largest and smallest numbers from a series of given number, Masking of 4- MSB of given number, Find square root of given number from Look up table.

Code conversion programs:-Hex to ASC II conversion, BCD to binary conversion, Decimal to seven segment conversion. **(16P, 20M)**

Unit 2: Interfacing of Memory and Peripheral Devices

Introduction, Interfacing with RAMS & ROMS, I/O interfacing basics, Interfacing with practical I/O memory mapped I/O and I/O mapped I/O schemes, Direct Memory Access (DMA) data transfer. **(12P, 12M)**

Unit 3: Programming Peripheral Interface (PPI)

Architecture of Intel-8255, Pin diagram of Intel 8255, Functions of each pin, Control word format, Operations of mode-0, mode-1 & mode-2**.** **(12P, 14M)**

Unit 4: Programming Communication Interface and counter/interval timer

Architecture of Intel-8251, Pin diagram of Intel 8251, Functions of each pin, Mode word format, Control word format, Status word format, Architecture of INTEL 8253, pin diagram of INTEL 8253, functions of each pin, Reading while counting operation- MODE 0, MODE 1, MODE 2, MODE 3, MODE 4 and MODE 5. **(12P, 14M)**

(Total: 52 Periods, 60 Marks)

References:

1. Fundamentals of Microprocessors and Microcomputers – Badri Ram,DhanpatRai& Sons, Delhi.
2. Microprocessor Fundamentals – Roger L. Tokheim.
3. 8085 Assembly Language Programing – L. A. Leventhal.
4. Microprocessor Architecture programming and Applications 8080 & 8085 – Ramesh Gaonkar.
5. 8086 Microprocessor programming and Interfacing – Gibson.
6. Advanced Microprocessor and peripherals (Architecture, programming and interfacing) – A. K. Ray, K. M. Bhurchandi.

PHY- 366(E): Programming in C+ + - II

Unit 1: Objects & Classes

Simple classes (class specification, C++ objects, accessing class members), constructors and destructors, constant member functions. **(7P, 9M)**

Unit 2: Functions and operator overloading

Overloading functions, introduction to operating overloading, overloading unary and binary operators, overloading arithmetic assignment operator. **(12P,12M)**

Unit 3: Inheritance

Derived class and base class, derived class constructors, public and private inheritance, multiple inheritance, hierarchical inheritance, multilevel inheritance, containership (classes within classes). **(12P, 12M)**

Unit 4: Virtual functions

Virtual functions, pure virtual functions, friend functions, Static functions, copy constructor, this pointer. **(7P, 9M)**

Unit 5: Generic programming

Introduction to template, function within template, introduction to exceptional handling.

(6P, 8M)

Unit 6: File and streams

Input/Output streams, classes for steam operation, opening and closing files, file pointers and their manipulations, error handling during file operations. **(8P, 10M)**

(Total: 52 Periods, 60 Marks)

References:

1. Master in C++ - K.R.Venugopal
2. C++ Programming - E.Balaguruswami
3. Turbo C++ Programming - Robert Lafore
4. C++ Programming - Yashwant Kanitkar.

PHY- 366(F): Solar Energy- II

Unit 1: Introduction

Fundamentals of photovoltaic energy conversion, Principle, & Construction of solar cell and its working principle, Materials for solar cells, Criteria for choice of Materials for Solar cell , Types of solar cells , Applications of solar cell, Advantages and Disadvantages of solar cell.

(10P, 12M)

Unit 2: Review of Semiconductor Properties

Introduction, crystal structure and orientations, forbidden energy gaps, probability of occupation of allowed states, dynamics of electrons and holes, energy density of allowed states, Bond model of group IV semiconductor, group III and group V dopants, carrier densities, location of Fermi level in doped semiconductors. **(12P, 12M)**

Unit 3: P N Junction Diodes

Introduction, electrostatics of p-n junction, junction capacitance, carrier injection, dark characteristics, illuminated characteristics, solar cell output parameters. **(10P, 12M)**

Unit 4: Efficiency Limits, Losses and Measurement

Introduction, efficiency limits: general, short circuit current, open circuit voltage and efficiency, efficiency limits for black body cell, effect of temperature, efficiency losses: general, short circuit current losses, open circuit current losses, efficiency measurement. **(10P, 12M)**

Unit 5: Photovoltaic Systems: Components And Applications

Introduction, Basic Photovoltaic system for power generation, energy storage: electro chemical batteries, large capacity approaches, Power conditioning equipments, Photovoltaic (PV) systems and their types, photovoltaic applications. **(10P, 12M)**

(Total: 52 Periods, 60 Marks)

References:

1. Solar Cells Operating Principles, Technology and System Applications – Martin A. Green, University of New Wales, Australia.
2. Solar Energy- Principles of Thermal Collection and Storage- Sukhatme S. P., Second Edition, Tata Mc Graw Hill Co. Ltd.
3. Solar Energy Fundamentals and Applications – Garg H. P. and Satyaprakash (2000) Tata Mc Graw Hill Co. Ltd.
4. Solar Energy Utilisation – G. D. Rai, (2004), Khanna Publishers.
5. Solar Thermal Engineering – Duffie J. A.

PHY- 367: Practical Course-III

Perform any eight experiments:

1. Surface tension by Quinke's method.
2. Surface tension by soap bubble method.
3. Thermal conductivity of rubber by tubing method.
4. Thermal conductivity of metal by Forbe's method.
5. Verification of certain laws of probability distribution.
6. Verification of Stefan's law by torch bulb filament.
7. Characteristics of G.M. counter.
8. Diffraction by straight edge/cylindrical obstacle.
9. e/m using Thomson's method.
10. Verification of Clausius-Clapeyron's latent heat equation
11. Jolly's steam calorimeter.
12. Study of directional characteristics of unidirectional microphone.
13. Velocity of sound by phase shift method.
14. Viscosity by rotating cylinder method.
15. Determination of 'g' by conical pendulum.
16. Study of oscillatory charge and discharge through an inductance and resistance.

PHY- 368: Practical Course-IV

Group A: Perform any four experiments (Material Science, Thermodynamics,Electronics):

1. Determination of curie temperature of Ferrite.
2. Specific heat of graphite at different temperature
3. To study characteristics of thermisters.
4. Determination of thermoelectric power.
5. Study of Astable Multivibrator using IC 555.
6. Binary weighted DAC (R-2R ladder) using OP-AMP.
7. Core losses in transformers.
8. IC 723 as regulated power supply.
9. Study of IC 7490 as mod 2, mod 5 and mod 10 counter.

Group B: Perform any four experiments from the following optional courses:

A) Technical Electronics:

1. Half wave precision rectifier using OP AMP.
2. Full wave precision rectifier using OP AMP.
3. Study of P. A. system (series and parallel connection of two speakers) and measurement of equivalence resistance.
4. Study of OP AMP as an adder.
5. Study of OP AMP as substractor.
6. Study of OP- AMP as a differentiator.
7. Study of OP- AMP as an integrator.
8. Frequency response of loudspeaker (twitter, woofer, mid-range).
9. Study of E.C.G.

B) Refrigeration and Air conditioning:

1. To find the COP of a domestic refrigeration system.
2. Detection of trouble/faults in a refrigerator and window air conditioner.
3. Dismantling of Window type A.C. and testing after assembly.
4. Visit to a cold storage plant.
5. Visit to a centrally air conditioned building.
6. Visit to a Ice plant.

C) Vacuum technology:

1. To measure the pumping speed of vacuum system (use of Gaedes equation).
2. Demonstration of oil diffusion pump & to evacuate the system & to measure the ultimate vacuum.
3. To study the effects of conductance of pumping speed of oil diffusion pumping module.
4. Deposition of metallic thin film.
5. To investigate the variation of pumping speed of vapour diffusion pumpingmodule with the pressure in vacuum system.

D) Microprocessor:

1. 8-bit decimal addition/subtraction.
2. Find largest/smallest number from series of 8-bit numbers.
3. Conversion of Hex to ASCII code.
4. 8-bit binary multiplication.
5. LED interface (Time delay generation).
6. Study of shift register (using IC).

E) Programming in C++:

1. Write a C++ program to implement string operations
   i) strlen( )
   ii) strcat( ) as class membersWrite a C++ program to display the string "T. Y. B. Sc. Physics"
2. Write a C++ program to swap two integers, two floats and two character variables using function overloading.
3. Write a C++ program to demonstrate use of constructors and destructors.
4. Write a C++ program to overload + operator to add two complex nos.
5. Write a C++ program to implement hierarchical inheritance.
6. Write a C++ program to implement multiple inheritance.
7. Write a C++ program to implement virtual functions.
8. Write a C++ program to demonstrate use of function templates

F) Solar Energy:

1. Study of Solar Box Cooker: Evaluation of F1 and F2.
2. Study of Solar still for Water distillation.
3. Study of Solar Hot water system.
4. Study of Concentrating type Solar Cooker – SK 14.
5. Study of Solar Dryer: Hot air collector.

PHY- 369: Project work – II

ASSESSMENT OF PROJECT- SECOND TERM:

Student should submit a Final Project Report on the work done by him/her during the First and Second Phase of the Project i.e. on the topics :

1. Experimental work.
2. Characterize the samples, if any.
3. Discussion of the results.
4. Conclusions.

The student must perform his project presentation by PPT on LCD projector.

CAREER OPPORTUNITIES FOR B. Sc. PHYSICS STUDENTS

B.Sc. Physics students can find jobs in public as well as in private sectors. There are many opportunities available for B. Sc Physics students in technical as well as scientific fields. They can work as Science and Mathematics Teachers, Quality Control Manager, Laboratory assistant, Laboratory Technician, School Science Technician in any government or private organization.

Private Sector:

There are many opportunities available in IT field for B. Sc Physics graduates. Many IT companies such as Infosys, Wipro and TCS are recruiting B. Sc. Physics graduates for software jobs. They can also get jobs in Energy Plants. Another jobs available for these graduates is Technician in Electronic Industry. They can apply for jobs in many companies in automobile industry. Some of those companies are Maruti Udyog, TATA Motors and Tech Mahindra.

Government Sector:

There are vast opportunities available for B. Sc graduates in Government sector. They can apply for jobs in Scientific Research and Development Organizations such as The Defence Research and Development Organisation (DRDO), CSIR, Physical Research Laboratory (PRL) Ahmedabad, Saha Institute of Nuclear Physics Kolkata and Nuclear Science Centre New Delhi. They can also apply for various jobs in popular government organizations such as Bhabha Atomic Research Centre (BARC), Atomic Energy Regulatory Board (AERB), Oil and Natural Gas Corporation (ONGC), Bharat Heavy Electricals Limited (BHEL), National Thermal Power Corporation (NTPC).

They can also apply for the various competitive exams conducted by Union Public Service Commission such as IFS, IPS and IAS. Several other government exams conducted for recruiting B. Sc Physics graduates are Tax Assistant Exam , Statistical Investigator Exam, Combined Graduate Level Exam.

Another option available for B. Sc Physics graduate is to apply for jobs in public sector banking. Several banks are conducting exam every year for recruiting graduates to the post of Probationary Officers. They can also find many jobs in Railway sector. They should qualify the exams conducted by Railway Recruitment Board to get a job in Railway sector. These graduates can also apply for Combined Defence Services Exams conducted for recruiting candidates to various posts in Defence Department.

Equivalent courses:

Semester	Course Title (Old)	Semester	Course Title (New)
V	PHY-351: Mathematical Physics	V	PHY-351: Mathematical Physics
	PHY-352: Classical Mechanics		PHY-352: Classical Mechanics
	PHY-353: Atomic and Molecular Physics		PHY-353: Atomic and Molecular Physics
	PHY-354 (A): Electronics II OR		PHY-354 (A): Electronics II OR
	PHY-354 (B): Instrumentation II		PHY-354 (B): Instrumentation II
	PHY-355: Solid State Physics		PHY-355: Solid State Physics
	PHY-356 (A): Technical Electronics- I OR		PHY-356 (A): Technical Electronics- I OR
	PHY-356 (B): Refrigeration and air conditioning-I OR		PHY-356 (B): Refrigeration and air conditioning-I OR
	PHY-356 (C): Vacuum Technology-I OR		PHY-356 (C): Vacuum Technology-I OR
	PHY-356 (D): Microprocessor- I OR		PHY-356 (D): Microprocessor- I OR
	PHY-356 (E): Programming in C+ + - I OR		PHY-356 (E): Programming in C+ + - I OR
	PHY-356 (F): Solar Energy - I		PHY-356 (F): Solar Energy - I
VI	PHY-361: Classical Electrodynamics	VI	PHY-361: Classical Electrodynamics
	PHY-362: Quantum Mechanics		PHY-362: Quantum Mechanics
	PHY-363: Nuclear Physics		PHY-363: Nuclear Physics
	PHY-364: Statistical Mechanics and Thermodynamics		PHY-364: Statistical Mechanics and Thermodynamics
	PHY-365: Elements of Material Science		PHY-365: Elements of Material Science
	PHY-366 (A): Technical Electronics- II OR		PHY-366 (A): Technical Electronics- II OR
	PHY-366 (B): Refrigeration and air conditioning-II OR		PHY-366 (B): Refrigeration and air conditioning-II OR
	PHY-366 (C): Vacuum Technology-II OR		PHY-366 (C): Vacuum Technology-II OR
	PHY-366 (D): Microprocessor- II OR		PHY-366 (D): Microprocessor- II OR
	PHY-366 (E): Programming in C+ + - II OR		PHY-366 (E): Programming in C+ + - II OR
	PHY-366 (F): Solar Energy - II		PHY-366 (F): Solar Energy - II
V and VI	PHY-307: Practical Course-I	V	PHY- 357: Practical Course-I
		VI	PHY- 367: Practical Course-III
V and VI	PHY-308: Practical Course-II	V	PHY- 358: Practical Course-II
		VI	PHY- 368: Practical Course-IV
V and VI	PHY-309: Project	V	PHY-359: Project work-I
		VI	PHY-369: Project work-II