Gujarat University

M. Sc. (Physics) Semester - III
(Effective from – 2021-2022)

Course	Name of the Course	Lect. Hrs. / Week	Internal Marks	External Marks	Total Marks	Course Credits
PHY-501	Nuclear Physics-I, Advanced Quantum Mechanics-I and Instrumentation	4	30	70	100	4
PHY-502	Numerical Methods and Digital Electronics	4	30	70	100	4
PHY-503	Satellite Communication, Fiber Optics and Microprocessor-I	4	30	70	100	4
PHY-504	Electronic Communication-I	4	30	70	100	4
PHY-505PR	Practicals	6	30	70	100	4
PHY-506PT	Project	6	30	70	100	4
TOTAL		28	180	420	600	24

GUJARAT UNIVERSITY
M. Sc. (PHYSICS) SEMESTER – III
(EFFECTIVE FROM – 2021-2022)

PHY-501: Nuclear Physics-I, Advanced Quantum Mechanics-I and Instrumentation

In this we are studying the Nuclear properties, like electric moment, magnetic moments etc., Two body problems of deuteron. In scattering theory Born-approximation and complex potential and absorption are studied along with this the essential experimental techniques for physical sciences are covered.

UNIT I: Nuclear Properties

Nuclear spin, electric moments, magnetic moments, a brief description of hyperfine structure of atomic spectra, effect of an external magnetic field on the hyperfine structure, determination of I from molecular band spectra, molecular beam resonance method – experiments on hydrogen and deuteron.

UNIT II: Two-body forces

Deuteron. Excited states of the deuteron, neutron proton scattering at low energies, scattering length, spin dependence of neutron proton scattering, singlet state in n-p system, effective range theory in n-p scattering, tensor forces, magnetic moment and electric quadrupole moment of the deuteron, proton proton scattering at low energy, exchange forces, meson theory of nuclear forces.

UNIT III: Scattering theory

Kinematics of the scattering process: differential and total cross sections elastic and inelastic scattering, wave mechanical picture of scattering: the scattering amplitude, Green's functions: formal expression for scattering amplitude. The Born approximation, validity of the Born approximation, The Born series, The Eikonal approximation, Asymptotic behavior of partial waves: phase shifts, The scattering amplitude in terms of phase shift, The differential and total cross sections: optical theorem, Phase shifts: Relation to the potential, Potentials of finite range, Low energy scattering, scattering by a square well potential, scattering by a hard sphere, scattering by a coulomb potential, Complex potential and absorption.

UNIT IV: Transducers, Measurement and control

Transducers: Desired characteristics of transducer, Different transducers: Temperature, Capacitive, Magnetic field, LVDT, Optical, Piezoelectric, Pyrometer. Measurement and control: Types of noises in electrical systems, Signal to noise ratio, Enhancement of signal to noise ratio, Signal conditioning and recovery, Impedance matching, filtering and noise reduction, shielding and grounding, Phase sensitive detector and lock-in amplifier.

Reference Books:

1. Enge H. A., Introduction to Nuclear Physics
2. Roy R. R. and B. P. Nigam, Nuclear Physics theory and experiment
3. Tayal D. C., Nuclear Physics
4. Patel S. B., Nuclear Physics - an introduction
5. Khanna M. P., Introduction to particle physics, PHI
6. Leon M., Particle Physics - an introduction
7. Perkins D. H., Introduction to High Energy Physics
8. David C. Cheng and Gerard K. O. Neill, Elementary Particle Physics - an introduction
9. Gasiorowicz S., Particle Physics
10. T. P.Holmann., Experimental systems, Applications and Design : TMH publication.
11. M. Sayer & A Mansingh., Measurement, Instrumentation and experimental design for physicists and engineers: Prentice Hall of India
12. Mathews & Venketesan, A Text Book of Quantum Mechanics, TMH, 1976
13. V. K.Thankappan, Quantum Mechanics

GUJARAT UNIVERSITY

M. Sc. (PHYSICS) SEMESTER – III
(EFFECTIVE FROM – 2021-2022)

PHY-502: Numerical Methods and Digital Electronics

Study of numerical techniques to solve ordinary differential and partial differential equations are essential to solve the problems of physical systems. Digital electronics is a very important area of electronics. Digital circuits, memories, clocks, timers and counters are taught in detail. ADC and DAC techniques for digitization of signals are included.

Unit I: Numerical Solution of Ordinary Differential Equations

Introduction, Picard's method, Taylor's series method, Euler's method, Modified Euler's method, Runge's method, Runga-Kutta method, Predictor-corrector method, Milne's method, Adams-Bashforth method.

Unit II: Numerical Solution of Partial Differential Equations

Introduction, Classification of second order equations, Elliptical equations, Solution of Laplace equation, Solution of Poisson's equation, Parabolic equations, Solution of one-dimensional heat equation, Solution of two dimensional heat equation, Hyperbolic equations, Solution of wave equation.

UNIT III: Digital Electronics

Parity generators and checkers, read only memory, programmable array logic.
Clocks & Timers: Clock waveform, TTL clock, 555 Timer (internal block diagram) as Monostable Multivibrator and as Astable Multivibrator.
Shift Registers: Types of registers, serial in - serial out, serial in - parallel out, parallel in - serial out, parallel in - parallel out, ring counter.
Counters: Concept of asynchronous counters (IC 7493 Binary counter, IC 7490 Decade counter), Concept of synchronous counters (IC 74193-4-bit updown counter) Digital clock.

UNIT VI: D/A and A/D Conversion

Variable register network, Binary ladder, D/A converter, D/A accuracy and resolution, A/D converter - simultaneous conversion, counter method, continuous A/D conversion, A/D techniques, Dual slope A/D conversion, A/D accuracy and resolution, application of DAC & ADC,
Displays: LED (seven segment), dot matrix, plasma, LCD.

Reference books:

1. Numerical Methods in Engineering and Science, B.S. Grewal and J. S. Grewal, Khanna Publishers, New Delhi (2002)
2. Numerical Methods, Balgurusamy, Tata McGraw-Hill Pub. Co. Ltd, New Delhi (2000)
3. Numerical Methods with Computer Programs in C++, Pallab Ghosh, Prentice-Hall of India Private Limited, New Delhi (2006)
4. Digital Principles and Applications, Albert Paul Malvino , Donald P. Leach and Saha, Tata McGraw-Hill Publishing Company Limited, New Delhi
5. Fundamentals of Digital Circuits, Anand Kumar, PHI Private Limited, New Delhi (2006)
6. Digital Logic and Computer Design, Morris Mano, PHI Private Limited, New Delhi (2006)

GUJARAT UNIVERSITY
M.Sc. (PHYSICS) SEMESTER – III
(EFFECTIVE FROM – 2021-2022)

PHY-503: Satellite Communication, Fiber Optics and MICROPROCESSOR – I

Electronic communication is a very important area of electronics. Various techniques of modulation and different aspects of digital communication are included in this paper. Radio wave propagation is an important aspect of long distance communication; different modes of radio wave propagation are covered in this paper. Satellite communication and optical fiber communication which revolutionized the communication systems are also covered this paper. Microprocessor is considered as the building block of modern computers. Microprocessor - I course covers an architecture, instruction sets including classification, buses, machine cycles, writing and executing of simple programs as well as pin and functional block diagrams of 8-bit 8085 Microprocessor. This course also includes some details of Microcomputer systems along with logic devices, and memory interfacing. Students can get some information about ASCII, and BCD codes.

UNIT I: Radio Wave Propagation and Satellite communication

Radio Wave Propagation: Propagation in free space - mode of propagation, microwave systems. Tropospheric Propagation - mode of propagation, radio horizon, super and sub refractions, attenuation in atmosphere, VHF/UHF radio system. Ionospheric propagation - ionospheric layers, effect of ionosphere on wave propagation, plasma frequency and critical frequency, secant law skip distance and MUF, optimum working frequency, virtual height, effect of earth's magnetic field, service range, ionospheric irregularities and disturbances, HF radio systems. Surface wave – mode of propagation, ground wave.

Satellite communication: Kepler's laws, orbits, geostationary orbit, power systems, attitude control, station keeping, antenna look angles, limits of visibility, frequency plan and polarization, satellite antenna radiation pattern, transponders, uplink and downlink power budget calculations, overall budget calculations, multiple access methods, applications of satellite communication, satellite radio navigation, Indian communication satellites.

UNIT II: Fiber optic Communication

Principle of light transmission in a fiber - propagation with in a fiber, fiber index profiles, Modes of propagation - overview of modes, key modal concepts, Maxwell's equations, waveguide equations for cylindrical fiber, wave equations for step index fiber, modal equation, modes in step index fiber, single mode fiber. Losses in fibers - absorption losses, leaky modes, mode coupling losses, bending losses, combined fiber losses. Dispersion - effect of dispersion on pulse transmission, intermodal dispersion, material (chromatic) dispersion, total dispersion and maximum transmission rates. Light sources and detectors for fiber optics. optical receiver circuit. Connectors and splices - losses in connectors and splices, connectors, fiber splices. Fiber optic communication link.

UNIT-III: Microprocessor- based systems: Hardware and interfacing

A programmable machine: device, Memory, Input/output, CPU. Block diagram of a Microcontroller, Advances in semiconductor Technology, Organization of Microprocessor-Based system. Microprocessor Instruction set and computer languages: Machine Language: 8085 Machine language, 8085 Assembly language. ASCII code, writing and Executing Assembly language program, High level languages, Block diagram of Translation High level language into Machine code, operating system. From large computer to Single chip Microcontrollers: Large Computers, Medium size computers, Microcomputers, personal computers, workstations, single board Microcomputers, Single chip Microcomputers (Microcontrollers)

Application: Microprocessor controlled Temperature system (MCTS): System hardware, Microprocessor-controlled Temperature system (MCTS) block diagram, Microprocessor, Memory,

input (A/D converter) Temperature sensor, output including Fan, Header, LCDs, system software (Programs). Introduction to 8085 Assembly Language Programming: The 8085 Programming Model

Hardware Model, Programming model: Registers, Accumulator, Flags, Program Counter (PC) and Stack Pointer (SP); Instruction classification: The 8085instruction set, Data transfer operations, Arithmetic operations, logical operations, Branching Operations, Machine control operations and Review.
Instruction, Data format and Storage: Instruction Work size: one byte, two byte, Three byte, Opcode format, Data format: ASCII Code, BCD code, Signed integer, Unsigned integers, Instruction and data storage: Memory.
How to write Assemble and execute a simple program: Illustrative program: Addition of two hexadecimal numbers, including Flow chart, Manual assembly process and executing a program. Writing and hand assembling a program: Illustrative program: Subtracting two hexadecimal numbers and storing the result in Memory, writing Mnemonics, and Assembling Hex code, common errors.

UNIT IV: **Microprocessor Architecture and Microcomputer Systems**
Microprocessor Architecture and Its Operations, Memory: Flip-Flop or Latch as a storage Element, Memory Map and Addresses, Examples, Memory Address Range of a 1K Memory chip, Memory Address Lines, Memory work size, Memory and Instruction Fetch, Memory classification: From static Memory to Flash Memory, Advances in Memory technology.
Input and output (I/O) devices: I/Os with 8-bit Addresses (Peripheral-Mapped I/O), I/O with 16-bit Addresses (Memory-Mapped I/O)
Logic devices for interfacing: Tri-state devices, Buffer, Examples of Tri-state buffer. Bidirectional buffer, octal buffer, Logic diagram and Function Table, Decoder, (2 to 4), (3 to 8), Examples of Decoders, Encoder (8 to3), D-Flip-Flops: Latch and clocked; Examples of Latches (Registers), Logic diagram and Function Table.
8085 Microprocessor, Architecture and Memory interfacing: The 8085 MPU : The 8085 Microprocessor, Address bus, The 8085 Microprocessor pin out and signals, Multiplexed Address/data bus, Control and status signals, power supply and clock frequency, Externally initiated signals, Microprocessor communication and Bus timings, Examples of Data flow from Memory to MPU, Timing diagram, De-multiplexing the bus AD7-AD0, Generating control signals, A detail look at the 8085 MPU and its Architecture, The 8085A Microprocessor: Functional block diagram Example of Instruction decoding and execution, Example of an 8085-based Microcomputer: 8085 single-Board Microcomputer system, The 8085 Machine cycles and Bus timing, Op-code Fetch Machine cycle, Memory read Machine cycle with example and Timing diagram, How to recognize machine cycle.

Reference books:

1. Roddy D. and Cooln J., Electronic communications, PHI, 2006
2. Kennedy G and Davis B. Electronic Communication systems, TMH 1999.
3. Tosmasi W., Advanced Electronic Communication system, PHI.
4. Keiser G, Optical fiber communications, MGH, 2000
5. Senior J.M., Optical Fiber Communications – Principles and practice, Pearson, 2007
6. Roddy D., Satellite communications,
7. M.L. Gupta, Electronic and Radio engineering Dhanpat Rai & Sons, 1991
8. Microprocessor Architecture, Programming and Applications with 8085 Ramesh S. Gaonkar, Penram International Publishing India Private LTD. (Fifth edition)
9. Microprocessor, Microcomputer & their Applications, A.K Mukhopadhaya, NAROSA Publisher.
10. Fundamentals of Microprocessors & Microcomputers B. Ram, Dhanpat Rai & Sons.

GUJARAT UNIVERSITY
M. Sc. (PHYSICS) SEMESTER – III
(EFFECTIVE FROM – 2021-2022)

PHY- 504: Electronic Communication – I

The transmission line theory bridges the gap between field analysis and basic circuit theory. The phenomenon of wave propagation on transmission lines is approached from an extension of circuit theory as well as from a specialization of Maxwell's equation. Analysis of transmission line will be undertaken. It covers lossy, lossless, short circuit, open circuit and quarter wave lines. Another important course on various antenna parameters and the basic operating principles of antennas is introduced. They will also learn about the different types of the antennas that are commonly used. Elements of analogue and digital communication systems are covered here in detail. Electronic communication is a very important area of electronics. Various techniques of modulation and different aspects of digital communication are included in this paper.

UNIT I: Transmission Line Theory

Lumped element circuit model for a transmission line, Field analysis of transmission lines, The terminated lossless transmission line, Smith chart. The quarter wave transformer, Generator and load mismatches, Lossy transmission lines.

UNIT II: Antenna

Basic antenna parameters (radiation pattern, radiation resistance, directivity and gain), Half-wave dipole antenna, effect of ground on the radiation pattern of ungrounded antenna, antenna arrays, Yagi antenna, antenna system employing parabolic reflectors, frequency independent log-parabolic antenna.

UNIT III: Analog Modulation

Amplitude modulation: Theory of amplitude modulation, Frequency spectrum of AM wave, AM modulator and detector.
Single side band modulation: Single sideband principle, FET balanced modulator, SSB generation: Filter method, Phasing method and Third method.
Angle Modulation: Theory of frequency and phase modulation, frequency spectrum of FM wave. Reactance FM Modulator, Armstrong method of frequency modulation. Slope detector, Stagger tuned detector, Foster-Seeley discriminator, Ratio detector.

UNIT IV: Pulse Modulation and Digital Communication

Pulse Modulation: Pulse amplitude modulation, Pulse code modulation, PCM Receiver, Pulse time modulation, Pulse position modulation, Pulse width modulation.
Synchronization, Probability of bit error in baseband transmission, matched filter, Bit-timing recovery, carrier recovery systems.
Digital carrier systems: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Continuous Phase Frequency Shift Keying (CPFSK), Minimum Shift Keying (MSK), Phase Shift Keying (PSK).

Reference books

1. David M. Pozar, Microwave Engineering (Third Edition), Wiley- India.
2. J. D. Ryder, Networks, Lines and Fields, PHI Pvt. Ltd. New Delhi, 1991
3. G. P. Srivastava, V. L. Gupta, Microwave Devices and Circuit Design, PHI.
4. G. S. Raghuvanshi, Microwave Engineering, CENGAGE Learning.
5. E. C. Jordan and K. G. Balman, Electromagnetic waves and radiating systems, PHI
6. Roddy D. and Coolen J., Electronic communications, PHI, 2006
7. Kennedy G and Davis B. Electronic Communication systems, TMH 1999.
8. Tosmasi W., Advanced Electronic Communication system, PHI.

GUJARAT UNIVERSITY
M. SC. (PHYSICS) SEMESTER - III
(EFFECTIVE FROM – 2021-2022)

PHY– 505PR : PRACTICALS

LIST OF PRACTICALS:

1. Design and Study of Astable Multivibrator using IC 741
2. Design and Study of Phase Shift Oscillator using IC 741
3. Design and Study of Voltage Regulated Power Supply using IC 723
4. Design and Study of Schmitt Trigger using IC 741.
5. Design and Study of Astable & Monostable Multivibrator using IC 555.
6. Design and Study of Two Stage Amplifier using ICs 741.
7. Design and Study of different types of Flip-Flops using IC 7400,7402 & 7473.
8. Study of different types of Shift Registers using IC 7493.
9. Design and study of decade counter and divide by six counter using IC 7490.
10. Determination of Guide Wavelength of a rectangular wave guide.
11. Study of PLL characteristics using IC 565.
12. ExpEyes based Experiments - I
13. ExpEyes based Experiments - II
14. Numerical study of Chaos

15% of new experiments can be introduced AND / OR replaced as per the need, with the permission of the Chairman of the Board of Studies.

PHY 506PT: POJECT

- In-house project work of 4-credit to be performed by each student.
- Alternatively, MOOC, Swayam or any other UGC recognized online course equivalent to 4-credit and approved under the GU_SWAYAM_POLICY by the Gujarat University for credit transfer will also be considered for 4-credit in this course.

Gujarat University

M. Sc. (Physics) Semester - IV

(Effective from – 2021-2022)

Course	Name of the Course	Lect. Hrs. / Week	Internal Marks	External Marks	Total Marks	Course Credits
PHY-507	Nuclear Physics-II and Advance Quantum Mechanics-II	4	30	70	100	4
PHY-508	Numerical Techniques and Programming in C-II	4	30	70	100	4
PHY-509	Microprocessor-II and Microwaves	4	30	70	100	4
PHY-510	Remote Sensing and Electronic Communication-II	4	30	70	100	4
PHY-511PR	Practicals	6	30	70	100	4
PHY-512PT	Project	6	30	70	100	4
TOTAL		28	180	420	600	24

GUJARAT UNIVERSITY
M. Sc. (PHYSICS) SEMESTER-IV
(Effective from - 2021-2022)

PHY-507: Nuclear Physics-II and Advanced Quantum Mechanics-II

In this paper the different types of nuclear reactions are studied and basic course on particle physics is also ncluded. The topics on the quantum mechanics like angular momentum and relativistic wave equation are also the part of the paper.

UNIT I: Nuclear reactions

Nuclear reactions and cross sections, Resonance: Breit Wigner dispersion formula for 1=0, the compound nucleus, continuum theory of nuclear reaction, Direct reactions, theory of stripping reactions - semi classical description and wave mechanical description. Model: Single particle shell model, spin-orbit potential, analysis of shell model predictions –spins and parities of nuclear ground states, magnetic moments, electric quadrupole moment, nuclear isomerism, stripping reactions and shell model, Collective nuclear model – rotational states and vibrational states, a brief description of Nilson model.

UNIT II: Particle Physics

Classification of elementary particles, types of interaction, Baryon number, lepton number, parity, charge conjugation and Time reversal, CPT theorem, charge independence of nuclear forces, Isospin, consequences of isospin invariance. G-parity, strange particles, associated production, strangeness, Gell Mann-Nishijima scheme. Neutral K-meson, strangeness oscillations. CP-violation in K^o decay. Isospin and Su(2), Su(3), Baryon and meson multiplets, Gell Mann Okabo mass formula, quark model, flavor and color.

UNIT III: Angular Momentum

Eigen value spectrum, Matrix representation of J in the |jm> basis, Spin angular momentum, Non relativistic Hamiltonian with spin, addition of angular momenta, Clebsch-Gordan Coefficients, Spin wave functions for a system of two spin 1/2 particles, Identical particles with spin, addition of spin and orbital angular momenta, Spherical tensors; Tensor operators, Wigner Eckart theorem, Projection theorem for a first rank tensor.

UNIT IV: Relativistic wave Equations

Generalization of Schrodinger equation - Klein - Gordan equation: Plane wave solutions; - Charge and Current densities - Interaction with electromagnetic fields; Hydrogen-like atom, -Non relativistic limit - The Dirac equation: Dirac's Relativistic Hamiltonian – Position Probability density; expectation values - Dirac matrices - Plane wave solution: Energy spectrum - The Spin of the Dirac particle - Significance of negative energy states. – Relativistic electron in a central potential: Total angular momentum - Radial wave equation – Series solutions of the radial equation: asymptotic behavior - Determination of the energy levels –Spin magnetic moment - Spin-orbit energy.

Reference Books:

1. Enge H. A., Introduction to Nuclear Physics
1. Roy R. R. and B. P. Nigam, Nuclear Physics theory and experiment
2. Tayal D. C., Nuclear Physics
3. Patel S. B., Nuclear Physics - an introduction
4. Khanna M. P., Introduction to particle physics, PHI
5. Leon M., Particle Physics - an introduction
6. Perkins D. H., Introduction to High Energy Physics
8. David C. Cheng and Gerard K. O. Neill, Elementary Particle Physics - an introduction
9. Gasiorowicz S., Elementary Particle Physics
10. P.M. Mathews & T. Venketesan, A Text Book of Quantum Mechanics, TMH, 1976
11. V. K.Thankappan, Quantum Mechanics

GUJARAT UNIVERSITY
M. Sc. (PHYSICS) SEMESTER – IV
(Effective from - 2021-2022)

PHY-508: Numerical Techniques and Programming in C - II

Study of numerical techniques is essential to solve the problems of physical systems. The empirical laws and curve fittings techniques are very essential for analyzing experimental observations.
To provide concepts on advanced topics of C-programming such as functions, structures, pointers and file management and to train how to write programs with various logics using the above concepts.
To familiarize coding of various numerical methods commonly used in physics problems

Unit I: Solution of Simultaneous equations
Consistency of a system of linear equations, System of linear homogeneous equations, Solution of linear simultaneous equations, Matrix inversion method, Gauss elimination method, Gauss-Jordan method, Factorization method, Jacobi's iterative method, Gauss-Seidal iterative method, Relaxation method, Ill-conditioned equation, Iterative method to improve accuracy of an ill-conditioned system, Solution of non-linear simultaneous equations by Newton-Raphson method.

Unit II: Empirical laws and Curve fitting
Introduction, Graphical method, Laws reducible to the linear law, Method of group averages, Laws containing three constants, Principle of least squares, Method of least squares, Fitting of other curves, Method of moments.

Unit III: C- Programming language
Functions: Need for user defined functions, the form of C functions, return values and their types, calling a function, category of functions, non-integer functions, nesting of functions, recursion, functions with arrays, scope and lifetime of variables, ANSI C functions.
Structures and Unions: Structure definition, giving values to members, structure initialization, arrays of structures, arrays within structures, structures within structures, structures and functions, Unions, size of structures.
Pointers: Concept, accessing the address of variables, declaring and initializing pointers, accessing variables through pointers, pointer expressions, pointer increments and scale factor, pointers and arrays, pointer and character strings, pointers and functions, pointers and structures
File management in C: Defining, opening and closing a file, I/O operations on files, error handling during I/O operations, random access to files.

Unit IV: Programming of Numerical methods
Solution of polynomial equations: Bisection method, Newton Raphson Method. Numerical Integration: Trapezoidal method, Simpson's method, Monte Carlo method. Solutions of simultaneous algebraic equations: Gauss Seidal method. Solution of ordinary differential equations: Ranga-Kutta method.

Reference books:

1. Numerical Methods in Engineering and Science, S. Grewal and J. S. Grewal, Khanna Publishers, New Delhi (2002)
2. Numerical Methods, E. Balgurusamy, TMGH Pub. Co. Ltd, New Delhi (2000)
3. Numerical Methods with Computer Programs in C++, Pallab Ghosh, PHI, New Delhi (2006)
4. Programming in ANSI C (8th edition), E. Balgurusamy, TMGH Pub. Co. Ltd, New Delhi (2019)
5. Programming in C, P. Day and M. Ghosh, Oxford Univ. Press, New Delhi (2011)
6. Programming with C, B. S. Gottfried and Chhabra, TMGH Pub. Co. Ltd, New Delhi (2005)
7. Let us C, Y. Kenetker, BPB Pub., (17th edition) New Delhi (2020)
8. C Programming language, B. W. Kernighan and D. K. Ritchie, PHI, New Delhi (1999)
9. Computer Oriented Numerical Methods, V. Rajaraman, PHI, New Delhi

GUJARAT UNIVERSITY
M. Sc. (PHYSICS) SEMESTER – IV
(Effective from - 2021-2022)

PHY-509: Microprocessor-II and Microwaves

Programming (set of instructions) is an integral part of any Microprocessors. The main objective of Microprocessor II course is to familiarization with 8085 MPU instructions, programming techniques, and debugging programs using static and dynamic techniques.
To develop, in the students of this course, a good understanding of the operation, properties and behaviour of some of the microwave components – topics on active as well as passive microwave components have been included in two units of this paper. Topics on measurement techniques of some parameters like the microwave power, frequency and impedance are also included in one of these units. This will give some idea about microwave measurement techniques to the students.

UNIT I:

Introduction to 8085 instructions: Data transfer (copy) operations, Examples, Addressing Modes, Illustrative program: Data transfer-From Register to Output Port, How to enter and execute a program, Illustrative program: Data transfer to control output devices, Arithmetic Operations. Addition, subtraction, Examples, Flag concepts and cautions, subtraction of two unsigned numbers, Review of important concepts, Logical operations; OR, Exclusive-OR and NOT, Data Masking with logic AND, Examples, ORing data from two input ports, Branch Operations, Unconditional jump, Unconditional jump to set up a continuous loop conditional jumps, Testing of a Carry flag Writing Assembly language program: Microprocessor controlled Manufacture Process.
Programming Techniques with Additional Instructions: Programming Techniques; Looping, Counting and Indexing, conditional loop, counter, Examples, Additional Data transfer and 16-bit Arithmetic instructions, 16-bit data transfer to Registers pairs (LXI), Data transfer from Memory to Microprocessor, Examples, Data transfer from the Microprocessor to Memory or directly into Memory, Arithmetic operations related to 16-bits (Register Pairs), Illustrative program: Block transfer of Data bytes, Arithmetic Operations related to Memory, Examples, Illustrative program: Addition with Carry, Logic operations: Rotate-Left, Right with and without carry, Applications of Rotate instructions, Illustrative program: Checking sign with Rotate instructions,

UNIT II:

Counters and Time delay: Counter, Time delay- using one Register, a Register pair, a loop within loop technique, Delay calculations, Additional techniques, Counter design with time delay, Hexadecimal zero to nine (Modulo ten_ Counters, Illustrative program: Generating pulse wave forms, Debugging counter and time delay programs.
Stack and Subroutine: Concepts of Stack and Subroutine, Examples, Illustrative programs: Resetting and displaying flags, Traffic Signal Controller, Multiple calling of a subroutine Restart, Conditional call and Return instructions, Advance subroutine concepts: Nesting, Multiple ending subroutines, Similarities and differences between CALL-RET, PUSH-POP instructions.
Code Conversion, BCD Arithmetic and 16-bit data operations: BCD to binary conversion, Illustrative program: 2-digit BCD to binary conversion, binary to BCD conversion, Illustrative program: binary to unpacked BCD conversion, BCD to seven segment LED code conversion, BCD to-common cathode- LED code conversion, Binary to ASCII Hex code conversion, ASCII Hex code to Binary conversion, BCD addition, Addition of Unsigned BXS numbers, BXD subtraction, subtraction of two packed BCD numbers, Advanced instructions, 16-bit data Transfer and Data exchange group, Example, Arithmetic group. Instructions related to the stack Pointer and program Counter, Miscellaneous instruction Multiplication: Multiplication of Two 8-bit unsigned numbers, Subtraction with Carry, 16-bit subtraction, Review of instructions and Applications.

UNIT III:

Microwave Devices: Klystrons, Magnetrons and Traveling wave tubes, Velocity modulation, Basic principle of two cavity klystrons and Reflex Klystrons, principles of operation of magnetrons, helix traveling wave tube wave modes, transferred electron devices, Gunn effect, principle of operation, modes of operation of Gunn diode, Impatt diode.

UNIT IV:

Microwave Passive Circuit Components and Measurements: Attenuators, E-plane tee, H-plane tee and hybrid tee, directional couplers, isolator and circulators, Detection of microwaves, microwave power measurement, measurement of impedance and frequency.

Reference Books:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming and Applications with 8085 (fifth edition), Penram International Publishing (India) Private LTD.
2. S. Y. Liao, Microwave devices and circuits, Prentice Hall, 1995
3. M. Kulkarni, Microwave and Radar Engineering, Umesh Publication Delhi, 1998
4. K. C. Gupta, Microwave, Wiley Eastern Ltd. 1985
5. D. C. Sarkar, Microwave propagation and techniques, S. Chand and Company, New Delhi
6. G. Kennedy, Electronic Communication system Tata M. Graw Hill, 1996
7. D. Roddy and J. Coolen, Electronic Communication, Prentice Hall, 4th edition, 1995

GUJARAT UNIVERSITY
M. Sc. (PHYSICS) SEMESTER – IV
(Effective from - 2021-2022)

PHY-510: Remote Sensing and Electronic Communication_-II

To introduce basic concepts of remote sensing in visible, IR and microwave bands, various types of platforms and sensors used for remote sensing, and different interpolation techniques.
To acquaint the students with the basic super heterodyne system, which is the preferred design for most receivers. And also, to acquaint them with each block of the radio receivers, its functions and design limitations. This will be done for receivers corresponding to the two modulation schemes namely AM and FM that they have studied so far.
Students of this course have, so far studied various microwave circuit elements- active as well as passive and also transmission lines. Now in this semester they will be made familiar with a system called RADAR, which uses these circuit elements as building blocks. By studying this unit students will know about the operation and properties of the various types of the radar systems which have a large number of civilian as well as military applications.

UNIT I: Remote Sensing principles, platforms and sensors
Remote Sensing principles: Electromagnetic remote sensing process, Radiation laws, Atmospheric interaction with electromagnetic radiation, Interaction with earth surface and spectral signatures Microwave remote sensing: The Radar principle, Factors affecting microwave measurements, Side looking airborne radar systems (SALR), Synthetic aperture radar (SAR), Interaction between microwaves and earth surface, Geometrical characteristics
Remote Sensing platforms and Sensor: Satellite system parameters instrumental parameters, viewing parameters, Sensor parameters spatial resolution, spectral resolution, radiometric resolution, Imaging sensor systems- multispectral, thermal and microwave imaging, Earth Resource and meteorological satellites

UNIT II: Image interpretation
Visual image interpretation: Basic elements of image interpretation, interpretation of satellite imagery, Application of aerial interpretation
Digital image processing: Basic character of digital image, Preprocessing geometric correction, radiometric correction, atmospheric correction, Image enhancement techniques contrast enhancement, Spatial filtering techniques different filters, filtering for edge enhancement, Image transformation NDVI transformation, PCA transformation, Image classification supervised and unsupervised classification

UNIT III: Radio receivers
Superheterodyne AM receiver, block diagram, RF section, image frequency and its rejection, mixer & local oscillator section, IF section, detection and automatic gain control, Noise in AM receiver. FM receivers, Common circuits-comparison with AM receivers, Noise in FM receiver

UNIT IV: Radar
Radar system, basic principles, fundamentals, radar performance factors, pulsed systems, Basic pulse Radar system, Antennas and scanning. Display methods, pulsed radar systems, Moving target indication (MTI), Radar Beacons, CW Doppler radar, FM CW radar.

Reference books:

1. Fundamentals of remote sensing, George Joseph and Jaganathan, University press, 3rd edition, 2018
2. Lillesand T.M., Kiefer R.W. and Chipman, Remote sensing and image interpretation, John Wiley, 7th edition, 2015
3. Campbell J.B. and Wynne, Introduction to remote sensing, Taylor and Francis, 2011
4. Sabins F.F., Remote Sensing, Principles and Interpolation, W.H. Freeman and Co.
5. Jenson J.R., Remote sensing environment: An earth resource perspective, PHI, 2000.
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GUJARAT UNIVERSITY

M. SC. (PHYSICS) SEMESTER - IV
(EFFECTIVE FROM – 2021-2022)

PHY– 511PR: PRACTICALS

LIST OF PRACTICALS:

1. Design and Study of Low pass filter Circuit using IC 741.
2. Design and Study of high pass filter Circuit using IC 741.
3. Study of Amplitude Modulation and Demodulation using Trainer kit.
4. Study of Transmission Line characteristics using Trainer Kit.
5. Study of ADC using IC 0800.
6. Writing and Execution of simple Programs using Microprocessor 8085 Kit.
7. Writing and Execution of advanced Programs using Microprocessor 8085 Kit.
8. Determination of dielectric constant of a given sample at microwave frequency.
9. ExpEyes based Experiments - III
10. ExpEyes based Experiments - IV
11. Experiments on optical fiber using kit
12. I-V characteristics of a Gunn Diode
13. Mode characteristics of klystron
14. Solution of Ordinary Differential Equation by forth order Runge Kutta method - Programming

15% of new experiments can be introduced AND / OR replaced as per the need, with the permission of the Chairman of the Board of Studies.

PHY 512PT: POJECT

- In-house project work of 4-credit to be performed by each student.
- Alternatively, MOOC, Swayam or any other UGC recognized online course equivalent to 4-credit and approved under the GU_SWAYAM_POLICY by the Gujarat University for credit transfer will also be considered for 4-credit in this course.