SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH21 (4 Credit Course)
COURSE TITLE : Advanced Quantum Mechanics
(Effective from June 2020)

UNIT 1 : Mathematical tools of Quantum mechanics

Introduction, The Hilbert space and wave function; the linear vector space, the Hilbert space, Dimension and basis of a vector space, square integrable functions: wave functions, Dirac notations, operators; Hermitian Adjoint, projection operators, commutator algebra, uncertainty relation between two operators, functions of operators, inverse and Unitary operators, Eigenvalues and Eigenvectors of an operator, infinitesimal and finite Unitary transformation, matrix representation of Kets, Bras and operators, change of Bases and unitary transformation, matrix representation of the Eigenvalue problem.

UNIT 2 : Postulates of quantum mechanics

Introduction, The basic Postulates of Quantum Mechanics, the state of a system probability density, the superposition principle, observables and operators, measurement in quantum mechanics, how measurements disturb systems, expectation values, connecting the Quantum to classical mechanics; Poisson Brackets, and commutators, The Ehrenfest theorem.

UNIT 3 : One Dimensional problems

Introduction, properties of one dimensional motion; discrete spectrum, continuous spectrum, mixed spectrum, symmetric potential and parity, the free particle; potential step, the potential barrier and well; for $E>V_0$**,** for $E<V_0$ (tunnelling), tunnelling effect, the infinite square well potential; asymmetrical square well, symmetrical potential well, finite square well potential; the scattering solutions ($E>V_0$), the bound state solutions, ($0<E<V_0$), the harmonic oscillator; energy Eigen values, energy Eigen states, energy Eigen states in position space.

UNIT 4 : Angular momentum

Introduction, orbital angular momentum, general formalism of angular momentum, matrix representation of angular momentum, geometrical representation of angular momentum, spin angular momentum; experimental evidence of the spin, general theory of spin, spin ½ and Pauli matrices, Eigen functions of orbital angular momentum; Eigen functions and Eigen values of $\widehat{L_z}$, Eigen functions of $\widehat{\boldsymbol{L^2}}$.

Text Books:

1. Quantum mechanics concepts and applications by Nouredine Zettili, Wiley Publications (2^{nd} Edition)
2. Fundamentals of Quantum Mechanics by Mathews and Venktesan

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH22 (4 Credit Course)
COURSE TITLE : Remote Sensing and Its Applications
(Effective from June 2020)

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

Introduction, land-cover and land-use, land-use/land-cover change, land cover mapping, crop type mapping, crop monitoring and crop damage assessment, forestry, clear-cut mapping and deforestation, species identification and typing, burn mapping, geology, structural mapping and terrain analysis, lineament extraction, geologic unit mapping, geomorphology.

UNIT 3 : Applications of remote sensing

Urban applications, hydrology, flood delineation and mapping, soil moisture, groundwater prospects and recharge, mapping, planimetry, digital elevation models, topographic and BTM, oceans and coastal monitoring, ocean features, ocean colours and phytoplankton concentration, measurement of SST, oil spill detection, sea-surface height, sea-surface roughness, ship routing, sea ice, monitoring of atmospheric constituents.

UNIT 4 : Geographical Information System(GIS)

Introduction, definitions of GIS, key components of GIS, hardware, software, procedure, data, users, GIS-An integration of spatial and attribute information, GIS-Three views of information system, GIS and related terms, GIS – A knowledge hub : geography, cartography, remote sensing, photogrammetry, surveying, geodesy, GNSS, statistics, operations research, computer science, mathematics, civil engineering, GIS-A set of interrelated subsystems, GIS-An information infrastructure, origin of GIS, functional requirements of GIS : relating informations from different sources, data capture, database storage and management, data integration, projection and registration, data structure, spatial analysis, data modelling, presenting results, 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 : US06CAPH23 (4 Credit Course)
COURSE TITLE : Instrumentation and Sensors
(Effective from June 2020)

Unit 1 : Temperature Measurement

Introduction, Temperature scales, International practical temperature scales (IPTS), Measurement of temperature, Non electrical methods, Bimetallic thermometer, Liquid-in-glass thermometer Pressure thermometer, Electrical methods: Electrical resistance thermometers, Thermistor, Pyrometer.

Unit 2 : Pressure Measurement

Introduction, Terminology, Pressure units and measuring instruments, Manometer, Manometric liquids, Advantages and disadvantages of manometers, Low pressure gauge: Mcleod gauge, Thermal conductivity gauge, Resistance thermometer Pirani) gauge, Ionisation gauge, Measurement of High pressure, Cathode ray scilloscope for varying pressure measurement.

Unit 3 : CRO measurements

Introduction, Oscilloscope block diagram, Cathode Ray Tube: Early cathode ray tubes, Electrostatic deflection, Screens for CRTs, CRT circuits, Delay Line: Function of the delay line, Lamped-parameter delay line, Distributed-parameter delay line, Multiple trace, Oscilloscope technique: determining frequency, Phase angle and time delay measurement, Determining signal origins, Determining modulation characteristics

Unit 4 : Fiber-optics Sensors

Introduction, what is a fiber-optic sensor? Classification of Fiber-optic sensors, Intensity-modulated sensors, Phase-modulated sensors, fiber-optic Mach-zehnder Interferometic sensor, Fiber-optic Gyroscope, Spectrally modulated sensors: Fiber-optics fluorescence temperature sensor, Fiber Bragg Grating sensors, Distributed fiber-optic sensors, Fiber-optic smart structures, Industrial application of fiber-optic sensors.

Text Books:

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

3. Modern Electronics Instrumentation and Measurement Techniques by Albert D Helfrick and William D Cooper.
4. Fiber optics and optoelectronics by R. P. Khare

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06CAPH24 (4 Credit Course)
COURSE TITLE : Solid State Electronics
(Effective from June 2020)

UNIT 1 : 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 Numerical

UNIT 2 : 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, Colpitt's oscillator, Basic principles of RC oscillator, Phase shift oscillator, Wien bridge oscillator, Crystal oscillators, Crystal oscillator circuit, Related Numerical

UNIT 3 : Field Effect Transistors(FET)

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

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.

Text Books

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 : US06CAPH25 (4 Credits, 8 hrs per week)
COURSE TITLE : Applied Physics Practicals
(Effective from June 2020)

1. Capacitance by de Sauty's method
2. 'e/m' of an electron by magnetron method
3. Study of Direct Coupled amplifier
4. Study of Proportional Controller
5. Study of LVDT characteristics
6. Study of RTD characteristics
7. Study of Strain gauge characteristics
8. Study of Thermocouple characteristics
9. Verification of the laws of vibration of a string under tension (Melde's experiment).
10. Thermal conductivity of a bad conductor by Lee's method
11. Determination of refractive indices of O-ray and E-ray using double refraction
12. Young's modulus by Searl's method.
13. Optical fiber (To find numerical aperture for optical fiber)
14. Michelson interferometer
15. Thickness of a thin wire using optical bench(Cylindrical Obstacle)
16. Febry-Parot Etalon
17. Lloyd's mirror
18. Study of Fourier series
19. Numerical Integration
20. B-H(Hysteresis) curve

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06DAPH26 (2 Credit Course)
COURSE TITLE : Thermal and Nuclear Physics
(Effetive from June 2020)

UNIT 1 : Transmission of Heat

Introduction, Coefficient of thermal conductivity, Rectilinear flow of heat along a bar, Cylindrical flow of heat, Spherical shell method (Radial flow of heat), Searle's method, Lee and Charlton's method for bad conductors, Lee's method for liquids, Thermal Conductivity of rubber, Thermal Conductivity of glass

UNIT 2 : Radiation of Heat

Kirchoff's law, Stefan-Boltzmann's law, Wien's Displacement law (statement only), Rayleigh-Jeans law, Planck' radiation law, Derivation of Stefan's law, Derivation of Newton's law of cooling from Stefan's law, Experimental verification of Stefan's law, Determination of Stefan's constant (Laboratory Method), Disappearing filament optical pyrometer, Total radiation pyrometer, Solar Constant, The Green House Effect

UNIT 3 : Nuclear Structure

Nuclear Composition, atomic masses, some nuclear properties : nuclear radius, spin and magnetic moment, stable nuclei, nuclear decay, binding energy, binding energy per nucleon, the strong interaction, liquid-drop model, correction to the formula, shell model, magic numbers, meson theory of nuclear forces

UNIT 4 : Nuclear transformations

Radioactive decay, radioactivity and the earth, half-life, radiometric dating, radioactive series, alpha decay, tunnel theory of alpha decay, beta decay, gamma decay, nuclear reactions, nuclear fission, nuclear reactors, breeder reactors, nuclear fusion in stars, fusion reactors

Text Books:

1. Concepts of Modern Physics by Arthur Beiser, sixth edition, Tata McGraw-Hill Edition
2. Thermodynamics and Statistical Physics by Brijlal, Subrahmanyam and Avadhanulu, S. Chand Publications

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 6
APPLIED PHYSICS COURSE CODE : US06DAPH27 (2 Credit Course)
COURSE TITLE : Electronic Communication and Thin Film Interference
(Effective from June 2020)

UNIT 1 : Introduction to electronic communication and digital modulation

Introduction, power measurement, electronic communication systems, modulation and demodulation, the electronic frequency spectrum, bandwidth and information capacity, noise analysis, bit rate, baud rate, M-ray encoding, amplitude shift keying, phase shift keying, bandwidth efficiency, career recovery

UNIT 2 : Cellular telephone concepts

Introduction, mobile telephone service, evolution of cellular telephone, cellular telephone, frequency reuse, interference, cell splitting, spectoring, segmentation, dualization, cellular system topology, roaming and hadoffs, cellular telephone network components, cellular telephone call processing

UNIT 3 : Interference in Thin Films

Thin film, plane parallel film, interference due to reflected light, conditions for maxima and minima, important points, narrow vs. extended sources, restriction on thickness, interference due to transmitted light, Haidinger fringes, wedge shaped film, Fizeau fringes, Newton's rings, conditions for bright and dark rings, circular images, radii of dark fringes, fringes of equal thickness, determination of wavelength and refractive index

UNIT 4 : Applications of Thin Film Interference

Multiple beam interference, coefficient of fineness, visibility of fringes, sharpness of fringes, Fabry-Perot interferometer and etalon, Lummer and Gehrcke plate, Applications of thin film interference, measurement of small displacements, testing of surface finish, testing of a thin film coating, antireflection coating, multilayer coating

Text Books :

1. Electronic communication systems by Wayne Tomasi
2. Modern Digital and Analog Communication Systems by B. P Lathi
3. Electronic Communication Robert L. Shrader
4. A text-book of optics by N. Subrahmanyam, Brijlal, M. N. Avadhanulu, S. Chand Publications, New Delhi.