SEMESTER - II

AP2C05 APPLIED MATHEMATICS – II Unit I

Differential Equations & Special Functions (18 hrs)

Gamma and Beta functions-Different forms-evaluation of standard integrals Bessel differential equation- series solution- the Bessel function of first kind and the second kind- generating function for Bessel functions- Recurrence relations, Legedre differential equation- series solution-Legendre polynomials- generating function for the Legendre polynomials- Recurrence formula- Orthogonality of Legendre polynomials- Rodrigues formula for Legendre polynomials- Spherical harmonics

Hermite differential equations – series solution- Hermite polynomial-Recurrence relation- generating function- orthogonality property of Hermite polynomial – Quantum mechanical harmonic oscillator-Leguerre differential equation- Associated Leguerre polynomials

Text Book:

1.

Unit II

Tensor Analysis (18 hrs)

Tensors-co-ordinate transformations-contravariant,covariant and mixed tensors-Einstien summation convention-symmetric & skew-symmetric tensors-fundamental operation with tensors-contraction & Direct product-Quotient rule-Levi-civita symbol-Dual tensors-Christoffel symbols & their

transformation laws-covariant differentiation-tensor form of gradient,divergence curl & Laplacian-Geodesic equation.

Text Book:

Mathematical method for physics, G. B. Arfken & H. J. Weber.

Unit III

Group Theory (18 hrs)

Introduction to group theory-Definition of group-cyclic groups-point groups-homomorphism & isomorphism-classes-reducible & irreducible representations-Schru's lemma-great orthogonality theorem-Group character table-C2v & C3v groups-generators of continous groups-Rotation groups SO(2) & SO(3)-Lie group & Lie algebra-poincare-Lorentz group-SU(2) & SU(3)

Text Book:

Elements of Group Theory for physicists, A. W. Joshy, New Age India Pub.

Unit IV

Partial differential equations (18 hrs)

Introduction to partial differential equations-separation of variables: Cartesian coordinates, circular cylindrical coordinates, spherical polar coordinates

Examples of partial differential equations and boundary conditions-Heat equation-Wave equation-Laplace equation-Inhomogeneous partial differential equation:Poissons equation & Quantum mechanical scattering-Green's function.

Text Book:

1. Mathematical method for physics, G.B. Arfken & H. J. Weber.

Reference Books:

Mathematical method for physics, G. B. Arfken & H. J. Weber.

Mathematical Physics, B.D. Gupta, Vikas Pub. House Pvt Ltd, New Delhi,1997.

Advanced engineering mathematics, Cr Wylie, Tata McGraw Hill.

Advanced Mathematics for Engineers & Scientists, Schaum's outline M R Spiegel Tata McGraw Hill.

Matrices & Tensors in Physics, A.W Joshi, New Age India Pub.

AP2C06 ELECTRONICS AND COMMUNICATIONS

Unit I

Linear Integrated Circuits (18 hours)

Differential amplifier- Frequency response of an OPAMP – Compensating networks – General linear applications – Instrumentation amplifier – Active filters – First and second order Butterworth filters – Phase shift and Wien bridge oscillators – Square - Traiangualr and Saw tooth wave generators – Comparators and Converters-D/A and A/D converter – Successive approximation – Dual slope integrator – 555 timer – Internal architecture – VCO - Phase locked loop – Voltage regulators.

Text Book:

1. OP-Amp and Linear integrated circuits, Ramakant Gayakwad, 4th Edition, TMH.

Unit II

Communication Systems (18 hours)

Modulation – Bandwidth requirements - Amplitude modulation – SSB technique – Frequency modulation – Frequency spectrum of FM wave – Phase modulation – Generation of FM – Pulse communications – Pulse modulation – Pulse width, pulse position, pulse code modulation – Digital communication – Digital codes – Error detection and correction – Modem classification – Modem interfacing.

Text Book:

Electronic communication system, George Kennedy, TMH.

Unit III

Microprocessors and Microcontrollers (18 hours)

Intel 8086 – Architecture – Addressing modes – Accessing and register data – Accessing memory and I/O ports – Addressing modes – Instruction set – Instruction format – Assembler dependent instructions – System design using 8086 – System concepts – Interfacing memory – Programmed I/O – 8086 based microcomputer – Basic ideas of 8088, 80186, 80286, 80386, 80486 and Pentium processors.

Evolution of microcontrollers – Comparison of microprocessors and microcontrollers – 8 bit microcontrollers – 8051 architecture – hardware – I/O pins, ports and circuits – External memory – Basic programming concepts – applications.

Text Books:

1. Microprocessor and Microcomputer based system design, M. Rafiquzzaman , Universal Book Stall, New Delhi.

   The 8051 Microcontroller, Architecture, Programming and Applications, Kenneth J. Ayala Penram Int Pub, Mumbai.

Unit IV

Digital Signal Processing (18 hours)

Continuous time (CT) and Discrete time (DT) signals – Some elementary discrete time signals – Classification of discrete time signals – discrete time systems – classification of discre time systems – Convolution sum – Correlation of discrete time signal – Z transform- Analysis of CT signals – Fourier series and Fourier transforms – Analysis of DT signals – Fourier series and Fourier transforms - Discrete Fourier transform of DT signals – Fast Fourier transform –Digital filtering in time domain – FIR filters – IIR filters.

Text Books:

Signals and Systems, A.V. Oppenheim, A. S. Willsley and I. T. Young, PHI.

Digital Signal Processing, John G. Proakis, Dimitris G. Manolakis, 4th Edn. PHI.

Reference Books:

Op. Amps and Linear Circuits, R. A. Gayakwad, PHI (1997).

Microprocessor Architecture and Applications, R.S. Gaonkar, Wiley Eastern.

The Intel Microprocessors – 8086, 8088, 80186, 80286, 80386 and 80486,B.B. Bery, PHI.

Electronic fundamentals and applications, John Ryder.

Digital Signal Processing, John G. Proakis, Dimitris G. Manolakis,4th Edn. PHI.

Advance microprocessors and peripherals, A. K. Ray and K. M. Burchandi, TMH.

AP2C07 SPECTROSCOPY Unit

I

Atomic Spectra (18 hrs)

Vector atom model-electron spin-Stern-Grelach experiment-LS and jj coupling schemes-spectroscopic terms-Pauli's exclusion principle-spin-orbit interaction-interaction energy-interaction energy in LS and jj coupling schemes-selection rule-Hund's rule-Lande interval rule- normal and anomalous Zeeman effect-Paschen-Back effect and Stark effect in one electron systems-hyperfine structure-width of spectral lines.

Text Books:

Introduction to atomic spectra, White H. E., McGraw Hill.

Spectroscopy Volume 1, Straughan and Walker, John Wiley & Sons.

Unit II

Resonance Spectroscopy (18 hrs)

ESR-theory-relaxation process-experimental setup-hyperfine structure-applications.

NMR-classical and quantum theories-relaxation process-experimental technique-chemical shift-spin-spin coupling-applications.

Mössbauer effect-theory-experimental technique-chemical isomer shift-magnetic hyperfine interactions-electric quadrapole interaction-applications

Text Books:

Spectroscopy volume 2 Straughan and Walker, John Wiley & Sons.

Molecular structure and spectroscopy, G. Aruldhas, PHI.

Unit III

Microwave and Infrared Spectroscopy (18 hrs)

Rotational spectra of rigid diatomic molecules-isotopic effect-intensity of rotational lines-non rigid rotator-linear polyatomic molecules-symmetric top molecules-microwave spectrometer-informations from rotational spectra.

Vibrating diatomic molecules as harmonic and anharmonic oscillators-diatomic vibrating rotator-breakdown of Born-Opeenheimer approximation-vibrational spectra of polyatomic molecules-overtones and combinations-influence of rotation on the spectra of linear and symmetric top molecules-IR spectroscopic analysis-FT-IR spectroscopy.

Text Books:

Molecular structure and spectroscopy, G. Aruldhas, PHI.

Fundamentals of molecular spectroscopy, C. N. Banwell and E. M. McCash, TMH.

Unit IV

Raman Spectroscopy (9 hrs)

Raman effect, theory, rotational Raman spectra-linear molecules-symmetric top molecules-vibrational Raman spectra-rotational fine structure-Raman activity-mutual exclusion principle-structure determination using Raman and IR spectroscopy-laser Raman spectrometer, basic idea of nonlinear Raman

effects, stimulated Raman effects, Hyper Raman effect, inverse Raman effect and CARS.

Electronic Spectroscopy (9 hrs)

Electronic spectra of diatomic molecules- progressions and sequences- Frank Condon principle- rotational fine structure of electronic vibration spectra-the Fortrat parabola-dissociation-pre dissociation-fluorescence and phosphorescence.

Text Books:

Molecular structure and spectroscopy, G. Aruldhas, PHI.

Fundamentals of molecular spectroscopy, C. N. Banwell and E. M. McCash, TMH.

Raman spectroscopy, D. A. Long, McGraw Hill Inc.

Reference Books:

Introduction to atomic spectra, H. E. White.

Introduction to molecular spectroscopy, G. M. Barrow McGraw Hill.

Elements of spectroscopy, Gupta, Kumar and Sharma, Prgathi Prakshan.

Molecular spectra and molecular structure, Vol. I, II & III, Hertzberg G., Van Nostrad, London.

The infrared spectra of complex molecules, Vol I and II, Bellamy L. J. Chapman and Hall.

AP2C08 QUANTUM MECHANICS – I Unit

I

Applications of Schrodinger Equation (16 hrs)

Harmonic Oscillator-Three dimensional square well potential-Spherically symmetric potentials in three dimensions-Central force problems—the rigid rotor-Hydrogen atom

Text Book:

1.

Unit II
Mathematical
Tools of
Quantum Mechanics (18 hrs)

Hilbert space-Dimension and Basis of a vector space-Dirac notation-Ket space-Bra space-inner products-Operators-eigen values and eigen vectors of an operator-Hermition ,Unitary operators (eigen values & eigen vectors)-Projection operators-Compatible Obsevables-Uncertainity relation between two operators-Matrix representations of Kets,Bras & Operators-Change of Bases & Unitary transformations-Unitary equivalent observables-Position representation-Translation-Momentum as a generator of translation-Position-momentum uncertainity relation-Canonical commutation relations-Position space wave function-Momentum operator in the position basis-Momentum space function-Connection between position and momentum space function-Gaussian wave packets-Expectation value of x,x^2,p,p^2 for a Gaussian wave packet.

Text Book:

Modern Quantum Mechanics - J. J. Sakurai, Pearson Education.

Unit III

Quantum Dynamics (20 hrs)

Time evolution Operator-Schrodinger equation for the time evolution operator-Schrodinger picture & Heisenberg picture: Behaviour of state kets & Observables-Heisenberg equation of motion-Ehrenfest'stheorem-Energy eigenkets & eigenvalues of a simple Harmonic Oscillator using creation and annihilation operators.

Text Book:

Modern Quantum Mechanics, J. J. Sakurai, Pearson Education.

Time Independent Perturbations: Time independent perturbation theory-Nondegenerate case-Correction to wave function and energy to second order. anharmonic oscillator-Quadratic Stark effect-Degenerate case-Secular equation-linear Stark Effect & Zeeman effect in hydrogen.

Text Books:

Modern Quantum Mechanics - J . J. Sakurai, Pearson Education.

Quantum concepts and Applications, Nouredine Zettili, John Wiley & Sons.

Unit IV Scattering

(18 hrs)

Scattering amplitude-Differential Scattering cross section & Total Scattering cross section-The Born approximation: The first Born approximation & its

validity-Application of Born approximation to square well, Yukawa & Screened Coulomb potential.

Method of Partial waves-Scattering by a perfectly rigid sphere & by a square well potential-Optical theorem-Ramsaur-Townsend effect-Resonance Scattering.

Text Books:

A modern approach to Quantum Mechanics, Townsend.

Introduction to Quantum Mechanics, David J. Griffiths.

References:

Modern Quantum Mechanics, J. J. Sakurai, Pearson Education.

Introduction to Quantum Mechanics, David J. Griffiths.

A Text book of Quantum Mechanics, P. M. Mathews & K. Venkatesan.

Quantum Mechanics, L. I. Schiff.

A modern approach to Quantum Mechanics-Townsend, Viva Books Pvt. Ltd. MGH

Quantum Mechanics, Ghatak and Loknathan.

Quantum Mechanics, G. Aruldas, PHI

Quantum Mechanics,V. K. Thankappan, New Age Int. Pub.

Quantum Mechanics, L. D. Landau and E. M. Lifshitz.

Quantum Mechanics, Messiah A. P. Q. Q. M - Vol I & II.

Quantum Mechanics- an Introduction, W. Greiner, Springer Verlag.

AP2P02 ELECTRONICS PRACTICALS

Differential amplifier using Op amp.

Diiferential Amplifier using Transistors(With constant current source)

RC coupled CE Amplifier

First order lowpass & High pass filter

Second order lowpass & High pass filter

Square wave Generator

Triangular wave generator

Astable Multivibrator

Wein-Bridge Oscillator using Op.Amp.

Voltage regulator using Op.Amp.

Wave form generators using Op.Amp.

Voltage controlled Oscillator – IC 555

PLL and frequency multiplier

Frequency mixing, AM and demodulation

Frequency modulation and demodulation

DC and AC milli – voltmeter construction and calibration

Instrumentation amplifier using transducer

Amplified DC meter (FET Voltmeter)

Pulse width modulation