SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar
Third Year B. Sc. [Applied Physics] Course Structure for Semester(CBCS) System
SEMESTER-6

Course Type	Subject	Course Code	Name of Course	Theory/ Practical	Credits	Contact Hrs/week	Exam duration in hrs	Component of Marks		
								Internal	External	Total
Core Course	Applied Physics	US06CAPH01	Advanced Concepts of Applied Physics	Theory	3	3	3	30	70	100
		US06CAPH02	Solid State Electronics	Theory	3	3	3	30	70	100
		US06CAPH03	Mathematical Methods in Physics and FORTRAN – 2	Theory	3	3	3	30	70	100
		US06CAPH04	Process Instrumentation – 2	Theory	3	3	3	30	70	100
		US06CAPH05	Applications of Remote Sensing	Theory	3	3	3	30	70	100
		US06CAPH06	Introduction to 8085 microprocessor and control systems - 2	Theory	3	3	3	30	70	100
		US06CAPH07	Applied Physics Practicals	Practical	2	4	3	30	70	100
		US06CAPH08	Applied Physics Practicals	Practical	2	4	3	30	70	100
		US06CAPH09	Applied Physics Practicals	Practical(Project Work)	2	4	3	30	70	100
					Total 24 Credits	Total 30 hours				

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH01 (3 Credit Course)
COURSE TITLE : Advanced Concepts of Applied Physics
(Effective from June 2019)

UNIT 1 : Biophysics

Introduction, Energies, forces and bonds: Inter atomic potentials for strong bonds and weak bonds, Non-central forces, Bond energies. Rates of reaction: Free energy, internal energy, Thermodynamics and statistical mechanics, Reaction kinetics, Water acids, bases and aqueous reactions. Radiation energy, Transport processes: Diffusion, Viscosity and conduction. Biological Polymers: Nucleic Acids. Nucleic Acids conformation: DNA and RNA. Proteins, Biological membranes: Historical background, Membrane chemistry and structure. Biological energy: Energy consumption, Respiration and photosynthesis. Movement of organism: Bacterial motion, Chemical memory in primitive organisms. Muscular movements.

UNIT 2 : Non-Destructive Testing(NDT)

Introduction: The objective of non-destructive testing, types of defects, methods, methods of non-destructive testing, liquid penetrant, dye penetrant, radiographic, X-ray radiography, X-ray fluoroscopy, electrical current testing, ultrasonic inspection method, magnetic particle inspection, pulse echo system, visual display units, other non-destructive inspection techniques (optical inspection probes, time of flight diffraction, thermography, surface texture analysis.

UNIT 3 : Magnetism in Solids

Introduction, classification of magnetic materials, importance of magnetic materials, diamagnetism, paramagnetism, origin of permanent magnetic moment in paramagnetism, Langevin's classical theory of paramagnetism, Weiss theory of paramagnetism, ferromagnetism, Weiss theory of ferromagnetism, ferromagnetic domains, origin of domains, antiferromagnetism, ferrimagnetism, temperature dependence of susceptibility, Types of energy involved in process of domain theory, Reversible & irreversible domains, Hysteresis, Explanation of basic of domain theory.

UNIT 4 : Superconductivity

Experimental aspects: The phenomenon, properties do not change in superconductivity, properties change in transition, influence of external agents on superconductivity, isotope effect, persistent currents, magnetic effects, Meissner effect of flux exclusion, critical field of small specimens, thermodynamic effects, the gyromagnetic effects,

thermoelectric fields, alloys and compounds, thermodynamics of superconducting transitions, heat capacity, energy gap, tunnel effects. Entropy specific heat energy gap, isotope effect & flux quantization, Josephson effect, tunneling, BCS theory (Qualitative aspect), introduction to high temperature superconductors, applications.

REFERENCE BOOKS
1. Bio physics, an introduction by Rodney Cotterill. John wiley and sons
2. Fundamental concept in bio physics (Vol.-1) Thomas Jue Springer.
3. Biological Physics: energy, information, life. By Philip Nelson
4. Elementary Biophysics an introduction by P K Shrivstava
5. Solid state physics, R. K. Puri, V. K. Babbar (S. Chand publication)
6. Introduction of solid state physics (8th edition) Charles Kittel (John wiley and sons).
7. Non-destructive testing by Barry Hull, Vernon John (Macmillan education)

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH02 (3 Credit Course)
COURSE TITLE : Solid State Electronics
(Effective from June 2019)

UNIT-I Feedback in Amplifiers
Concepts of feedback in amplifiers, Types of feedback, Voltage gain of feedback amplifier, Advantages of negative feedback, Stabilization of gain, Reduction in distortion and noise, Increase in input impedance, Decrease in output impedance, Increase in bandwidth, Amplifier circuit with negative feedback, RC coupled amplifier without bypass capacitor, Emitter follower, Related Numericals

UNIT-II Oscillators
Need of an oscillator, Classification of oscillators, Tuned circuit for generation of sine waves, Frequency of oscillation in LC circuit, Sustained oscillations, Positive feedback amplifier as an oscillator, The starting voltage, Hartley oscillator, Colpitts oscillator, Basic principles of RC oscillator, Phase shift oscillator, Wien bridge oscillator, Crystal oscillators, Crystal oscillator circuit, Related Numericals

UNIT-3 Field Effect Transistors
Introduction, Junction Field Effect Transistor: n-channel JFET, P-channel JFET, JFET fabrication and packaging, JFET characteristics: Depletion regions, Drain characteristics with VGS =0, Drain characteristics with external bias, Transfer characteristics, p-channel JFET characteristics, JFET data sheets and parameters: Maximum ratings, Saturation current and pinch-off voltage, Forward transfer admittance, Output admittance, Drain-source on resistance, Gate cut-off current and Input resistance.

UNIT-4 MOSFET Technology
An overview of MOSFET technologies: Simple MOSFET structures, PMOS and NMOS structures, PMOS vs NMOS, Complementary symmetry MOSFET technologies: CMOS as dominant technology for VLSI fabrication, Metal-Gate CMOS process, Silicon-Gate CMOS process, Monolithic resistors: Base diffused resistor, Monolithic capacitors: Junction capacitors, MOS capacitor for Bipolar technology.

Books Recommended:
1. Electronic Principles A P Malvino Tata McGraw Hill Publishing Co. Ltd., New Delhi
2. Basic Electronics (Solid State) B L Theraja S Chand, New Delhi
3. Basic Electronics and Linear Circuits N N Bhargava, D C Kulshreshtha and S C Gupta
4. Electronics Devices and Circuits fifth edition by David A Bell.

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH03 (3 Credit Course)
COURSE TITLE : Mathematical Methods in Physics and FORTRAN – 2
(Effective from June 2019)

UNIT – 1 : Fourier Series

Simple harmonic motion and wave motion: periodic functions, applications of Fourier series, average value of a function, Fourier coefficients, Dirichlet conditions, complex form of Fourier series, even and odd functions, an application to sound

UNIT – 2 : Partial differential equations

Introduction, Laplace's equation : steady-state temperature in a rectangular plate, the diffusion or heat flow equation : heat flow in a bar or slab, the wave equation: the vibrating string, vibration of a circular membrane, Poisson's equation.

UNIT – 3 : FORTRAN Programming

Logical expressions and more control statements – introduction, logical constants, variables and expressions, precedence rules for logical operators, some examples of use of logical expressions, the case statement, Functions and subroutines – basics, introduction, function subprograms, syntax rules for function subprograms, subroutines

UNIT – 4 : FORTRAN Programming

Defining and manipulating Arrays, array variables, use of multiple subscripts, DO type notations for i/p and o/p statements, initializing arrays, use of arrays in DO loops, whole array operations, elementary format specifications, format description for numerical data-READ statement & PRINT statements, multi record formats, generalized input/output statements

Text Books:
1. Mathematical methods in the physical sciences, Mary L. Boas, John Wiley and Sons
2. Computer programming in FORTRAN 90 and 95, V. Rajaraman, Prentice Hall of India, New Delhi

Reference Books:
1. Mathematical methods in Physics, D. Biswas, New Central Book Agency (P) Ltd., Kolkata
2. Numerical Recipes in FORTRAN, the art of scientific computing, W. H. Press, S. A. Teukolsky, W. T. Vetterling, Brian P. Flannery, Cambridge University Press, Delhi.

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH04 (3 Credit Course)
COURSE TITLE : Process Instrumentation – 2
(Effective from June 2019)

Unit- 1 Flow Measurement-I
Introduction, Nature of flow, Classification of fluid- Flow measurement Techniques, Theory of variable Head meters, Venturi flow meter, Flow nozzle, Orifice flow meter, Pitot tubes.

Unit-2 Flow Measurement-II
Anemometer and current meters, Variable area flow meters, Quantity meters, Rota meter, Hot wire anemometer, Electro-magnetic flow meters, Ultrasonic flow meters, Thermal flow meters.

Unit-3 Tachometers
Introduction, Types of tachometers, Mechanical tachometers: Revolution counter and timer, Tachoscope, Hand speed indicator, Slipping clutch tachometer, Centrifugal force tachometer, Electrical tachometers: Drag cup tachometer, commutated capacitor tachometer, Tachogenerators, Contactless electrical tachometers: Inductive pick-up tachometer, capacitive type pick-up tachometer, Photo-electric tachometer.

Unit-4 Recent Developments in instrumentation and measurement
Computer-aided measurements, Fibre optic transducers, Micro-sensors, smart sensors, smart transmitters and field bus, Virtual instrumentation.

Reference book
1. Instrumentation Measurement and analysis by B C Nakra and K K Chaudhry
2. Mechanical measurements and control by D S KUMAR

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH05 (3 Credit Course)
COURSE TITLE : Applications of Remote Sensing
(Effective from June 2019)

UNIT 1 : Influence of Atmosphere on remote sensing
Introduction, optical depth and visual range, the radiance received by the sensor, effect of turbulence, partial cloud cover, atmospheric correction, atmospheric correction over the ocean in the OIR region, atmospheric correction for extraction of sea surface temperature.

UNIT 2 : Applications of remote sensing for earth resources management
Introduction, agriculture, yield forecasting, multiple in-season crop production forecast, precision farming, forestry applications, type and density mapping, forest cover change, land cover/land use mapping, wastelands, urban sprawl, water resources, geographical information system(GIS).

UNIT 3 : Concept of GIS
Introduction, definitions of GIS, key components of GIS, GIS-An integration of spatial and attribute information, GIS-Three views of information system, GIS and related terms, GIS-A knowledge hub, GIS-A set of interrelated sybsystems, GIS-An information infrastructure, origin of GIS

UNIT 4 : Functions and Advantages of GIS
Introduction, functions of GIS, application areas of GIS, advantages of GIS, functional requirements of GIS, limitations of GIS

Text Books:
1. Fundamentals of remote sensing, George Joseph, University Press, Hyderabad.
2. Remote sensing and GIS, Basudeb Bhatta, second edition, Oxford University press, New Delhi.

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH06 (3 Credit Course)
COURSE TITLE : Introduction to 8085 microprocessor and control systems - 2
(Effective from June 2019)

Unit 1 Programming techniques with additional instructions

Programming techniques: looping, counting and indexing, additional data transfer and 16-bit arithmetic instructions, arithmetic operations related to memory, logic operations rotate, logic operations compare, dynamic debugging, counters and time delays, time delay using one register, time delay using register pair, time delay using loop within loop technique

Unit 2 Counter, time delays, interrupts and DMA

Hexadecimal counter, modulo ten counter, generating pulse waveforms, stack, subroutine, restart, conditional call and return instructions, advanced subroutine concepts, operating systems, tools for developing assembly language programs (editor, assembler, loader, debugger), cross-assembler, 8085 interrupts, 8085 vectored interrupts, direct memory access

Unit 3 SCADA and PLC

Supervisory control and data acquisition systems (SCADA), channel scanning, data processing, distributed SCADA system, remote terminal unit, input module, output module, communication modules, software facilities, introduction to microcomputers, programmable controllers, programmable logic controllers (PLC), PLC architecture, basic structure, PLC programming, ladder diagram, PLC communication and networking, PLC selection, PLC installation, advantages of using PLCs

Unit 4 Distributed control system (DCS)

Overview of distributed control system (DCS), operator's console, video display, keyboard, information displays, DCS software configuration, operating system configuration, controller function configuration, DCS communication, integration field-bus standards, data highway designs, network access protocol, DCS supervisory computer task, man-machine interface (MMI), DCS integration with PLCs, DCS integration with computers, features of DCS, advantages of DCS

Text Books

1. Microprocessor architecture, programming and applications by Ramesh S. Gaonkar
2. Microprocessor (8085) by B. Ram
3. Process control instrumentation by Curtis Johnson
4. Industrial instrumentation and control by S. K. Singh

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH07 (2 Credit : 4 hours)
COURSE TITLE : Applied Physics Practicals
(Effective from June 2019)

10. Verification of Curie -Weiss law for a ferroelectric material –temp. Dependence of a ceramic capacitance
11. Capacitance by de Sauty's method
12. 'e/m' of an electron by magnetron method
13. Susceptibility of paramagnetic /ferromagnetic solution by quink's method
14. Study of Direct Coupled amplifier
15. Study of Proportional Controller
16. Study of LVDT characteristics
17. Study of RTD characteristics
18. Study of Strain gauge characteristics
19. Study of Thermocouple characteristics
20. 8085 microprocessor kit based experiments
    a. Branch Operations
    b. Time Delay and counter programming
    c. Analog to Digital conversion
    d. Programming using Stack & Subroutine

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH08 (2 Credit : 4 hours)
COURSE TITLE : Applied Physics Practicals
(Effective from June 2019)

12. Verification of the laws of vibration of a string under tension (Melde's experiment).
13. Thermal conductivity of a bad conductor by Lee's method
14. Determination of refractive indices of o-and e-rays using double refracting prism.
15. Young's modulus by Searl's method.
16. Optical fiber (To find numerical aperture for optical fiber)
17. Michelson interferometer
18. Thickness of a thin wire using optical bench(Cylindrical Obstacle)
19. Febry-Parot Etalon
20. Lloyd's mirror
21. Study of Fourier series
22. Numerical differentiation
23. Numerical Integration
24. Computer based experiments using FORTRAN Programming.

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH09 (2 Credit : 4 hours)
COURSE TITLE : Project Work (Applied Physics)
(Effective from June 2019)

PROJECT WORK BASED ON THE CONCEPTS OF APPLIED PHYSICS