Semester-V

BSc/Phy/SM/5/DSC/301: Mathematical Physics-II

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Note: The question paper will consist of nine questions in all. Question no. 1will contain seven short answer type questions of 2 marks each without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT-I

Fourier Series: Periodic functions, Orthogonality of sine and cosine functions, Dirichlet Conditions(Statement only).Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients, Complex representation of Fourier series, Expansion of functions with arbitrary period, Expansion of non-periodic functions over an interval, Even and odd functions and their Fourier expansions Application, Summing of Infinite Series, Term-by-Term differentiation and integration of Fourier Series,P arseval Identity.

Some Special Integrals: Beta and Gamma Functions and its Relation, Expression of Integrals in terms of Gamma Functions, Erro rFunction (Probability Integral).

Dirac Delta function and its properties: Definition of Dirac deltaf unction, Representation as limit of a Gaussian function and rectangular function, Properties of Dirac delta function.

UNIT-II

Frobenius Method and Special Functions: Singular PointsofSecond Order Linear Differential Equations and their importance, Frobenius method and its applications to differential equations, Legendre, Bessel, Hermite and Laguerre Differential Equations, Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality, Simple recurrence relations, Expansion of function in a seriesof Legendre Polynomials.

Bessel Functions of the first Kind: Generating Function, simple recurrence relations, Zeros of Bessel Functions(Jo(x)andJ1(x)) and Orthogonality.

UNIT-III

Complex Analysis : Brief Revision of Complex Numbers and their GraphicalRepresentation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables .Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.

UNIT-IV

Partial Differential Equations: Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical spherical symmetry.Waveequationanditssolutionforvibrationalmodesofastretched string, rectangular and circular embranes, Diffusion Equation.

Reference Books:

1. Mathematical Methods for Physicists:Arfken,Weber,2005,Harris,Elsevier.
2. Fourier Analysis by M.R.Spiegel,2004,Tata McGraw-Hill.
3. Mathematics for Physicists, SusanM.Lea,2004, Thomson Brooks/Cole.

BSc/Phy/SM/5//DSC/302: Basic of Quantum Mechanics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Course Objectives: The course content covers foundations of quantum mechanics, Schrodinger wave equation and applications to one dimensional problems, Hydrogen Atom and time dependent and independent Schrodinger equation.

Course Outcomes: The students will be equipped with basics of quantum Mechanics, Schrodinger wave equation and its applications.

Note: The question paper will consist of nine questions in all. Question no. 1will contain seven short answer type questions of 2 marks each without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from eac hunit.

UNIT-I

Linear Vector Space and Matrix Mechanics: Vector spaces, Hilbertspaces, square integrable functions, Operators, Projection operator, Hermitian and Unitary operators, change of basis, Eigen valueand Eigenvectors of operators, Infinitesimal and Finite Unitary operators, Dirac's bra and ket notation, commutators, Simultaneous eigen vectors, Parity operators, Matrix Mehanics and Wave Mechanics, Postulates of quantum mechanics, uncertainty relation. Harmonic oscillator in matrix mechanics, Time development of states and operators, Heisenberg and Schroedinger representations, Exchange operator.

UNIT-II

Schrodinger Wave Equation: wave function, Normalization, Probability current density, Expectation values, Eigen values and eigen functions, Time evolution of expectation values, stationary states, Ehrenfest Theorem, Degeneracy and orthogonality, Operator formalism and its algebra, Hermitian operators and their properties, Linearity and Superposition Principles, Matrix representation of an operator, Momentum and energy operators, Commutator,Wave Packets, Application to spread of Gaussian Wave packet, Time dependent Schrodinger equation and dynamical evolution of a quantum state,General solution in terms of linear combinations of stationary states.

UNIT-III

Problems in One- Dimension: Discrete and continuous spectrum, Symmetric Potentials and Parity, Free Particle, Potential Step, Potential Barrier and well,1-D infinitesquare well potential, Simple harmonic oscillator: Energy levels and energy eigen functions using Frobenius method; Hermite polynomials; ground state, zero poin tenergy, 1-dFinite potential well problem, Reflection and transmission (tunneleffect)of wave packet from rectangular potential well.

UNIT-IV

Quantum theory of Hydrogen atom: Schrodinger equation for H-atom, Separation of variables, Quantum numbers, Electron probability density, Radiative transition, Selection rules, Angular momentum operators and their Commutation relations, Schrodinger equation in spherical symmetric potential, Stern-Gerlach experiment

Identical particles : Symmetric and antisymmetric wave functions, distinguishability of identical particles, the exclusion principle, the connection with statistical mechanics, collisions of identical particles, Spin angular momentum: connection between spin and statistics, Atomic levels of Helium atoms as an example of two electron system.

ReferenceBooks:

1. Quantum MechanicsbyJ .L. PowellandB. Crasemann
2. Quantum Mechanicsby D.J Griffith,Pearsonpublication
3. Quantum Mechanics by A.Ghatak&Loknathan, Mackmilan India Ltd.
4. Quantum Physics by S.Gasiorowicz ,Wiley

BSc/Phy/SM/5/DSC/303: Atomic and Molecular Spectroscopy

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Note for the Paper Setter: *The question paper will consists of nine questions in all. The first question will be compulsory and will consist of seven short questions of 2 marks covering the whole syllabus. In addition, eight more questions will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

One electron system: Quantum states of an electron in an atom, Electron Probability density, Space Quantization, Electron Spin, Stern-Gerlach experiment, Spectroscopic terms and selection rules, Spin – orbit interaction energy, Quantum mechanical relativity correction, Hydrogen fine structure, Hyperfine structure, Pauli exclusion principle, Exchange symmetry of wave function.

Unit-II

Two electron system: Atomic states arising due to two electron valence system: L-S and J-J coupling for equivalent non-equivalent electrons, Helium atom and its spectra: Ortho and para modification, Interaction with external field: Zeeman effect, Paschen-Back effect, Stark effect and their important example, Characteristics X-ray Spectra: Kossel's Explanation and Moseley Law.

Unit-III

Vibration-rotational spectra of diatomic molecules: Types of molecules, Diatomic linear symmetric-top, Asymmetric-top and Spherical-top, The diatomic molecule as rigid rotator, Harmonic oscillator, Non rigid rotator, Anharmonic oscillator and vibrating rotator (energy levelsand infrared spectra), Isotopic effect on vibrational-rotational spectra, Intensity of rotation-vibration spectra, Raman spectra of diatomic molecules.

Unit-IV

Electronic spectra: Resolution of the eigen function, Electronic and total energy: Born-Oppenheimer approximation, Classification of electronic states, Vibrational structure of electronic transitions, Rotational fine structure, P, Q, R branches of a band, The Fortrat parabola, Intensity of electronic bands, Franck-Condon principle: Absorption & emission, Isotopic effect on electronic states.

Text/Reference Books:

1. H. E. White: Introduction to Atomic Spectra (McGraw-Hill Inc. US)
2. G. Herzberg : Atomic Spectra and Structure –Vol - I & II (D.VanNostrand Company Inc. 6thed.)
3. G. Herzberg : Molecular Spectra and Structure
4. C.N. Banwell : Fundamentals of Molecular Spectroscopy(McGraw-Hill Higher ed.)
5. Raj Kumar : Atomic and Molecular Spectra: Laser(5th ed. KedarNath Ram Nath, Merrut, India)
6. K. P. R. Nair : Atom Molecules and Laser(Alpha Science International Ltd. USA)
7. Bransden and Joachain : Physics of Atom & Molecules (2nd ed. Prentice Hall)
8. Huber and Hertzberg : Molecular Spectra and Molecular Structure (Springer)
9. S. N. Ghoshal : Atomic Physics (S-Chand, 1sted.)
10. G. Aruldhas : Molecular Structure and Spectroscopy (PHI learning

BSc/Phy/SM/5/MIC/301:Analog Systems and Applications

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Note: *The question paper will consist of nine questions in all. Questionno.1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.*

UNIT-I

Ideal constant-voltage and constant-current Sources, Kirchhoff's Current Law & Kirchhoff's Voltage Law, Mesh& Node Analysis, Thevenin theorem, Norton theorem, StarDelta Transformation, Superposition theorem, Reciprocity Theorem, Maximum Power Transfer theorem, Applications to dc circuits.

UNIT-II

Concept of feedback in amplifier, Type of feedback, Small signal amplifiers, Analysis of stage amplifier by Graphical and Equivalent Circuit methods, Requirement of multistage amplifiers, Gain of multistage amplifier, Coupling of two stages, Frequency response of RC-coupled amplifiers, Distortion in amplifier, Classification of amplifiers, Power amplifier, Push-pull amplifier,

UNIT-III

Graphical Analysis of the CE Configuration, Two-port Devices and the Hybrid Model, Transistor Hybrid Model, Conversion Formulas for the Parameters of the Three Transistor Configurations, Analysis of a Transistor Amplifier Circuit Using h Parameters, The Emitter Follower, Comparison of Transistor Amplifier Configurations ,Linear Analysis of a Transistor Circuit, Cascading Transistor Amplifiers, Simplified Common- emitter Hybrid

UNIT-IV

Integrated Circuits(IC): Fabrication and Characteristics: Integrated circuit Technology, Basic monolithic IC, Epitaxial Growth, Masking and Etching, Diffusion of impurities, Transistors for Monolithic circuits, Monolithic diodes, Integrated resistors, Integrated capacitors and inductors,

Reference Books:

1. Basic Electronics and Linear Circuits, N. N. Bhargava et. al., 2nd Edition,McGraw Hill Education, India
2. A text book in ElectricalTechnology, B.L.Theraja,S.Chand&Co.
3. Circuitand Networks,2ndEdition, ASudhakarandShyammohanSPalli,TataMcGraw-Hill
4. Integrated electronics by Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education, India

BSc/Phy/SM/5/MIC/302: PHYSICS LAB-IX

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

ListofExperiments:

1. Study frequency response of R-C Coupled Amplifier
2. Study characteristics of a Push-Pull Amplifier
3. Study a LC/RCO scillator using transistors
4. Study of Analog Communication System.
5. Study of NPN transistor as Amplifier.
6. Study of PNP transistor as Amplifier.
7. Study of Tunnel Diode characteristics.
8. Study of h-parameter of a transistor.
9. To determine the frequency and amplitude of phase shift oscillator.
10. To draw the output waveform and determine the frequency of output waveform of Colpitt oscillator using DSO.
11. To determine the frequency and amplitude of Harley oscillator.
12. To study Class A, Class B Amplifier.

ReferenceBooks:

1. Basic Electronics: Atext lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller,1994, Mc-GrawHill.
2. Modern DigitalElectronics,R.P.Jain,4thEdition,2010,TataMcGrawHill.

CDLU/Phy/5/MIC/303: PHYSICS LAB-X

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Experiments:

1. To determine laser beam parameters using a He- Ne/diode laser source.
2. To study the characteristics of LED and Laser diode.
3. To study characteristics of Fiber optic photo-detectors.
4. Design and evaluation of a

(a) Laser diode linear Intensity Modulation system.
(b) Laser diode digital IM system.

5. To study various characteristics of PN junction: Reverse saturation current and material constant. To determine the temperature coefficient of junction and energy band gap.
6. Determination of applied magnetic field and resonance frequency (or g-factor) of a given sample using Electron spin resonance spectrometer.
7. To determine the value of forbidden energy gap of a diode and LED.
8. To verify inverse square law of radiation using photodiode.
9. Demonstration of spatial coherence of laser beam/ wavelength of sodium or white light using diffraction grating.
10. To study the Fraunhofer diffraction pattern

(a) of a circular aperture and to measure its diameter.
(b) anddetermine the slit width.

11. To determine the refractive index of a thin glass plate using Michelson interferometer.(Virtual Lab)
12. Verification of Malus law / polarization characteristics of laser light.
13. Find out the value of Planck's constant

(a) using LED.
(b) using Photocell.

14. With the help of Abbe refractometer,

(a) determine the polarizability of the given liquid samples at a given temperature.
(b) study the variation of refractive index with
(i) temperature of the liquid sample (ii) wavelength of the light source

15. To determine the thickness of a thin glass transparent plate using Michelson interferometer.(Virtual Lab)

Text/Reference Books:

1. S.Nagabhushana&N.Sathyanarayana :Lasers and optical instrumentation (I.K. International)
2. Ajay Ghatak : Optics (Tata Mc Graw Hill)
3. C. C. Davis : Lasers and Electro-optics (Cambridge University Press)
4. S.P.Singh : Practical Physics Vol.I& II (PragatiParkashan)
5. Gyan Prakash: Experimental Physics (Studium Press)
6. R.S. Sirohi : A Course of Experiments with He -Ne Laser (New AgeInternational)

BSC/PHY/SM/5/SEC/301

MATLAB (Practical)

Credits:03 **Marks (Total):75**
Duration of Exam: 3 Hrs.

Course Outcomes: This course will enable the students to:-
CO1: Get familiar with the importance and working of MATLAB as computation platform hrough the knowledge of characters, variables, operators, functions and expressions as used for elementary operations in matrix algebra along with the editing, load/save data and compilation/execution/quitting of source programs.
CO2: Learn the process of writing a source program in MATLAB as high-level language making use of the statements for input/output, conditional/non-sequential processing involving functions, arrays and structures.

Practical Course Syllabus:

1. Know syntax of expressions, statements, datatypes, structures, commands and to write source code for a programing MATLAB.
2. Edit, compile /interpret and execute the source program for desired results.

Computing lab work will be based on programming in MATLAB for computing various mathematical problems. There will be 12-15problems/ programmes during the course.

Recommended Books:

1. *Learning MATLAB*, COPYRIGHT1984-2005byTheMathWorks,Inc.
2. Amos Gilat, *MATLABAnIntroductionWithApplications5ed*, *Wiley*,*2008*.
3. C.F.VanLoanandK.-Y.D.Fan., *Insigh through Computing: AMatlabIntroductiontoComputationalScienceandEngineering, SIAMPublication,2009*.
4. T.A.DavisandK.Sigmon,*MATLABPrimer*7thEdition,CHAPMAN&HALL/CRC,2005.
5. B.R.Hunt, R.L.Lipsman,J.M.Rosenberg,K. R.Coombes,J.E.Osborn,andG.J.Stuck,*AGuidetoMATLAB*,SecondEdition,Cambridge University Press, 2006

BSc/Phy/SM/5/INT

INTERNSHIP

MAX. MARKS: 100 **MIN. MARKS: 40**

Each student will have to undergo an internship of credits having atleast 120 hours (1 Credit: 30 hours of engagement) with involvement/working with local Industry/Organization (Govt./Private), Business Organization, Artiest, Craft Persons and similar entities during summer vacations.

Student will have to submit a certificate in office within one month after the commencement of 5th semester, issued by the competent signatory of the Industry/Organization regarding their performance, discipline and activities during the courses of internship.

A panel of experts constituted by the Dean/Chairperson with conduct the Viva-Voce for the assessment of Internship.

SEMESTER-VI

BSc/Phy/SM/6/DSC/304: Nuclear Physics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Note for the Paper Setter: *The question paper will consist of nine questions in all. Questionno.1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.*

Unit-I

Introductory concepts and nuclear forces: Basic nuclear properties: size, shape, charge distribution, spin and parity, moments and statistics, binding energy, Fundamental forces of nature, charge independence and charge symmetry of nuclear forces, Isospin, deuteron problem: ground state of deuteron, magnetic dipole and electric quadruple moments of the deuteron.

Unit-II

Nuclear models: Weizsacher's semi-empirical mass formula, liquid drop model of the nucleous, mass parabolas: prediction of stability against β-decay for members of an isobaric family. Shell model of the nucleus: evidences that led to the shell model, assumptions of the single particle shell model, spin orbit coupling of an electron bound in an atom,

Unit-III

Nuclear decay and reactions: Disintegration energy of spontaneous α-decay, Alpha decay paradox- barrier penetration, Fermi's theory of β-decay, Selection rules for β-decay, Parity non-conservation in α β-decay, γ-ray emission- selection rules, Internal conversion, Types of nuclear reactions, Balance of mass and energy in nuclear reactions, Q-value equation and its solution.

Unit-IV

High energy physics: Classification of elementary particles, Conservation laws & symmetries: conservation of baryon and lepton numbers, concept of isospin, isospin multiplets, isospin & strangeness conservation and violation in different types of interactions, Gell–Mann–Nishijima formula, Baryons octet ($1/2^+$) and decuplet ($3/2^+$), Quark structure of hadrons and quark flavours, Introductory concept of colour quantum number and gluons, Charge conjugation (C) and parity (P) operators, C & P non-conserving property of neutrino, CPT theorem.

ReferenceBooks:

1. PhysicsofAtomicNuclei, VladimirZelevinsky, Wiley-VCH,2017
2. TheAtomicNucleus, J.M. Reid, PenguinBooks,1972
3. KennethS.Krane,IntroductoryNuclearPhysics,Wiley,NewYork,1988
4. R.R.RoyandB.P.Nigam,NuclearPhysics,Wiley-EasternLtd.,1983
5. NuclearPhysics,S.B.Patel,NewAgepublication
6. BasicIdeasandConceptsinNuclearPhysics:K.Heyde,(OverseasPressIndia)(2005).
7. NuclearPhysics:ExperimentalandTheoretical:H.S.Hans,(NewAcademicScienceLtd.,SecondRevisededition)(2010).

BSc/Phy/SM/6/DSC/305: Classical Mechanics

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Course Objective: The objective of the course is top rovide a basic knowledge of Kepler's laws of planetary motion, Hamiltonian dynamics and theory of small oscillations so that they can apply thes e methods to solve real world problems. The multi- disciplinary topic'Chaos' will enable the students to learn the techniques to handle the problems from the field of non-linear dynamics.

Course Outcomes: After completion of this course, students will be able to understand the basics of Two Body problem, Hamiltonian Dynamics, Poisson Brackets relations and small oscillations. In addition o this student will be familiar with the basic of non-linear dynamics.

Note for the Paper Setter: *The question paper will consist of nine questions in all. Questionno.1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.*

UNIT–I

Two-body central force problem and Hamiltonian Dynamics: Virial theorem, Differential equation for the orbit, stability of orbit under central force, conditions for closed orbits, The Kepler's laws of planetary motion and their deduction, Scattering in a central force field, Legendre transformations and the Hamilton equations of motion, Routh's procedure, The physical significance of the Hamiltonian,DerivationofHamilton'sequationsfromavariationalprinciple,TheprincipleofLeastAction.

UNIT–II

Poisson and Lagrangian bracket: The equations of canonical transformation, Examples of canonical transformations, The integral invariants of Poincare, Poisson brackets, Special cases of Poisson brackets, Poisson theorem, Poisson bracket relations, Jacobi's identity and its derivation, Lagrange brackets and its properties, Relationship between Poisson and Lagrange brackets and its derivation, Infinitesimal contact transformation, Angular momenta and Poisson bracket Relations, Liouville's Theorem.

UNIT–III

H-J Theory and theory of small oscillations: Hamilton-Jacobi equationfor Hamilton's principal function, Harmonic Oscillator problem, action and angle variables, problem of harmonic oscillato r using action angle variable, Theory of small oscillations: Formulation of the problem, Eigen value equation and the principle axis transformation, frequencies of free vibrations and normal coordinates, free vibrations of a line artri atomic molecule.

UNIT–IV

Introductory non-linear dynamics: Classical Chaos: Linear and nonlinear systems, periodic motion, Perturbation and Kolmogorov-Arnod-moser theorem, dynamics in phase space; Phase Trajectories-Singular Points, Phase Trajectories of Linear Systems, Phase Trajectories of NonlinearSystems,Attractors,ChaoticTrajectoriesandLiapunovexponents,PoincareMaps,Bifurcation.

Reference Books:

1. ClassicalMechanics,3rded.,2002byH.Goldstein,C.PooleandJ.Safko,PearsonEdition
2. Classical Mechanics of particles by Classical Mechanics by John R. Taylor2005, University Science Books.
3. Chaos and Integrabilityinnonlineardynamics:Anintroduction(1989)byMichaelTabor
4. Nonlineardynamics:Integrability,Chaosandpatterns(2003)byM.LakshmananandS.Rajasekar

BSc/Phy/SM/6/DSC/306: Introduction to Materials

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Course Objective: The aim of the course is to familiarize the students with the basic ideas about preparation properties and applications of nano materials, ceramic materials, polymers and composite materials.
Course Outcomes: After completion of this course, students will be able to understand the various types of materials and their applications in different fields.

Note: The question paper will consist of nine questions in all. Questionno.1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT-I

Nanomaterials: Introduction, Bottom up and Top Down approach, Classification of nanostructures: Zero dimension, one dimension and two dimensional nanostructures, Smart materials. Nano structure fabrication by Physical Methods: Physical Vapor deposition: evaporation, sputtering, Lithography: Photolithography, Electron Beam Lithography.

UNIT-II

Ceramic materials: Introduction, Fabrication and processing of ceramics, types and general properties of ceramic materials, glass-forming constituents, glass ceramics, Processing of glass ceramics and its advantages, perovskite structure of mixed oxides, lime, cement, cement concrete, reinforced cement concrete(RCC),chemically bonded ceramics.

UNIT-III

Polymers: Introduction, Polymer types and Polymersynthesis & processing, General Properties and Applications of Thermosetting Plastics; Elastomers-types and applications, conducting polymers and their applications.

UNIT-IV

Composite Materials: Introduction and Classification of Composites, Isotropic, Anisotropic, and Orthotropic Materials, Laminates, Advantages and Disadvantages of Composite Materials, Applications of composite materials

Reference Books:

1. Introduction to Nanotechnology–Charles P.PooleJr.andFrankJ.Owens,WileyIndiaPvt.Ltd.,2007.
2. Nanomaterials–GuozhongCao,ImperialCollegePress,2004.
3. W.D.Kingery, IntroductiontoCeramics,SecondEdition,Wiley&Sons,NewYork,1999.
4. V.R.Gowariker,N.V.Viswanathan,andJayadevSreedhar,PolymerScience,NewAgeInternational(P) Limitedpublishers,Bangalore,2001
5. C. A. Harper, Handbook of Plastics Elastomers and Composites, Third Edition, McGraw Hill

Professional Book Group, NewYork,1996.
6. FundamentalsofPolymersbyAnilKumarandRakeshKGupta,McGraw-Hill,1997
7. Miller,Tara, 1998, Introduction to Composites,4th Edition, Composites Institute, Society of the Plastics Industry, New York, NY.
8. KKChawla.FibrousMaterials.CambridgeUniversityPress,1998.
9. Composite Materials An Introduction R.P.L.Nijssen

BSc/Phy/SM/6/MIC/304: Digital Systems and Applications

Credits: 4 **Max. Marks: 100**
Lectures: 60 **Final Term Exam.: 70**
Duration of Exam.: 3 Hrs. **Internal Assessment: 30**

Course Objective: The aim of the course is to familiarize the students with the basic ideas about digital systems and applications.
Course Outcomes: After completion of this course, students will be able to understand the various types of digital systems and their use for practical applications in different fields.

Note: The question paper will consist of nine questions in all. Questionno.1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

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UNIT-I

Integrated Circuits(Qualitative treatment only): Active & Passive components. Discrete components. WaferChip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital lCs.

UNIT–II

Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. AND, OR and NOT Logic Gates (realization using Diodes and Transistor), and logic gates application as Parity Checkers. **Boolean algebra:** Fundamental Products. Idea of Min terms and Max terms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and(2)Karnaugh Map. **Data processing circuits**: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders.

UNIT-III

Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. HalfandFullAdders.Half&FullSubtractors,4-bitbinaryAdder/Subtractor. **Sequential Circuits:** SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered)Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S Flip-Flop. **Timers**: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator.

UNIT-IV

Shift registers: Serial-in-Serial-out,Serial-in-Parallel-out,Parallel-in-Serial-outandParallel-in-Parallel-outShiftRegisters(onlyupto4bits). **Counters (4 bits):** Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter. **Shiftregisters:**Serial-in-Serial-out,Serial-in-Parallel-out,Parallel-in-Serial-outandParallel-in-Parallel-outShift Registers(onlyupto4bits).
Counters (4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Reference Books:

1. DigitalPrinciplesandApplications,A.P.Malvino,D.P.LeachandSaha,7th Ed.,2011,TataMcGraw
2. FundamentalsofDigitalCircuits,AnandKumar,2nd Edn,2009,PHILearningPvt.Ltd.
3. DigitalCircuitsandsystems,Venugopal,2011,TataMcGrawHill.
4. DigitalSystems:Principles&Applications,R.J.Tocci,N.S.Widmer,2001,PHILearning
5. Logiccircuitdesign,Shimon P.Vingron,2012, Springer.
6. DigitalElectronics,SubrataGhoshal,2012,CengageLearning.
7. MicroprocessorArchitectureProgramming&applicationswith8085,2002,R.S.Goankar,PrenticeHall.

BSc/Phy/SM/6/MIC/305: Physics Lab-XII

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

List of Experiments:

1. Introduction to Digital Electronics lab- nomenclature of digital ICS, specifications, study of the data sheet, concept of V_{cc} and ground, verification of the truth tables of logic gates using TTL ICS.
2. Implementation of the given Boolean function using logic gates in both sop and pos forms.
3. Verification of state tables of RS, JK, T and D flip-flops using 3 NAND & nor gates.
4. Implementation and verification of decoder/de-multiplexer and 4 encoder using logic gates.
5. 5 Implementation of 4x1 multiplexer using logic gates.
6. Implementation of 4-bit parallel adder using 7483 IC.
7. Design and verify the 4-bit synchronous counter.
8. Design and verify the 4-bit asynchronous counter.
9. To design and verify operation of half adder and full adder.
10. To design and verify operation of half subtractor.
11. To design & verify the operation of magnitude comparator. 32-33 12 To study and verify NAND as a universal gate.

References:

1. Brian Holdsworth, Clive Woods, "Digital Logic Design", Elsevier India Pvt. Ltd., 2005.
2. Samir Palnitkar, "Verilog HDL, A Guide to Digital Design and Synthesis", Prentice Hall of India Pvt. Ltd., 2005.Modern Digital Electronics by R.P.Jain

BSc/Phy/SM/6/MIC/306: Physics Lab-XIII

Credits: 2 (Practical) **Max. Marks: 50**
Teaching per week: 4 Hrs. **Duration of Exam: 3 Hrs.**

Note: Each student should perform at-least seven experiments. The students are required to calculate the error involved in a particular experiment. Each student should follow up precautions.

List of Experiments:

1. To determine the Hall coefficient of a semiconductor sample.
2. TO Find Resistivity by Four Probe Method
3. Determine the relaxation time (EPR) for a given sample and find the value of 'g'.
4. Determine the wavelength of the microwave output of a given reflex klystron oscillator and also to determine its repeller mode pattern.
5. Calibrate a cooper resistance thermometer and use it to measure temperature from 77 K to room temperature.
6. Calibrate a silicon resistance thermometer and use it to measure temperature from 77 K to room temperature.
7. Determine the specific heat of a given sample at room and liquid nitrogen temperature. 13. Determine the Curie temperature of a given ferroelectric material.
8. Programming and interfacing with a given microprocessor.
9. Measurement of the critical temperature of a HTc-sample.

ReferenceBooks

1. Optical Properties of Photonic Crystals, K. Sakoda (Springer, 2001)
2. The Rietveld method, R.A.Young (IUCR-Oxford University Press, 1995)
3. Fundamentals of Crystallography, C.Giacovazzo (IUCR-Oxford University Press, 2002)
4. Characterization of nanophase materials, Zhon Ling Wang (Wiley-VCH Verlag GmbH, 2000)
5. Physical Properties of Semiconductors, C. M. Wolfe, J.R.N.Holonyak and G.E.Stillman (Prentice Hall International Inc., London, 1989).
6. Handbook on Semiconductors, Vol. 1-4., T.S. Moss, Ed., by S.P.Keller (NorthHolland, Amsterdam, 1980)

BSC/PHY/SM/6/SEC/302

SOFT SKILLS AT WORKPLACE

Credits: 3 (Theory) **Max. Marks: 75**
Lectures: 45 **Final Term Exam: 50**
Duration of Exam: 3 Hrs. **Internal Assessment: 25**

Course Objective:

- Acquaint students with soft skills used at workplace.
- Familiarise students with the skill sets needed and code of conduct needed at the professional setup.

Learning outcomes:

- Understanding different skills and competencies required in professional world.
- Realize the potential one can hold by learning these skills to become an efficient human resource.

UNIT 1

COMMUNICATION SKILLS: Understanding Human Communication, Constitutive Processes of Communication, Language as a tool of communication, Barriers to Effective communication, Strategies to Overcome the Barriers.

EMOTIONAL INTELLIGENCE: Importance, concept, theory and measurements.

UNIT 2

INTERVIEW SKILLS: Interview Skills: in-depth perspectives, Interviewer and Interviewee, Before, During and After the Interview, Tips for Success.

MEETING ETIQUETTE: Managing a Meeting-Meeting agenda, Minute taking, Duties of the chairperson and secretary; Effective Meeting Strategies - Preparing for the meeting, conducting the meeting, Evaluating the meeting.

UNIT 3

STRESS MANAGEMENT: Strategies for preventing and relieving stress.

TIME MANAGEMENT: Meaning; Techniques and styles.

PRESENTATION ETIQUETTES: Importance of Preparation and Practice; Effective Delivery Techniques, Audience Analysis, Handling Stage Fright

ESSENTIALREADINGS:

- Soft Skills for Career Development. 1." Personality Development and Soft Skills (Old Edition)" by Barun K Mitra. ...
- Soft Skills for Employability. 1." Soft Skills" by Hariharan S and S P Shanmugapriya.

SUGGESTED READINGS:

- Silber H, Kenneth and Foshay RW. (2009). Handbook of Improving Performance in the Workplace,
- Instructional Design and Training Delivery, John Wiley & Sons, New York, 63. [2] Anju A. (2009).
- A Holistic Approach to Soft Skills Training. IUP Journal of Soft Skills, 3(1), 7-11. [3] Dennis R Laker and Jimmy LP. (2011).
- The differences between hard and soft skills and their relative impact on training transfer. Human Resource Development Quarterly, 22(1), 111–122.
- Jane A and Helen H. (2008). Graduate Employability, 'Soft Skills' Versus 'Hard Skills' Business Knowledge: A European Study, Journal of Higher Education in Europe, 33(4), 412- 422. [5]
- Jungsun K, Mehmet E, Jung Woo B and Hwayoung J. (2011). Training soft skills via e-learning, International Journal of Contemporary Hospitality Management, 23(6), 739-763.

CDLU/VAC/101

Communication Skills

Credits: 2 (Theory) **Max. Marks: 50**

Lectures: 30 Final Term Exam: 35

Duration of Exam: 2 Hrs. **Internal Assessment: 15**

COURSE OBJECTIVES

• Identify common communication problems that may be holding learners back

• Perceive what the non-verbal messages are communicating to others

• Understand the role of communication in the teaching-learning process

LEARNING OUTCOMES

• Get a clear understanding of good communication skills.

• Know what they can do to improve their communication skills.

Unit-1

Listening: Techniques of Effective Listening, Listening and Comprehension, Probing Questions Barriers to Listening.
Speaking: Pronunciation, Enunciation, Vocabulary, Fluency, Common Errors.
Reading: Techniques of Effective Reading, Gathering Ideas and Information from a Given Text, evaluating these Ideas and Information, Interpreting the Text.
Writing and Different Modes of Writing: The Writing Process, Effective Writing Strategies, Different Modes of Writing.
Digital Literacy and Social Media: Basic Computer Skills, Introduction to Microsoft (MS) Office Suite, Open Educational Resources, Basic Virtual Platforms, Trending Technologies, Machine Learning, Artificial Intelligence (AI), Internet of Things (IoT), Social Media, Introduction to Social Media Websites, Advantages of Social Media, Ethics and Etiquettes of Social Media, How to Use Google Search Better?, Effective Ways of Using Social Media, Digital Marketing, Introduction to Digital Marketing, Traditional Marketing versus Digital Marketing, Digital Marketing Tools, Social Media for Digital Marketing, Digital Marketing Analytics.

Unit-2

Digital Ethics and Cyber Security: Digital Ethics, Digital Literacy Skills, Digital Etiquette, Digital Life Skills, Cyber Security, Understanding and introducing the environment of security, Types of attacks and attackers, the art of protecting secrets.

Nonverbal Communication: Meaning of nonverbal communication, Advantages of using nonverbal communication, Introduction to modes of nonverbal communication, Open and Closed body language, Eye contact and Facial expression, Hand gestures, Do's and Don'ts in NVC, Learning from experts, Activities-based learning.

Suggested Readings: Follow Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0 at UGC website:
https://www.cdlu.ac.in/assets/admin/miscellaneous/Implementation%20of%20Curriculum%20and%20Guidelines%20on%20Life%20Skills%20(Jeevan%20Kaushal)%202.0.pdf

Note for the Paper Setter: *The question paper will consist of* ***five*** *questions in all. The first question will be compulsory and will consist of* ***seven*** *short questions of* ***1*** *marks each covering the whole syllabus. In addition,* ***four*** *more questions of* ***14 marks each*** *will be set unit-wise comprising of* ***two*** *questions from each of the* ***two*** *units. The candidates are required to attempt* ***one compulsory question*** *and* ***two more questions*** *selecting at least one question from each unit.*

CDLU/VAC/105

Vedic Mathematics

Marks (Theory): 35 **Marks(Total): 50**
Marks (Internal Assessment):15 **Time:2Hrs**
Credits:02

Note for the Paper Setter: *The question paper will consist of* ***five*** *questions in all. The first question will be compulsory and will consist of* ***seven*** *short questions of* ***1*** *marks each covering the whole syllabus. In addition,* ***four*** *more questions of* ***14 marks each*** *will be set unit-wise comprising of* ***two*** *questions from each of the* ***two*** *units. The candidates are required to attempt* ***one compulsory question*** *and* ***two more questions*** *selecting at least one question from each unit.*

Course Outcomes(COs): At the end of the course, the students will be able

CO1: Discuss the rich heritage of mathematical temper of Ancient India Learning Outcomes: Overcome the fear of maths, Improved critical thinking

CO2: Familiarity with the mathematical under pinnings and techniques, Ability to do basic maths faster and with ease.

UNIT-I

Vedic Maths- High Speed Addition and Subtraction Sessions/Lectures, Vedic Maths: History of Vedic Maths and its Features, Vedic Maths formulae: Sutras and Upsutras, Addition in Vedic Maths: Without carrying, Dot Method, Subtraction in Vedic Maths:Nikhilam Navatashcaramam Dashatah, Fraction– Addition and Subtraction.

UNIT-II

VedicMath-Miracle Multiplication and Excellent Division, Multiplication in Vedic Maths: Base Method (any two numbers upto three digits), Multiplication by Urdhva Tiryak Sutra, Miracle multiplication: Any three-digit number by series of 1's and 9's,Division by Urdhva Tiryak Sutra(Vinculummethod).

Bookssuggested:

1. TheEssentialofVedicMathematics,RajeshKumarThakur,RupaPublications,NewDelhi2019.
2. VedicMathematicsMadeEasy,DahavalBathia,JaicoPublishing,NewDelhi2011
3. VedicMathematics:SixteenSimpleMathematicalformulaefromtheVedas,JagadguruSwamiSriBharatiKrishnaTrithaji,MotilalBanarasidas,NewDelhi2015.
4. Learn Vedic Speed Mathematics Systematically, Chaitnaya A. Patil 2018.17 Suggested Readings
5. A Modern Introduction to Ancient Indian Mathematics,TSBhanumurthy,Wiley Eastern Limited, New Delhi.