RANI DURGAWATI UNIVERSITY

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Department of PG Studies & Research in Physics & Electronics

Syllabus of All Programme

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RANI DURGAVATI VISHWAVIDYALAYA, JABALPUR
SYLLABUS PRESCRIBED FOR THE EXAMINATION FOR THE
DEGREE OF MASTER OF SCIENCE IN PHYSICS
FIRST AND SECOND SEMESTERS (with effect from 2020-2021)
UNDER CHOICE BASED CREDIT SYSTEM
(In Accordance with University Ordinance No – 222) AND LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

SYLLABUS

M.Sc. FIRST SEMESTER PHYSICS

Theory Courses		Marking Scheme			
Paper Code	Title of Paper	Credits	End Semester Exam.	CCE	Total
PY C- 101	Core Paper Mathematical Physics	5	60	40	100
PY C- 102	Core Paper Classical Mechanics	5	60	40	100
PY C- 103	Core Paper Electronic Devices	5	60	40	100
PY E - 101 PY E - 102	Elective Paper (any one) A - Computational Methods and Programming B - Physics of Electronic devices & Fabrication of IC & Systems	5	60	40	100

	Practical Course	Credits	End Semester Exam.	CCE: Pract Record. & Viva	CCE: Seminar related to Pract	Total	Total
PY L- 104	Lab A	3	60	20	20	40	100
PY L- 105	Lab B	3	60	20	20	40	100
PY S - 101	Skill Development	2					
	Total	28	360	240		600	

CORE PAPER – I

PY C – 101 MATHEMATICAL METHODS

60+40=100 MARKS **5 CREDITS**

Course Objectives: The objectives of the course are

1.	To develop an understanding of Tensors.
2.	To teach the use of different special functions/polynomials in solving physical problems.
3.	To provide an understanding of different Integral Transforms.
4.	Able to solve problems related to complex variables which contain real and imaginary parts.

5.	To give the basic knowledge of Group theory.

Course Outcomes: The purpose of the course is to introduce the methods of mathematical physics and after completion of the course students should be able to

1.	Learn about the concept and uses of Tensors and Tensor algebra (Null tensor, addition, subtraction, inner product, outer product).
2.	Familiarized with different special functions like Associated Legendre Polynomials, Laguerre's Polynomials, etc. and their solutions in solving different physical problems.
3.	To obtain knowledge of Fourier and Laplace Transforms in solving different problems of Mechanics and Electronics etc.
4.	Know about Green Function and its application in solving non homogeneous differential equations.
5.	Solve different physical problems which contain complex variables and implementation of complex variable for calculation of integrals, and also able to expand functions in Taylor's and Laurent's series. Knowledge of theorems of residues and contour integration.
6.	Obtain the basic knowledge of Group theory and its applications. This theory is also used to describe the crystal symmetry and electronic structure of crystals.

UNIT- I

Tensor Analysis

Elements of Cartesian tensors in three dimensions, Definition of transformation laws of scalars, vectors, tensors of second, third and fourth rank, covariant, contravariant and mixed tensors, Isotropic tensor δ^i_j , Levi-Civita symbol $\in_{ijk}$, Tensor algebra (Null tensor, addition, subtraction, inner product, outer product).

Green's Function

Elements of Green's function, Green's function for the Sturm-Liouville operator, Series expansions for G(x/ξ), Green's functions in two dimensions, Green's functions for initial conditions, Green's functions for boundary conditions, the Green's function method, A case of continuous spectrum.

UNIT II

Differential Equation

Recursion relation, generating function and orthogonality of Bessel and Legendre functions. Elementary ideas of Associated Legendre, Hermite and Laguerre's polynomials.

Integral Transforms

Fourier and Laplace transforms. Inverse Fourier and Laplace Transforms. Fourier and Laplace transforms of derivatives. Convolution theorem. Application to simple problems.

UNIT - III

Complex Variables

Analyticity of complex functions; Cauchy- Riemann equations; Cauchy's Theorem; Integral Formula; Taylor's and Laurent's series; Theorem of residues; Jordan's Lemma, simple cases of contour integration.

UNIT - IV

Group Theory

Introduction to Groups, Reducible and irreducible representation of groups, Concept of reducibility in terms of invariant subgroups, Schur's Lemma, orthogonality relations for irreducible representation, the characters of representations, reduction of a reducible representation, multiplication of conjugate classes. The number of irreducible representations of a finite group.

Crystal symmetry operators, Translation groups, Crystal systems and point groups: applications of group theory in the electronic structure of crystals, in the translation group and in reciprocal lattice. A brief introduction to continuous groups and their representations:O(2), O(3), SU (2), SU (3); generators of U(N) and SU(N).

UNIT - V

This unit will consist of short questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:-

(1) Geometrical representation of a second rank Cartesian tensor, principal axes system, application to electrical conductivity, quotient Rule.
(2) Green's function for a linear oscillator, Green's function and the Dirac δ-function, finding Green's function for Linear operators in 1-D.
(3) Potential due to discrete or continuous charge distribution; vibration of a circular membrane, solving the 1-D harmonic oscillator Schrodinger equation; Relation of the hydrogen atom, Schrodinger equation with Laguerre equation and solution.
(4) Solution of initial value problems by using Laplace transform; LT and inverse LT of various functions,
(5) Solution of limit dept problems by Fourier transform; FT of Gaussian function, Application of FT of Dirac delta function.
(6) Verification of analyticity of simple function, Evaluation of some definite integral using residues etc.
(7) Evaluation of integrals in complex variables
(8) Construction of the character table for the group D_3

In addition to above tutorial will also consist of solving problems given in the Text Reference books.

Text and Reference Books

- Mathematical Methods for Physicists : G. Arfken
- Matrices and Tensors for Physicists : A.W. Joshi
- Advanced Engineering Mathematical : E. Kreyszig
- Special functions : E.D. Rainville
- Special functions : W.W. Bell
- Mathematical Methods for Physicists Engineers : K.F. Reily, M.P.Hob Son and and S.J. Bence
- Mathematics for Physicist : Mary L Boas

CORE PAPER –II

PY C – 102 CLASSICAL MECHANICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The course enables the students

1.	To define the concepts of Newtonian mechanics, Langrangian Equations
2.	To interpret the concepts of Hamiltonian Mechanics.
3.	To explain generating function, canonical transformation & Poisson brackets.
4.	To illustrate the dynamics of a rigid body and non-inertial frames of reference.
5.	To formulate the concepts of coupled oscillators.

Course Outcomes: To apprise the students of advanced classical formulations and completion of the course students will have understanding of

1.	Newtonian mechanics, Virtual work, DÁlembert's principle, Formulation of Lagrangian mechanics and problem solving with the help of it. Compare the formulation of Hamiltonian and Lagrangian mechanics and solve the problems of classical and relativistic mechanics
2.	Generating function, canonical transformation & Poisson brackets.
3.	Kepler problem, Legendre Transformations, Hamilton's equation, Canonical transformations and generating functions. Properties of Poisson's bracket.
4.	Understanding small oscillations, Solve the equations of coupled oscillator and to examine the two coupled pendulums, and double pendulum related problems. Understanding rotating coordinate system, Coriolis force and Eulerian coordinate system
5.	Understand space and time symmetries, covariant and four-dimensional formulation, covariant Lagrangian and Hamiltonian with examples.

UNIT - I

Newtonian mechanics of one and many particles systems; Conservation theorems for linear momentum, angular momentum and energy; Constraints; their classification; Principle of virtual work; D'Alembert's principle in generalized coordinates; The Lagrangian, Lagrange's equations; velocity dependent potential and dissipative function. Configuration space, Hamilton's principle; generalized momenta and Lagrangian formulation of the conservation theorems and Jacobi's integral. Reduction to the equivalent one body problem; the equation of motion and first integrals; the differential equation for the orbit and integration power-law potentials.

UNIT - II

The Kepler problem: inverse square law of force; Artificial satellites; Scattering in a central force field, Rutherford scattering; Legendre transformations and the Hamilton's equations of motion; Conservation theorems and the physical significance of the Hamiltonian. Derivation of Hamilton's equations from a variational principle. The principle of least action.

The equations of canonical transformations and generating functions; Poisson's Brackets: their canonical invariance; Simple algebraic properties of Poisson Brackets. The equations of motion in Poisson's Brackets notation; Poisson's theorem; Angular momentum PB's Hamilton's principal and characteristic functions; The Hamilton-Jacobi equation; Action Angle variables.

UNIT - III

Theory of small oscillations Equations of motion, Eigen frequencies and general motion. Normal modes and coordinates. Applications to coupled pendulum and linear triatomic molecule.

Rotating co-ordinate systems, Acceleration in rotating frames. Coriolis force and its terrestrial and astronomical applications. Elementary treatment of Eulerian co-ordinates and transformation matrices. Angular momentum inertia tensor. Euler equations of motion for a rigid body. Torque free motion for a rigid body. Symmetrical top and gyroscopic forces.

UNIT – IV

Symmetries of space and time. Invariance under Galilean transformation, Covariant four- dimensional formulation. 4-Vectors and 4-Scalars. Relativistic generalization of Newton's laws, 4-momenturn and 4-force. Invariance under Lorentz transformation relativistic energy. Lagrangian and Gange invariance Hamiltonian formulation in relativistic mechanics. Covariant Lagrangian, covariant Hamiltonian, Examples.

UNIT-V

This unit will consist of questions based on tutorial problems covering all the four units. The student will have to answer any two questions out of four. Some sample problems are-

(1) Simple pendulum with rigid support. Two connected masses with string passing over a pulley, virtual work.
(2) Various Poisson's brackets thin relation with PBs in quantum mechanics stability of orbits under central force' orbital elements of planetary orbits.
(3) Rotating frames, Foucault's pendulum, small oscillations in Linear triatomic molecule and coupled pendulum.
(4) Relativistic Kinetic energy, mass variation, 4-momentum and 4-force.

In addition to above the tutorial will also consists of solving problems given in the Texts and references books.

Text and References Books

- Classical Mechanics : N. C. Rana and P.S. Jog (Tata Mc Graw Hill, 1991)
- Classical Mechanics : H. Goldstein (Addision Wesley, 1980)
- Mechanics : A Sommerfiels (Academi Press 1952)
- Introduction to Dynamics : I. Perceival and Richards(Cambridge Univ. Press, 1982

CORE PAPER –III
PY C 103 ELECTRONIC DEVICES

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The aim and objective of the course on Electronics Devices is to introduce students to principal, construction and circuitry of various semiconductor devices and circuits for use in electronic instrumentation

1.	To introduce the formal structure of the subject and to equip them with the knowledge of various semiconductor field effect ransistors and Microwave devices.
2.	To describe Photonic devices
3.	Introduction to digital logic families and their characteristics
4.	To impart knowledge about various memory devices, systems, elements and materials used in developing them.
5.	An understanding on integrated circuit operational amplifiers and their applications.

Course Outcomes: At the end of the course, the student will be able to

1.	Understand working of Different Semiconductor devices like JFET, BJT, MOSFET & MESFET (Construction, Working Principles and V-I characteristics) and their applications.
2.	Understand photonic devices like LDR, LED and Diode Lasers along with their applications.
3.	Develop a comprehensive understanding of contemporary integrated circuits both saturated and unsaturated logic families like RTL, DTL, TTL TTC, ECL etc. Operational amplifier design and applications like adder, subtractor, differentiator function generator etc.
4.	Develop an insight into the physics and technology that go into the development of various memory devices using semiconductors and other electronic devices using elctro-acousto-magneto-optic effects. LCD. Piezoelectric effect based devices.
5.	Enjoy the new and stimulating ideas behind the future novel devices and also appreciate the link between electronics and the quantum effects that come into play.

UNIT-I

Transistors

JFET, BJT, MOSFET and MESFET, Construction, Structure, working Derivations of the equations for I-V characteristics under different conditions. High frequency limits.

Microwave Devices; Tunnel diode, transfer electron devices (Gunn diode), Avalanche transit time devices, Impatt diodes and parametric devices.

UNIT-II

PhotonicDevices

Radiative and non-radiative transitions. Optical absorption, Bulk and their film photoconductive devices (LDR), diode photodetectors, solar cell (open circuit voltage and short circuit current, fill factor). LED (high frequency limit, effect of surface and indirect recombination current, operation of LED).

Diode lasers (condition for population inversion, in active region, Light confinement factor. Optical gain and threshold current for lasing. Fabry-Perrot cavity length for lasing and the separation.

UNIT - III

Digital Integrated Circuits

Characteristics of logic families, saturated logic families. RTL, DCTL, DTL,TTL, IIL, HTL Non saturated bipolar logic families, TTC, ECL, Unipolar logic families, Digital integrated circuits-SSI, MSI, LSI and VLSI circuits.

Operational Amplifiers

DC Amplifier, Difference amplifier, operational amplifier, OP-AMP Parameters, Inverting and Non-Inverting modes, Use of OPAMP as adder, substractor, inverter, differentiator, integrator, function generator.

UNIT - IV

Memory Devices: Static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, non- volatile memory, magnetic, optical and ferroelectrics memories, charge coupled devices (CCD).

Introduction to other electronic devices: Electro optic, magneto optic and Acousto-optic effects; Examples of some active devices in integrated optics based on theseeffects. Liquid crystal display devices.

Piezoelectric effect, important materials exhibiting this property, piezoelectric filters and resonators, high frequency piezoelectric devices – surface acoustic devices. Capacitor, Electrets and piezo electric electro mechanical transducer devices.

UNIT – V

This unit will consist of questions based on tutorial problems covering all the four units. The student will have to answer any two questions out of four.

1. Design of MOSFET amplification in different configurations.
2. Microwave oscillators: Klystron and Magnetron.
3. Deviation of the condition of lasing action in a two level system, optical pumping
4. Derivation of rate equation for three – Laval Devices system.
5. Design of gates using DL, DTL etc. logics OPAMP
6. Derivation of expressions for OPAMP adder, substrates differentiator, integrator current voltage.
7. Derivation of expansions negated to pier clement effect.

The problems given in this Text and preference books will form tutorial course.

Text and reference books

- Semi-Conductor Devices – Physics and Technology : SM Sze (Wiley, 1985)
- Introduction to Semiconductor devices : M.S. Tyagi (John Wiley and Sons)
- Measurement, Instrumentation and Experimental Design in Physics and Eugineeruin : M. Sayer and A. Mansingh
- Optical Electronics: Ajoy Ghatak and K. Thygarajan (Cambridge Univ. Press.)
- Digital Principles and Applications: Albert Paul Malvino and Donald P.Leach (TATA McGRAW-HILL)
- Modern Digital Electronics: R,P,Jain (TATA McGRAW-HILL)

ELECTIVE PAPER IV (ANY ONE OF THE FOLLOWING)
PY E – 101
IV (A) COMPUTATIONAL METHODS AND PROGRAMMING

60+40= 100 Marks **5 CREDITS**

Course Objectives: To impart the basic knowledge of computational Physics with the numerical methods used in computation and programming using BASIC language.

1.	Teach the basics of computers and BASIC programming.
2.	Train them to solve systems of linear and non-linear equations.
3.	Teach them the concept of interpolation.
4.	Instruct them to calculate integrals and differentials using different numerical methods.
5.	Computational methods for solving differential equations.

Course Outcomes: At the end of the course, the student will be able to

1.	Understand the basics of computer and BASIC programming. Estimate errors while solving equations and effectively use methods like matrix inversion, Gauss elimination and LU decomposition to solve linear equations.
2.	Understand the methods of linear and non-linear algebraic equations, simultaneous linear equations
3.	Enrich a given set of data points using interpolation methods, Newton's divided difference, etc.
4.	Numerically differentiate and integrate expressions and solve equations from physics.
5.	Enriched with various computational methods like Euler, Newton-Raphson and Runge-Kutta etc.

	to solve problems. Idea of random variables and Monte Carlo evaluation.

UNIT - I

Programming: Elementary information about digital computer principles, compilers, interpreters and operating system. BASIC programming, Flow charts, integer and floating point arithmetic expressions, built in functions, executable and non-executable statements, assignments, control and input-output elements, subroutines and functions, operations with files, Graphics, statements.

UNIT-II

Methods for determination of zeros of linear and nonlinear algebraic equation and transcendental equations, convergence of solutions. Solutions of simultaneous linear equation, Gaussianelimination, pivoting, iterative method, matrix inversion.

UNIT-III

Eigen values and Eigen vectors of matrices, power and Jocobi method, finite differences, and interpolation with equally spaced and unevenly spaced points. Curve fitting, polynomial least squares and cubic spline fitting.

Numerical differentiation and integration, Newton-Cotes formulae, Error estimates, Gauss method.

UNIT - IV

Random variables, Monte Carlo evaluation of integrals, Methods of importance sampling, Random walk and metropolis method, Numerical solution of ordinary differential equation, Euler and Runge- Kutta Methods, Predictor and corrector method, Elementary ideas of solution of partial differential equation.

UNIT-V

This unit will have four questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four some sample problems are-

(1) Explain the use of sequential formatted data files. What are Random data files?

(2) How is a sequential data file created in Basic?

(3) Write a program to obtain the roots of a quadratic equation with the provision that if the roots are complex, the execution should stop.

(4) Invert and diagonalizable 3×3 and 4×4 symmetric matrices for example.

$$2 \begin{pmatrix} 0.5 & 0.1 & \\ 0.5 & 3 & 0.1 \\ 0.1 & 0.1 & 4 \end{pmatrix} \quad 3 \begin{pmatrix} 1 & 1 & 0.5 & \\ 1 & 4 & 1 & 1 \\ 1 & 1 & 5 & 1 \\ 0.5 & 1 & 1 & 6 \end{pmatrix}$$

(5) Find equations for the coefficients ‘a’ and ‘b’ of the curve $y=ae^{bx}$ by the least squares method.

(6) Use the Lagrange from to find the quadratic interpolation polynomial to the function f(x) having values.

X	:	1	2	3
F(x)	:	2	3	7

(7) Find out C_0, C_1, X_0 and X_1 such that the Gaussion quadrature rule

$$f(x)dx = c_0f(x_0) + c_1f(x_1)$$

is exact for polynomials of degree upto three. Hence evaluate the integral of exp(x) over x from x = 0 to x = 2.

(8) What are the methods to solve partial differential equations? Write down the difference analogue of the Laplace equations.

$$U_{xx}+U_{yy}=0$$

(9) Write a program to solve the Laplace equations using Lattice method.

(10) Give In addition to above, the tutorial will also consist of Solving problems given in the Text and Reference books.

Text and reference books

- Introductory Methods of Numerical Analysis : Sastry
- Numerical Analysis : Rajaraman
- Fortran Programming : Rajaraman
- Numerical Recipes : Utter mind Teukolsky, Press and Flattery
- Programming with Basic : Gottfried (Schema Series)
- Programming with Basic : Balaguruswamy
- Numerical Analyses : Balagurswamy

PY E - 102

(b) PHYSICS OF ELECTRONICS DEVICES & FABRICATION OF INTERGRATED CIRCUITS AND SYSTEMS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The course enables the students

1.	To provide basic knowledge and concepts of Semiconductor materials and devices.
2.	To understand operation of semiconductor devices and carrier transport in semiconductors.
3.	To apply concepts for the design of Junction Devices.
4.	To know the fabrication techniques of Integrated Devices.
5.	To be able to implement mini projects based on concept of electronic devices and ICs.

Course Outcomes: The purpose of the course is to introduce the methods of mathematical physics and after completion of the course students should be able to

1.	Understand the basic concepts of various Inorganic and Organic Semiconductor materials for electronic device applications in modern electronic industry.
2.	Understand the carrier transport in semiconductors. Drift, Diffusion, Conductivity measurement, Direct and Indirect Band gap semiconductors.
3.	Analyze various junction devices: p-n junction, Schottky and MOS devices..
4.	Understand fabrication techniques of integrated devices such as thin film, vapor deposition, etching, lithography ,sputtering etc.
5.	Evaluate and understand behavior of semiconductor Electronics and their applications in design of various circuitry.

UNIT-I

Semiconductor Materials

Energy Bands, Intrinsic carrier concentration. Donors and Acceptors, Direct and Indirect band semiconductors. Degenerate and compensated semiconductors, Elemental (Si) and compound semiconductors (GaAs). Replacement of group III element and Group V elements to get tertiary alloys such as $Al_x Ga_{(1-x)}$ As or $GaP_yAs_{(1-y)}$ and quaternary $In_xGa_{(1-x)}P_yAs_{(1-y)}$ alloys and their important properties such as band gap and refractive index changes with x and Y. Doping of Si

(Group III (n) and Group V (P) compounds) and GaAs (Group II (P) , IV (n-p) and VI (n compounds) . Diffusion of impurities – Thermal Diffusion, constant surface concentration, Constant Total Dopant Diffusion, ion implantation.

UNIT-II

Carrier Transport in Semiconductors

Carrier Drift under low and high fields in (Si and GaAs) saturation of drift velocity. High field effects in two valley semiconductors. Carrier Diffusion carrier injection, Generation Recombination processes- Direct, indirect bandgap semiconductors. Minority carrier Life Time, Drift and Diffusion of minority carriers (Haynes= Shockley Experiment) Determination of conductivity (a) four probe and (b) van der Pauw techniques. Hall coefficient, minority carrier Life Time.

UNIT- III

Junction Devices: (i) p-n junction- Energy Band diagrams for homo and hetro junctions. Current flow mechanism in p-n junction, effect of indirect and surface recombination currents on the forward biased diffusion current, p-n junction diodes-rectifiers (high frequency limit) (ii) Metal-semiconductor (Schottkey Junction): Energy band diagram current flow mechanisms in forward and reverse bias, effect of interface states. Applications of Schottky diodes, (iii) bimetal Oxide – Semiconductor (MOS) diodes. Energy band diagram depletion and inversion layer, High and low frequency capacitance voltage (c-v) characteristics. Smearing of c-v curve, flat band shift. Applications of MOS diode.

UNIT- IV

Fabrication of Integrated Devices

Thin film Deposition Techniques; Vacuum pumps and gauges- pumping speed, throughout Effective conductance control chemical vapor Deposition (CVD), MOCVD, PEMOCVD (plasma enhanced chemical vapour deposition) Physical vapor Deposition: Thermal Evaporation, Molecular Beam Epitaxy (MBE), Sputtering and Laser Ablation.

Lithography, Etching and Micro- Machining of Silicon, Fabrication of integrated circuits and integrated micro- electro- mechanical – Systems (MEMS)

UNIT-V

The unit will have four short questions based on the tutorial problems covering all the four units. The students will have to answer any two questions. Some samples problems are:

1. Obtain an expression for intrinsic carrier density in a semiconductor.
2. Derive the expression for the concentration of a diffusant at a distance x at time t from the surface having a constant concentration N_o.
3. Derive an expression for Hall coefficient for semiconductors.

4. Prove that the minimum conductivity of an extrinsic semiconductor is given by

$$\sigma = 2n_i e (\mu_n \mu_p)^{1/2}$$

Show that the conductivity minimum occurs when

$$N_A - N_D = n_i [(\mu_n / \mu_p)^{1/2} - (\mu_p/\mu_n)]^{1/2}$$

5. Discuss the Mechanism of forward and reverse current flow in p-n junction.
6. Applications of Schottky Diode
7. Thin film deposition techniques.
8. Discuss Sputtering and Laser Ablation.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- The Physics of Semiconductor Devices - D.A. Eraser, oxford physics Series (1986)
- Semiconductor Devices - Physics and Technology. By SM Sze Wiley (1985).
- Introduction to semiconductor devices - M.S. Tyagi, John Wiley & Sons
- Measurement, Instrumentation and Experimental Design in physics and Engineering - M. Sayer and A. Mansingh, prentice Hall India (2000)
- Thin film phenomena - K.L. Chopra
- Solid State Physical Electronics - Aldert van der Ziel
- Solid State Physics - J.P. Srivastava Prentice Hall of India (2001)
- The material science of thin films - Milton S. Ohring
- Optical electronics - Ajoy Ghatak and K. Thyagarajan, Cambridge Univ. Press
- Material science for engineers - James F. Shackelford, Prentice Hall
- Deposition techniques for films and coatings - R.F. Bunshah (Noyes publications)
- Solid State Electronics - Ben G. Streetman (Prentice Hall of India) 1994.
- Integrated Circuit - K.R. Botkar (Khanna) 1997.
- Integrated Circuit - Nagchoudhary

M.Sc. SECOND SEMESTER PHYSICS

Theory Courses		Marking Scheme			
Paper Code	**Title of Paper**	**Credits**	**End Semester Exam.**	**CCE**	**Total**
PY C-201	**Core Paper** **Quantum Mechanics -I**	**5**	**60**	**40**	**100**
PY C-202	**Core Paper** **Statistical Mechanics**	**5**	**60**	**40**	**100**
PY C-203	**Core Paper** **Electrodynamics and Plasma Physics**	**5**	**60**	**40**	**100**
PY E-201 **PY E-202**	**Elective Paper (any one)** **A - Condensed Matter Physics** **B - Informatics**	**5**	**60**	**40**	**100**

	Practical Course	**Credits**	**CCE**			**Total**	**Total**
			End Semester Exam.	**Pract Record. & Viva**	**Seminar related. to Pract**		
PY L-204	**Lab A**	**3**	**60**	**20**	**20**	**40**	**100**
PYL-205	**Lab B**	**3**	**60**	**20**	**20**	**40**	**100**
PY S - 201	**Skill Development**	**2**					
Total		**28**	**360**	**240**			**600**

CORE PAPER – I
PY C - 201
QUANTUM MECHANICS- I

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objectives of the course are to give exposure about the various tools employed to analyze the quantum mechanical problems.

1.	To know the basics of quantum mechanics. Understanding Schrodinger equation and its solution in different problems. To define Heisenberg & Dirac formulation of quantum mechanics and explain their importance.
2.	To demonstrate the linear harmonic oscillator and hydrogen-like atom using Dirac formulation.
3.	To explain the angular momentum operators associated with spherical and symmetrical systems.

Course Outcomes: The purpose of the course is to introduce the concept of Quantum Mechanics and on completion of the course; the student should acquire basic knowledge and will be able to

1.	To understand and apply principles of Quantum mechanics for understanding the physical systems in quantum realm.

2.	Importance of quantum mechanics compared to classical mechanics at microscopic level.
3.	To formulate the Heisenberg & Dirac formulation of quantum mechanics
4.	To solve the linear harmonic oscillator and hydrogen-like atom problems using Dirac formulation
5.	To demonstrate angular momentum operators associated with spherical and symmetrical systems and various tools to calculate Eigen values and total angular momentum of particles.

UNIT – I

Why QM? Brief prevision. Basic postulates of quantum mechanics, equation of continuity, Normality, orthogonlity and closure properties of eigen functions, Expectation values and Ehrenfest theorems. Free particle solution of Schrodinger equation, Box normalization, Dirac delta-function and its properties, solution of Schrodinger equation for one dimensional (a) potential well (b) potential step and (c) potential barrier.

UNIT – II

Linear vector space, concept of Hilbert space, Bra and Ket notation for state vector, Representation of state vectors and dynamical variables by matrices, change of basis and Unitary transformation (Translation and rotation), Schrodinger, Heisenberg and Interaction pictures, Matrix theory of linear harmonic Oscillator, Creation and annihilation operators, Matrices for x, p, H. Heisenberg uncertainty relation through operators (Schwartz inequality).

UNIT – III

Solution of Schrodinger equation for (a) linear harmonic oscillator (b) hydrogen-like atom (c) three-dimensional harmonic oscillator (d) square well potential and their respective applications to atomic spectra, molecular spectra and low energy nuclear states (deuteron).

UNIT – IV

Angular momentum is quantum mechanics, Eigen values and Eigen functions of L^2 and L_2 in terms of spherical harmonics, Relation of angular momentum with rotation operator, commutation relations, Matrix representation of angular momentum, Pauli spin matrices and their algebra, Coupling of two angular moments and Clebsch-Gorden coefficients for $j_1=j_2=1/2$ and $j_1=1/2$ and $j_2=1$.

UNIT –V

This Unit will have four questions based as tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are :

(1) Black body radiation and Planck's hypothesis, Insignificance of de Broglie hypothesis in macrophysics.

(2) Plotting of Harmonic oscillator wave functions in 1-d.

(3) Energy levels of a particle of mass 'm' moving in one-dimensional potential.

$$V(x) = \begin{cases} +\infty & x < 0 \\ +\frac{1}{2} m\omega^2 x^2 & x > 0 \end{cases}$$

(4) Admissible wave functions, stationary states.

(5) Wave function corresponding to minimum uncertainty product. Gaussian wave packet. Spread of wave packet in time.

(6) Continuous basis corresponding to position Eigen values and wave functions corresponding to state vectors using position and momentum representation.

(7) Rotational spectra of diatomic molecules.

(8) Vibrational and rotational spectra of diatomic molecules.

(9) Obtaining the matrices for L+, L-, Lx, Ly, L^2, Lz, $[L_+, L_-]$.

(10) Problems related to panli spin matrices. eq

$$e^{i\sigma y\theta/2} = \cos\ \theta/2 + i\sigma y\ \sin\theta/2$$

In additions to above the tutorial will also consist of solving problems given in the Text and Reference Books.

Text and Reference Books

- Quantum Mechanics : L I. Schiff (Mc Graw-Hill)
- Quantum Physics : S. Gasiorowiz (Wiley)
- Quantum Mechanics : B. Craseman and J.D. Powel (Addison Wesley)
- Quantum Mechanics : AP Messiah
- Modern Quantum Mechanics : J.J. Sakurai
- Quantum Mechanics : Mathews and Venkatesan

CORE PAPER – II
PY C - 202
STATISTICAL MECHANICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of this course is to learn the properties of macroscopic systems using the knowledge of the properties of individual particles.

1.	To equip with the techniques of Ensemble theory in order to understand the macroscopic properties of the matter in bulk in terms of its microscopic constituents and compute thermodynamic parameters by using classical statistics.
2.	To learn the use of methods of quantum statistics to obtain properties of systems made of microscopic particles which either obey Fermi-Dirac statistics or Bose-Einstein statistics.
3.	To grasp the concepts of first order and second order phase transitions and critical phenomena.
4.	To understand phase transition arising in Ising model.
5.	To learn to obtain the properties of out-of-equilibrium systems using concepts from equilibrium physics.

Course Outcomes: At the end of the course, the student will be able to

1.	To use various ensemble theories to calculate the thermodynamic properties of different systems.
2.	To compute properties of systems behaving as ideal Fermi gas or ideal Bose gas.
3.	To describe the features and examples of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics.
4.	The student should be able to know Cluster expansion, Viril equation, Ising model and Landau theory.
5.	Understand the thermodynamic fluctuations, Langevin theory, Fokker-Planck and Onsager relations.

UNIT-I

Foundations of statistical mechanics, specification of states of a system, contact between statistics and thermodynamics, classical ideal gas, entropy of mixing and Gibb's paradox.

Microcanonical ensemble, Phase space, trajectories and density of states, Liouville's theorem, canonical and grand canonical ensembles; partition function calculation of statistical quantities, Energy and density fluctuations.

UNIT - II

Statistics of ensembles, statistics of indistinguishable particles, Density matrix, Maxwell-Boltzmann, Fermi-Dirac and Bose- Einstein statistics, properties of ideal Bose gases, Bose-Einstein condensation. Properties of ideal Fermi gas, electron gas in metals. Boltzmann's transport equation

UNIT - III

Cluster expansion for a classical gas, Virial equation of state, Dynamical model of phase transition, Ising model in zeroth approximation, Ising model in first approximation. Exact solution in one-dimension.

Landau theory of phase transition, scaling hypothesis for thermodynamic functions.

UNIT - IV

Thermodynamics fluctuation, spatial correlation. Brownian motion, Langevin theory, fluctuation dissipation theorem. The Fokker-Planck equation. Onsager reciprocity relations.

UNIT - V

This unit will have four questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

(1) Calculation of number of states and density of states.
(2) Relative population of particles in two energy levels.
(3) Liquid helium II
(4) Electrical and thermal conductivities.
(5) Evaluation of virial coefficient
(6) Critical indices.
(7) Applications of Onsager relation
(8) Diffusion co-efficient

In addition to above the tutorial will also consist of soloing and reference books.

Text and Reference Books

- Fundamentals of Statistical and Thermal Physics : F. Reif
- Statistical Mechanics : K. Huang
- Statistical Mechanics : R.K. Pathria
- Statistical Mechanics : R. Kubo
- Statistical Mechanics : Landau and Lifshitz

CORE PAPER – III
PY C - 203
ELECTRODYNAMICS AND PLASMA PHYSICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: To apprise the students regarding the concepts of electrodynamics and its use in various situations.

1.	To cover Electrostatics and Magneto statics including Maxwell equations, and their applications to propagation of electromagnetic waves in dielectrics; EM waves in bounded media, waveguides, Radiation from time varying sources.
2.	Introducing the mathematical tools used in electrodynamics & Review of electrostatics and magneto statics in matter.
3.	Providing easy headway into the covariant formulation of Maxwell's equations.
4.	Teaching basic principles of waveguides and transmission lines & Rendering insights into fields generated by oscillating sources, and their applications.
5.	To expose the basics of the challenging research field of Plasma physics.

Course Outcomes: At the end of the course, the student will be able to

1	Understand and apply the laws of electromagnetism and Maxwell's equations. Basics of electrostatics and magneto statics Solve the electric and magnetic fields problems for different configurations.
2	Radiations by moving charges and retarded potentials. Fields of accelerated charged particle with different velocity. Angular distribution of radiated power. Abrahm- Lorentz method.
3	Understand 4Vectors and Lorentz transformation in 4- dimensional space, relativistic transformation properties of E and H.
4	Understand the plasma oscillations and its limit, Debye screening.
5	Know Magneto hydrodynamic equations, magnetic diffusion, MHD flow, Pinch effect MHD waves.

UNIT – I

Review of basics of electrostatics and magnetostatics. (Electric field, Gausse law, Laplaces and Poisson's equations, method of images. Biot-sawart law, Ampere's law). Maxwell's equations, scalar and vector potentials, Guage transformation Lorentz Guage, Coulomb guage, Solution of Maxwell's equation in conducting media.

UNIT – II

Radiations by moving charges, Retarded potentials, Lienard-wiechert potentials, Fields of charged particle in uniform motion, Fields of arbitrarily moving charged particle, Fields of an accelerated charged particle at low velocity and high velocity. Angular distributions of power radiated, Bremsstrahlung, Reaction force of radiation, Abrahm-Lorentz method of self-force, Difficulty with the Abrahm-Lorentz model, line-breadth and level-shift of an oscillator.

UNIT - III

Review of Four-vectors and Lorentz transformation is 4-dimensional spaces Invariance of electric charge, relativistic transformation properties of E and H fields, electromagnetic field tensor in 4-dimensionl Maxwell equation 4-vector current and potential and their invariance under Lorentz transformation, covariance of electrodynamics Lagrangian and Hamiltonion for a relativistic charged particle in External EM field; motion of charged particles in electromagnetic fields, uniform and non-uniform E and B fields, Particle Drifts in Non-uniform field, static magnetic fields, Adiabatic invariant.

UNIT – IV

Magnetohydrodynamic equations, Magnetic diffusion, viscosity and Pressure, Magnetohydrodynamic flow between Boundaries with crossed Electric and magnetic fields, Pinch Effect, Instability in a Pinched Plasma column, magnetohydrodynamic waves, magneto sonic and Alfven waves, Plasma oscillations, short wave length limit for plasma oscillations and Debye Screening Distance.

UNIT – V

This unit will have four questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

(1) Obtain the formal solution for electromagnetic boundary value problem with Green function.

(2) Discuss the problem of conducting sphere is a uniform electric field by method of images and Green's functions.

(3) For a solenoid wound with N turns per unit length and carrying a current I, show that the magnetic flux density on a point on the axis is given (for $N \to \infty$) by

$$B_z = \frac{2\pi NI}{C}(\cos\theta_1 + \cos\theta_2)$$

Where θ_1, θ_2 are the angles between the axis and the lines joining the point on the axis to the first and last turns of the solenoid.

(4) A linear accelerator accelerates protons to almost relativistic speeds. Determine fraction of power radiated by the protons to the power supplied in terms of the gradients of the linear electric field.

(5) A charged particle oscillated according to the harmonic law Determine the total average intensity of the emitted radiation.

(6) Discuss the Lagrangian and Hamiltonian for a relativistic charged particle in External electromagnetic field.

(7) Obtain the expression for energy radiated as Cherenkov radiation per unit distance along the path of the particle.

(8) Consider a magnetic field configuration that is cylindrically symmetric and a charged particle is injected into it. Use the adiabatic invariant of motion to describe conditions in which the injected particle would bounce back from the direction of increasing field gradient.

(9) Consider the problem of waves in an electronic plasma when an external magnetic field B_0 is present. Use the fluid model, neglecting the pressure term as well as collisions.

  (a) Write down the linearized equations of motion and Maxwell equations, assuming all variables vary as exp (ik.x-iωt).

  (b) Show that the dispersion relation for the frequencies of the different modes in terms of the wave number can be written.

$$\omega^2(\omega^2-\omega_p^2)(\omega^2 - \omega^{p2} - k^2c^2) = \omega^2_B(\omega^2 - k^2c^2)[\omega^2(\omega^2 - \omega p^2 - k^2c^2) + \omega p^2c^2(k.b)^2]$$

where b is the unit vector in the direction of B, ω_p and ω_B are the plasma and precession frequencies, respectively.

(c) Show that for propagation parallel to B_0 the dielectric constant is recovered.

(d) Assuming $\omega_B << \omega_p$, solve approximately for the various roots for the cases

(i) K parallel to b

(ii) K perpendicular to b. Sketch your result for w^2 versus k^2 in the two cases.

Text and Reference Books

- Classical Electronics : Jackson
- Electromagnetic Theory : B.B. Laud
- Classical Electricity and Magnetism : Pan of sky and Philips
- Plasma Physics : Chen
- Plasma Physics : Buttencourt

ELECTIVE PAPERS (ANY ONE OF THE FOLLOWING)
PY E - 201
ELECTIVE PAPER
IV (A) CONDENSED MATTER PHYSICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: To study some of the basic properties of the condensed phase of materials especially solids.

1.	To expose the students with topics like crystal structure using XRD, defects in crystals, dielectric properties, energy band and transport theory so that they are equipped with the to understand advanced aspects of the matter in condensed phase.
2.	To relate crystal structure to symmetry, recognize the correspondence between real and reciprocal space.
3.	Acquire knowledge of the behavior of electrons in solids based on classical and quantum theories.
4.	To become familiar with the different types of magnetism and magnetism based phenomenon & to develop an understanding of the dielectric properties and ordering of dipoles in ferroelectrics.
5.	To get familiarized with the different parameters associated with superconductivity.

Course Outcomes: The purpose of the course is to introduce the concept of Condensed Matter Physics and on completion of the course; the student should acquire basic knowledge and will be

1.	Able to understand the X-ray diffraction and its use in crystal structure, Concept of reciprocal lattice, defects in solids and their observation.
2.	Able to understand the electronic properties of solids and understand the difference in the classical free electron theory, quantum free electron theory and the nearly free electron model.
3.	Able to understand types of polarizabilities, Hall effect and quantum hall effect. Superconductivity and high T_c superconductors.
4.	Able to understand ferromagnetism and its theory, Curie-Weiss law, magnetic order.
5.	Able to understand optical properties, Kramer-Kronig relations, cyclotron resonance, Raman effect.

UNIT – I

Interaction of X-rays with matter, absorption of x-ray, Elastic scattering from a perfect lattice. Thereciprocal lattice and its applications to diffraction techniques in the Laue, powder and rotating crystal methods. Crystal structure factor and intensity of diffraction maxim.

Point defects, line defects and planer (stacking) faults. The role of dislocation in plastic deformation and crystal growth. The observation of imperfections in crystals – x-ray and electron microscopic techniques.

UNIT - II

Free electron Fermi gas, Energy levels of orbital in one and three dimensions. Electrons in a periodic lattice, Bloch theorem band theory of solids. Classification of solids Effective mass. Tight-binding, cellular and pseudo potential methods, Fermi surface, de Hass von Alfen effect.

UNIT - III

Atomic and molecular polarizability, Claussius-Mossotti relation, types of polarizabilities, Dipolar polarizability, and frequency dependence of dipolar polarizability. Ionic and electronic polarizability .Hall effects in low fields, Quantum Hall effect, Magneto-resistance. Super conductivity, critical temperature persistent current, Meissner effect. General idea about high temperature superconductors.

UNIT - IV

Weiss theory of ferromagnetism, Heisenberg model and molecular field theory, spin waves and magnons, Curie-Weiss law for susceptibility, Ferri and antiferro-magnetic order, Domains and Bloch-wall energy.

Optical reflectance, Kramer-Kronig relations, Light absorption spectrum of semiconductors cyclotron resonance Photo electromagnetic effect, Faraday effect, Elements of Raman effect in solids.

UNIT - V

This unit will have four questions based on tutorial problems covering all four units. The students will have to answer any two questions out of four. Some sample problems are:

(1) Given that the primitive basis vectors of a lattice a = (a/2) (i + j), b = a/2 (j + k) and c = a/2 (k + j) where i, j and k are usual three unit vectors along Cartesian coordinates. What is the Bravais lattice?

(2) Determine planes in a fcc structure having highest density of atoms.

Or

Evaluate density of atoms for Cu. in atoms/cm^2.

(3) For the delta function potential and with p > 1 find at k = 0 the energy of the lowest energy band. Also find the band gap at $k = \pi /a$.

(4) Consider a square, lattice in two dimensions with the crystal potential.

$$U(x,y) = 4U \cos (\pi x/a) \cos (\pi y/a)$$

Apply the central equation to find approximately the energy gap at the corner point $(\pi/a, \pi/a)$ of the Brillouin Zone.

(5) Explain why the Hall constant is inversely proportional to the electron concentration M.

Text and Reference Books

- Solid State Physics : C. Kittel
- Introduction to Solid : Azaroff
- Crystallography for Solid State Physics : Verma and Shrivastava
- Solid State Physics : A.J. Dekker
- Elementary Solid State Physics : Omar
- Solid State Physics : Aschroft and Mermin
- Principles of Condensed Matter Physics : Chaikin and Lubensky
- X-ray Diffraction –Its Theory and Applications : S.K.Chatterjee
- Solids : H,C.Gupta

ELECTIVE PAPER
PY E - 202
IV (B) INFORMATICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The aim and objective of the course on Informatics is to familiarize with the information methods

1.	To provide an understanding of Integral Transform and Probability.
2.	To expose the basics of Fourier series and transform and application in data communication.
3.	Acquire knowledge of about Transmission and their types.
4.	To know about UNIX/LINUX and introduction to C/ C++ language.
5.	To get familiarized with the web enabling technologies & related languages.

Course Outcomes: At the end of the course, the student will be able to

1.	Use Fourier series and transformations as an aid for analyzing experimental data.
2.	Understand the principles of fiber optics communication in different media
3.	Intended to enrich the learner about transmission types, codes and communication. Modems and Transmission media.
4.	Introduction to UNIX/ LINUX, Programme with the C/ C^{++}, Data types, Functions and Program structures.
5.	Able to know Object oriented concepts, the languages used to delivered web enabling technologies.

UNIT – I

Introduction to Probability and Random variables, Introduction to Information theory and queuing theory.

Fourier series and transform and their applications to data communication. Introduction and evolution of Telecommunication, Fundamentals of electronic communication: Wired, Wireless, Satellite and Optical Fibre, Analog/Digital, Serial/Parallel, Simplex/half and full duplex, Synchronous/ Asynchronous, Bit/baud rates, Parity and error control, Signal to Noise ratio.

UNIT – II

Transmission types, Codes, Modes, Speed and throughput. Modulation types, Techniques and standards. Base band and carrier communication, Detection, Interference, Noise signal and their characteristics, Phase locked loops.

Modems, Transmission media (guided and unguided), common Interface standards.

UNIT – III

Introduction to Unix/Linux and shell scripting. Introduction to C/ C^{++}. Data types and operators, Statements and Control flow, Functions and Program structures, Strings, The preprocessor, Pointers, Memory allocation, Input and output, Sub program, Recursion, File access.

UNIT – IV

Object orientation concepts: Classes, objects, methods and messages, encapsulation and inheritance, interface and implementation, reuse and extension of classes, inheritance and polymorphism, analysis and design; Notations for object-oriented analysis and design, Application of some object oriented programming languages.

Introduction to web enabling technologies and authoring tools/ languages, (web casting data base integration, CGI, Peri, Java, HTML, C#)

UNIT - V

This unit will have four short question based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

(1) A raised cosine pulse used in commutation systems shows a signal $g_p(t)$ [1+ cos2πt] that is a periodic sequence of these pulses with equal spacing between them. Show that the Fourier series expansion of $g_p(t)$ is given by

$$g_p(t) = \frac{1}{2} + \frac{8}{3\pi}\cos(\pi t) + \frac{1}{2}\cos(2\pi t) + ---$$

What is channel capacity for a teleprinter channel with a 300 Hz bandwidth and a signal – to- noise ratio of 3 dB?

(2) Estimate the thermal noise level of a channel with bandwidth of 10 kHz carrying 1000 watts of power operating at 50^{o}c?

(3) A transmitter receiver pair is connected across a coaxial cable. The signal power measured at the receiver is 0.1 watt. Signal levels change 100 times per second. Noise energy is 0.05 μ Joules for every 1 milliseconds. If E_b/N_o= 10 dB is desired, determine how many levels must be accommodated in the signal to encode the bits. What would be the bit rate?

(4) Write an awk script to process Lete/ password file and print (a) List of accounts with access of super user (b) All accounts with no password.

(5) Write C/C^{++} program to manipulate file.

(6) For each of the following system identity the relative importance of three aspects of modeling (a) Object modeling (b) Dynamic modeling (c) Functional modeling. (1) Remote controlled machine (2) Telephone answering machine.

(7) How Java and HTML is implemented.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and References Books

- Data Networks - Gallager
- Data Communication - William stalling
- Analog and Digital communication - S. Haykins
- Object oriented Analysis and Design with Application - G. Booch, Addison Wesley, 2nd Edition, 1994
- Beginning Object Oriented Analysis and Design using C ++, - Jesse Liberty Wrox Press, 1998.
- Multimedia Networking - Bohdan O. Szuprowic, McGraw Hill, Snigapore, 1995 (ISE)
- Computer Networks - William Stalling, PHI
- Computer Networks - A.S. Tanenbaum Prentice Hall of India.

ABILITY ENHANCEMENT AND SKILL DEVELOPMENT PRACTICAL COURSES
SEMESTER I & II
LIST OF PRACTICALS
LAB A: PY L 104 and PY L 204

Section – I (General Physics)

(Preferably six experiments to be performed by the students)

(1) Determination of separation of two plates of Febry Perot Etalon.

(2) (a) Measurement of Wavelength of He-Ne Laser.
(b) Measurement of thickness of thin wire with laser.

(3) Determination of Poisson's Ratio of glass plate by Cornu's method.

(4) Optical Fibre
(a) Determination of numerical aperture.
(b) Attenuation loses.
(c) Bending loss.

(5) Production and study of elliptically and circularly polarized light by Fresnel's Rhomb.

(6) Verification of Hartman's formula by constant deviation spectrometer.

(7) Verification of Fresnel's law of reflection for polarized light.

(8) Study of the fluorescence spectrum of DCM dye and to determine the quantum yield of fluorescence maxima and full width at half maxima for this dye using monochromator.

(9) To study Faraday Effect using He-Ne Laser.

(10) Determination of e/m eluting by normal Zeman effect.

(11) Measurement of resistively of a semiconductor by four probe method at different temperature and determination of band gap.

(12) Measurement of Hall coefficient of given semiconductor identification of type of semiconductor and sign of charge, carrier concentration.

(13) Determination of lande's factor of DPPH using ESR.

TUTORIAL

(1) Coherence and its relevance in diffraction.
(2) Effect of magnetic field on the plane of polarization.
(3) Normal Zeaman effect by Ferry Pert Etelon.
(4) Longitudinal and transverse bending of glass plate.
(5) Variation of refractive index with wave length of light.
(6) Propagation of light wave through optical fiber.
(7) Identification of charge type by Hall voltage measurement.
(8) Four prove method and the contact renitence problem.

Section – I (Electronics)

(Preferably six experiments to be performed by the students)

(1) Design of a regulated power supply.
(2) Design of a common Emitter Transistor Amplifier.
(3) Experiment on Bias stability.
(4) Negative Feedback (Voltage Series/ Shunt and Current Series/Shunt).
(5) Astable, Monostable and bistable Multivibrator.
(6) Characteristics and application of Silicon controlled Rectifier.
(7) Experiment on FET and MOSFET characterization and application as an amplifier.
(8) Experiment an UJT and its applications.
(9) Digital I: Basic Logic Gates, TTL, NAND and NOR.
(10) Digital II:Combinational Logic.
(11) Flip-Flops.
(12) Operational Amplifier (741).
(13) Differential Amplifier.
(14) expEYES based Physics practicals(a) Transient response of LCR,(b) Two phase AC Generator using a rotating magnet and two coils(c)Interference of sound from piezo-electric buzzers(d) PN junction Diodeas half wave rectifier and its IV characterics

TUTORIAL

(1) Network Analysis- Thevnin and Norton’s equivalent circuits.
(2) Basics of p-n junction-Diffusion current, Drift current, junction width, forward and reverse biasing, significance of Fermi level in stabilizing the junction.
(3) Zener Diode- characteristics and Voltage regulation.
(4) Transistor biasing and stability.
(5) Wien Bridge and phase shift oscillators.
(6) Solving Boolean expressions.
(7) Atomic scattering power and geometrical structure factor.
(8) Effect of capacitance and load resistance on output of an amplifier.
(9) Integrated circuit timer familiarization.
(10) Op-amp differentiator.
(11) Multiplexor and De-multiplexor.
(12) Registers and counters.
(13) Coincidence circuits, counters, timers.

LAB B: PY L 105 AND PY L 205
(Computer Programming)

(Preferably six experiments to be performed by the students)

(1) Preparation of result of an examination.
(2) Mean standard deviation, coefficient of correlation and the equation of regression line for two variables.
(3) Least squares fit for a straight line.
(4) Least squares fit for a parabola.
(5) Solution of simultaneous equations.
(6) Solution of differential equations.
(7) Graphical depiction of expanding cube.
(8) Integration by Simpson's Rule.
(9) Integration by Gaussian Quadrature.
(10) Solution of partial differential equation.

TUTORIAL

(1) Different BASIC statements.
    (a) If (b) GOTO (c) GOSUB statement.
(2) Graphic statements in BASIC.
(3) GET-PUT and LOCATE statements.
(4) Newton Raphson iterative method for the solution of non-linear equations.
(5) What is meant by numerical integration? Derive Trapezoidal rule for numerical integration.
(6) Reading from a data file and writing on a data file in BASIC.

Note: Appropriate other experiments can be added based on the prescribed syllabus in both the Labs A & B

RANI DURGAVATI VISHWAVIDYALAYA, JABALPUR
SYLLABUS PRESCRIBED FOR THE EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE IN PHYSICS
THIRD AND FOURTH SEMESTERS (with effect from 2021-2022)
UNDER Choice Based Credit System (In Accordance with University Ordinance No – 222) AND LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

M.Sc. THIRD SEMESTER PHYSICS

Theory Courses		Marking Scheme			
Paper Code	**Title of Paper**	**Credits**	**End Semester Exam.**	**CCE**	**Total**
PY C - 301	**Core Paper** **Quantum Mechanics – II**	**5**	**60**	**40**	**100**
PY C - 302	**Core Paper** **Nuclear and Particle Physics**	**5**	**60**	**40**	**100**
III & IV **PY SE – 301** **PY SE – 302** **PY SE – 303** **PY SE – 304**	**Special Elective Papers (Any two)** **A- Condensed Matter Physics - I** **B - Electronics - I** **C - Materials Science - I** **D - Computational Physics - I**	**5** **5**	**60** **60**	**40** **40**	**100** **100**

Practical Courses		Credits	End Semester Exam.	CCE			Total
				Pract Record& Viva	**Seminar related to Pract.**	**Total**	
PY L – 301 **PY L – 302** **PY L – 303** **PY L – 304**	**Lab A**	**3**	**60**	**20**	**20**	**40**	**100**
	Lab B	**3**	**60**	**20**	**20**	**40**	**100**
PY S – 301	**Skill Development**	**2**					
Total		**28**	**360**	**240**			**600**

CORE PAPER – I
PYC 301 QUANTUM MECHANICS – II

60+40= 100 MARKS **5 CREDITS**

Course Objectives: To impart knowledge of advanced quantum mechanics for solving relevant physical problems.

1.	To learn how to apply Perturbation Theory (Time Independent) in non-degenerate and degenerate situations.
2.	To apply approximate method in Quantum Mechanics to treat molecules.
3.	To learn time dependent perturbation theory.
4.	To learn theory of scattering.
5.	To learn the basics of relativistic quantum Mechanics.

Course Outcomes: To equip with the techniques of quantum mechanics so that it can be used in understanding various branches of physics.

1.	Understand Approximation methods for bound states.
2.	Understand the Time Independent Perturbation Theory and its application.
3.	Understand theory of scattering, Born approximation and partial waves, Scattering by rigid sphere and spherically symmetric potential, Pauli spin matrices.
4.	Understand the central concept and principles of relativistic Quantum Mechanics.
5.	Understand Klein- Gordon equation, Dirac's relativistic equation, Zitterbewegung Dirac relativistic equation.

UNIT - I

Approximation method for bound states: Rayleigh-Schrodinger perturbation theory of non-degenerate and degenerate levels and their application to perturbation of an oscillator, normal Helium atom, and First order Stark effect in Hydrogen. Variation method and its application to ground state of helium, W.K.B. approximation method, connection formula, Ideas on potential barrier with applications to the theory of alpha decay.

UNIT-II

Time dependent perturbation theory: Method of variation of constants, constant and harmonic perturbation, transition probability, adiabatic and sudden approximation. Hamiltonian for a charged particle under the influence of external electromagnetic field, Absorption and induced emission, Transition probability in Electric dipole transition, Einstein's A and B coefficients.

UNIT - III

Theory of scattering, Physical concepts, Scattering amplitude, scattering cross section. Born approximation and partial waves. Scattering by a perfectly rigid sphere, complex potential and absorption, scattering by spherically symmetric potential. Identical particles with spin, symmetric and antisymmetric wave functions, Pauli's exclusion principle, Pauli's spin matrices.

UNIT – IV

Schrodinger's relativistic equation (Klein-Gordon equation), Probability and current density, Klein-Gordon equation in presence of electromagnetic field, Hydrogen atom, short comings of Klein-Gordon equation. Dirac's relativistic equation for a free electron, Dirac's matrices, Equation of motion for operators, position momentum and angular momentum; spin of an electron, Zitterbewegung Dirac's relativistic equation in electromagnetic field, negative energy states and their interpretation, Hydrogen atom, Hyperfine splitting.

UNIT - V

This unit will have four short questions based on tutorial problems covering all the four units. Students will have to answer any two questions out of four. Some sample problems are:

1. Normal Zeeman Effect.
2. Anomalous Zeeman Effect.
3. Vander Waals interactions.
4. Ionization of a hydrogen atom
5. Selection rules for single and many particle systems.

6. Optical theorem and Ramasuer- Townsend effect.
7. Scattering from standard simple potentials using partial wave analysis and Born Approximation.
8. Slater determinant.
9. Spin and statistics
10. Difference in collision process between classical and quantum identical particles.
11. Magnetic moment and spin of a Dirac's electron.
12. Covariance of a Dirac's equation.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- Quantum Mechanics : L. I. Schiff
- Quantum Mechanics : S. Gasiorowicz
- Quantum Physics : B. Craseman and J.D. Powell
- Quantum Mechanics : A.P. Messiah
- Modern Quantum Mechanics : J.J. Sakurai
- Quantum Mechanics : Mathews and Venkatesan
- Quantum Mechanics : A.K. Ghatak and Loknathan

CORE PAPER II
PY C – 302 NUCLEAR AND PARTICLE PHYSICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The aim and objective of the course on Nuclear and Particle Physics is to familiarize with the basic aspects of Nuclear and Particle Physics

1.	To impart the knowledge regarding the fundamentals and basics of Nuclear interactions and Nuclear Reactions..
2.	To provide the knowledge of the Two-nucleus problem, concept of nuclear force.
3.	To acquire knowledge about the various nuclear models.
4.	To have an understanding of nuclear decay theories.
5.	To have an idea of elementary particles and their classification. Idea of basic nature and origin of Cosmic rays.

Course Outcomes: Students will have understanding of

1.	The method and analysis of Scattering process & understand structure and properties of nuclei, radioactive decay, and different types of nuclear reactions.
2.	Compare various nuclear models and properties of the nucleus & to study the nuclear structure properties.
3.	Various nuclear radiation detectors like Betatron and Synchrotron & describe various types of nuclear reactions and their properties.
4.	Nuclear decay processes and theory for beta and gamma decay.
5.	The nature, interaction etc. of the elementary particles and origin, nature of Cosmic rays. Bhabha-Heitler theory.

UNIT – I

Nuclear Interactions and Nuclear Reactions

Nucleon- nucleon interaction, exchange forces and tensor forces, meson theory of nuclear forces, nucleon, nucleon scattering, Effective range theory, spin dependence of nuclear forces, charge independence and charge symmetry of nuclear forces, Isospin formalism, and Yukawa interaction.

Direct and compound nuclear reaction mechanisms, cross sections in terms of partial wave amplitudes, compound nucleus, scattering matrix, Reciprocity theorem, Breit- Wigner one–level formula, Resonance scattering.

UNIT - II

Nuclear Models

Liquid drop model, Bohr–wheeler theory of fission, Experimental evidence for shell effects- shell model, spin, orbit coupling, magic numbers, Angular momenta and parities of nuclear ground states, Qualitative discussion and estimates of transition rates, magnetic moment and Schmidt lines, Collective model of Bohr and Mottelson .

UNIT – III

Nuclear Decay

Beta decay, Fermi theory of beta decay, Comparative half, lives, Parity violation, Two component theory of neutrino decay, Detection and properties of neutrino Gamma decay, Multipole transition in nuclei Angular momentum and parity selection rules Internal conversion, Nuclear isomerism.

General ideas of nuclear radiation detectors, linear acceleration, Betatron, Proton-synchrotron, Electron synchrotron.

UNIT - IV

Elementary particle physics

Types of interaction between elementary particles, Hadrons and leptons, Symmetry and conservation laws, Elementary ideas of : CP and CPT invariance, Classification of hadrons, lie algebra, SU(2) – SU (3) multiplets, Quark model, Gell Mann- Okubo mass formula for octet and decuplet hadrons, Charm, bottom and top quarks.

Cosmic Rays

Nature, composition, charge and energy spectrum of primary cosmic rays, production and propagation of secondary cosmic rays. Soft, penetrating and nucleonic components, Origin of cosmic rays, Rossi curve, Bhabha – Heitler theory of cascade showers.

UNIT – V

This unit will have four short questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are.

1. Scattering Matrix.
2. Nucleon- Nucleon phase Shifts.
3. Double Scattering Experiment to measure polarization.
4. Ground state spectroscopic configuration of nuclei on the basis of single particle shell model.
5. The Q – Equation.
6. Calculation of Absorption Cross Section.
7. Nuclear Quadrapole moment.
8. Kurie Plot
9. Selection Rules for β and γ decay.
10. Parity Violation Experiment.

11. Neutrino Helicity.
12. Isospin Symmetry.
13. Lie Algebra.
14. Origin of cosmic rays.
15. Bhabha-Heitler theory.

In addition to above the tutorial will also consist of solving problems given in the Text and Reference books.

Text and Reference Books

- Kenneth S. Kiane. Introductory Nuclear Physics, Wiley New York 1988..
- H.A. Enge, Introduction to Nuclear Physics, Addison- Wesley, 1975.
- G.E.Brown and A.D. Jackson, Introduction to Nuclean nucleon Interaction, North – Holland, Amsterdam, 1976.
- Y.R. Waghmare, Introductory Nuclear Physics, Oxford-IBH Bombay,1981
- I. Kaplan, Nuclear Physics, 2” Ed. Narosa, Madras, 1989
- R.D.Evans, Atomic Nucleus, McGraw Hill, New York, 1955.
- B.L. Cohen, Concepts of Nuclear Physics, TMGH, Bombay, 1971.
- R.R. Roy and B.P. Nigam Nuclear Physics, Wiley- Eastem Ltd, 1983.
- Bruno Rossi, Cosmic Rays
- B.N. Shrivastava, Basic Nuclear Physics and Cosmic Rays
- M.P. Khanna, Particle Physics, Prentice Hall
- Burcham, Nuclear Physics

PAPERS III &IV: SPECIAL ELECTIVE PAPERS
(ANY TWO OF THE FOLLOWING)
PY SE – 301
(A) CONDENSED MATTER PHYSICS – I

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	To become familiar with the effect of defects and deformation behavior of solids. Nature of Dislocations and their multiplication
2.	To become familiar with the interaction of dislocations, Partial dislocations and stacking faults in crystal structures. Experimental techniques to observe dislocations and stacking faults.
3.	To be familiar with thin films and their surface topography and electrical behavior.
4.	To become familiar with the lattice dynamics of monatomic and Diatomic lattice.
5.	To understand the different optical processes and photo-physical properties of solids.

Course Outcomes: Students will have understanding of

1.	Mechanism of plastic deformation, Dislocations and their stress and strain fields, Multiplication, Dislocations in different types of lattices.
2.	Concept of Dislocation interaction and partial dislocations, Demonstrate techniques of microscopy for their observation. About elementary concepts of surface crystallography.
3.	Idea about thin films, their surface topography & electrical properties of thin films.
4.	Optical properties of solids, direct and indirect transitions, phonon absorption, skin effect.
5.	Able to define the concepts of Phonons and to understand the lattice dynamics of mono and diatomic lattices, Debye-Waller factor, UmKlapp process, interaction of electron and phonons with photon.

UNIT - I

Imperfection in Crystals

Mechanism of plastic deformation in solids, stress and strain field of screw and edge dislocations. Elastic energy of dislocations. Forces between dislocations. Stress needed to operate Frank-Read source, dislocations in fcc, hcp and bcc lattices.

UNIT - II

Partial dislocations and stacking faults in closed packed structures. Experimental methods of observing dislocations and stacking faults. Electron microscopy, kinematical theory of diffraction contrast and lattice imaging.

Elementary concepts of surface crystallography. Scanning tunneling and atomic force microscopy.

UNIT - III

Films and Surface

Study of surface topography by multiple-beam interferometry, conditions for accurate determination of step height and film thickness (Fizeau Fringes). Electrical conductivity of thin films, difference of behavior of thin films from bulk, Boltzmann transport equation for a thin film (for diffused scattering), expression for temperature coefficient of resistivity of thin films.

UNIT – IV

Lattice Dynamics

Lattice Dynamics of monatomic and Diatomic lattice, Optical phonons and dielectric constants. Mossbauer Effect, Debye – Waller factor Anharmonicity, Thermal expansion and thermal conductivity. Umklapp process, Interaction of electrons and phonons with photons.

Optical Properties of Solids

Direct and indirect transitions. Absorption in insulators, polaritons, one phonon absorption, optical properties of metals, skin effect and anomalous skin effect.

UNIT – V

This unit will have four short questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are.

1. Consider two parallel dislocations lying on the same slip plane. Their Burgers vectors lie parallel to the slip plane but are not parallel to each other. Their magnitudes are equal. Find all possible orientations of the Burgers vectors for which the component of the force between the dislocations that acts parallel to the slip plane is zero.
2. Prove that the stress σ_{ZZ} never exerts a force on a dislocation in which burgers vector lies parallel to the x direction regardless of the orientation of the dislocation line.
3. Derive Taylor's relation between dislocation density and applied stress.
4. Discuss the working of atomic force microscope
5. Bring out the essential differences between diffuse and specular electron scattering from the conventional solid: bulk and films by taking the specific property of electrical conductivity.

6. What are thin and thick film? With reference to electronic conduction which films can be referred to as thin and which as thick taking into account the mean free path as a reference parameters.
7. Estimate for 300 K the root mean square thermal dilation AV/V for a primitive cell of sodium. Take the bulk modufus as 7×10^{10} erg cm^{-3}. Note that the Debye temperature 158 K is less than 300 K so that the thermal energy is of the order of K_BT. Use this result to estimate the root mean square thermal fluctuation Δa/a of the lattice parameter.
8. Consider a classical harmonic oscillator with small anharmonic terms so that the potential energy is $V(x) = ax^2 + bx^3 + cx^4$. Using the partition function approach shows that the mean energy (ξ) and mean thermal displacement from equilibrium (x) are:

$$(\xi) = K_BT\ [15b^2/16a^2 - 3c/4a^2]\ (K_BT)^2$$
$$(x) = -(3b/4a^2)\ K_BT$$

The former leads to a high temperature contribution to the specific heat that is linear in temperature. The latter is an indication of the origin of thermal expansion (and the proper sign of the coefficient)

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- X-ray crystallography : Azaroff
- Elementary Dislocation Theory : Weertman & Weertman
- Crystallography for Solid State Physics : Verma & Srivastava
- Solid State Physics : Kittel
- The Powder Method : Azaroff & Buerger
- Crystal Structure Analysis : Buerger
- Transmission Electron Microscopy : Thomas
- Multiple Beam Interferometry : Tolansky
- Thin films : Heavens:
- Physics of thin film : K.L.Chopra
- Introduction to Solid State Theory : Medlung
- Quantum Theory of Solid State : Callaway
- Physical Metallurgy Principles : Robert E-Read
- Materials Science and Processes : S.K. Hajra Choudhary
- Introduction to Dislocations : D.Hull
- Dislocations and Plastic Deformation : I.Koracs and L.Zsotdos

SPECIAL ELECTIVE PAPER III & IV (B)
PY SE – 302
ELECTRONICS - I

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	Information about communication electronics and types of modulation and demodulation processes.
2.	Contains information about Microwave electronics and Satellite communication.
3.	Knowledge about Micro-wave passive components and methods to measure various microwave

	parameters. Idea about Radars and its communication.
4.	Introduces architecture and functioning of 8085 Microprocessor.
5.	Idea of programmable interface devices and converters.

Course Outcomes: At the end of the course, the student will be able to

1.	Know the basic phenomenon of communication, modulation and demodulation and their types. Knowledge of microwave transmission and parameters affecting along with Satellite communication and geostationary system.
2.	Gain knowledge about working, design and application of microwave devices and systems. Idea of Radar and Antenna system and related parameters.
3.	Enrich the learner about Microwave transmission lines and waveguides. Through it students would be able to understand the propagation of microwave through transmission lines and Waveguides.
4.	Get knowledge of 8085 microprocessor architecture and its functioning and ability to understand and design the microcontroller and microprocessor based systems.
5.	Know the principle and working concepts of Interfacing devices like 8155/8255 and 8257 DMA and 8279 systems. Methods for digital and analog conversions.

UNIT - I

Communication Electronics

Amplitude modulation- Generation of AM waves- Demodulation of AM waves DSBSC modulation. Generation of DSBSC waves, Coherent detection of DSBSC waves, SSB modulation, Generation and detection of SSB waves. Vestigial sideband modulation. Frequency division multiplexing (FDM).

Microwave

Advantages and disadvantages of microwave transmission, loss in free space, propagation of microwaves, atmospheric effects on propagation, Fresnel zone problem, ground reflection, fading sources, detectors, components, antennas used in MW communication systems.

Introduction to satellite communication, geostationary satellite, orbital patterns, satellite systems link modules.

UNIT-II

Microwave and Radar

Klystrons, Magnetrons and Travelling Wave Tubes, Velocity modulation, Basic principles of two cavity Klystrons and Reflex Klystrons, principles of operation of magnetrons. Helix Travelling Wave Tubes, Wave Modes.

Radar block diagram and operation, radar frequencies, pulse considerations. Radar range equation, minimum detectable signal, derivation of radar range equation, Antena parameters, system losses, propagation losses, Rader transmitters- receivers, display.

UNIT-III

Introduction to Intel 8085 microprocessor, instruction for 8085, and addressing modes, Data Transfer, Arithmetic, Logical and branch group of instructions. Stack, I/O and machine control group. (Examples related to each group of instructions). Timing and operation status, Memory read write, I/O read, I/O write, register move, and move immediate, Timing diagrams.

Interrupts: Various interrupts handling facilities of inlet 8085 vector and non vectored interrupt Maskable and non maskable interrupts.

UNIT-IV

Programmable Interface devices:

Internal Architecture and pin out diagrams of 8155 and 8255 programmable interface. Programmable interrupt controller Intel 8259, Direct memory access and 8257 DMA controller 8279 display/ key board controller.

Interfacing with D/A and A/D converters

Elementary method of digital to analog conversion. Working of DAC 0808 and programme for interfacing with 8255 in 8085 based system. Basic technique for analog to digital conversion. Internal block diagram of ADC 809 and working. Interfacing of IC 809 with 8085 based system.

UNIT – V

This unit will have four short questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

1. Effect of frequency and phase error in detection of DSBSC and SSBC signals.
2. Frequency considerations in satellite communication.
3. Make a clear distinction between velocity modulation and current modulation. Show how each occurs in Klystron amplifier, and explain how current modulation is necessary if the tube is to have significant power gain.
4. Different type of Radar system.
5. Timing diagrams for 8085 microprocessor instruction for fetch and execute machine cycles and calculation of T states used.
6. Program with flow chart to take in ten data samples of one microsecond interval and store them in memory.
7. Interfacing of 8255 with 8085 in MOD 0 and MOD 1.
8. Program for a interrupt driven clock using 50 Hz mains as an interrupting source.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- Vacuums Tubes : Karl R. Spangenberg McGraw Hill
- Communication System : Taub and Schilling McGraw Hill
- Communication Electronics : John Kennedy
- Microprocessor Architecture : Ramesh S. Gaonkar
- Programming &Application
- with 8085MICROPROCESSORS : B. RAM
- Microcomputer : Malvino
- Microwaves : K.L. Gupta
- Advance Electronics Communication System : Wayne Tamasi

SPECIAL ELECTIVE PAPER III & IV (C)

PY SE – 303

MATERIALS SCIENCE – I

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject

1.	To understand the correlation between bonding and structure, and bonding and properties & the physical origin and demonstrate the correlation between structure and properties of materials.
2.	The meaning of phases, and the different types of phase transformations.
3.	To introduce common crystal defects and to understand their role in materials behavior & time-dependent and time-independent diffusion in solids.
4.	To introduce with the preparation of materials and concept of crystal structure, and the myriad of structures possible in metals and ceramics, as well as crystalline polymers, including crystal planes and diffraction.
5.	Characterization of microstructure using optical microscope.

Course Outcomes: Students will have understanding of

1.	Able to qualitatively describe the bonding scheme and its general physical properties, as well as possible applications.
2.	Given a binary phase diagram, what microstructures can be obtained by suitable thermal treatments? examples for near-equilibrium and far-from-equilibrium processing.
3.	Able to identify phases (and their abundance), phase rule, and invariant reactions, as well as identify simple microstructures that can occur (including possible effects on mechanical response).
4.	Demonstrate techniques of microscopy for investigation on the nanometer and atomic scales
5.	Ability to know the basic instruments in materials science and engineering to characterize the structural properties.

UNIT - I

Introduction to Materials Science

A brief introduction to general engineering materials (Metals, alloys, glasses, ceramics, polymers, composites), General classification based on structure and properties, Fusion and crystallization, glass transition, significant difference between crystalline and non-crystalline materials.

Atomic bonding and Coordination

Individual atoms and ions, molecules, macromolecules, three dimensional bonding, interatomic distances, Generalizations based on atomic bonding, crystalline phases, cubic structures, non-cubic structures, imperfection in crystalline solids, grains and grain boundaries, non-crystalline materials, order and disorder in polymers, solid solutions, solid solutions in ceramic and metallic compounds and polymers.

UNIT - II

Phase Equilibrium and Reaction Rates

Introduction, phase diagram (Qualitative) chemical compositions of equilibrated phases, phase rule, quantities of phases in equilibrated mixtures, Invariant reactions, Deferred reactions (Glasses), Segregation during solidification, Nucleation.

Diffusion in Materials

Introduction to kinetics and diffusion, Atomic Vibration, Atomic Diffusion, mechanism of diffusion, macroscopic and microscopic view points, Ficks laws of diffusion, Einstein's relation, (relation between diffusivity and mobility) solution of Ficks second law and its application, Kirkendall effect, diffusion tensors experimental determination of diffusion coefficient.

UNIT - III

Preparation of Materials

Growth of single crystals; vapour – solid, liquid – solid, solid - solid and zone refining process. Preparation of polymers, ceramics, composites and nanomaterials. Introduction to preparation of thin films.

Characterization of materials using x-ray diffraction

Measurement of diffraction pattern of crystals, Inter planar spacing, Diffraction analysis, Determination of Lattice constant.

UNIT IV

Micro Structures

Single phase materials, Grains, ASTM Grain size numbers, Grain growth, phase distributions (Precipitates) - precipitation rates, inter-granular and intra-granular precipitation; phase distribution (Eutectoid Decomposition)- Pearlite, Hypo and Hyper eutectoid microstructures, Isothermal Decomposition of Austenite; modification of microstructures- coalescence, Spheroidization, Martensite, Tempered Martensite; Microstructures within polymers-crystallinity in polymers, polyblends.

Optical and Thermal Characterization Techniques

Electron microscopy, scanning and transmissions, optical microscopy and topography by multiple beam interferometry, brief introduction to Auger, ESCA, FIM and AFM, DTA, DSC and TGA techniques.

UNIT – V

The unit will have four short questions based on the tutorial problems covering all the four units. The students will have to answer any two questions. The samples problems are:

1. Which part has the greater stress : (a) a rectangular aluminum bar of 24.6 mm × 1.21 in) in cross section, under a load of 7640 kg and therefore a force of 75,000 N (16,800 lb); or (b) a round steel bar whose cross sectional diameter is 12.8 mm (0.505 in), under a 5000 - kg (11,000 lb) load ?
2. How much energy is required, + (or, released, -) if 2.6 kg of acetylene C_2H_2, react with hydrogen to produce ethylene, C_2H_4 ?.
3. A plastics molding company buys a phenol formaldehyde raw material that is only two thirds polymerized; that is there is an average of only two - CH_2 bridges joining each phenol rather than the maximum three.

   (a) How many g of additional formaldehyde are required per kg of the above raw material to complete the network formation (that is, to make the phenols fully trifunctional ? (b) How many g of water will be formed in this thermosetting step?
4. For Ag-Cu system. (a) Locate the liquidus and solidus (b) How many phases are present where the two meet?

5. To produce a p-type semiconductor, the third column element boron is doped in pure silicon. The doping is done through a $B_2 O_3$ vapour phase of partial pressure equal to 1.5 Nm^{-2}. This atmosphere is equivalent to surface concentration of 3×10^{26} boron atoms per m3. Calculate the time required to get a boron content of 10^{23} atoms per m^3 at a depth of 2μm. The doping temperature is 1100^{o}C and In-Si at this temperature is 4×10^{-17} m^2 S^{-1}.

6. At 500 ^{o}C (7773 k) a diffusion experiment indicates that one out of 10^{10} atoms has enough activation energy to jump out of its lattice site into an interstitial position. At 600 ^{o}C (873 k), this fraction is increased to 10^{-9} (a) what is the activation energy required for this jump? (b) What of the atoms has enough energy at 700 ^{o}C (973 k)?

7. Discuss the method of preparation of (one)
   (i) Alkali halide crystal using Kyropolous technique,
   (ii) $BaTiO_3$ using solid state ceramic method
   (iii) Polymer blends.

8. A diffraction pattern of a cubic crystal of lattice parameter a 3.16 Å is obtained with a monochromatic X-ray beam of wavelength 1.54 Å. The first four lines on this values :

Line	θ (in degrees)
1	20.3
2	29.2
3	36.7
4	43.0

   Determine the inter planner spacing and the auller indices of the reflecting planes.

9. From a powder diameter 114.6mm, using X-ray beam of wavelength 1.54 Å, the following 5 values in mm are obtained for a material:
   86, 100, 148, 180, 188, 232 and 272.
   Determine the structure and the lattice parameter of the material.

10. Calculate the density of fully crystalline poly ethylene whose chains are aligned longitudinally. The unit cell is orthorhombic with 90^{o} angles. The unit cell parameters are 0.740 nm, 0.493 nm and 0.253 nm.

11. What do you understand by ASTM Grain size numbers? Explain the procedure to obtain it giving examples.

12. Discuss the application of DTA, DSC and TGA techniques in the development of material.

In addition to above the tutorial will also consist of solving problems given in the text and reference books.

Text and Reference Books

- Elements of Materials Science and Engineering (Sixth Edition)-Lawrence H., Van Vlacle, Addition Wesley (1989).
- Elements of Solid State Physics-J.P. Shrivastava- Premtice Hall India (2001).
- Materials Science and Engineering-V. Raghwan-Fourth Edition-Prentice Hall (2000).
- The Structure and Properties of Materials Vol. I, II, III, and IV –John Wulff et al. Wiley Eastern Limited.
- Physical Metallurgy Principles Robert E-Reed-Hill, East West Press New Delhi.
- Introduction to Solid-A Zroff.

- Materials Science and Processes– Hajra Choudhry Indian Book Distribution co.
- Materials Science and Engineering- William D. Callister Jr, John Wiley (2001).
- Experiments in Materials Science- E.C. Subbarao, L.K. Swghal, D. Chakraborty, M.F. Merriam and V.Raghavan, Tata McGraw Hill, New Delhi.

SPECIAL ELECTIVE PAPERIII & IV (D)
PY SE – 304

COMPUTATIONAL PHYSICS – I

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	To become familiar with the numerical methods used in computation and programming using any high level language such as C^{++}, so that they can use these in solving simple physics problems.
2.	To give comprehensive exposure to the students regarding associated digital electronics for implementation of computational techniques.
3.	To apply computational methods to solve problems in physics with representative examples.
4.	To gain knowledge on integral equations & also to gain familiarity with the numerical solutions of partial differential equations.
5	To apply computational methods to solve various problems of Electronics with representative examples.

Course Outcomes: Students will have understanding of

1.	General concepts and structure of C^{++} programming for developing computational methods.
2.	Review of instruments and related electronics used in computer controlled instrumentation. Idea of 8085 and 8086 based microcomputer system their programming and interface.
3.	Computation and the evolution of phase space as various parameters are changed.
4.	Solving problems related to propagation of elastic waves in solids, Phase trajectory of chaotic pendulum, Poincare section etc. Using computational techniques.
5.	To explore application of computational physics in frontier areas of Electronics such as electromagnetic oscillation in LC circuit, Fourier analysis in harmonic waves, circuits having LCR, acceleration of charged particle in cyclotron etc.

UNIT – I

Introduction to C^{++}

General concepts, structure of C^{++} program, variables and constants, operators and expression, Flow of control, conditional and unconditional loops, Data types, Array, functions, standard Library functions, Programming methodology, type of errors, scientific programmes with examples, organization and handling of files in C^{++}.

UNIT – II

Interfacing and computer controlled Laboratory, Brief review of instruments used in computer controlled instrumentation : Logic Gates (AND, OR, NOT, NAND, NOR, EXCLUSIVE-OR) and their truth tables, Flip-flops (SR. JK, Master-slave, JK, D,T) counters shift registers, encoders, decoders, multiplexing, demultiplexing, General ideas of 8-bit microprocessors (8085), 8086 based microcomputer system, programming and interfacing with ADC, and DAC, use of IEEE 488 OR RS 232 interfaces with application.

UNIT – III

Computer Application to problems in Physics - I : (1) propagation of elastic waves in crystalline solid, (2) Bifurcation points of one- dimensional logistic maps using Newton's method, (3) Phase Trajectory of chaotic pendulum, (4) Study of poincare section, (5) Study of motion of charged particle in an Electric field.

UNIT – IV

Computer Application to problems in Physics - II: (1) Study of Electronic configuration of any Element, (2) Study of Electromagnetic Oscillation in LC circuit, (3) Study of Fourier Analysis of Harmonic wave, (4) Study of circuit with Inductors, capacitors and Registers, (5) Acceleration of a charged particle in cyclotron.

UNIT - V

This unit will have four short question based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

1. (a) Write a programme to calculate and print roots of a quadratic $ax^2+bx+c = 0$ ($a \neq 0$).
   (b) Write a programme to add and multiply two matrices.
2. Illustrate the use of function by a program.
3. Explain the meaning of latches and multiplexing.
4. Using a block diagram explain the computer interfacing of a spectrum analyzer.
5. Modeling and simulation of predator and prey problem.
6. Charged particle in a magnetic field.
7. Study of convection of fluids.
8. Discuss Lorentz system and Lorentz attractors.

In addition to above the tutorial will also consist of solving problems given in the text and reference books.

Text and Reference Books

- Computational Physics - R.C. Verma, P.K. Ahluwalia and K.C. Sharma, New Age Publishers (1999)
- Programming in ANSI C, - E. Balaguruswami Tata Mc Graw Hill (1994)
- Numerical Recipes in FORTRAN - Press W.H., Teukolsky S.A. Vellerling W.T. and Flannery B.P. (Cambridge Univ. Press 1992)
- Simulation using Personal Computers - Carroll, J.M. (Prentice Hall, 1987)
- FORTRAN-77 with applications for Scientists and Engineers - Rama, M. Reddy and Carola, Ziegler.

M.Sc. PHYSICS FOURTH SEMESTER

Theory Courses		Marking Scheme			
Paper Code	Title of Paper	Credits	End Semester Exam.	CCE	Total
PY C - 401	Core Paper Atomic and Molecular Physics	5	60	40	100
PY E – 401 PY E – 402 PY E – 403	Elective (Any One of the following) A - Physics of Lasers and Laser Applications B - Non-linear Dynamics C - Physics of Nano-materials	5	60	40	100
PY SE – 401 PY SE – 402 PY SE – 403 PY SE – 404	Special Elective Papers (Any two) A - Condensed Matter Physics - II B - Electronics - II C - Materials Science - II D - Computational Physics - II	5	60	40	100
		5	60	40	100

Practical Courses		Credits	End Semester Exam.	CCE: Pract Record. & Viva	CCE: Seminar related to Pract	CCE: Total	Total
PY L – 401 PY L – 402 PY L – 403 PY L – 404	Lab A	3	60	20	20	40	100
	Lab B	3	60	20	20	40	100
PY PW– 401	Project Work	2	60	40			100
PY S - 401	Skill Development	2					
Total		30	420	280			700

CORE PAPER – I

PY C - 401

ATOMIC AND MOLECULAR PHYSICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: Objective of this course is to learn the fundamentals of atomic and molecular spectroscopy key for Physics problems.

1.	To learn about the intricacies of spectra of Hydrogen-like atoms and alkali metals. Concepts of molecular quantum mechanics.
2.	To understand the details of rotational, spectra of diatomic molecules and elements of microwave spectroscopy.
3.	To know about the vibrational spectra of molecules and elements of IR spectroscopy..
4.	To equip them with the knowledge of other spectroscopies like UV, Visible, Raman.

5.	To learn about PES, PAS, NMR and Mossbauer spectroscopy instrumentation.

Course Outcomes: At the end of the course, the student will be

1.	Able to deal with problems related to Hydrogen-like atomic spectra and alkali metals. Understand coupling schemes and hyperfine structures.
2.	Able to know the features of molecular quantum mechanics such as Thomas Fermi model, Hartree and Hartree-Fock methods.
3.	Able to understand the basics of microwave spectroscopy with rotation of diatomic molecules.
4.	Able to understand the basics of IR spectroscopy with vibrating diatomic molecules and vibrating –rotator molecule.
5.	Understand the behavior of atomic and molecular spectra with UV, Visible, Raman, Photo-electron, Photo- acoustic, NMR and Mossbauer spectroscopies.

UNIT –I

Quantum states of one electron atoms Atomic orbitals, Hydrogen spectrum, Pauli's principle. Spectra of alkali elements, spin orbit interaction and line structure of alkali spectra, Methods of molecular Quantum Mechanics, Thomas Fermi Statistical Model, Hartree and Hartree Fock Method. Two electron system, interaction energy in LS and JJ coupling, Hyperfine structure (qualitative), line broadening mechanisms (general ideas).

UNIT – II

Types of molecules, Diatomic linear, symmetric top, asymmetric top and spherical top molecules, Rotational spectra of diatomic molecules as a rigid rotator, Energy level and spectra of non-rigid rotator, intensity of rotational lines.

UNIT – III

Vibrational energy of diatomic molecule, diatomic molecule as a simple harmonic oscillator, Energy levels and spectrum, Morse potential energy curve, Molecules as vibrating rotator, vibration spectrum of diatomic molecule PQR branches IR spectrometer (qualitative).

UNIT – IV

Introduction to ultraviolet, visible and infra-red spectroscopy, Raman spectroscopy: Introduction, Pure rotational and vibrational spectra, Techniques and instrumentation, Stimulated Raman spectroscopy, Experimental techniques: Photo electron spectroscopy, Elementary idea about photo acousticspectroscopy, Mossbauer spectroscopy and NMR Spectroscopy.

UNIT –V

This unit will have four short questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

1. Write all possible term symbols for the following electron configurations

   (a) [Be]2p3p (b) [He]2s2p (c) [Be]2p3d

   2. Normal and anomalous Zeeman effect

   3. Paschen Back effect, Stark effect.

4. The measured value of the first line (J = 0) in the rotational spectrum of carbon monoxide is 3.84235 cm^{-1}. Determine the moment of inertia and bond length of the molecule.

5. The data for the $^{1}H^{35}Cl$ molecule are :
Bond length = 127.5 pm
Bond force constant = 516.3 Nm^{-1}
Atomic masses: $^{1}H = 1.673 \times 10^{-27}$kg, $^{35}Cl = 58.066 \times 10^{-27}$ kg
Determine the following
(a) The energy of fundamental vibration ν_o.
(b) The rotational constant B.
(c) The wave numbers of the line $P_{(1)}$, $P_{(2)}$, $R_{(0)}$, $R_{(1)}$ and $R_{(2)}$.
(d) Sketch the expected vibration-rotation

6. How many normal models of vibration are possible for the following molecules :
HBr, 0_2, OCS (linear), SO_2 (bent), BCl_3, HC ≡ CH, CH_4, CH_3I, C_6H_6?

7. With which type of spectroscopy would one observe the pure rotational spectrum of H_2? If the bond length of H_2 is 0.07417 nm. What would be the spacing of the lines in the spectrum?

8. Raman Spectrum of Chloroform, $CHCl_3$, molecule shows that Raman lines appear at 262, 366, 668, 761, 1216 and 3019 cm^{-1} on low frequency side of exciting line. Comment of the spectrum.

9. The strongest lines in the Infra-red and Raman spectra of nitrous oxide are shown in the table

Vcm^{-1}	Infra-red	Raman
589	Strong; PQR contour	-
1285	Very strong; PR contour	Very strong; polarized
2224	Very strong; PR contour	Strong; depolarized

Comment on the spectra.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- Introduction to Atomic Spectra : H.E. White
- Fundamentals of molecular spectroscopy : C.B. Banwell
- Spectroscopy vol.I, II & III : Walker and Stanghen
- Introduction to molecular spectroscopy : G.M. Barrow
- Spectra of diatomic molecules : Herzberg.
- Molecular spectroscopy : Jeanne L. Mc Hale
- Molecular spectroscopy : J.M.Brown
- Spectra of atoms and molecules : P.F.Bemath.
- Modern spectroscopy : J.M. Halian

PAPER - II
ELECTIVE PAPERS (ANY ONE TO BE OPTED)
PY E - 401
II (A): PHYSICS OF LASERS ITS APPLICATIONS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The course aims at imparting knowledge about principle and working of Lasers, and fiber-optic communication

1.	To identify conditions for lasing phenomenon and properties of the laser.
2.	To classify different types of lasers with respect to design and working principles.
3.	Laser florescence and Raman scattering and applications.
4.	To know about Optical fibers and use of Lasers in optic communication.
5.	To illustrate various aspects of crystal optics and propagation of light.

Course Outcomes: At the end of the course, the student will be

1.	Evaluate conditions for lasing phenomenon and properties of the laser.
2.	To understand various types of Lasers and their applications.
3.	To know about Laser fluorescence and Raman scattering and their applications.
4.	To understand the Optical fibers and use of Lasers in light wave communication along with the engineering and medical applications.
5.	To understand the basics of crystal optics and propagation of light ,electro- optical effects, laser induced multiphoton processes, parametric generation, optical stability etc.

UNIT –I

Working principle of laser, threshold condition characteristics of laser, Gaussian beam and its properties, optical Resonators, longitudinal and transverse modes of laser cavity, mode selection, gain in a Regenerative Laser cavity.

Rate equations and threshold for 3 and 4 level systems. Q switching, mode locking and obtaing altrashort pulses. Spectral narrowing.

UNIT – II

Ruby laser, He-Ne laser, Nd based lasers, semiconductor lasers, Nitrogen laser, CO_2 laser, ionlaser Dye laser, chemical laser, excimer laser, Higher power laser systems.

UNIT –III

Laser fluorescence and Raman scattering and their use in ranging and pollution studies; ultra high resolution spectroscopy with laser, and its application in isotope separation, single atom detection and rotational and vibrational level of molecules. Optical fibers, use of lasers in light waves communication. Qualitative treatment of medical and engineering applications of lasers.

UNIT – IV

Crystal optics, propagation of light in a medium with variable refractive index, Electro, optical effect. Non-linear interaction of light with matter, laser induced multiphoton processes, second harmonic generation phase matching, third harmonic generation optical mixing, Parametric generation of light self focusing of light, Frequency mixing in gases and vapours, Optical bistability and optical phase conjugation, Frequency up coversion.

UNIT – V

This unit will have four short questions based on tutorial problems covering all the four units. The students will have to answer any two questions some sample problems are:-

1. Calculation of threshold population inversion for laser action in a cavity of given parameters.
2. Calculation of gain coefficient.
3. Determining line width of laser line.
4. Determining line pulse duration in case of Q switched or mode locked laser.

5. Calculation of power of the laser output in case of certain laser system.
6. Tuning of laser in order to obtain- a particular wave length
7. Finding distance of an object by laser range finder.
8. Determining vibrational levels of molecule by scattering of laser light.
9. Calculation of intensity of second harmonic and third harmonic generated by non-linear interaction of laser light with matter.
10. Calculate the wave length separation between the longitudinal modes of a 1530 nm semiconductor laser in which the active layer in 0-2 μm long and has a refractive index of 4.0.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Book

- Svelte : Lasers
- Yariv : Optical Electronics.
- Demtroder : Laser spectroscopy
- Letekhov : Non-Linear Laser spectroscopy
- Lasers : A.L. Siegman
- Optical Electronics : K.Tyagrajan & A.K. Ghatak.

PY E - 402
II (B) NONLINEAR DYNAMICS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The aim and objective of the course is to familiarize with the basics of the field of dynamics of nonlinear systems.

1.	Introduction to Dynamical systems.
2.	Introduction to Dissipative systems.
3.	Introduction to Hamiltonian systems.
4.	Introduction to some advanced topics like Solitons and their types.
5.	To identify nonlinear optical phenomenon for applications in optical devices.

Course Outcomes: At the end of Course students will be able to

1.	Understand basic knowledge of nonlinear dynamical systems, their equations, bifurcations, Poincare section.
2.	Understand dissipative systems, noninvertible maps, attractors, intermittency, Lyapunov exponents, Henon map and Fractals and their geometry.
3.	Learn skills by solving problems on solving nonlinear problems using numerical methods.
4.	Understand Hamiltonian Systems, Integrability, Liouvill’s theorem, perturbation techniques, Concept of Chaos and stochasticity.
5.	Understand advanced topics like Solitons, Sine Gordon and Kartweg devries, Baclund transformation, magnetic monopole and Vortex solitons.

UNIT – I

Introduction to Dynamical Systems

Physics of nonlinear systems, dynamical equations of motion, phase space, fixed points, stability analysis, bifurcations and their classifications, Poincare section and iterative maps.

UNIT- II

Dissipative Systems

One-dimensional noninvertible maps, simple and strange attractors, iterative maps, period doubling and universality, intermittency, invariant measure, Lyapunov exponents, higher-dimensional systems, Henon map, Lorenz equation. Fractal geometry, generalized dimensions, examples of fractals.

UNIT – III

Hamiltonian Systems

Inerrability, Liouville's theorem, action-angle variables, introduction to perturbation techniques, KAM theorem, area presserving maps, concepts of chaos and stochasticity.

UNIT- IV

Advanced Topics

Completely integrable systems, Solitons solution, Sine-Gordon and Kartweg devries solitons, Perturbation of solitons, Baclund transformation, Solitons like solutions, ϕ^4 theories with both signs, Magnetic monopole and vortex solutions.

UNIT - V

This unit will have four short questions based on tutorial problems covering all the four units. Students will have to answer any two questions out of four. Some sample problems are:

1. Saddle Points, solitons and homoclinic orbits.
2. Limit cycles.
3. Rossten's equations and strange attractors.
4. Mandelbrot set.
5. Sine Gordon solutions
6. Lorentz equations and strange attractor
7. Logistic map, period doubling and Lypunov exponents
8. Backlund transformations
9. Davydov soliton

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- Introduction to Dynamics : Percival and D. Richards
- Nonlinear Dynamics I & II : E.A. Jackson
- Introduction to Dynamical Systems : R.L. Devaney
- Chaos : Hao Bai-lin
- Regular and Stochastic Motion : A.J. Lichtenberg and M.A. Lieberman
- CHAOS IN CLASSICAL AND : M.C. GUTZWILLR, E. Ott, M. Tabor

PY E - 403
II (C) PHYSICS OF NANOMATERIALS

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The aim and objective of the course on Physics of Nano-materials is to familiarize with the various aspects related to preparation, characterization and study of different properties of the nanomaterials.

1.	Define Nanotechnology and outline the various properties of nano materials and their fabrication techniques.
2.	Able to know the various methods of synthesis of nanoparticles & describe the physical properties.
3.	To learn about the techniques of fabrication of MQW & SL structures.
4.	To equip them with the optical properties and thereby find the nano-size of the experimental samples.
5.	To learn about the electrical & magnetic properties of nano materials and their applications in different field of science.

Course Outcomes: At the end of Course students will able to

1.	Understand concept of quantum confinement, electron confinement in deep square well and two and three dimensions, idea of quantum well, dot and wires.
2.	Understand quantum well and super lattices, techniques of fabrication of MQW and SL structures.
3.	Acquire knowledge of basic approaches like Bottom up and Top down to synthesize inorganic colloidal nanoparticles and their self-assembly in solution and surfaces, Physical properties of nanoparticles.
4.	Understand and describe the use of unique optical properties of nanoscale metallic structures using Luminescence and Raman scattering.
5.	Understand electrical properties, magnetic materials and stability of nano structures, Various applications and perspectives of nanotechnology in the development of value added new products and devices

UNIT-I

Concept of Quantum Confinement

Free electron theory (qualitative ideas) and its features. Idea of band structure, Metals, insulators and semiconductors, Density of states in bands, Variation of density of states with energy.

Electron confinement in infinitely deep square well, confinement in two and three dimension, Idea of quantum well, quantum wire and quantum dots, classification of nanostructured materials.

UNIT-II

Quantum wells and Super lattices

Energy levels and density of states in quantum wells. Band structure in quantum well, coupling between the wells, multiple quantum well structure, super lattice dispersion relation and density of states, Band structure in super lattice, Types of super lattices.

Techniques of Fabrication of MQW and SL structures (MBE, MOCVD, LPE etc).

UNIT-III

Nanoparticles

Synthesis of nanoparticles: Bottom up: cluster beam evaporation, ion beam deposition, chemical bath deposition with capping techniques; and Top up: Ball milling.

Physical properties of nanoparticles: Impurities and composition surface roughness, structure, thermodynamic properties. Determination of particle size by width of XRD peaks.

UNIT-IV

Characteristics of Nanoparticles

Optical properties: Absorption spectra, luminescence, Raman scattering, spectral response. Determination of particle size by shift in photoluminescence peaks.

Electrical properties of nanoparticles, nanostructured magnetic materials, stability of nanocrystals. Application of nanostructured materials.

UNIT-V

This unit will have four short questions based on tutorial problems covering all the four units. The student will have to answer any two questions out of four. Some sample examples are:

(1) Density of state function in 1D, 2D and 3D systems.
(2) Calculation of energy levels and change in band gap in a quantum well of given dimensions.
(3) Energy difference between two levels in a double QW.
(4) Variation of specific heat with size of crystal.
(5) Calculation of crystal size from XRD peaks.
(6) Calculation of crystal size from PL peaks.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and References Books

- Nanotechnology Molecularly designed material by Gan-Moog, Chow , Kenneth. E Gonsalves, AmericanChemical Society.
- Quantum dot Heterostructure by D. Bimerg, M. Grundmann and N.N. Ledentsov John Wiley and sons 1998.
- Nanotechnology: Molecular Speculations on global abundance by B.C. Gran dall MIT Press 1996.
- Physics of low dimensional semiconductors by John W. Davies, Cambridge Univ. Press 1999.
- Physics of semiconductor nanostructures by K.R. Jain Narosa 1999
- Nano-fabrication and bio-systems: Integrating materials science engineering Science and biology by Harvey C. Hoch, Harold G. Craighead and Lynn Jelinski, Cambridge Univ. Press- 1996.
- Nano particles and nano structured films: Preparation, characterization and application, Ed. J. H. Fendler, Jhon Wiley and sons 1998.
- Wave mechanics applied to semiconductor heterostructures by Gerald Bastard.

PAPERS III & IV

SPECIAL ELECTIVE PAPERS (ANY TW0 TO BE OPTED)
PY SE - 401

III & IV (A) CONDENSED MATTER PHYSICS – II

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	To get familiarized with the different parameters associated with superconductivity and the theory of superconductivity, idea of high temperature superconductivity.
2.	Able to understand point defects, and color centers.
3.	To differentiate the structure and symmetries of liquids, idea of quasi crystals.
4.	To equip them with the knowledge of types of CNT's and its applications.
5.	To learn about disordered and amorphous solids, Atomic correlation function and structural descriptions of glasses and liquids.

Course Outcomes: After the completion of this course, students will be

1.	Able to differentiate between type-I and type-II superconductors and their theories and explain the behavior of superconductors, applications and high temperature superconductivity.
2.	Understand the point defects, shallow impurity states and color centers.
3.	Understand structure and symmetries of liquid crystals, quasi crystals, Penrose lattice.
4.	Understand the physical and chemical properties of carbon nanotubes, methods of synthesis of nano structures, quantum size effect.
5.	Understand the crystalline, non- crystalline materials, disorder in condensed matter, atomic correlation, glasses and liquids, Anderson model, and amorphous semiconductors.

UNIT – I

Interaction of electrons with acoustic and optical phonons, polarons, Superconductivity: Manifestations of energy gap, Cooper pairing due to phonons, BCS theory of superconductivity, Ginsburg –Landau theory and application to Josephson Effect: d-c-Josephson effect, a-c Josephson Effect, macroscopic quantum interference. Vortices and type II superconductors, high temperature superconductivity (elementary).

UNIT – II

Point defects: Shallow impurity states in semiconductors. Localized lattice vibrational states in solids, vacancies, interstitial and color centers in ionic crystals.

Structure and symmetries of liquids, liquid crystals and amorphous solids. Aperiodic solids and quasicrystals; Fibonaccy sequence, penrose lattice and their extension to 3-dimensions.

UNIT – III

Special carbon solids; fullerenes and tubules, formation and characterization of fullerenes and tubules. Single wall and multi -wall carbon tubules. Electronic properties of tubules. Carbon nanotubes based electronic devices. Definition and properties of nanostructured materials. Methods of synthesis of nanostructures materials. Special experimental techniques for characterization of nanostructured materials. Quantum size effect and its applications.

UNIT - IV

Disorder in condensed matter, subsitutional, positional and topographical disorder, short and long range order, Atomic correlation function and structural descriptions of glasses and liquids.

Anderson model for random systems and electron localization, mobility edge, qualitative application of the idea to amorphous semiconductors and hopping conduction.

UNIT - V

This unit will have four short question based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

1. Draw diagrams showing some possible two-phonon processes in which a neutron enters with momentum p and leaves with momentum P'. In labeling the diagrams take due account of the conservation law.
2. The average rate of dissipation of energy for an electromagnetic wave is W = < E.J.> where the average is over a complete cycle. Show that

$$W = (\omega\varepsilon_2/ 8\pi)\ Eo2 = \sigma\ E_o^2/2 = \sigma_1 E^2$$

3. How do the (2l+1) fold degenerate energy levels of a free atom split up in a crystal field invariant to all proper rotations which transform a cube into itself? The free atom is invariant to operations of the (infinite) rotation group. The characters of the irreducible representations of this group are

$$\lambda^{(l)}(\varphi) = \sin (l + ½)\ \phi / \sin \phi/2$$

The point group of the crystal field has 24 elements in five classes and hence also five irreducible representations. Set up character table for this group

4. (a) Show whether periodicity can exist together with a periodicity in a structure (b) What is golden mean ratio? How it is relevant to quasi crystals.
5. Band structure formula for crystals is not quite valid for Nanostructure, why?
6. Distinguish between crystalline, amorphous solids and liquids.
7. What are onion carbon structures? How are they related with fullerene?
8. Calculate the lifetime of electrons and holes in a semiconductor with recombination centers (acceptors with levels E_R in the energy gap) treat explicitly the limits of large and small defect concentration n_r. Discuss the recombination mechanism in both cases. Compare the two possible definitions: $\delta n(t) – \exp(-t/\tau)$ (decay time) and $\delta n = G\tau$ (steady state).
9. The carbon nanotubes can be both semiconducting and metallic why?

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and References Books

- Crystal Structure Analysis : Burger
- The Physics of Quasicrystals, : Eds.Steinhardt and Ostulond
- Hand Book of Nanostructured Materials : Ed. Hari Singh Nalwa
- And Nanotechnology (Vol. l to 4)
- Quantum Theory of Solid State : Callaway
- Theoretical Solid State Physics : Huang
- Quantum Theory of Solids : Kittle

- Introduction to Solid State Theory : Madelung
- Solid State Physics : J.P. Shrivastava
- X-ray Crystallography : Azaroff
- Elementary Dislocation theory : Weertman and Weertman
- Crystallography for Solid State Physics : Verma and Shrivastava
- Solid State Physics : Kittel
- Elementary Solid State physics : M. Ali Omar
- Structure and Properties of Liquid Crystals : Lev M.Blinov
- Solids : H.C. Gupta

SPECIAL ELECTIVE PAPER
PY SE - 402
III & IV (B) ELECTROINCS – II

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	To introduce with various aspects of digital communication,
2.	To introduce with noise in digital communication systems.
3.	To introduce with computer communication systems.
4.	To introfuce with 8086 microprocessor and assembly language programming.
5.	To learn about 8086 connection timings, Interrupts, Digital and Analog interfacing.

Course Outcomes: At the end of Course students will be able to

1.	Understand digital communication systems such as PM, PAM, PCM, Delta modulations.
2.	Understand digital modulation techniques like BPSK, DPSK, QPSK, PSK FSK etc.
3.	Understand noise in pulse code and delta modulation systems, various noise parameters, signal to noise ratio.
4.	Understand computer communication systems, types of networks, design of networks, mobile and satellite network.
5.	Understand 8086 architecture and functioning, its assembly language programming, 8086 connection timings, Interrupts, digital and analog interfacing, elementary idea of Pentium processors.

UNIT-I

Digital Communication

Pulse-Modulation Systems: Sampling theorem- Low pass and Band pass Signals, PAM, Channel Bandwidth for a PAM signal, Natural sampling, Flat-Top sampling, Signal recovery through Holding, Quantization of signal, Quantization, Differential PCM, delta Modulation, Adaptive Delta Modulation, CVSD.

Digital Modulation techniques: BPSK, DPSK, QPSK, PSK, QASK, BFSK, FSK, MSK.

UNIT-II

Noise in pulse code and Delta modulation systems: PCM transmission, calculation of Quantization noise, output-signal power, Effect of thermal noise, Output signal to noise ratio in PCM,DM, Quantization noise in DM, output signal power, DM output-signal –to Quantization- noise ratio. Effect of thermal noise in Delta modulation, output signal- noise ratio in DM.

Computer communication systems: Types of networks, Design of a communication network, examples TYMNET, ARPANET, ISDN, LAN.

Introduction to Mobile radio and satellites: Time division multiple Access (TDMA), Frequency Division Multiple Access (FDMA), ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA) Poisson distribution, protocols.

UNIT-III

Introduction to 8086, Microprocessor chip, Internal Architecture, Introduction (Basics of) to Programming of 8086 and Assembly language. Programme development steps. Construction of machine code for 8086 Instructions, writing a programme for use with assembler, Assembly language program development tools.

Assembly Language Programming Technique: Simple sequence programmes. Basic idea of flags and jumps, While – Do, IF- THEN, IF –THEN-ELSE structure based simple programs. Writing and using Assembler Macros.

UNIT – IV

8086 System Connection Timings : 8086 Hardware Review, Addressing Memory and ports in microcomputer system , Basic Idea about Timing parameters, Minimum mode waveform and calculation for access time.

Interrupts: 8086 Interrupts and Interrupts response with some hardware applications.

Digital and Analog Interfacing of 8086: Methods of parallel data transfer, single Handshake I/O, Double Handshake Data transfer. 8255 Handshake applications:Lathe control and speech synthesizer. Display and keyboard interfacing with 8279, D/A interfacing with microcompiler, A/D interfacing (introduction)

Elementary Idea about 80816, 80286, 80386 to Pentium processors.

UNIT - V

This unit will have four short question based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

1. Explain the meaning of pulse code modulation. Draw one complete cycle diagram. Draw one complete cycle of some irregular waveform and show it is quantized using eight standard pulses.
2. Efficiency of PCM
3. Noise in PCM system
4. Signal to noise ratio in time division multiplexed PAM systems.
5. Program for creating a delay loop using 16 bit register pair.
6. Program for 8086 in Assembly Language using IF-THEN-ELSE structure.
7. Debugging Assembly Language Programs for 8086 μp with simple examples.
8. Assembly Language for interrupts procedure in 8086.

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and References Books

- Principles of communication system : Taub & Schilling (1994) II Edition
- Communication systems : Simon Haylein III Ed.
- Microprocessors and Interfacing : Douglas Hall 2nd Ed. (1992)
- Programming and Hardware

- The Intel Microprocessor 8086/8088/ : Brey & Brey
- 80186/80286/80386/80486 Pentium and
- Pentium ProProcessor Architecture
- Programming and Interfacing

SPECIAL ELECTIVE PAPER
PY SE - 403
III & IV (C) MATERIALS SCIENCE – II

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	To know about the mechanical properties of materials, factors governing mechanical behavior.
2.	Able to know the various dielectric properties of materials and its implementation in different applications. Properties of Polymer Electrets
3.	Idea of piezo, pyro, and ferro electric materials, their theory and applications.
4.	To understand thin films, their preparation, size effect, magnetic and optical properties.
5.	To know about ceramics, glasses and modern materials.

Course Outcomes: At the end of Course students will be able

1.	To understand various mechanical properties and mechanism responsible for it. Failure of materials.
2.	To understand the dielectric behavior and polarization mechanism of materials.
3.	To understand the Polymer electrets and their applications, mechanism like Poole Frenkel, Richardson Schottky, tunneling and hopping inside the materials.
4.	To understand piezo, pyro, and ferro electric materials and their applications, to know about thin films, their deposition techniques, and electrical conduction, their magnetic and optical properties.
5.	To understand ceramics, glasses, and modern materials, their preparation and applications, modern materials like, liquid and quasi crystals, fullerenes, GMR materials, composite materials, bio polymers and conducting polymers.

UNIT – I

Mechanical Properties of Materials

Elastic, visco-elastic and plastic deformation. Deformation mechanisms; slip and twinning, origin and multiplication of dislocations, Frank-Read Source, Intersection of dislocations, Fracture, Introduction to hardness and toughness.

Performance of materials in service failure, Corrosion and its control, Delayed fracture, fatigue performance of material at high temperatures, creep, service performance of polymers and ceramics.

UNIT - II

Dielectric Properties of Materials

General theory of dielectric relaxation, cooperative dipolar relaxation in polymers single and multiple dielectric relaxation processes in solids, temperature dependence of electrical properties, Polarization mechanism, dipolar and space charge polarization, thermally stimulated depolarization processes.

Polymers and Electrets

Aspects of molecular characterization, molecular weight its distribution and determination, glass transition temperature, Elastic strain, flow, polymer viscosity, visoelastic deformation, processing of polymers-Addition, fillers, plasticizers, mixing, shaping, molding, spinning. Ionic and electronic conduction in polymers, space charge conduction, charge transport in polymers. Poole Frenkel, Richardson Schottky, tunneling and hopping. Charge storage in polymers electret effect.

UNIT – III

Brief Introduction of piezo, pyro and ferroelectric materials- Idea of theory of ferroelectricity and their applications.

Brief review of diamagnetism, paramagnetism, ferromagnetism and ferri-magnetism, magnetic moments due to electron spin, Domain structure, The hysteresis loop, soft magnetic materials, hard magnetic materials, square loop magnetic materials.

Thin Films

Vacuum deposition, Ion - plasma deposition. Elementary idea about hot - metal spraying, metallization by fusion, chemical deposition, thermochemical and plasma-chemical methods and electrolytic deposition. Electrical conduction in continuous metal films. Theories of size effect, size effect anisotropy ,TCR of continuous films. Galavanomagnetic size effects - Magnetoresistance and Hall effect in thin films. Anomalous skin effect, Eddy current.

Optical properties of thin films, reflectance, transmittance and other optical constant of thin films, absorbing films, Elementary idea about the application of thin films.

UNIT – IV

Ceramics, Glasses and Modern Materials

General introduction to Ceramic materials, Preparation (solid state and wet chemical methods), Processing and sintering, Electronics ceramics, Cermaics structures, Glass, Glass ceramics, Application of ceramics as sensors, I-R and gas sensors, Ferro electric devices, heating elements, optical, Electro-optic ceramic.

Introduction to some of the modern materials like : liquid crystals, quasi crystals, fullerenes, nanostructured materials, Transparent materials, high T_c superconductivity materials, GMR materials, composite materials, Biopolymers and conducting polymers.

UNIT – V

The unit will have four short questions based on the tutorial problems covering all the four units. The students will have to answer any two questions. The samples problems are:

1. (a) The activation volume for dislocation motion in a crystal in $20b^3$, where b is the Burgers vector of the moving dislocation b = 2 Å. The P-N stress for this crystal is 1000 Mn m^{-2}. For a specified rate of dislocation motion, the activation energy Q = 40 kT. Calculate the stress required energy the dislocation at (i) 0 K (ii) 100 K (iii) 300 K and (iv) 500 K.

(b) The length of a dislocation line between two tie points is on an average equal to the reciprocal of the square root of the dislocation density in a crystal. Calculate the dislocation density in copper, work hardened to a stage where slip occurs at a shear stress of 35MN m^{-2} (Given shear modulus of copper is 44 GN m^{-2})

2.(a) A stress of 11 MP a (1600 psi) is required to stretch a 100 mm rubber band to 140 mm. After 42 days at 20 ^{o}C in the same stretched position, the band exerts a stress of only 5.5 Mpa. (800 psi) (i) what is the relaxation time ? (ii) What stress would be exerted by the band in the same stretched position after 90 days ?

(b) The relaxation time at 25 ^{o}C is 50 days for the rubber band in above problem. What will be the stress ratio s/so, after 36 days at 30 ^{o}C.

3. Assume that all energy required to produce scission in a polyethylene molecule comes from a photon (and that none of the energy is thermal).
   (a) What is the maximum wavelength that can be used?
   (b) How many eV are involved?

4. Calculate the polarization of a $BaTiO_3$ crystal. The shift of the titanium ion from the body centre is 0.06 Å. The oxygen anions of the side faces shift by 0.06 Å, while the oxygen anions of the top and bottom faces shift by 0.08 Å, all in a direction opposite to that of the titanium ion.

5. The relative dielectric constant for polyvinyl chloride (PVC) are 6.5, 5.6, 4.7, 3.9, 3.3, 2.9, 2.8, 2.6, and 2.6 at frequencies 10^2, 10^3, 10^4, 10^5, 10^6, 10^7, 10^8, 10^9 and 10^{10} Hz respectively. The values of relative dielectric constants at the above frequencies for polytetrafluoroethylene (PTFE) are 2.1.
   (a) Plot the capacitance versus - frequency curves for three capacitors with 3.1 cm × 10.2 cm effective area separated by 0.025 mm of (i) vacuum (ii) PVC and (iii) PTFE.
   (b) Account for the decrease in the relative dielectric constant of PVC with increased frequency, and for the constancy in the relative dielectric constant of PTFE.

6. The glass-transition temperature of a thermoplastic polymer is 95 ^{o}C. The viscosity at 110 ^{o}C is four times too great for a particular molding process.
   (a) What temperature is required ? Assume that the temperature cannot be controlled to closer than ± 1 ^{o}C.
   (b) What viscosity variation might by expected ?

7. Deduce the magnetic moment for formula of the following ferrites :
   Fe_3O_4, $NiFe_2O_4$, $CoFe_2O_4$ and $MnFe_2O_4$. In Fe_3O_4, the ferric ions are antiferromagnetically coupled. All the divalent cations have lost their 4S electrons. Compare the deduced values with the listed values and explain any discrepancy.

8. Discuses Mangnetoresistance and Hall effect in thin films.

9. Describe the preparation of solid solutions.

10. Discuss the preparation of nanomaterials

In addition to above the tutorial will also consist of solving problems given in the Text and References books.

Text and Reference Books

- Elements of Materials Science and Engineering Sixth Edition-Lawrence H., Van Vlacke, Addition Wesley.
- Elements of Solid State Physics-J.P. Shrivastava- Prentice Hall India.

- Materials Science and Engineering-V. Raghwan-Fourth Edition-Prentice Hall.
- The Structure and Properties of Materials Vol. I, II, III, and IV –John Wulff et al. Wiley Eastern Limited.
- Physical Metallurgy Principles Robert E-Reed-Hill, East West Press New Delhi.
- Introduction to Solid-A Zroff.
- Materials Science and Processes– Hajra Choudhry Indian Book Distribution co.
- Materials Science and Engineering- William D. Callister Jr, John Wiley (2001).
- Experiments in Materials Science- E.C. Subbarao, L.K. Swghal, D. Chakraborty, M.F. Merriam and V.Raghavan, Tata McGraw Hill, New Delhi.

SPECIAL ELECTIVE PAPER
PY SE - 404
III & IV (D): COMPUTATIONAL PHYSICS – II

60+40= 100 MARKS **5 CREDITS**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject.

1.	To know the basics of Mathematica programming.
2.	To equip with the application of Computers for problem solving in quantum mechanics.
3.	Implement optimization techniques to solve the problems related to condensed matter physics.
4.	To provide the concept on computation of free energies of solids and how to obtain them numerically.
5.	Introduction to computer simulation techniques.

Course Outcomes: At the end of Course students will understand and apply computational skills for understanding and describing the various problems of Physics. They will be able to

1.	Get a wide knowledge of Mathematica programming, its commands, numerical calculations like Factorial, exponential etc. Factorial, exponential & polynomials, Plots of data functions.
2.	To solve quantum mechanical problems in computational methods, like Schrodinger equations
3.	Solve propagation of free waves and through one dimensional well.
4.	Use computational methods to simulate phonon dispersion, density of states, two dimensional free electrons.
5.	Use simulation techniques to solve molecular dynamics with random oscillations, Monte Carlo and Ising model, magnetic susceptibility.

UNIT – I

Basic of Mathematica Programming

Introduction, commands and variables, numerical calculations with examples such as Factorial, Exponential etc. Symbolic calculations : polynomials, equations calculus (differential and integrals) Manipulations with matrices, Eigen values and Eigen vectors, Plots of data and functions.

UNIT – II

Computer Applications to problem solving in Quantum Mechanics

Solving one dimensional Schrodinger equation for stationary states, solution of time independent Schrodinger equation for linear harmonic osillator. Radial solution of

Schrodinger equation for three dimensional harmonic oscillator potential, The propagation of free wave packets, study of wave packet propagation through a one-dimensional well.

UNIT – III

Computer Application to problems in Condensed Matter Physics

Simulation of phonon dispersion curves and density of states, The reciprocal lattice and Harrison construction(2D), One dimensional phonon propagation, Two dimensional Lattice vibrations, Two dimensional nearly free electrons.

UNIT – IV

Introduction to Computer Simulation

Molecular Dynamic Simulation Gas with random collisions, N body gas, Monte Carlo simulations, The 2-D Ising model for interacting spins, specific heat, average energy, Magnetization, susceptibility.

UNIT - V

This unit will have four short questions based on tutorial problems covering all the four units. The students will have to answer any two questions out of four. Some sample problems are:

1. General ideas of computer algebra software viz Mathematica, Matlab.
2. Use of Mathematical graphics with examples.
3. Discuss the numerical solution of the Schrodinger equation for an harmonic oscillator potential $v(x) = \frac{1}{2}x^2 + bx^4$. Choose b of different magnitudes and check how the grounds state wave function depends on this.
4. Develop a program to find energy Eigen value for a general power law potential. $V(r) = a\,r^n$, $n > 0$.
5. In a linear monatomic chain of four atoms, the end atoms are fixed, considering only the nearest neighbor interaction and assuming that the force between any two atoms is proportional to their relative displacement, set up the equation of motion for longitudinal vibrations of the free atoms. Solve this equation numerically and verify that the frequencies of the two normal modes are related as $w_1^2 = 3w_2^2$.
6. In a one-dimensional nearly free electron model, solve the Schrodinger equation and plot the periodic occurrence of the parabolic energy curves of a free electron in one-dimensional reciprocal space.
7. Simulation of (i) travelling pulse (2) standing wave.
8. Simulation of radioactive decay and random walk.

In addition to above the tutorial will also consist of solving problems given in the text and reference books.

Text and Reference Books

- Computational Physics - R.C. Verma, P.K. Ahluwalia and K.C. Sharma, New Age Publishers (1999)
- Programming in ANSI C, - E. Balaguruswami Tata Mc Graw Hill (1994)
- Numerical Recips in FORTRAN - Press W.H., Teukolsky S.A. Vellerling W.T. and Flanney B.P.

(Cambridge Univ. Press 1992)

- Simulation using Personal Computer - Carroll, J.M. (Prentice Hall, 1987)

ABILITY ENHANCEMENT AND SKILL DEVELOPMENT PRACTICAL COURSES SEMESTER III & IV

M.Sc. (Physics) III & IV Semester:

Note: Appropriate other experiments can be added based on prescribed syllabus in both labs A and B

SPECIAL ELECTIVE PAPER LABORATORY COURSE PY L 301/PY L 302/PY L 303/ PY L 304 & PY L 401/PY L 402/PY L 403/ PY L 404

(A) CONDENSED MATTER PHYSICS I & II

PY L 301 & PY L 401

(Preferably six experiments to be performed by the students)

1. Measurements of lattice parameters and indexing of powder photographs.
2. Interpretation on transmission Laue photographs.
3. Determination of orientation of a crystal by back reflection Laue methods.
4. Rotation/Oscillation photographs and their interpretation.
5. To study the modulus of rigidity and internal friction in metals as a function of temperature.
6. To measure the cleavage step height of a crystal by Multiple Fizeau fringes.
7. To obtain Multiple beam Fringes of Equal Chromatic Order. To determine crystal step height and study birefringence.
8. To determine magnetoresistance of a Bismuth crystal as function of magnetic field.
9. To study hysterisis in the electrical polarization of a TGS crystal and measure the Curie temperature.
10. To measure the dislocation density of a crystal by etching.
11. Solution of some problems in spherical geometry using stereographic wulffnet.
12. Study of symmetry of crystal models.
13. Measurement of Hall coefficient.
14. Determination of Lande’s ‘g’ factor using ESR.
15. Determination of Energy band gap
16. Study of Lattice dynamics.
17. Measure of resistivity using four probe.
18. Hysteresis Loop tracer.
19. Study of Luminescence.

Tutorial: Laboratory /Practical Course CONDENSED MATTER PHYSICS

1. Study of X-ray diffraction from liquid, amorphous materials.
2. Determination of dislocation density by Reflection X-ray topography.

3. To take Burger Precession photograph of a crystal and index the reflections.
4. To measure the superconductivity transition temperature and transition width of high-temperature superconductors.
5. To determine the optical constants of a metal by reflection of light.
6. Model evaluation of dispersion curves of one-dimensional lattice.
7. Creation of low pressure and measurement.
8. Thin film deposition and operation of vacuum coating unit.
9. Data analysis using computers.
10. Operation of Spectrophotometer.
11. NMR Instrumentation.
12. Surface structural study of materials using Carl Zeiss microscope.

(B) ELECTRONICS I & II PY L 302 & PY L 402

Preferably six experiments to be performed by the students

1. Amplitude Modulation and Demodulation.
2. TDM PULSE Amplitude Modulation and Demodulation.
3. Study of PCM Receiver and Transmitter.
4. Study of satellite – C Band Receiver.
5. Study of AM – FM Receiver set.
6. Pulse position/ Pulse width Modulation and Demodulation.
7. FSK Modulation.
8. Microwave characterization and measurement.
9. Study of Motor speed control Interface and programming.
10. Temperature control using 8086.
11. Programs for Addition, Division, Subtraction, & Multiplication with 8085 μp system.
12. Programs for (a) To find Largest Number.
    (b) To find Smellers Number
13. Programme for Addition, Subtraction, Multiplication and Division with 8086.
14. Dielectric measurement of Solid/Liquids using Microwave.
15. SWR Reflection Coefficient Measurement.
16. Study of E Plane, H Plane, Magic Tees Bends.
17. Frequency Guide wavelength measurement.

Tutorials: Laboratory/Practical course
ELECTRONICS

1. Digital Communication.
2. Cellular Communication
3. Mobile Communication via satellite
4. Trouble shooting in 8086 Microprocessor System.
5. 8086 Instruction Description
6. Microprocessor based process control system
7. Trouble shooting in 8085 based system
8. Trouble shooting AM based Radio Receiver

(C) MATERIALS SCIENCE - I & II PY L 303 & PY L 403

(Preferably six experiments to be performed by the students)

PREPARATION AND CHARACTERIZATION

1. Growth of single crystals from solution
2. X-ray diffraction study of crystal structure and indexing (a) Laue photograph (b) Rotating Crystal and (c) Powder

MICROSTRUCTURE AND IMPERFECTIONS

3. Preparation of specimen for metallographic examination measurment of grain size and amount of constitutional phase.
4. Study of dislocations and measurement of dislocation density by etching technique.
5. Application of Fizeau fringes for measurment of step height.
6. Application of FECO for study of pilling-up and sinking- in.

TRANFORMATION AND KINETICS

7. To study the kinetics of crystallization of polyethylene
8. Study of microstructure of metals and alloys after various phase transformations
9. To demonstrate the electrochemical nature of aqueous corrosion and to study electrochemical methods of corrosion control
10. Effect of recovery, recrystallization and grain growth on microstructure and mechanical properties of commercially pure copper.

MECHANICAL PROPERTIES

11. To study Griffith flaws in glass.
12. Tensile testing of Aluminium, Copper, Steel etc.
13. Study of hardness of different materials by Vicker's pyramid hardness tester
14. Fatigue testing of materials

ELECTRICAL PROPERTIES

15. Study of short circuit TSC
16. Measurement of Transient charging and Discharging current
17. Study of Hall effect and measurement of Hall coefficient
18. Study of dielectric behaviour of barium titanate
19. Determination of energy band gap
20. Determination of Resistivity using four probe methods.
21. Hysteresis loop of ferroelectric.

DEVICES

22. Study of Solar Cell
23. Preparation of thermo-electret and measurement of initial surface charge density
24. To measure the piezoelectric coefficient/P-E curve of barium titanate.

Tutorials: Laboratory/practical course

1. Creation of low pressure and measurement.
2. Thin film deposition and operation of vacuum coating unit.
3. Data Analysis using computer.
4. NMR Instrumentation
5. Preparation of nanomaterials.
6. Preparation of polymer blends materials.
7. Fabrication of high temperature furnaces.

8. Operation of Spectrometer.

(D) COMPUTATIONAL PHYSICS – I & II PY L 304 & PY L 404

(Preferably six experiments to be performed by the students)

1. Monte Carlo simulation of Radio Active Decay.
2. Determination of Phonon Dispersion Relation.
3. Wave packet propagation through square well potential.
4. Monte Carlo simulation of two dimensional Ising model.
5. Graphic representation of 3D object.
6. Gas of point particles with Random Elastic collision.
7. Motion of a satellite around a planet.
8. Phase Trajectory of a chaotic pendulecan.
9. Electromagnetic Oscillation of LC Circuit.
10. Motion of charged particle in Electric field.
11. Diffusion as a random walk problem.
12. Simulation of Brownaian motion
13. Lyapunov Exponents and Bifurcation.

Tutorial : Laboratory/ Practical Course

COMPUTATIONAL PHYSICS

Setting up of new experiments will form tutorial for this laboratory course.

RANI DURGAVATI VISHVAVIDHYALAYA, JABALPUR
DEPARTMENT OF POST GRADUATE STUDIES AND RESEARCH IN PHYSICS AND ELECTRONICS

M. Sc. Electronics Semester I & II (With Effect from 2020-21)

Choice Based Credit System (CBCS) & Learning Outcome Curriculum Framework (LOCF)

(In accordance with the University Ordinance No.222)

SEMESTER – I

Theory Courses		Marking Scheme					
Paper Code	Title of Paper	Credits	End Sem. Exam.	Continuous Evaluation			Total
ELE C 101	<u>Core</u> Electromagnetic Fields and Waves	5	60	40			100
ELE C102	<u>Core</u> Properties of Electronics Materials	5	60	40			100
ELE C103	<u>Core</u> Signals and Systems	5	60	40			100
ELE EL101 ELE EL102	<u>Elective (Any one)</u> A. Computational Methods in Electronics B. Digital Design and Applications	5	60	40			100
Ability enhancement & Skill Development (Practical Courses)				Practical Record. & Viva	Seminar Related to Practical	Total	
ELE L 101 Lab A		3	60	20	20	40	100
ELE L 102 Lab B		3	60	20	20	40	100
ELE S Skill Development		2					
Total		28	360	240			600

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SEMESTER – II

Theory Courses		Marking Scheme					
Paper Code	Title of Paper	Credits	End Sem. Exam.	Continuous Evaluation			Total
ELE C 201	Core Analog and Digital Circuits	5	60	40			100
ELE C 202	Core Optical and Quantum Electronics	5	60	40			100
ELE C 203	Core Network Analysis and Synthesis	5	60	40			100
ELE EL 201 ELE EL 202	Elective (Any one) A. Microprocessor and Object Oriented Programming B. Microwave Electronics	5	60	40			100
Ability enhancement & Skill Development (Practical Courses)				Practical Record. & Viva	Seminar Related to Practical	Total	
ELE L201 Lab A		3	60	20	20	40	100
ELE L 202 Lab B		3	60	20	20	40	100
ELE S Skill Development		2					
Total		28	360	240			600

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RANI DURGAVATI VISHVAVIDHYALAYA, JABALPUR
DEPARTMENT OF POST GRADUATE STUDIES AND RESEARCH IN PHYSICS AND ELECTRONICS

M. Sc. Electronics Semester III & IV (With Effect from (2021-22)

Choice Based Credit System (CBCS) & Learning Outcome Curriculum Framework (LOCF)
(In accordance with the University Ordinance No.222)

SEMESTER – III

Theory Courses		Marking Scheme					
Paper Code	Title of Paper	Credits	End Sem. Exam.	Continuous Evaluation			Total
ELE C 301	Core Integrated Circuit technology	5	60	40			100
ELE C 302	Core Microwave and Digital Communication	5	60	40			100
ELE C 303	Core Control Systems	5	60	40			100
ELE EL 301 ELE EL 302	Elective (Any one) A. Electronics Instrumentation and Measurement B. VHDL	5	60	40			100
Ability enhancement & Skill Development (Practical Courses)				Practical Record & Viva	Seminar Related to Practical	Total	
ELE L 301 Lab A		3	60	20	20	40	100
ELE L 302 Lab B		3	60	20	20	40	100
ELE S Skill Development		2					
Total		28	360	240			600

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M. Sc. Electronics (With Effect from (2021-22)

Choice Based Credit System (CBCS) & Learning Outcome Curriculum Framework (LOCF)

(In accordance with the University Ordinance No.222)

SEMESTER – IV

Theory Courses		Marking Scheme					
Paper Code	Title of Paper	Credits	End Sem. Exam.	Continuous Evaluation .			Total
ELE C 401	Microcontroller and Embedded Systems	5	60	40			100
ELE C 402	Cellular and Satellite Systems	5	60	40			100
ELE C 403	Digital Signal Processing	5	60	40			100
ELE EL 401 ELE EL 402	Special/Elective (Any One) a) Internet and Web Technology and Management b) Nano-electronics	5	60	40			100
				Practical Record & Viva	Seminar Related to Practical	Total	
ELE L 401 Lab A		3	60	20	20	40	100
ELE IT 402 Industrial Training		3	60 (Report + Presentation.)	40			100
ELE PW 401 Project Work		2	60 (Report +Presentation)	40			100
ELE S 401 Skill Development		2					
Total		30	420	280			700

M.Sc. Electronics I Semester 2020-21 onwards (CBCS)

ELE C 101 Core Paper 1: ELECTROMAGNETIC FIELDS AND WAVES

60+40= 100 Marks **5Credits**

Course Objectives: The objectives of the course are

1.	To provide an understanding of continuous volume, symmetrical charge distribution.
2.	To give an understanding of method of electrostatic images for charges, magnetic flux and flux density.
3.	Elucidate the Time varying fields and reflection of uniform plane wave.
4.	Able to solve Lienard wiechert potential and field related problems.
5.	To provide the basic knowledge about the relativistic electrodyanamics.

Course Outcomes: The purpose of the course is to give the basic knowledge

1.	About basic phenomenon like electric field intensity, Gauss law and its applications, Divergence theorem etc.
2.	To obtain knowledge of boundary value problems and obtain their solution using keys like Laplace's and Poission's equations, Bio savert law, Stokes theorem, Scalar and magnetic vector potential and multi pole expansion.
3.	To understand Maxwell's equations, their integral form and uniform plane wave, basic knowledge about groups and types, skin effect and standing wave ratio.
4.	To obtain information about Transmission lines and electromagnetic radiations for accelerated charge and angular distribution of power radiation.
5.	To develop an understanding of relativistic electrodynamics by discussing transformation properties, Four vector and Lagrangian and Hamiltonian.

UNIT I

Electrostatic Fields:- The Experimental Law of Coulomb, Electric field Intensity , field due to a continuous Volume Charge Distribution , Field of a line Charge , Field of Sheet Charge , Streamline and Sketches of Fields. Electric Flux Density, Gauss's Law, and Application of Gauss's Law: Some Symmetrical Charge Distributions, Differential Volume Element. Divergence, point form of Gauss law, the vector Operator V and the Divergence Theorem,

UNIT II

Boundary Value Problems in Electrostatics:- Conductor properties and and boundary conditions Poisson's and Laplace's Equations, Uniqueness Theorem, Example of Solution of Laplace's Equations, Example of Solution of Poisson's Equation , Product Solution of Laplace's Equation , Method of electrostatic images for point charge and charged sphere near grounded and insulated conducting sheets, Biot-Savart Law , Ampere's Circuital Law , Curl , Stokes theorem , Magnetic Flux and Magnetic Flux Density , The Scalar and Vector Magnetic Potentials. Multipole expansion,

UNIT III

Time- Varying Fields and Maxwell's Equations and The Uniform Plane Wave:- Faraday's Law**,** Displacement Current , Maxwell Equation in Point form , Maxwell Equation in Integral Form, Potentials of electromagnetic field, Gauge transformation, Coulomb Gauge, Lorentz Gauge , Retarded potentials, Wave Motion in Free Space , Wave Motion in Perfect Dielectrics , Plane wave in lossy dielectric, The Poynting Vector and Power Considerations , Propagation in Good Conductor: Skin Effect, Reflection of uniform plane waves, Standing Wave Ratio.

UNIT IV

Transmission Lines and Electromagnetic Radiations:- The transmission line equation, Transmission line parameters, Some transmission line examples, Graphical methods, Some practical problems. Radiations from oscillating dipole, Linear antenna, Lienard wiechert potentials, field of charge particle in uniform motion and arbitrary motion. Fields of an accelerated charge, Radiation from accelerated charged particles at low velocity, Angular distribution of power radiation, Electric quadrupole radiation.

UNIT V

Relativistic Electrodynamics:- Review of four vector and Lorentz transformation, Invariance of electric charge, relativistic transformation properties of E and H fields, Electromagnetic fields tensor in 4-dimensional Maxwell equation, Four vector current and potential and their invariance under Lorentz transformation, Covariance of electrodynamics, Lagrangian and Hamiltonian for relativistic charged particles in electromagnetic fields, uniform and non-uniform E and B fields.

Text/Reference Books

1. Engineering electromagnetic By William H. Hayt
2. Electrodynamics by Satyaprakash
3. Electrodynanmics by Gupta and Kumar
4. Electromagnetics by B.B.Laud
5. Classical Electrodynamics by J.D.Jackson
6. Electrodynamics by Chopra and Agrawal

ELE C 102 Core Paper 2: PROPERTIES OF ELECTRONIC MATERIALS

60+40= 100 Marks **5 Credits**

Course Objectives: The objectives of the course are

1.	To illustrate the electrical and dielectric properties of materials.
2.	To discuss optical properties and band structure of materials.
3.	To explain magnetic properties of materials.
4.	To give the basic idea and knowledge about semi conductors.
5.	To formulate concept of semiconductor devices; construction and working.

Course Outcomes: To apprise the students of various properties of electronic materials and completion of the course students will have understanding of

1.	Conductivity, reflection and absorption properties, dielectric constant and polarizability, phase transition, piezoelectricity.
2.	Optical constant and their physical significance, Kramer kronig relations, colour of material, properties of nano materials.
3.	Various theories related to types of magnetism, adiabatic demagnetization, magnetic domains.
4.	Electron and hole transport in semiconductor, experimental methods to study the electrical parameters, intrinsic and extrinsic semiconductors.
5.	Construction and working of semiconductor devices, JFET, MOSFET, negative conductance devices, IMPATT and TRAPATT and quantum well structure.

UNIT I

Electrical and Dielectric Properties:- Electrical properties: of metals: Conductivity, reflection and absorption, Fermi surfaces, Thermo electric phenomena. Conduction in metals oxides, amorphous materials. Dielectric Properties of materials: Macroscopic electric field, local electric field at an atom, dielectric constant and polarizability, Ferro electricity, anti ferro electricity, phase transition, piezoelectricity, Ferro elasticity, electrostriction.

UNIT II

Optical Properties:- Optical properties of materials: Optical constants and their physical significance, Kramers – Kronig Relations, Electronic inter bond and intra bond transitions Relations between Optical properties and band structure, colour of material (Frenkel Excitons), photoluminescence, Electroluminescence. Properties of nano materials.

UNIT III

Magnetic Properties of Materials: Langevin Theory of Dimagnetism and paramagnetism, various contributions to para and dia magnetism, Adiabatic demagnetization, Paramagnetic susceptibility, Ferromagnetism, ferrimagnetism, ferrites, antiferromagnetism, Magnetic Domains.

UNIT IV

Semiconductors:- Direct and indirect band gap methods to determine the forbidden gap electronic and hole transport in semiconductors, electrical parameters, carrier concentration, mobility, temperature dependence, experimental methods to study the electrical parameters, thermo electric effect. Hall effect, intrinsic and extrinsic semiconductors, electrons and phonons in semiconductors.

UNIT V

Semiconductor Devices:- Field Effect transistors : JFET, MOSFET, ideal MOS capacitor, control of threshold voltage, surface field effect transistors, Id-Vds characteristics, practical device effects. Negative conductance devices – IMPATT, TRAPATT, Gunn diode, masers Power Devices : p-n-p-n diode, Semiconductor Controlled Rectifier Quantum well structures.

Text/Reference Books:

1. Solid State Physics Dekkar
2. Introduction to Solid State Physics C.Kittle
3. Solid State Physics Ashcroft, Mermin
4. Principles of Electronic materials & Devices S.O. Kasap
5. Physics of Semiconductor Devices S.M. Sze

ELE C 103 Core Paper 3: SIGNALS AND SYSTEMS

60+40= 100 Marks **5 Credits**

Course Objectives: The aim and objective of the course is to provide the knowledge about the basic signal and system, modeling concepts, Fourier series and Transform functions.

1.	To impart knowledge about various signals and spectra singularities, functions, representation of system (linear and non linear). System modeling and simulation.
2.	To obtaining trigonometric Fourier series, symmetric properties, Fourier transform theorems related to linearity, time delay and various other parameters and general idea of Hilbert transform and its applications.
3.	An understanding of Laplace transform, product of two signals and network analysis using Laplace transform.
4.	Introduction to transform function and frequency response of systems, stable and unstable systems and concepts of stability
5.	To explain the transfer function and frequency response of systems, asymptotic and marginal stability, Routh- Hurwitz criterion.

Course Outcomes: At the end of the course students should be able to

1.	Discuss the signal models, types, and functions, representation of systems, properties, stability and impulse response of a fixed linear system.
2.	Develop a comprehensive understanding of Fourier series and Transforms, Transfer functions, distortion less systems, Frequency translation, modulation, convolution etc., window functions and Gibbs phenomenon.
3.	Develop an insight into Laplace transform, various theorems related to transform of derivatives, integral, Laplace transform of convolution of two signals, network theorems (Thevenin and Norton's), Loop and node analysis.
4.	To understand and apply transfer function and frequency response of system for linear lumped stable systems, asymptotic and marginal stability, Routh-Hurwitz criterion, Bode plots etc.
5.	Evaluate and understand the behavior of discrete time signals and systems, analog to digital conversion, state variable concept, Frequency domain solution of state equations for discrete time systems, related examples, inverse Z

	transformation by the immersion signal.

UNIT I

Signal and System modeling concepts:- Introduction, Examples of systems, Signal models (examples of deterministic signals, continuous-time vs discrete –time signals, periodic and aperiodic signals, phaser signals and spectra, singularities functions, unit impulse function (delta function)) ,Energy and power signals, Energy and power spectral densities.
System modeling concepts : terminology, representation of systems, properties of systems (continuous-time and discrete –time systems, fixed and time-varying systems, causal and noncausal systems, dynamic and instantaneous systems, linear and nonlinear systems). The superposition integral for fixed linear systems. Examples illustrating evaluation of the convolution integral. Impulse response of a fixed linear system. Superposition integral in terms of step response, Stability of linear systems, System modeling and simulation.

UNIT II

Fourier Series and Transforms:- Introduction, Obtaining trigonometric Fourier series representations for periodic signals, spectral form of the trigonometric Fourier series, The exponential Fourier series, Symmetry properties of the Fourier coefficients, Parseval's theorem, line spectra, Transfer function of a fixed linear system, distortionless systems, Frequency groups, Fourier series and signal spaces.
Fourier Transform : The Fourier integral, energy spectral density, Fourier transform in the limit, Fourier transform theorems related to: linearity, time delay, scale change, time reversal, duality, frequency translation, modulation, differentiation, integration, convolution, multiplication. Table of Fourier transform pairs,F.T. of dc and ac pulses,System analysis with Fourier transform, Steady state system response to sinusoidal inputs by means of Fourier transform, Ideal filters, Window functions and Gibbs phenomenon, Rate of convergence of spectra, Fourier transform of periodic signals. General idea of Hilbert transform and its applications.

UNIT III

Laplace Transform : Introduction, examples of evaluating Laplace transforms, Laplace transform theorems related to :- linearity, transform of derivatives , transform of integrals, s-shift theorem, delay (t-shift) theorem, Laplace transform of convolution of two signals, Laplace transform of a product of two signals, initial value theorem, final value theorem, scaling theorem. Inversion of rational functions. The inversion integral and its use in obtaining inverse Laplace transforms.

Network analysis using Laplace transform: Laplace transformed equivalent circuit elements, mutual inductance, network theorems (Thevenin's and Norton's) in terms of Laplace transform, Loop and Node analysis of circuits by means of the Laplace transform

UNIT IV

Transfer function and frequency response of systems: general concepts of a transfer function, properties of transfer function for linear lumped stable systems, frequency response, zero-input and zero state response, asymptotic and marginal stability.

Stable and unstable systems and concept of stability, Routh-Hurwitz criterion ,Routh array, Bode plots, Block diagrams , Block diagrams and their reduction.Operational amplifiers as elements in feedback circuits.

State – variable techniques : State-variable concepts, Form of state equations, Time-domain solutions of state equations, concept of state transition matrix, Frequency-domain solutions of state equations, Finding the state transition matrix, State equations for electrical networks, State equations from transfer functions, State equations for discrete –time systems.

UNIT V

Discrete – time signals and systems: Introduction, Analog –to-digital conversion (sampling, sampling theorem, Impulse train sampling, Data reconstruction, quantization and encoding,), The z – transform (definition, linearity, Initial value and final value theorems, inverse z-transform, Delay operator), Difference equations and discrete- time systems (properties of systems, shift invariant systems, causal and noncausal systems, linear systems, difference equations, steady state frequency response of a linear discrete –time system, frequency response at f=0 and f=0.5fs), Example of a discrete –time system, Inverse z-transformation by the inversion integral.

Text/Reference Books

1. Signals and Systems: Continuous and discrete, by Rodger E. Ziemer, William H.Tranter and D. Ronald Fannin, second edition,, Maxwell Macmillan nternational Edition (1990).
2. Sihnals and systems by Simon Haykin and Barry Van Veen second edition, John Wiley and sons (2003)
3. Signals and systems by Samarajit Ghosh, Pearson education (2006)

ANY ONE TO BE OPTED AMONGST THE FOLLOWING ELECTIVE PAPERS

ELE EL 101 Elective Paper (A): Computational Methods in Electronics

60+40= 100 Marks **5 Credits**

Course Objectives: To impart the basic knowledge of computational methods in electronics with the programming, numerical differentiation and Integration.

1.	Discuss the high level computer language and operating systems.
2.	Teach the basic programming, flow chart, Graphics statements, methods of determination of zero's of linear and non linear algebraic equations.
3.	Obtaining solution of simultaneous linear equations, Gaussion elimination, Curve fitting polynomials.
4.	Understanding of numerical differentiation and integration with Newton cotes formulae, Euler and Ranga- Kutta methds.
5.	Train them to familiar computer application to problems in electronics.

Course Outcomes: At the completion of the course the students should be able to

1.	Know the various operating systems like DOS, OSII, GUI in general also multitasking UNIXshell, text processing in UNIX environment.
2.	Aware the elementary idea about compilers, interpreters, assignments and functions.
3.	Understand the interative methods, Matrix inversion, Eigen values and Eigen vectors of matrices.
4.	Enriched with numerical solution of ordinary Differential Equation, predictor and corrector methods.
5.	Understand the basic of oscillations in LC, RC and LCR circuits, Harmonic waves, charging and discharging in circuit with inductor capacitor and registers.

UNIT-I

High level computer language and Operating systems: Operating system: Familiarities with various operating systems like DOS, OSII, GUI, Like Windows, Unix/Linux. Detail of one Operating system such as UNIX - Introduction multitasking, multiuser capabilities, UNIX bacis, files and Directories, understanding the UNIX shell, text processing in UNIX environment, editor like VI, EMAC, SED.

UINT-II

Programming: Elementary idea about Digital computer principles, Compilers, Interpreters, and Operating system. BASIC Programming, Flow Charts, integer and floating point, arithmetic expressions build in function, executable and non-executable statements, assignments and functions, operation with files, Graphics statements, Methods of determination of zero's of linear and nonlinear algebraic equations and transcendental equations convergence of solutions.

UNIT-III

Solution of simultaneous linear equations, Gaussion elimination, pivoting, iterative method matrix inversion, Eigen values and Eigen vectors of matrices, power and Jocobi method, finite differences, interpolation with equally speeds points, Curve fitting polynomials least squares and least spline fittings.

UNIT – IV

Numerical differentiation and integration Newton cotes formulae, Error estimates Gauss method. Numerical solution of ordinary differential equation. Euler and Ranga- kutta Methods. Predictor and corrector method. Elementary ideas of solution of partial differential equation.

UNIT-V

Computer application to problems in electronics:

i. Study of oscillations in LC, RC and LCR circuits.
ii. Study of Fourier analysis by using analytical expressions for Fourier series and Fourier transformations of periodic function, Harmonic wave, DC pulse and AC pulse.
iii. Study of charging and discharging in circuit with inductor, capacitors and registers.
iv. Acceleration of charge particle in cyclotron.

Text/ Reference Books

1. Introductory Methods of Numerical analysis by Sastry
2. Numerical Analysis by Rajaraman
3. Numerical Analysis by Balagurswamy
4. Numerical Reciper Uttermind Tenkolsky Press Flattery
5. Computational Physics by R.C.Verma, P.K.Ahluwalia and K,C.Sharma New Age Publishers 1999

ELE EL 102 Elective Paper Paper (B): DIGITAL DESIGN AND APPLICATIONS

60+40= 100 Marks **5 Credits**

Course Objectives: The course enables the students

1.	To provide the basic knowledge of logic circuits and concept of logic families.
2.	To understand Boolean functions , K-map and designing of families.
3.	To apply concept of combinational logic circuits.
4.	To know the construction and working of sequential circuits design like flip flops and counters.
5.	To understand the working utility and applicability of sequential logic circuit design i.e., shift registers and their types.

Course Outcomes: The purpose of the course is to give the basic knowledge about digital designs and their applications in various areas and after completion of course students should be able to

1.	Have an idea about number systems, logic gate characteristics and construction. Working and characteristics of logic families for several applications.
2.	Numerically understand the Boolean Algebra, simplification of K- map and applications designing of various devices.
3.	Analyze various arithmetic circuits like Half adder, digital comparator, parity generator/ checker etc.
4.	Understand fabrication techniques of sequential circuits like flip flop counters and types.
5.	Evaluate and understand behaviour of shift registers and their types and applicability in electronic circuits.

Unit I

Basic Logic Circuit- Introduction of basic gates, universal gates, number systems and codes, Boolean algebra, switching characteristics of semiconductor devices. logic gate characteristics,

Logic families- RTL, DTL, TTL, ECL interfacing , ECL and TTL, Speed of operation, power dissipation , figure of merit, fan in, fan out, noise margin..

MOS logic MOSFET NAND and NOR gates, CMOS inverters, CMOS - NAND and NOR gates, interfacing CMOS and TTL, inter facing CMOS and ECL, comparison of logic families.

Unit-II

Logic Design- Minimization of Boolean functions, Karnaugh Map and Applications, Analysis and Synthesis of combinational circuit

Simplification of boolean algebra using K-map, minterm and maxterm, design of binary adder, substractor , digital comparator, parity generator/checkers, priority encoder, BCD to 7 segments decoder,

Unit III.

Combinational logic circuits: arithmetic circuits – Half adders, Full adders; Digital Comparators, Encoders, Decoders, multiplexer, multiplexer tree, demultiplexer and demultiplexer tree.

Unit IV

Sequential Circuit Design - I

Excitation table of flip flops – S-R, J-K , Master-Slave – JK, D and T flip flops, clocked flip flop design – conversion of one form of flip flop to another type. Different types of Counters: Ripple Counter, Asynchronous and Synchronous Counters, UP/Down Counters, Modulo (MOD) Counters.

Unit V

Sequential Circuit Design-II

Shift Registers: Serial in ,Serial out, Parallel in Serial out Shift Registers, Parallel in Parallel out Shift registers, Bi directional Shift Registers, Shift register counters, Shift Register Application, Application of Counters. Introduction to Synchronous sequential Machines.

Reference Books :

1. Digital Design III rd edition : M. Morris Mano**.**

2. Z. Kohavi (TMH), “Switching & Finite Automata Theroy”.
3.Digital and Analogue Techniques-G.N.Navneeth,V.M.Gokhale,R.G.Kale(Kitab Mahal)
4. Digital Fundamentals-Floyd& Jain,Pearson Education.
5. Digital Computer Electronics-Malvino (Tata McGraw Hill)
6. Integrated Circuits- K.R.Botkar (Khanna Publishers)

M.Sc. Electronics II Semester 2020-21 onwards (CBCS)

ELE C 201 Core Paper 1: ANALOG AND DIGITAL CIRCUITS

60+40= 100Marks **5 Credits**

Course Objectives: The objectives of the course are to get exposure about the various tools employed to analyze the problems related with analogue and Digital circuit

1.	To know the basic concept and specification of operational amplifier.
2.	To understand the application of operational amplifier and idea about filters.
3.	To examine the nonlinear applications of operational amplifier and their use in circuits.
4.	To discuss Boolean function, analysis and synthesis of combinational circuits.
5.	To explain various counters registers and digital equipments.

Course Outcomes: The purpose of the course to introduce the concept of analogue and digital circuits in detail and on completion of the course the student should acquire basic knowledge and will be able to

1.	Understand the construction and working of Operational Amplifier including all parameters and specifications.
2.	Know the linear applications of Operational Amplifier and general idea about instrumentation amplifier and filters.
3.	Discuss and analyze the nonlinear applications of OP-AMP in the form of various devices.
4.	Formulate the Boolean functions, simplification of k map and generalization of combinational circuits
5.	Discuss the synchronous sequential machines, Mealy and Moore model machines, state table and transition diagram etc.

UNIT I

Operational Amplifier – Differential amplifier and its DC & AC analysis, block diagram of OP- AMP , its parameters, frequency response , current mirror and current loading biasing ,concept of ideal op-amp , specification of standard op-amp like IC 741,LM 324,µA 741.

UNIT II

Linear application of OP-AMP: - voltage amplifier, summing amplifier, averaging amplifier, current source, differential amplifier, instrumentation amplifier, filters: LPF, HPF, BPF and all pass filter.

UNIT III

Non linear application of OP–AMP: - active diode circuits –rectifiers, peak detector, clipper and clamper, comparator: - Zero crossing detectors, limit detectors, window comparator and Schmitt triggers. Differentiator, Integrator, Waveform Generator and conversion using op-amp oscillators.

UNIT IV

Minimization of Boolean functions, Karnaugh Map and Applications, Analysis and Synthesis of combinational circuit, Digital Comparators, MUX and DMUX, Encoders, Decoders, Code Converters.

UNIT V

Different types of Counters and Registers. Introduction of Synchronous Sequential Machines, Digital Voltmeter, Digital frequency counter; Realization of Flow table from verbal description, Sequence Detector, Mealy and Moore model Machines, State Table and Transition diagram.

Text/Reference Books :

1. Digital Principal and application : Malvino and Leach.
2. Electronics Principle: A.P. Malvino
3. Digital Design III rd edition : M. Morris Mano**. (**TEXT)
4. Z. Kohavi (TMH), “Switching & Finite Automata Theroy”.
5. Integrated Circiuts, K.R.Botkar
6. Operational Amplifiers, Gackwad

ELE C 202 Core Paper 2: OPTICAL AND QUANTUM ELECTRONICS

60+40= 100Marks **5 Credits**

Course Objectives: The objective of this course is to learn the general idea about Semiconductor devices their characteristics and Laser system using the knowledge of various properties

1.	To equip with the basic idea of semiconductors and Semiconductor devices.
2.	To learn the cold emission mechanism and working principle of LED Plasma display etc.
3.	To grasp the concept of optical, electrical and magneto effect.
4.	To understand mechanics related with basic principle of laser their types and applicability, mode locking.
5.	To learn the applications of lasers, general idea about nonlinear optics and second harmonic generation.

Course Outcomes: At the end of the course the student should be able to

1.	To know the general mechanism of photoconductivity devices like photodetectors, phtotransducer, photomultiplier tubes, impulse and frequency response etc.
2.	Know the mechanism of Luminescence, various models like configuration, coordinate and energy band model.
3.	To understand the outcomes of various effects discuss the mechanism related with laser.
4.	To understand the construction and working of types of LASER. Q switching.
5.	Understand the various applications of laser and applicability of nonlinear optics.

UNIT I

Photoconductivity and Photodetectors:- General mechanism of photoconductivity, Simple model of photoconductor, homogeneous and non-homogeneous photoconductors, photoresisters. Types of photodetectors and their applications, General principle, p-n photodiode, Optocouplers, Optointerruptors Impulse and frequency response of p-i-n photodiode avalanche photodiode, phototransistors and photomultipliers tubes.

UNIT II

Luminescence and LEDs:- Spectrum of recombination radiation, mechanism of luminescence, types of luminescence, configuration co-ordinate curve model and energy band model, rise and decay of luminescence, acceleration –colision electroluminescence, cathodoluminescence, television phosphors. working principle of LEDs and their applications, behaviour at high frequency, double hetrerostructure LEDs, their properties, LED lighting, Display devices, indicators, numeric, alphanumeric and special function displays, Liquid Crystal Display elements, Plasma Displays, Multimedia projectors.

UNIT III

Photovoltaic effect, Basic Principles Solar cell characteristics and parameters, spectral response, solar cell fabrication technology Photovoltaic modules and array, Applications.

Electro-Optic Effect: Kerr effect, Pockels effect, Faraday effect, Electro-Optic

Modulator

Acousto-Optic Effect: Raman-Nath and Bragg Diffraction, Raman-Nath acoustooptic modulator, bragg modulator, acousto-optic modulator.

Magneto-Optic Effect: Faradays effect, magneto-optic modulator.

UNIT IV

Quantum electronics: Basic principle of lasers, threshold condition, laser rate equations for two, three and four level laser systems, Modes of rectangular cavity, open plane resonator, mode locking and Q switching of lasers, Rubi laser, He-Ne laser, CO_2 laser, Semiconductor lasers, condition for amplification, optical gain and threshold current density for lasing in SC lasers.

UNIT V

Application of lasers: Laser in manufacturing, laser cutting of material, laser marking, laser transmitter, measurement of distance through Laser. Lasers used in safety interlocks, power isolators, rotary and linear encoders and remote control. Fiber optic sensors. Digital camera and automatic inspection systems, Introduction to Optical computing and holography. Nonlinear optics: second and third order nonlinearity, second harmonic generation

Text/ Reference Books

1. Optoelectronics by Willson and hawkes
2. Optical Electronics By Ghatak anf TyagRajan
3. Semicondutor Opto Electronics Devices By P. Bhattcharya
4. Solid State Physics By Dekkar
5. Photoconductivity By Bube
6. Essentials of Solar Cell By Kotnala and Singh
7. Optical Communication System By Johan Gowar
8. Lasers and non linear optics By B. B. Laud

ELE C 203 Core Paper 3: NETWORK ANALYSIS AND SYNTHESIS

60+40= 100 Marks **5 Credits**

Course Objectives: The aim and objective of the course is to familiarize with the basics of the network analysis and synthesis

1.	To simplify and generalize mesh and node analysis and network theorems for electronic circuits.
2.	Introducing coupled circuit waveform synthesis and graph theory analysis for circuits.
3.	To understand and verify network functions and frequency response slots and their time domain behavior.
4.	Teaching basic principles of two port network analysis for various interconnections.
5.	To expose the basics of the network. Synthesis by Foster form and cauer RL and RC networks.

Course Outcomes: At the end of the course students will be able to

1.	Understand the star and delta conversion, source transformation. Mesh and node analysis of electric circuits and network theorems.
2.	Know the coupled circuit's waveform, synthesis using functions their types and concept of network graph and network transformation.
3.	To explore application of network functions and time domain behaviour from the plots and understand the Nyquist stability criterion.
4.	To gain knowledge on two port network analysis with the use of parameters and their relationship.
5.	Solve the problems related with network synthesis by LCR and R-C cauers forms.

UNIT I

Mesh and Node Analysis and Network Theorems:- Mesh and Node Analysis - Kirchoff's laws , Star and Delta conversion, source transformation, mesh and node analysis of electric circuits, response of the network by differential equation and laplace transform method ,initial conditions in the network. Network Theorems- Thevenin's theorem, Norton's Theorem, Superposition, Millman theorem, Maximum power transfer theorem, and Reciprocity theorem, Tellegen theorem and Substitutions theorem.

UNIT II

Coupled Circuit , Waveform Synthesis and Graph Theory:- Coupled Circuit – Dot convention and magnetic coupling. Waveform Synthesis – Standard signals, unit step function ,ramp function , impulse function ,initial and final value of f(t) from F(s), the convolution integral. Graph Theory - Concept of a network graph, twigs and links, trees, cotrees, formation of incidence matrix ,cut-set matrix, tie-set matrix and loop currents, analysis of networks ,network equilibrium equation ,duality, network transformation.

UNIT III

Network Function and Frequency Response Plots:- Network Function - Network function for one port and two port, the calculation of network functions - ladder networks and general networks, pole and zero of network functions, restrictions on pole and zero locations for driving point functions ,restrictions on pole zero locations ,time domain behavior from the pole and zero plot, stability of active networks. Frequency Response Plots- Magnitude and Phase plots, Root Loci, Bode Diagrams, Nyquist- Stability Criterion.

UNIT IV

Two Port Network Analysis:- Relationship of two port variable , Z-parameters, Y-parameters, Hybrid parameters, ABCD parameters, conditions of reciprocity and symmetry, inter-relationship11 between parameter of two port network, different types of interconnections of two port networks.

UNIT V

Network Synthesis:- Concept, Procedure of Synthesis, Reactive Networks, Properties of Expressions of Driving point Admittances of L-C Networks, Pole-Zero Interpretations in L-C Networks. L-C Networks Synthesis-Foster’s Canonic Form (First and Second Foster form), Significance of Elements in the Foster form. Cauer Canonic form of Reactive Networks-First and Second form of Cauer Networks, Applicability of Foster and Cauer forms, R-L & R-C Network Synthesis by Foster form, Identification of foster form, Identification of Admittance, R- L& R-C Network Synthesis by Cauer form, Identification of Immittance Function in Cauer form, Determination of end elements in Foster and Cauer R-L & R-C Networks.

Text/Reference Books

1. Networks and System ; D. Roy Choudhary, New Age International
2. Network Analysis : M.E. Van Valkenburg.PHI

3. Circuit theory (analysis and synthesis) ; A. Chakrabarti, Dhanpat Rai and co.

ANY ONE TO BE OPTED AMONGST THE FOLLOWING ELECTIVE PAPERS

ELE EL 201 Elective Paper (A): Microprocessor and Object Oriented Programming

60+40= 100 Marks **5 Credits**

Course Objectives: To apprise the students regarding the concept of microprocessor and object oriented programming with advanced knowledge in the subject

1.	Information about the microprocessor architecture, instruction and various operation modes.
2.	Knowledge about interfacing of input output and DMA controller, D/A and A/D converter.
3.	Contain information about 8086 microprocessor architecture operation modes and registers.
4.	Introduce 8088 & 8086 microprocessor programming using various instruction sets, software model.
5.	Enrich the learner about object oriented programming C^{++} with detailed knowledge about the data types, standard libraries end bit manipulation.

Course Outcomes: Students will have understanding of

1.	Microprocessor architecture and its operation, memory interfacing ,writing assembly language programs.
2.	Basic interfacing concepts, interfacing about displays and input devices and Programmable interrupt.
3.	Pin description, operation modes of resistors and internal architecture of 8086 and 8088 microprocessor, segment register and memory segmentation.
4.	Instruction set of 8085/8086 various data transfer instructions.
5.	Introduction to C^{++} and object oriented programming, data Hiding and encapsulation ,stack and queues

UNIT I

8085 Microprocessor: - Microprocessor and its architecture and its operation , Memory interfacing , Addressing Modes ,Memory Mapped I/O , Introduction to 8085/8080A Instructions , Data Transfer Operation , Arithmetic Operation , Logic Operations, Branch Operation , Writing Assembly Language programs , Debugging a Program , Interrupts , Timing Diagram and instruction execution in 8085.

UNIT II

Interfacing I/O Devices: - Basic interfacing concept , Interfacing output Displays , Interfacing Input Devices, Intel 8212 I/O port , Programmable Peripheral Interface Intel 8255 , Programmable Interrupt Controller Intel 8259A , Direct Memory Access (DMA) and 8257 DMA Controller. D/A Converter and A/D Converter.

UNIT III

8086 Microprocessor :- Pin Description , Operation Modes , Minimum Modes and Maximum Modes, Registers of Intel 8086 , Internal Architecture of 8088/8086 Microprocessor , Software Model of the 8088/8086 Microprocessor , Segment Register and Memory Segmentation , Data Registers , Pointer and Index Registers , Status Register , The Stack , Input/output Address Space , Addressing Modes of the 8088/8086.

UNIT IV

8088/8086 Microprocessor Programming: - The Instruction set of the 8088/8086 , Data Transfer Instruction , Arithmetic Instructions , Logic Instructions , Shift Instructions , Rotate Instructions , Flag Control instructions Compare Instruction , Jump Instructions , Subroutines and Subroutine – Handling Instructions , The Loop and Loop Handling Instructions , Strings and String-Handling Instructions.

UNIT V

Object Oriented Programming (C++):-Introduction to C++ and object oriented programming , compiling and linking the source code , Identifier and Keywords , Data Types , Constant , Variables and Arrays , Structures , Nested Structures , Classes and Objects , Data Hiding and Encapsulation , Constructers and Destructors , Function Overloading , Inheritance , Pointers and Arrays , Stack and Queues , Link List , Standard libraries and bit manipulation.

Text/Reference Books

1. Microprocessor Architecture Programming and Application By Ramesh S. Gaonkar
2. The 8088 and 8086microprocessor By Avatar Singh
3. Fundamental of microprocessor and microcomputer By B. Ram
4. Object oriented programming (C++) By Balaguruswami

ELE EL 202 Elective Paper (B): MICROWAVE ELECTRONICS

60+40= 100 Marks **5 Credits**

Course Objectives: The main objective of the course on microwave electronics is to introduce, construction working and circuitry of various microwave devices and Measurement technique

1.	To introduce general idea and characteristic features of Microwave and conventional tubes.
2.	Describe generation of Microwave and basic knowledge about microwave oscillator and amplifiers.
3.	Impart knowledge about various microwave integrated circuits and their working and characteristics.
4.	An understanding of Concept, modes and dimensions of waveguide, slotted sections. PIN diode and switches etc.
5.	Describe standing wave features frequency and other measurement techniques related to microwave.

Course Outcomes: At the end of the course students will be able to

1.	Learn about the concept and uses of Microwave, generation of microwave by conventional vacuum tube.
2.	Know about bipolar and field effect transistor, gun oscillator and IMPATT and TRAPTT mode of operation.
3.	To obtain the basic knowledge of integrated circuit design, substrate materials, conductor and dielectric.
4.	To impart understanding of waveguide, Impedance Matching , element ,tees and magic tees.
5.	Develop a comprehensive understanding of microwave measurement techniques and devices.

UNIT I

Introduction, definition of microwave, characteristic features, application of microwave Generation of microwave by vacuum tube - limitation of conventional tubes klytron amplifier-reflex klystron oscillator, magnetrons-traveling wave tubes

UNIT 2

Generation of microwave by solid state devices, bipolar transistor field effect transistors, gunn oscillator, avlanche diode, oscillator, IMPATT & TRPATT mode of operation parametric amplifiers.

UNIT 3

Microwave integrated circuit design, introduction, hybrid microwave integrated circuits (HMIC), monolithic microwave integrated circuit (MMIC), MIC materials, substrate material, conductor material, dielectric materials, resistive filMS, types of mics, microwave monolithic integrated circuits (MMIC'S).

UNIT 4

Waveguide and waveguide component, concept of waveguide, advantage of hollow wave guide, reflection from a metal surface, field pattern obtained by oblique reflection, higher order modes, waveguide dimensions, impedance matching elements, waveguide short circuit, tees and magic tee, phase shiftless, attenuators, matched terminators, waveguide slotted section, PIN diodes, PIN diode switches

UNIT 5

Microwave measurement techniques, standing wave measurements, impedance measurement, cavity resonator, cavity σ. frequency measurements and calibration techniques, dielectric measurments.

Recommended Books:

l. Microwave Devices and Circuits- S. Y. LIAO, PHI
2. Introduction to Microwave Theory and Measurments -L.A. LANCE, TMH
3. Radio Frequecy and Microwave Electronics, M.M. RADMANESH, PEARSON
4. Taub’s Principal of Communication System- Taub Schilling-Saha (Oxford)
5.Electronics Communication System-Kennedy,Daves, McGraw Hill.

M.Sc. Electronics I Semester 2020-21 onwards (CBCS)

ELE L 101 Lab A

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1. Mean variance, standard deviation, correlation coefficient and equations of lines of regression for a bivariate data.
2. Solution of simultaneous linear algebra equations by Gauss elimination method.
3. Solution of simultaneous linear algebra equations by Gauss iteration method.
4. Solution of simultaneous first order differential equations by Runge Kutta method.
5. Evaluation of an integral by Gaussian quadrate.
6. Solution of Laplace equation.

ELE L 102 Lab B

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1. Determination of energy band gap of Germanium diode
2. Study of Hall Effect.
3. Study of sampling theorem.
4. Study of luminescence properties of materials
5. Study of JFET – characteristics and its applications using Multisim software.
6. MOSFET - characteristics using Multisim Software.
7. Design of simple circuits using Multisim Software.
8. Design of simple amplifier by using Multisim Software and study of biasing.

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M.Sc. Electronics II Semester 2020-21 onwards (CBCS)

ELE L 201 Lab A

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1. Study of characteristics of LED.
2. Study of characteristics of photo-transistor.
3. Study of characteristics of light dependent resister (LDR).
4. Study of characteristics of solar cell.
5. Study of characteristics of diode LASER and determine the absorption coefficient of glass using diode LASER.
6. Study of characteristics of thermister.
7. Study of characteristics of optical fiber.

ELE L 202 Lab B

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1. Design and study of Op-Amp based inverting and non-inverting amplifier with frequency response.
2. Design of low pass Butterworth filter (I & II order) using Op-Amp.
3. Design and study of four bit binary counter and its truth table using C.R.O. tracing
4. Assembly Language Programming of 8085 Part I – Sum, Difference, Compare etc.
5. Assembly Language Programming of 8085 Part II –
   (a) Smallest number of a series
   (b) Largest number of a series
   (c) Block transfer scheme
6. C^{++} based object oriented programming.

M.Sc. Electronics III Semester 2021-22 onwards(CBCS)

ELE C 301 Core Paper 1: INTEGRATED CIRCUIT TECHNOLOGY

60+40= 100Marks **5 Credits**

Course Objectives: To impart knowledge of integrated circuit technology in a wide spectrum so that students should familiar to

1.	Material specification, Vacuum Technology, Methods and Measurement Techniques.
2.	Ion implantation system, plasma technology and X-ray lithography and fabrication of some devices.
3.	Integrated circuit fabrication and characteristics FET, CMOS technology and monolithic circuits.
4.	Operational amplifier its characteristics, operation and applications. Universal balancing circuits.
5.	Linear and nonlinear applications of operational amplifiers, knowledge of phase locked loop, Timers: construction and working.

Course Outcomes: To equip with the techniques so that they can be used in understanding of

1.	Purification : Different techniques, redistribution of dopants and oxidation, induced defects ,general idea of diffusion mechanism.
2.	The method of metallization, selectivity and control rate of eatch rate and edge profile.
3.	Basic Monolithic integrated circuits, layout making and etching, packing and characteristics of integrated circuit components.
4.	Construction and characteristics of Differential and Operational amplifier, calculation of Operational Amplifier parameters, slew rate and methods of improvising slew rate.
5.	Op-Amp working modes, linear and nonlinear circuits using Operational Amplifier and their analysis.

UNIT – I

Integrated Circuit Technology : Material purification. Epitaxial growth: LPE, VPE, MBE. Clean room specifications and requirements. Vacuum technology, sputtering, oxidation, growth mechanism and kinetics (thin and ultrathin oxides), oxidation techniques, redistribution of dopants at the interface and oxidation induced defects. Diffusion: Fick's law, diffusion mechanism, measurement techniques, diffusion in SiO_2.

UNIT II

Ion Implantation: systems and dose control, ion range, ion stopping, knock on ranges, metallization choices. Etching: dry etching, pattern transfer, plasma etching, sputter etching, control of etch rate and selectivity, control of edge profile. Process simulation and process integration. Lithography: optical, electron beam, ion beam, X-ray lithography, lift off, dip pen. Pattern generation. Fabrication of few devices like MMIC, laser diode etc.

Unit III-

Integrated Circuit Fabrication and Characteristics- Integrated circuit technology- SSI, MSI, LSI, VLSI, basic monolithic integrated circuits, planner process, epitaxial growth, masking and etching, diffusion of impurities, bipolar transistor fabrication, fabrication of FET,CMOS technology, monolithic diodes, integrated registers, integrated capacitors and inductors, monolithic circuit layout, metal semiconductor contact, packaging and characteristic of integrated circuit components.

UNIT IV

Operational Amplifier, Characteristics and Applications- Basic operational amplifier, differential amplifier, transfer characteristics of differential amplifier, characteristics of ideal and practical operation amplifier, parameters of operational amplifier : error offset voltages and currents, universal balancing circuits, temperature drift of input offset voltages and currents, measurement of operational amplifier parameters, frequency response of operational amplifier, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate.

UNIT V

Applications Of Operational Amplifiers ,Timer & PLL- Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers, Differentiator, Integrator, Voltage to current converter, Instrumentation amplifier, Sine wave Oscillator, Low -pass and band pass filters, Comparator, Multivibrators and Schmitt trigger, Triangular wave generator, Log and Antilog amplifiers Block Diagram of Timer IC 555 ,Astable and Monostable Multivibrators using 555 Timer, Phase locked loops, phase detector, voltage controlled oscillator, effect of low pass filter on loop performance, PLL applications.

Text/References Books

1. VLSI Design by K.Lal Kishore etal, I.K.International Publishing House
2. VLSI DESIGN –S.M. Sze
3. VLSI TECHNOLOGY- Gandhi
4- Integrated Circuits : K. R. Botkar, Khanna Publishers New Delhi.

5. Designing with op-amps and Analog and Digital IC's – S. Francio, MC Graw Hill.

ELE C 302 Core Paper 2: MICROWAVE AND DIGITAL COMMUNICATIONS

60+40= 100 Marks **5 Credits**

Course Objectives: The aim and objective of the course on Microwave and Digital communication is to familiarize with the basic aspects

1.	To acquire knowledge about the propagation of waves, atmospheric effects on propagation and geostationary satellite.
2.	to get an idea about conventional microwave devices, wave modes and effect, linear and nonlinear characteristics devices.
3.	To provide the knowledge microwaves measurement, microwave transmission and reception.
4.	To gain knowledge on Digital Communications, nature and characteristics of modulation, pulse code modulation, Delta modulation , multiplexing phenomenon.
5.	To define and discuss the digital modulation techniques, data transfer and computer networking.

Course Outcomes: Students will have understanding of

1.	Ground space wave, Sky wave propagation, advantage and disadvantage of microwave transmission satellite system etc.
2.	Principle and operation of klystron, magnetrons travelling wavetube Impatt diode. Gun & Trapatt diode.
3.	Microwave system, repeater system, microwave antennas, Radar system and Satellite system.
4.	Pulse modulation system, sampling, Companding noise in system and various types of modulation.
5.	Various digital modulation techniques including BPSK, DPSK, QPSK, QASK and BFSK, internet and ATM network, Bluetooth and mobile computing.

UNIT I

Propagation of Waves: Ground Waves, sky wave, space wave, propagation, maximum usable frequency, skip distance, virtual height, fading of signals, Microwave: Advantages and disadvantages of microwave transmission loss in free-space, propagation of microwaves, atmospheric effects on propagation, Fresnel Zone problem used in microwave communication systems. Satellite communication:

orbital satellite, geostationary satellites, orbital pattern, look angles, orbital spacing, satellite system, link modules, system parameters, link equations, link budget.

UNIT II

Microwave Devices: Klystrons, Magnetrons and traveling wave tubes. Velocity modulation basic principles of two cavity klystron and reflex klystron, principles of operation of magnetron. Helix traveling tubes. Wave modes. Effect, principles of operation, modes of operation. Read diode, IMPATT diode, Gunn, TRAPATT diode. Parametric Amplifiers –Up converter – down converter Mixers – non-linear – linear – Balanced Mixer – Detector square law characteristic,

UNIT III

Microwave measurement – Guide wavelength, standing wave ratio, measurement of impedance, Q and attenuation.

Introduction, advantages and disadvantages of Microwave Radio - FM Microwave Radio systems , Repeaters – Repeater station. Microwave Transmission and Reception : Microwave Antennas, Radar System and Satellite system.

UNIT IV

Digital Communications: Pulse-Modulation system, sampling theorem, Low pass and Band pass signals, PAM, channel BW for a PAM signal, Natural Sampling, Flat top sampling, signals Recovery through Holding, Pulse Code Modulation:Quantization of signals, quantization error, pulse code modulation (PCM), companding, Bandwidth of PCM System, Noise in PCM System, Differential pulse code modulation, Delta modulation, Adaptive Delta modulation. Differential PCM Delta Modulation, Adaptive Delta Modulation, CVSD. Multiplexing- TDM & FDM

UNIT V

Digital Modulation Techniques and Data Transfer - Introduction, Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK) and Binary Frequency Shift Keying (BFSK). Data transfer and computer networking: packet switching, ISDN, ATM, LAN, WAN, Internet and WAP. ATM Networks, ISDN, BISDN, VoIP, VoDSL, Bluetooth, Wi-Fi WLAN, WAP and Mobile computing.

Book Suggested

1. Digital Communications by W. Tomasi
2. Microwave by K. C. Gupta
3. Microwave Devices and circuits (PHI) by S.Y.LIAO
4. Electronic Communication Systems by KENNEDY
5. Advanced Electronic Communication Systems by W.TOMASI

6. Foundation of Microwave Eng. (Mc.Grew Hill) by R.E.COLLIN
7. Introduction to Radar Systems by SKOLNIC:
8. Modern Digital & Analog Comm. System by B.P.Lathi

ELE C 303 Core Paper 3: CONTROL SYSTEMS

60+40= 100 Marks **5 Credits**

Course Objectives: The objective of the course is to develop specialization skill with advance knowledge in the subject

1.	Information about control system and their feedback characteristics, feedback and non feedback systems and reduction of parameters.
2.	Time response analysis, first order and second order time response, derivative output an integral error compensation PID controller.
3.	Stability analysis concept condition and Criterion root counters for polar and bode plots procedure for construction, experimental determination of transfer function.
4.	Contains information about stability in frequency domain mathematical preliminaries closed-loop frequency response, constant- M and constant N-circle.
5.	Introduction to design and its preliminary consideration non linear system and general ideas of analysis.

Course Outcomes: After the completion of this course students will be

1.	Familiarized with the loop control Servo mechanism mathematical methods of physical system.
2.	Standard test signals, types of feedback, control system, design specification, effect of adding a system zero to a system.
3.	Routh- Hurwitz stability criterion, Routh array construction rules, all pass and minimum phase systems.
4.	Stability criterion assessment of relative stability gain margin and phase margin closed-loop frequency response.
5.	The design problem tuning of PID controller feedback compensation behaviour of nonlinear system, phase plane method, general idea of analysis.

UNIT-I

General introduction of control systems : examples, Closed loop and open loop control, servo mechanisms. Mathematical models of physical systems: differential equations of physical systems, Transfer function, sinusoidal transfer function, procedure for deriving transfer function, modeling of a dc motor with armature control and field control, Block diagram of a closed loop system ,Block diagram reduction, Signal Flow graphs.

Feedback characteristics of control systems : Elementary idea of accuracy, sensitivity and disturbance, Feed -back and non-feedback systems, reduction of parameter variation by use of feedback, Control over system dynamics by use of feedback, control of the effects of disturbance signals by use of feedback, regenerative feedback .

UNIT-II

Time response analysis: Introduction, Standard test signals, Time response of first order control systems subjected to step input, ramp input and impulse input functions. Time response of second order control system subjected to unit step function. Steady state errors and error constants, types of feedback control systems, Effect of adding a zero to a system,

Design specifications of a second order system, derivative Error Compensation (PD controller), Derivative output compensation, Integral error compensastion (PI controller), Proportional Plus Integral Plus Derivative (PID) Controller.

UNIT-III

Stability Analysis : Concepts of stability, necessary conditions for stability, Routh-Hurwitz stability criterion, Routh array, Relative stability analysis; Root locus technique, construction foot loci , construction rules, Root contours. Sensivity of the roots of the characteristic equation, Root sensivity to gain , root sensivity for small parameter changes.

Frequency Response Analysis: correlation between time and frequency response, Polar plots, inverse polar plots, Bode plots, general procedure for constructing Bode plots, All –pass and minimum phase systems,experimental determination of transfer function.

UNIT –IV

Stability in frequency domain: Mathematical preliminaries, Nyquist stability criterion,open-loop poles on jw –axis, Nyquist criterion applied to inverse polar plots,Assessment of relative stability using Nyquist criterion (measure of relative stability, Gain margin and phase margin). Closed loop frequency response(frequency domain specifications, Constant- M circles, Constant –N circles, Nonunity feedback systems, Nichols chart, gain adjustment), Sensivity analysis in frequency domain.

UNIT-V

Introduction to design: The design problem, preliminary considerations of classical design. Realization of basic compensators (lead compensator, lag compensator, lag-lead compensator), Tuning of PID Controllers, Feedback compensation.

Non-linear systems: Behavior of nonlinear systems, common physical non-linearities, Phase- plane method –basic concepts, singular points, stability of nonlinear systems, general ideas of analysis by describing function method, and by Liapunov' direct method.

Text/Reference Books:

1. Control Systems Engineering , I.J Nagrath and M. Gopal, New Age International .
2. Modern Control engineering , K. Ogata, Pearson Education.
3. Automatic Control Systems, B.C. Kuo , Prentice- Hall of India.
4. Linear Control Systems, B.S. Manke, Khanna Publishers

ANY ONE TO BE OPTED AMONGST THE FOLLOWING SPECIAL/ELECTIVE PAPERS

ELE EL 301 Elective Paper (A): ELECTRONICS INSTRUMENTATION & MEASUREMENTS

60+40= 100 Marks **5 Credits**

Course Objectives: The objective of the course is to develop specialisation skill with knowledge of

1.	Measurement performance and static characteristics, different first and second order system.
2.	Transducers, concept and type, measurement of various physical parameters.
3.	Basic concept of signal processing circuit in electronic instrumentation.
4.	Advanced measuring instruments Technology using various digital devices
5.	Biomedical electronic instrumentation, Measurement used in measurement of blood pressure heart sound and Plethysmography.

Course Outcomes: After the completion of this course students will be

1.	Able to understand the concept of measuring concept of measurement error in measurement type of errors specification and testing of dynamic response.
2.	Able to know the working types and characteristics of transducers, measurement of velocity, force, strength, speed, flow, humidity and thickness etc.

3.	Understand the principle working and basic characteristics of digital instruments like DC amplifier isolation amplifiers and Signal Processing circuits i.e., peak detectors, RMS converter UPS.
4.	Acquire knowledge of basic approaches of Advanced measuring instruments like digital multimeter frequency metre and electrometer etc.
5.	Understand and describe the use of Biomedical electronic instruments and measurements like biochemical transducers cardiovascular and pacemakers.

UNIT I

Concept of Measurement- Basic concept of Measurement, Performance & Static Characteristics, Error in Measurement, Types of Errors-Gross, Systematic & Random, Dynamic Characteristics, Zero Order, First Order,& Second Order System, Real Time Element, Specification & Testing of Dynamic Response.

UNIT II

Transducers- Fundamental Concept & Transducers Classification Resistance, Capacitance, inductance, Piezoelectric, Thermoelectric, Hall effect, Techogenerator, Optical & Digital Transducers, Measurement of Displacement, Velocity, Acceleration, Force,Torque, Strain, Speed & Sound, Temperature, Pressure, Flow, Humidity, Thickness.

UNIT III

Basic Concepts of Circuits in Electronics Instrumentation - Instrumentation Amplifiers, Basic Characteristics, D.C. Amplifiers, Isolation Amplifiers, Feedback Transducers system, feedback Fundamentals, Inverse Transducers, Temperature Balance System. Signal Processing Circuits-Phase Sensitive Detection, Absolute Value Circuit, Peak Detector, Sample & Hold Circuit, RMS Converter, Logarithmic Amplifier, Frequency to Voltage & Voltage to Frequency Converter, waveform Generators, Lock in Amplifiers, SMPS, UPS.

UNIT IV

Advanced Measuring Instruments Technology- Measurement of R,L,C using LCR meters, Block diagram, working principle and procedure of operation of Digital Voltmeter, Voltage, Current, Frequency/Time measurement: Digital Multimeters, Digital Frequency Meter, Q-Meter, Block diagram, working principle and procedure of operation of Digital Storage Oscilloscopes, mixed signal oscilloscopes, Arbitrary waveform generators,. medical oscilloscopes, Sampling oscilloscopes AF/RF power meter, Frequency meters, Electrometer, Spectrum analyzers, Impedance analyzer, Network analyzers, Logicanalyzer, Automatic test equipment - PCB test and Inspection system, Semiconductor parameter analyzer

UNIT V

Biomedical Electronic Instrumentation and Measurements- Introduction to biomedical instrumentation, sources of bioelectric potentials, Electrodes electrode theory, biopotential electrodes, biochemical transducers, cardiovascular measurements- electrocardiography, measurement of blood pressure, blood flow and heart sound, plethysmography, the elements of intensive care monitoring; calibration and reparability of patient monitoring equipment, pace makers.

Text /References Books

1. Instrumentation Devices & Circuit System Rangan,Sharma& Mani,
2. Transducers& Instrumentation D.V.S.Murthi.PHI
3. Biomedical instrumentation and measurements – Leslie Cromwell, fred J. Weibell,
4. Erich A. Pfeiffer
5. Electronic Instrumentation - H. S. Kalsi,2nd Edition, tata Mcgraw Hill
6. Electronic Instrumentation and Measurements Bell PHI

ELE EL 302 Elective Paper (B): VHDL

60+40= 100 Marks **5 Credits**

Course Objectives: The aim and objective of the course on VHDL is to familiarize with the

1.	Introduction and history of VHDL capabilities overview package declaration, model analysis.
2.	Basic language elements, data objects, classes and data types arrangement and sequential statements and process.
3.	Modeling, structural modeling with example.
4.	Generic and Configuration, Default rules, generic value configuration in architecture.
5.	Programmable Logic arrays, Design of keypad, Scanner using VHDL.

Course Outcomes: At the end of the course the students will be able to

1.	Know hardware abstraction, entity declaration, configuration and package declaration.
2.	Understand the operators identifiers resolution functions.
3.	Get familiarized with modeling state, behavioral modeling and data flow modeling etc.

4.	Explain why configuration architecture configuration subprograms and overloading.
5.	Discuss read-only memory and Programmable Logic devices.

UNIT I

Introduction to VHDL: History, capabilities, hardware abstraction, Overview, basic terminology, entity declaration, architecture body, Configuration declaration, Package declaration, Model analysis, Simulation

UNIT II

Basic language elements: Data objects, classes and Data types, Operators, Identifiers, logical operators, Assignments and sequential statements and process, resolution functions.

UNIT III

Modeling style: Behavioral Modeling, data flow modeling, structural modeling with examples, component declaration, structural layout and generics.

UNIT IV

Generic and Configuration: Generic, why configuration, Default rules, component configurations, Generic Configurations, Generic value specifications in architecture, Block configurations, architecture configuration, subprograms and overloading (brief).

Package and Libraries : Package Declaration, Package Body, Design file, Design Libraries, order of Analyses simulation, Model simulation, Writing a Test Bench, Text Bench Examples.

UNIT V

Read- only memories, Programmable logic Arrays (PLA's), Programmable array logic (PAL's), other sequential Programmable logic devices (PLD's), Design of Keypad Scanner, using VHDL.

Reference/Text Books

1. A VHDL Primer; by J.Bhaskar, II Edition, Pearson Education Asia
2. VHDL, by Douglas L.Perry, III Edition, Tata McGraw Hill
3. VHDL – Analysis and Modeling of Digital Systems, by Zainalabedin Navabi, McGraw Hill

M.Sc. Electronics IV Semester 2021-22 onwards (CBCS)

ELE C 401 Core Paper 1: MICROCONTROLLER AND EMBEDDED SYSTEMS

60+40= 100 Marks **5 Credits**

Course Objectives: the objective of the course is to develop specialization skill with advance knowledge in the subject electronics

1.	To know what are embedded system, hardware and software architecture, microcontrollers for embedded systems.
2.	Able to know the various instructions set, single bit operation and programming, input-output programming.
3.	To understand architecture of microcontrollers, interrupt structure and interfacing of peripherals with microcontroller.
4.	To introduce counter data and timer programming, interfacing of LCD modules, system design with 89C51 to monitor various parameters.
5.	To learn about architecture of microcontroller family, various addressing and instruction set, peripheral interfacing and applications.

Course Outcomes: At the end of the course students will be able to

1.	Understand architecture, specialties applications of embedded system, examples and categories of embedded systems challenges and issue in embedded software, memory advance hardware, etc
2.	Gain knowledge about Assembly language programming, concept of arithmetic and logic instructions jump loop and call instructions
3.	To understand architecture internal structure programming and addressing modes board controller 8279, interfacing of 8 bit A/D and D/ A converters.
4.	To know interrupt programming types of interrupt, Stepper Motors, traffic light control system with software development.
5.	To able to know registors, resistor file structure, features of a RISC and CISC architecture, comparison and advantages.

UNIT –I

Introduction, Application Areas, Examples of Embedded Systems Categories of embedded systems, Overview of embedded systems architecture, Specialties of embedded systems, challenges and issues in embedded software development Recent Trends, hardware architecture, Software architecture, Application software, Communication Software, core platform development, boot sequence, development/testing tools. Basic Considerations, Timing Diagrams, Memory Advanced Hardware : Micro controllers & Embedded Processors: Microcontroller versus General-purpose Microprocessors, Microcontrollers for embedded systems, embedded applications,

UNIT- II

Instruction set, 8051 assembly language programming , Addressing modes: immediate and register addressing modes, accessing memory using various addressing modes. Arithmetic instructions and programs: unsigned addition and subtraction, unsigned multiplication and division, signed members concepts and arithmetic operations. Logic Instruction and programs: Logic and compare instructions rotate and swap instructions. Jump, Loop and call instructions; Loop and jump instructions, call instructions, time delay, generation and calculation. Single bit instructions and programming: single bit instruction programming, single bit operation with carry reading input pins versus port latch. I/O port programming: I/O programming, bit manipulation.

UNIT – III

Introduction to Intel 8051/8751/8031 Microcontrollers – Architecture, internal structure of 8051, power resetting, built up RAM and ROM, I/O Programming and Addressing modes. Data memory, Interrupt Structure, I/O ports, Timer / counters, Serial ports and Registers,. Interfacing of Peripherals with 8051 Microcontroller - Interfacing of EPROM's, RAM's, PPI 8255, Programmable Interval Timer -8253/54, Display/Key Board Controller - 8279, interfacing of 8 bit A/D and D/A converters

UNIT – IV

Counter and time details, counter and timer programming using 8051, interrupt programming, types of interrupt. Asynchronous serial communication, data programming, RS232 standard, RS422 standard, 1488 and 1489 standard, GPIB, max 232 driver, serial communication programming. Applications of 80C51 Microcontrollers - Interfacing of LCD Modules, Stepper Motors. System Design with

89C51 to monitor frequency, voltage, displacement, Temperature, speed, traffic light control system with software development

UNIT -V

Introduction to PIC 16C6x/7x family microcontrollers, Architecture, Registers, Register File Structure, Addressing Modes, Instruction set. Interrupt Structure, Timers, Counters, I/O Port Concepts, Peripheral Interfacing and Applications. Features of RISC architectures, CISC and RISC architecture comparison, advantages of RISC, Power saving methods.

Text/ References Books

1. Microprocessors and Microcontrollers Krishna Kant PHI (EEE) © 2007
1. 8051 Programming, Interfacing and Applications -K.J. Ayala, Penram Pub
2. 8051 Microcontroller and Embedded systems -Muhammad Ali Mazidi & Janice Gillispie mazidi
3. Embedded systems - Raj Kamal, TMH
4. Embedded/Real Time Systems – Dr.K.V.K.K.Prasad, dreamtech Press.
5. Design with PIC Microcontrollers – John B.Peatman, Pearson Education Asia
6. PIC Microcontrollers : An Introduction to Microelectronics, Martin P. Bates,
7. Embedded system design F. Vahid,T. Gargivis John Wiley and Sons
8. Embedded system design An Introduction to processes tools and Techni1ques A.S. Berger, CMP Books
9. Embedded systems**,** Raj Kamal, TMH

ELE C 402 Core Paper 2: CELLULAR AND SATELLITE COMMUNICATION

60+40= 100 Marks **5 Credits**

Course Objectives: objective of this course is to learn the fundamentals of cellular and satellite communication

1.	To learn about mobile communication, fundamental, radio propagation and antenna gain.
2.	To aware of spread spectrum systems and Diversity techniques frequency hopping systems, combining and switching methods.

3.	To know medium access control, classical spread and slotted Aloha telecommunication GSM and subsystems localisation and calling.
4.	To understand satellite system, geosynchronous satellite, classification spacing and frequency allocation, high pass and low noise amplifier
5.	To learn skills of FDM/ FM satellite systems, defence satellite, Wireless networking.

Course Outcomes: At the end of the course students will be able to

1.	Understand basic knowledge of mobile and personal computers instrumentation for lab testing
2.	Learn skills by solving problems on pseudo noise sequence, hopping systems, carrier to noise and carrier to interference ratio.
3.	Know specialized MAC multiple access with collision avoidance avoidance and mobile services
4.	Understand principle of satellite communication, satellite link module handover, Earth station configuration etc.
5.	Illustrate condition of INTELSAT, VSAT ,MAST, lower earth orbit satellite personal communication networks.

UNIT I

CELLULAR CONCEPTS- Mobile communications-evolution, International Mobile Satellite, Personal Communication Systems [PCS], Standards, Mobile Personal Computers, Speech Codecs. Fundamental Radio Propagation and System concepts, Antenna Gain, Propagation characteristics, model for multipath-faded radio signals, Instrumentation for lab testing.

UNIT II

SPREAD SPECTRUM SYSTEMS AND DIVERSITY TECHNIQUES- Concept of Spread Spectrum System, pseudo-noise sequences, performance of Direct Sequence Spread Spectrum Systems, Code Division Multiple Access, Direct Sequence and Frequency Hopping systems, Synchronization . Applications. Concept of Diversity Branch and Signal Paths, Combining and Switching Methods, Carrier-to- Noise and Carrier- to-Interference Ratio, Performance Improvements.

UNIT III

MEDIUM ACCESS CONTROL- Motivation for a specialized MAC, Hidden and esposed terminals, Near and far terminals, SDMA, FDMA, TDMA, Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packer reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhabit sense multiple access, CDMA, Spread Aloha multiple access, Comparison of S/T/F CDMA Telecommunication GSM, mobile services, system architecture, GSM subsystems, GSM communication frame, localization and calling, handover, security, new data services,

UNIT IV

SATELLITE SYSTEMS- History, Principle of Satellite Comm., Kepler's law, Geosynchronous Satellite Antenna look angles, Satellite classifications spacing and Frequency allocation, Satellite antenna Radiation patterns, Footprints, Satellite link models, Parameter & Equations. Applications, Basics, GEO, LEO, MEO, Routing, Localization, Handover, Examples. Simplified Block Diagram**:** Earth Station Configuration, High Power Amplifier(HPA), Low Noise Amplifier (LNA), Echo Suppression / Cancellation, Earth Station Characteristics.

UNIT V

FDM/FM Satellite Systems, INTELSAT, VSAT (data broad – band Satellite), MSAT. LEOs (lower Earth Orbit Satellite), Defence Satellites. Design Specifications for VSAT and major benefits. Wireless Networking :Difference between wireless and fixed telephone networks,1G, 2G, 3G wireless networks. Traffic routing in wireless networks, wireless data services, personal communications networks, network databases.

Text/ References Books

1. Wireless Digital Communications -- Kamilo Feher
2. Mobile Communications – Jochen Schiller
3. Advanced Electronic Communications Systems: Wayne Tomasi.
4. Electronic Communications: Dennis Roddy & John Coolen.
5. Data Communication & Networking - Behrouz A Foruzon.
6. Wireless communications and networking" William Stallings, PHI
7. Data and Computer Communications – By William Stalling., 7th Ed., PHI
8. Mobile communications"-by Johan schiller, PEA,2nd ED.
9. Mobile and personal communications systems and services" Rajpandya, PHI

ELE C 403 Core Paper 3: DIGITAL SIGNAL PROCESSING

60+40= 100Marks **5 Credits**

Course Objectives: The course aims at imparting knowledge about

1.	Discrete time Signals and Systems, their processing, frequency domain representation of discrete Time systems and signals, Z- transform concept and theorems.
2.	Discrete fourier series and transform, representation and properties, computation of FET with different radix and general considerations.
3.	Signal flow graph representation of digital networks , matrix representation, basic network structure of FIR system ,Tellegen's theorem for Digital filters.
4.	Digital filter design techniques, frequency transformation of low power IIR filters, design using WINDOWS.
5.	Qualitative ideas of voice processing wavelet and time frequency representation general idea of applications of wavelet transform.

Course Outcomes: The purpose of the course is to introduce the concept of Digital Signal Processing and at the end of the course students will be able to know

1.	The digital signals and their processing, sampling of continuous time signals Z transform of finite length sequence, right side left sided and both sided multiplication and convolution of sequences.
2.	Representation of periodic sequences, sampling the z transform, linear convolution using DFT, general introduction of FET, Goertzel algorithm , FET with different radix.
3.	Metric representation of digital networks, networks for linear phase FIR systems, parameter. quantization effects.
4.	Design examples of digital filters using impulse invariance and bilinear transformations, computer-aided design of IIR digital filters, properties of FIR/nonrecursive digital filters comparison of IIR and FIR filters.
5.	Speech signals, analysis, compression and coding voice privacy application to radar and image processing continuous discrete wavelet transform.

UNIT-I

Discrete Time Signals and Systems : Introduction to digital signals and their processing, Discrete time signals- sequences, Linear Shift –invariant systems, Stability and Causality, Frequency domain representation of Discrete-Time Systems and signals, Sampling of Continuous –Time signals.

Z- transform : concept of z-transform, z-transforms of finite length, sequences, right sided, left sided and two sided sequences, Inverse z-transform, z-transform theorems and properties (region of convergence, linearity, shift of a sequence , multiplication by an exponential sequence, initial value theorem, convolution of sequences, complex convolution theorem, Parseval's relation) , system functions.

UNIT-II

Discrete Fourier Series (DFS): Representation of periodic sequences- Discrete Fourier Series, Properties of DFS (linearity, shift of a sequence, symmetry properties, periodic convolution) , Sampling the z-transform.

Discrete Fourier Transform (DFT): Representation of Finite-duration sequences- Discrete Fourier Transform, Properties of DFT(linearity, circular shift of a sequence, symmetry properties, circular convolution), Linear convolution using DFT.

Computation of DFT: General introduction and FFT , Goertzel algorithm, Decimation-in-time FFT algorithm , Decimation-in-frequency FFT algorithm , FFT algorithm for N a composite number, FFT with different radix, General computational considerations in FFT algorithms.

UNIT- III

Signal flow graph representation of digital networks, Matrix representation of digital networks, Basic network structure of IIR systems (direct form, cascade form, parallel form), Transposed forms, Basic network structure of FIR systems (direct form, cascade form, networks for linear-phase FIR systems, frequency-sampling structure, structure based on polynomial interpolation formulas), Parameter quantization effects in IIR systems and in FIR systems. Tellegen's theorem for digital filters.

UNIT-IV

Introduction to digital filter design techniques, Design of IIR/ recursive digital filters from analog filters (impulse invariance, designs based on numerical solutions of the differential equation, bilinear transformation,), Design examples of digital filters using impulse invariance and bilinear transformation (Butterworth filters, digital Chebyshev filters, elliptic filters), Frequency transformations of low pass IIR filters. Computer –Aided design of IIR digital filters (minimization of mean-square error, minimization of a p-error criterion, least square inverse design).

Properties of FIR/nonrecursive digital filters, Design of FIR filters using Windows (rectangular, Barlett, Hanning, Hamming, Blackman, Kaiser), Computer –Aided design of FIR filters (frequency sampling design, Equiripple approximation), A comparison of IIR and FIR filters.

UNIT –V

Applications of DSP : Qualitative ideas of Voice processing (speech signal, short term spectrum analysis, speech abnalysis synthesis system, compression and coding, channel vocoders, sub band coding, voice privacy, digital FM stereo), Application to Radar, Application to image processing,

Introduction to wavelets and time frequency representation, continuous wavelet transform CWT, Inverse CWT, properties of CWT (linearity, translation,scaling,wavelet shifting, energy conservation, time and frequency localization) , discrete Wavelet transform, general ideas of applications of wavelet transform(data compression, sound synthesis, fingerprint compression, denoising noisy data)

Text/Reference Books:

1. Digital Signal Processing, A.V. Oppenheim and R.W. Schafer, Pearson Education Inc.(2009)
2. Digital Signal Processing, S. Salivahanan, A. Vallavaraj and C. Gnanapriya, Tata McGraw-Hill (2009).
3. Digital Signal Processing, Proakis

ANY ONE TO BE OPTED AMONGST THE FOLLOWING SPECIAL/ELECTIVE PAPERS

ELE EL 401 Elective Paper (A): INTERNET, WEB TECHNOLOGY AND MANAGEMENT

60+40= 100Marks **5 Credits**

Course Objectives: The objectives of the course are to give exposure about the various networks Web Technology and Management to demonstrate the

1.	Concept applications and types of networks and network connectivity devices.
2.	Internet technology and services on internet, Web server and Firewall
3.	Network protocols, operating systems and management.
4.	Web designing , current internet, browser software and features

	development skills of WEB pages.
5.	Development and application of JAVA script, HTML variable and values, arrays string.

Course Outcomes: After the completion of the course students should be able to

1.	Understand the network system, Topology, Modems Routers Gateways.
2.	Evaluate the server and client connectivity, world-wide-web(www) , FTP and Telent, ATM virtual and private networks.
3.	Understand Ethernet basics, Token passing protocols, Netware protocols, NOVEL Netware, simple network management protocol.
4.	Know the mechanism and features of URL's, DHTML, JAVA scripts interpreter plug-ins protocols.
5.	Analyze and discuss simple JavaScript and HTML, active page, working with images working in Frames the JAVA Script URL.

UNIT I

Network- Introduction, Need, Use, Application, and criteria of Network, Types of Network, Network Building Blocks (Creating LAN in Lab), Topology, Network Connectivity Devices : Scaling, Modems, Transceiver, Repeaters, Hubs, Bridges, Routers, Gateways etc., Role of various layers in Networking.

UNIT II

Internet Technology- History, Server and Client Connectivity, World Wide Web :Basic features, Mechanism, Browsers, URL, DNS, Search Engines, Search Tools, etc. IP Address, FTP and TELNET. Services on Internet like: Money transactions, ATM, Frame Relay, ISDN, Ethernet, Token Ring, FDDI, Web Server, Mail Server, File Server, Print Server, Packet Filtering, Encryption, Virtual Private Network, Password Management, Firewall.

UNIT III

Network Protocols, Operating Systems and Management-. Ethernet Basics , Fast Ethernet and Gigabit Ethernet , Token passing protocols, TCP/IP , Netware protocols , Net BIOS , Net BEUI and Server message blocks

Network operating systems : Windows 2000 and Windows NT , Active directory , Windows NT domains ,NOVEL Netware , NOVEL directory services , UNIX , LINUX, Network clients.

Management : Network management in window 2000 & XP, Simple network management Protocol (SNMP),Network management function : Fault , fault identification and isolation, Eveen correlation Techniques. Network Security: Levels of security, approach to network security, Security services. Virus and security threats

UNIT IV

Web Designing- Review of current Internet browser software and Introduction of features : URL's, DHTML, Java Scripts Interpreter, Java Applets, Plug-ins, Potocols etc. Development skills of Web Pages like Heading, Ruling, frames, buttons, text, list boxes, hyperlink/anchors, adding graphics, HTML documents, maps, clickable images, etc, with HTML, DHTML using various tags, and commands. Design/ Linkage/ Structure of pages on internet, design of interlinked pages/ frame- based web applications, Problems with HTML, DHTML.

UNIT V

Java Script : Development and application of Java Script : Simple Script and HTML, even handlers, write, dialog boxes, status line, color comment, working with different browsers. Variable and Values : variable and types of data, creating variables, assigning value calculation, operator precedence, arrays, array methods array of elements, strings. Programe flow : testing values, loops, break, continue, branching, withif the conditional operator, Using fuctions. Active page : dates, time, timeout, scrolling, text, sounds, controlling sounds, the embeds array. Working with images : image files, image objects, simple animation, animated/ animating gigts, image maps. Interactive systems : Checkboxes and radio buttons, links from lists, feedback on line, checking entries, working in frames, windows control, the Java script URL.

Tex/ References Books

1. Internet & Web Technology by Dr. Raj Kamal
2. Web Technologies by Ivan Bayross.
3. Networking Encyclopedia.
4. HTML, DHTML, Java script : Ivan Bayross
5. Essential SNMP : D.R. &K.J. Schidt

ELE EL 402 Elective Paper (B): NANO-ELECTRONICS

60+40= 100 Marks **5 Credits**

Course Objectives: The objectives of the course is to learn the fundamentals of nano electronics and techniques and idea about

1.	Nanostructured materials, electronic structure and density of states in 3D,2D,1D and 0D Structure.
2.	Quantum well energy levels, coupled quantum wells and superlattices, non-linear and electroptic effects, electrical conductivity in low dimensional systems

3.	Models of FETs, electronic devices based on perpendicular transport Quantum well laser.
4.	Fullerenes, nanotubes and their applications, band gap engineered quantum devices, q d phosphors nanostructured solar cell.
5	Pattern transfer with additive techniques, physical and chemical vapour deposition, sol- gel deposition technique. Selection for deposition methods.

Course Outcomes: At the end of the course students will be able to

1.	Understand the emergence of NanoTechnology, concept of quantum confinement, top-down and bottom-up approaches for preparation of Nano structures.
2.	Know the tunneling structure, modulation doping of hetrostructures, carrier excition dynamics, ballistic transport, spintronics.
3.	Learn about various of heterojunctions FETs, three terminal electronic devices, multiple QW laser.
4.	Understand Nano grained structure, polymer nanocrystals. AC power electroluminescence and display devices.
5.	Illustrate doping of Si oxidation of silicon, methods of organic layers in BIOMEMS, Plasma sparying.

UNIT I

Introduction to Nanostructures- Definition and importance of nanostructured materials, emergence of nanotechnology, classification of nanostructures, nanoporous materials, reason s of size dependent properties. Energy bands and concept of quantum confinement, electronic structure and density of states in 3D, 2D, 1D and 0D structures. Top down and bottom up approaches for preparation of nanostructures.

UNIT II

Thin semiconductor Heterostructures- Quantum well energy levels, excitons and shallow impurities in QW. Tunneling structures, coupled quantum wells and superlattices, modulation doping of heterostructures, carrier and exaction dynamics. Non-linear and electro-optic effects.

Elecrical conductivity in low dimensional systems, mobility in parallel transport and perpendicular transport, tunneling junction and tunneling, quantum transport, ballistic transport, transport of spin and spin transport. General idea about spintronics.

UNIT III

Application of Quantum Semiconductor Structures- Models of FETs, performance analysis, variants of heterojunction FETs. Two terminal and three terminal electronics devices based on perpendicular transport, quantum well lasers, single QW laser, multiple QW lasers, temperature dependence of threshold current, specific features of QW lasers, material systems for QW lasers.

Unit IV

1D and 0D Structures- Fullerenes, carbon nanotubes and their applications, Micro and mesoporous materials, core shell structures, nano-grained structures, polymer nanocrystals and nanocomposites, supramolecu;ar structures. Band-gap engineered quantum devices. Electrical devices based on 1D and 0D structures: resonant tunneling devices, single electron transistor etc. Optical devices based on 1D and 0D structures: luminescence, QD phosphors, AC power electrolimunescence and display devices, QD lasers photovoltaic effect, nanostrcurured solar cells.

UNIT V

Pattern Tranfer with additive Techniques : Introduction si-growth, Doping of Si Oxidation of Silocon, Physical vapour deposition, Chemical vapour deposition silk screening or screen printing, Sol-gel deposition technique, Doctor's Blade or Tape casting, Plasma spraying, depositysion and Arraying, Methods of organic layers in BIOMEMS, Thin versus thin film deposition, Selection for depositin methods.

Reference/Text Books

1. Quantum Semiconductor Heterostructures: Fundamentals and Applications; by Cloude Weisbuch and Borge Vinter; Academic Press 1991
2. Introduction to Nanotechnology; by Charles P. Poole, Jr. and Frank J.Owens, Wiley India 2007
3. Nanotechnology: Principles and Practices; by S.K.Kulkarni, Capital publishing Co. New Delhi, 2007
4. Introduction to Nanoelectronics; by Vlaadiniz U. Mitin, Cambridge University Press.
5. Fundamental of Microfabrication : The Sceince of Miniaturization, Second Edition : The Science of Miniatirization, Marc J. Madou, 2nd Edition.
6. Etching in Microsystem Technology by Michael Kohler 1999.

M.Sc. ELECTRONICS III SEMESTER 2021-22 ONWARDS (CBCS)

ELE L 301 Lab A

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1. Design and Study of OP-AMP Inverting Amplifier Circuit using Multisim software.
2. Design & Study of OP-AMP Non-Inverting Amplifier using Multisim software.
3. Design and Study of OP-AMP based Differentiator, Integrator, Voltage to Current Converter, Schimitt Trigger circuits.
4. Design and Study of Phase Lock Loop circuit using Multisim software.
5. Design and Study of OP-AMP based Adder and Subtractor and Comparator circuit using Multisim software.

ELE L 302 Lab B

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1. Study of Amplitude Modulation and Demodulation circuit.
2. Study of Pulse Code Modulation and Sampling theorem.
3. Study of Pulse Amplitude Modulation and Demodulation.
4. Time Division Multiplexing (TDM) based PCM circuit using Transmitter and Receiver circuit.

5. Study of Digital Communication System (Adaptive Delta Modulation)

M.Sc. ELECTRONICS IV SEMESTER 2021-22 ONWARDS (CBCS)

ELE L 401 Lab B

60+ 40 = 100 Marks **3 Credits**

The following experiments to be performed by the students. (Similar experiments of equal standard may be added)

List of Experiments:

1 Design and Study of OP-AMP based waveform Generator using Multisim software.
2 Design and Study of IC 555 based Monostable Multivibrator circuit using Multisim software.
3 Design of 4 bit digital frequency counter using Multisim software.
4 Design and Study of Digital Voltmeter using Multisim software.
5 Programming of 8051/80C51 Microcontrollers
   (a) Index Addressing
   (b) 16 bit addition
   (c) 8 bit Substraction
   (d) 8 bit Multiplication
   (e) 1!s and 2!s Complement
   (f) Sum of the elements in array.

ELE IT 402 INDUSTRIAL TRAINING AND SKILLED DEVELOPMENT

60+ 40 = 100 Marks **3 Credits**

End Semester Examination of 60 marks comprising of Report + Presentation.

ELE PW 403 PROJECT WORK

60+ 40 = 100 Marks **2 Credits**

End Semester Examination of 60 marks comprising of Report + Presentation.

ELE S 401 SKILL DEVELOPMENT 2 Credits

IGNOU TEE DEC 20 FEB 21 DATE 08-02-21

MONDAY MORNING

ROW 01	ROW 02	ROW 03	ROW 04	ROW 05	ROW 06
BPOI 04	MSEI 023	MPC 001	MHD 004	MEG 04	MEG 04
BYG 001	MVO 002	MBP 004			
MEV 024	BFEE 102				
MIP 101					
	BPC 005				
MST 004					

IGNOU TEE DEC 20 FEB 21 DATE 08-02-21

MONDAY EVENING

ROW 01	ROW 02	ROW 03	ROW 04	ROW 05	ROW 06
MS 22	BLII 012	BCS 011	PHE 10	BLI 222	BLI 222

MS 42					
	CHR 11				
MS 52	MHA 08	MS 62	TS 06		
BAB 101	MLI 101				
BECC 131					

IGNOU TEE DEC 20 FEB 21 DATE 09-02-21
TUESDAY MORNING

ROW 01	ROW 02	ROW 03	ROW 04	ROW 05	ROW 06
MS 05	MEC 002	MES 014	MCO 003	MSW 002	
		AFWE 01/BH			
		BEGA 001			

IGNOU TEE DEC 20 FEB 21 DATE 09-02-21 TUESDAY EVENING

ROW 01	ROW 02	ROW 03	ROW 04	ROW 05	ROW 06
BEGC 131	BCS 012				

IGNOU TEE DEC 20 FEB 21 DATE 10-02-21 WEDNESDAY MORNING

ROW 01	ROW 02	ROW 03	ROW 04	ROW 05	ROW 06
BPOI 001	MECE 004	MHD 07	MSTE 001	BSWE 004	ECO 10
BWEE 005			BFEE 104		
	MIP 102			CFN 02	
MAN 001					
	MPC 003		BPC 006	MED 008	
		MSOE 004			
MB P 006					MES 044

IGNOU TEE DEC 20 FEB 21 DATE 10-02-21 WEDNESDAY EVENING

	ROW 02	ROW 03	ROW 04	ROW 05	ROW 06	ROW 07
	BLI 011	BLI 223	BLI 223	BLI 223	MLI 102	
						BEGE 104
	BLI 223					

					BCSQ 31	
				MHA 013		
					BECE 107	

IGNOU TEE DEC 20 FEB 21 DATE 10-02-21 WEDNESDAY EVENING (ROOM)

ROW 01	ROW 02	ROW 03	ROW 04
ESO 16	ESO 16	EHI 06	EPA 06
			EPS 06
			EPS 09

Department of Post Graduate Studies & Research in Physics & Electronics
Rani Durgawati University, Jabalpur

M.Sc. Electronics (Under CBCS)

1. PROGRAMME OBJECTIVES

1.1. The objective of the Master's Program in Electronics is to develop the basic concepts of all core topics of Electronics like electronics components, network theorem, digital electronics, solid state semi-conductor devices, amplifier theory, Analog and Digital circuits, Communication electronics, design using circuit maker, software and their application.

1.2. Impart higher level knowledge of Sensor Technology, Semiconductor Devices, Mechatronics, and Industrial Communication to address multi-disciplinary demands of R & D organizations, educational institutes and automated process in modern industries in capacity of Scientist, Education Professionals, System Developers and System Integrators.

1.3. To develop strong student skills in research, analysis and interpretation of complex information.

1.4. To develop consciousness of professional, ethical and social responsibilities as experts in the field of Electronics and Communication Electronics.

1.5. To prepare the students to successfully compete for employment in Electronics, Manufacturing and Teaching and to offer a wide range of experience in research methods, data analysis to meet the industrial needs.

2. PROGRAMME OUTCOMES

On completion of program, the post-graduates will

2.1 Cater to the expanding demand for skilled manpower, which is equipped with an understanding of modern research, protocols and ethics involving related to Electronics and Communication Electronics.

2.2 Apply broad understanding of impact of electronics technology in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

2.3 Able to conduct experiments using a variety of scientific equipment with minimum guidance and design a circuits for a specific application.

2.4. Build, manage and lead a team to successfully complete a project and communicate across teams and organizations to achieve professional objectives.

2.5. Communicate effectively on complex electronics technology related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

3. PROGRAMME SPECIFIC OUTCOMES (PSOs)

3.1. Students are expected to acquire deep knowledge of electronics to design a variety of components and systems for applications including signal processing, image processing, communication, networking, embedded systems, VLSI and control system.

3.2. Have fundamental and advanced level knowledge in Electronics so as to handle the computational tools and Scientific software.

3.3. Select and apply cutting-edge engineering hardware and software tools to solve complex Electronics and Communication Electronics problems.

3.4. Have necessary skills and expertise in field of research and development and be able to apply experimental expertise in basic as well as advanced areas of Electronics.

3.5. Students will be capable of oral and written scientific communication and will prove that they can think critically and work independently.

Diploma in Elect.

2002-2003

RANI DURGAVATI VISHWAVIDYALAYA,
JABALPUR
DEPARTMENT OF POSTGRADUATE STUDIES & RESEARCH IN PHYSICS

SYLLABUS OF ONE YEAR POST B.Sc. DIPLOMA IN ELECTRONICS
~~1993-94~~ ~~2002-2003~~ 2010-11
Under Semester System

1. Nomenclature

This course shall be called One Year Post B.Sc. Diploma in Electronics.

2. Duration

The duration of the course will be of One Academic Session consisting of two semesters.

3. Eligibility

The candidate should have passed B.Sc. Examination with Physics as one of the subjects. In case of B.Sc.(Honours) degrees, the main subject should be Physics. Preference will be given to those who have also offered Mathematics. The candidates with B.E./B.Tech./B.Sc.(Engg.) etc. will be treated at par with B.Sc. degree.

4. Courses of Study and Eligibility for Passing

GROUP - A

SEMESTER - I

COURSES		MAX.MARKS	MIN.PASS MARKS
Course - I	Electronic Components, Devices and Circuits	100	For qualifying in Group A and going to II Semester, the candidate should secure 40% marks in aggregate i.e., 180 marks out of 450.
Course - II	Pulse Circuits and Digital Electronics	100	
Course -III	Network Electronic and Measurements	100	
Course -IV	Radio Engineering	100	
Course - V	Viva-Voce Examination	50	
	Total Marks	- 450	Pass Marks - 180

If a candidate fails to secure 180 marks, he/she will be allowed to appear in the first semester examination of the next academic session.

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SEMESTER - II

GROUP - B		MAX.MARKS	MIN.PASS MARKS
Course - VI	Instrumentation and Industrial Electronics	100	For qualifying in Group - B, the candidate should secure atleast 40% marks in aggregate, i.e., 180 marks out of 450.
Course - VII	Television Engineering, Microwave and Radar	100	
Course -VIII	Integrated Circuits and Microprocessors	100	
Course - IX	Computer Programming	100	
Course - X	Viva-Voce Examination	50	

Total Marks - 450 Pass Marks-180

If a candidate fails to secure 180 marks, he/she will be allowed to appear in the second semester examination of the next academic session.

GROUP - C		MAX.MARKS	MIN.PASS MARKS
Practicals			
Course - XI	Long duration practical	100	For qualifying in Group C, the candidate should secure atleast 45% marks in aggregate i.e., 135 marks out of 300, However, the minimum passing marks for sessional are 60%.
Course - XII	Short duration practical	100	
Course -XIII	Sessional	100	

Total Marks-300 Pass Marks - 135

If a candidate fails to qualify in Group - C, he/She will be allowed to appear in the practical examination of the next academic session. However, if the candidate has passed in sessional, these marks will be carried over.

GROUP - D		MAX. MARKS	MIN.PASS MARKS
PROJECT			
Course - XIV	(a) Evaluation of project and Script by the supervisor	125	For qualifying in Group - D, the candidate should secure atleast 45% marks, i.e., 90 marks out of 200.
	(b) Project Viva-Voce by external examiner	75	

Total Marks- 200 Min. Pass Marks-90

It the candidate fails to secure 90 marks, he/she will be allowed to appear in Group-D examinations of the next academic session.

FIRST DIVISION : 60% marks and above in aggregate (i.e., Groups A + B + C + D).

SECOND DIVISION: 45% marks but below 60% in aggregate (i.e., Groups A + B + C + D).

NOTE : (i) If a candidate is unable to secure atleast 45% marks in aggreagate he/she will be declared fail. He/she will have the option of appearing in Group A or Group - B or in both the examinations of next academic session for securing the minimum aggregate of 45%.

(ii) The system of awarding grace marks for awarding division and passing as applicable in post graduate examinations of the faculty of science will be applicable here also.

(iii) Each theory course will be divided into Five Units In all nine questions would be set in each paper. Two questions would be set from Unit I-IV. These questions would be divided into two parts : One for short answer/ numerical of 6 marks and the other of descriptive type carrying 14 marks. The question for Unit V would have ten questions of multiple choice type and the student will have to answer all the ten.

(iv) The candidate whose attendance is less than 60% will not be allowed to appear in the examination at the close of the semester and he/she would be declared as having failed.

SEMESTER - I

Course - I : ELECTRONIC COMPONENTS, DEVICES AND CIRCUITS

UNIT - I

Resistor : Types of resistor, carbon composition, metal films wire wound type , Resistor colour code, power rating, testing.

Capacitor: Types of capacitor : Mica, Paper, Ceramic, Polyester Tentalum, Electrolyte types, colour code, voltage rating and Testing.

Transformer and Coil : types of transformers : Step-up, Step-down, power transformer

Coil: Medium wave and short wave coils.

Vacuum Tubes : Vacuum Diode, Triode, Tetrode and Pentode Valve and their V-I characteristics.
Tube parameter : u, and g_m
Gas filled Diode and Triode,

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UNIT - II

Semiconductor d vices :N and P type semiconductors, P-N junction diode and forward and reverse biasing, Principle of operation, characteristic Zener diode and its characteristics. Rectifier: half & full wave, bridge rectifier. Biopolar transistors, P-N-P and N-P-N transistor Biasing technique, and characteristics, common base (CB), common emitte (CE) and common collector (CC) configurations. regulated power supply.

Devices Elementry idea of JFET, UJT and SCR.

UNIT-III

AMPLIFIER ; Classification of amplifier, small signal low frequency R-C coupled, Transformer coupled amplifiers. Gain, Frequency response curve, Band-width, Idea of push pull Amplifier : Class B Push Pull amplifier. Negative feed back and its types, voltage and current feedbacks, gain, ..., Input/output impedence advantages and disadvantages.

UNIT - IV

Transistor oscillators, classification of oscillators, Barkhansen colpitt for oscillations/positive feed back.

Oscillator : Hartly, Colpitts, Weign Bridge and Phase shift oscillators.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

Course - II PULSE CIRCUITS AND DIGITAL ELECTRONICS

UNIT - I

Wave Shaping (Semiconductor)

Linear and non - linear wave shaping circuits, High ... and low pass RC circuits; Response of sinusoidal wave pulse and square wave inputs, Differentiator and Integrator circuits. Clopping and clamping circuits Sweep generator, Miller integrating sweep generator.

UNIT - II

Digital Electronics :

Number systems - Binary number system, Boolean constant and variable; Binary to decimal and Decimal to binary conversion, Hexadecimal number sytem Binary addition, substration, multiplication and division, Binary and Gray Code, Binary Coded decimal number, Boolean Algebra, De Margans theorem, truth table.

UNIT - III

logic Gates

Fundamental logic gates - AND, OR, NOT, NOR and NAND, their operation and truth tables; EX-OR gate, Half adder and full adder circuits.

Logic Families

Logic families - RTL, DTL, DCTL, TTL, ... fundamental circuits and their comparative studies. (Parameters of logic families -fanin fan out, propagation delay, noise margins, noise immunity, power dissipation.

UNIT - IV

Multivibrators (Transistorised) :

Astable .. Monostable and Bistable multivibrators and Schmitt trigger.

Flip - Flop : R-S flip-flop, J-K filp-flop, T type filp flop and Master - slave flip flop

Binary counter, ripple counter, decade counter and shift Register.

Unit - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsarly asked from each of the four units.

Course - III NETWORK - ELECTRONIC AND MEASUREMENTS

UNIT - I

Kirchoff's laws, Branch current, loop current, Four Terminal Network, Impedance Matching, superposition, Reciprocity, Maximum power Transfer, Thermin's and Norton's Theorems.

UNIT - II

Series and parallel resonance, Idea of Q value, Resonant Frequency, Filter Circuit, Elementry Filter Theory, Characteristics Impedence of T and π sections, Low Pass Filter, High Pass Filter, Band Pass Filter, Band Elimination Filter, Advantages and Disadvantages of Simple Types of Filter M - Devived Type Filter.

UNIT - III

PMMM : Permanent magnet moving coil meter, AC-DC voltmeter and current meter, volt ohm meter, thermocoupled based instruments compensated and bridge type instruments

Introduction to binary, decade and ripple counters, digital frequency counter Ladder type, D/A converters, single slop. A/D convertor, Digital Voltmeter ramp type.

UNIT - IV

Receiver measurement ; Sensitivity Fidelity and Selectivity, Introduction to function generator, Op-amp based sine, square and triangular wave generator, Pulse characteristics, Introduction to cathode ray oscilloscope, operation of CRO with block diagram.

Unit - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsarly asked from each of the four Units.

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COURSE - IV : RADIO ENGINEERING

UNIT - I

Principle xof Radio Communication

Modulation, amplitude, Frequency and phase modulations, Linear series plate, Grid bias and Square law Diode Modulations, Balanced modulator. Transistor modulator: Collector, base and emitter modulation, FET square law modulation, balance modulator.

Amplitude demodulation, Square law detector, Linear diode detector, choice of RC time constant in linear diode detector, (both vacuum tube and semidonductor type).

UNIT - II

AM Radio Transmitters (Transistorised)

L-C and crystal controlled master oscillators, Frequency drift and scintillation, Buffer amplifier, Harmonic generator, High level and low level modulation, class 'B' and class 'C'

VODAS / and privacy devices, single side band transmission and its advantages and disadvantages, SSB transmitter, Harmonic supperssion,

UNIT - III

Antenna and FM Transmitters (Transistorised)

Antenna action, radiation mechanism, current voltage distribution, Antenna gain, Antenna resistance and band width General idea about different types of antennas.

Reactance tube modulation, pre-emphasing reactance tube FM transmitter, Armstrong FM transmitter. Advantages and dis-advantages of FM

UNIT - IV

AM Radio Receivers (Transistorised)

Receiving aerials, Block diagram of super hetrodyne receivers and its explanation RF amplifier, tracking and alignment IF amplifier, choice of IF, image rejection, AVC, Volume and Tone control, tunning control, communication receivers, SSB receiver, AFC,

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsarly asked from each of the four units.

COURSE - V: VIVA-VOCE EXAMINATION

This examination will cover all the four theory papers of Ist semester.

SEMESTER - II

Course - VI: INSTRUMENTATION AND INDUSTRIAL ELECTRONICS

UNIT - I

Measurement, significance of measurements, method of measurements, classification of instruments, Mechanical, electrical, electronics, Analog and Digital instruments, Application of measurement system.

Introduction, and classification of transducer and its advantages, Transducers : Active and passive transducers, analog and digital; use of transducer in : Measurement of pressure, measurement of temperature, measurement of light, measurement of flow and measurement of strain.

UNIT - II

Display Devices

Digital display methods, Digital Display units, segmental Displays : Seven Segmental Display, Fourteen Segmental Display, Dot Matrix, Nixie tube, light emitting diode, liquid crystal diode.

Recorder

Necessity of recorder, Recording instruments : Analog Recorder, Graphic Recorder, Strip Chart Recorder, and X-Y Recorder.

UNIT - III

Industrial Electric Heating of Materials :

Industrial heating of conducting materials, Principle of Dielectric Heating of Non conducting materials and its application

Resistance Welding : Principle of Resistance welding, Block diagram of welding machine working of main parts of welding machine Ignitron tube, Iguitron contactor, weld Timer, Technical Terms Related to Resistance Welding, Percent Daty, Averaging Time; Ultrasonics : Generation of ultrasonic frequencies Application of communication, Testing of Materials by ultrasonic, cutting and etching of Hard Materials, separation of Mixtures.

AP

UNIT - IV

Structure and characterstics of D.C. Motor, Armature control and field control of D.C. Motor, speed, control of small motor, speed Regulation, Action, Motor control by one SCR, speed variation by SCR control, Introduction to electronic control of A.C. Motors.

Inverters : Inverters to supply large A.C. Power uses of UJT in Inverter circuit, SCR Based Two phase inverter, McMurray Investor McMurray inverter, Mc Murray Beford inverter Three phase inverter. Introduction to poly phase Rectifier , Three diode, three phase and six diodes, six phase half wave and full wave rectifier.

UNIT - V

This unit will have ten questions of multiple choice type . At least two multiple type questions would be compulsarly asked from each of the four units.

COURSE - VII : TELEVISION ENGINEERING, MICROWAVE AND RADAR

UNIT - I

Scanning process, characteristics of human eye, resolution, Aspect ratio, persistence of vision and flicker, vertical resolution keel factor, horizontal resolution and video band width, interlaced scanning composite video signal, blanking, synchronizing and equalizing pulses. Video modulation, vestigial side band signal, standard channel characteristics. TV camera tubes, image orthicen and vidican.

UNIT - II

TV Transmitters and Receivers

Block diagrams and working of TV transmitter and receiver, response characteristics of receiver. Transmitting and receiving antennas, Duplexer, inter carrier sound. AGC, contrast and bright control.

UNIT - III

Colour Television

Three colour system, luminance and chrominance signal, colour TV Camera. Shadow mask, trinitron and In-time colour picture tubes, colour transmission and reception, frequency interleaving NTSC.

UNIT - IV

Microwave and Radar

Microwaves, characteristic features of microwaves, Application of microwaves, limitation of conventional tubes, Klystron amplifier, Reflex Klystron oscillator, General idea about Mergnetron.

Radar, basic arrangement of radar system, operating characteristics of radar system, Radar range equation Basic pulse rader system, Duplexer and radar receiver, General idea about radar indicator and MIT.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsarly asked from each of the four units.

Course - VIII : INTEGRATED CIRCUITS AND MICROPROCESSORS

UNIT - I

Linear Integrated circuits

Integrated circuit (IC) Technology, basic idea of integrated circuit - its advantages and limitations. Linear Integrated circuits-classification - SSI, MSI, LSI, VLSI.

Basic circuits for Linear ICS - Biasing circuits, current and voltage sources, voltage references, D.C. Level shifting stages. Differential Amplifier (emitter coupled) Common Mode Rejection Ratio (CMRR).

UNIT - II

IC Operational Amplifier

Basic building blocks of IC Operational Amplifier (OP-amp) Inverting and non-inverting imputs; characteristics of op-amp open- loop voltage gain, input and output offset voltages, Input offset current, slew rate.

Some basic applications of IC Op-amp : inverting and non-inverting amplifiers, adder, substractor, integrator and differentiator circuits.

UNIT - III

Voltage Regulator and comparators

Basic idea of voltage regulator, parameters of voltage regulator, line regulation, Ripple rejection, standby current drain, short circuit current limit, series and parallel type voltage regulation.

Practical form of monolethic voltage regulator short circuit protection, overvoltage protection IC voltage regulator 723 - Functional block diagram explanation regulator circuit using IC 723.

Basic idea of monolithic voltage comparator parameter of voltage comparator - logic threshold voltage, Input offset voltage, input offset current, Input bias current, [illegible] Differential input voltage range, Application of voltage - comparator - zero crossing detector window comparator, level detector.

UNIT - IV

Microprocessors

Semiconductor memories ROM & RAM. Organization and evaluation of Microprocessors. Address, data and control buses, INTEL 8085 Microprocessor, Pin description, Register organization programm counter, stack pointer, Addressing. Modes and Instruction set of 8085. Elementary idea of Assembly language programming with few standard examples - Addition of two numbers, sum of a series of n numbers and Multiplication of two numbers, finding a largest number in a series.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsarly asked from each of the four units.

COURSE - IX - COMPUTER PROGRAMMING

UNIT - I

SK Introduction to computer system : components of a computer system, MMU, ALU, CU, I/O Devices and their functions; Types of computers : Micro, Mini, Mainframe and super computer; Use of computers; Data and Information : Data field, Records and files; Data processing and its need; A brief introduction to file organization; commonly used I/C Devices; Auxillary memory Devices and Data storage.

UNIT - II

Data representation of character, integer and fraction, Number system and their mathematic, conversion of Number into Different Number System, ASCII, EBCDIC code and Floating point Representation

Problem solving and algorithm, Flow charts, Decision Tables, Data Input to object program, coding form, How the column are used, program identification, sorting and Merging, sequencing, comments, Blank column, system programs and their uses.

UNIT - III

Computer programs and its developments, L.L.L. and H.L.L., Assembler, compiler and Interpreter, use of Procedure-oriented langnage, A brief introduction to various programming languages and their purposes, (eg BASIC, PASCAL, COBOL, FORTRAN (without Programming) Print) Operating System and its need, Batch, Multi programming and Time sharing O.S.

UNIT - IV

BASIC Language : Character set, constants, variables, Arithematic expressions, Boolean expressions, statement syntax, Assignment statement, conditional and control statements, Input and output statements, library function, Nested Loops, uses defined function, General idea of files, simple programming for scientific calculation.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsarly asked from each of the four units.

COURSE - X : VIVA VOCE EXAMINATION

This examination will cover all the four theory papers of IInd semester.

GROUP - C : PRACTICAL

COURSE - XI : LONG DURATION PRACTICAL (THREE HOURS DURATION).

1. Triode Valve characteristics.
2. Tetrode valve characteristics.
3. Pentode valve characteristics.
4. Semiconductor diode and Zener diode characteristics .
5. Optoelestronics Devices : EDR.Photodiode and LED.
6. The diode clipper and clamper.
7. Half wave and full wave rectification with filter.
8. The Bridge Rectifier and over load protection.

9. Transistor characteristics CB, CE and CC.
10. R - C Coupled Amplifier.
11. Push - Pull Amplifier.
12. Negative feed back amplifier.
13. Operational amplifier.
14. Multivibrator : Astable monostable and bistable.
15. Phase shift oscillator.
16. U.J.T. Characteristics and as an Oscillator.
17. JFET and MOSFET Characteristics.
18. Logic gates : OR, NOT, AND , NOR NAND, and EX-OR gates.
19. Digital display system.
20. Radio Receiver.
21. Television Receiver.
22. Programming on Microprocessor.
23. Programming on Computer.

NOTE :- The other experiments related with the course may also be included.

COURSE - XII : SHORT DURATION PRACTICAL (TWO HOURSE DURATION TESTS).

1. Study of various type of resistors.
2. Study of various type of capacitors.
3. Study of warious type of transformers and Coils.
4. Testing of Semiconductor diodes and indentification of Anoce and cathode.
5. Testing of PNP and NPN transistor with the help of a multimeter and indentification of emitter, base and collector.
6. Operation of Analog and Digital multimeters.
7. Operation of Oscilloscope.
8. Operation of v rious types of Oscillators.
9. Valves transistors and IC'S and study of their datas from manuals.
10. Diode biasing.
11. Transistor biasing.
12. Tracing of Television circuit.
13. LED and LCD Display testing.
14. Tracing of Radio receiver circuits.

NOTE : The other experiments related with the course may also be included.

COURSE - XIII : SESSIONAL

The sessional marks will be awarded on the general performance, regularity in the practical classes, submission of records at appropriate times and completion of minimum number of experiments.

GROUP - D

COURSE - XIV : PROJECT (FOUR HOURS DURATION)

1. Assembling and testing of a rectifier type AC/DC voltmeter.
2. Assembling and testing of Battary Eliminator and stabilization of the circuit.
3. Assemble a power supply and measure its output with different leads.
4. To built a speed control of AC/DC motor by SCR.
5. To Assemble a single band radio-receiver (Transistorised).
6. Assembleing and testing of a temperature controlled circuit.
7. Assembling and testing of a Digital diaplay system (7 seg) mixetube and data matrix.
8. Design and assemble of a ripple/decade counter analog computation circuit for a solving of different equation.
9. To built and study the UJT Oscillator.
10. To built, study and measurement of frequency of I.C. oscillator (a) Hartlay (b) Colpits.
11. To built and study the encoder and decoder.
12. To built and study the I.C. timer (555).
13. To assemble a transistorised regulated power supply.
14. To assemble a regulated power supply using I.C. 723 and 741.
15. Assembling and testing of an audio amplifier using 741.
16. Assembling and testing of radio receiver.
17. Assembling and testing of Television receiver.

NOTE :- (i) The other projects related with the course may also be included.

(ii) The Viva-Voce examination of both the semesters will be conducted by a board consisting of Head of the Department or his nominee and two teachers, teaching the course.

(iii) The project examination will be conducted by a Board consisting of Head of the Department or his nominee, an external examiner and an internal examiner.

/Ansari/
/S.A. /

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2002-2003.

DEPARTMENT OF POSTGRADUATE STUDIES AND RESEARCH IN PHYSICS,
RANI DURGAVATI VISHWAVIDYALAYA,
JABALPUR.

SYLLABUS OF ONE YEAR DIPLOMA IN ELECTRONICS

~~1993-94~~, 2002-2003

Under Semester System

1. Nomenclature

The course shall be called one year Diploma in Electronics.

2. Duration

The duration of the course will be of one Academic Session consisting of two semesters.

3. Eligibility

The candidate should have passed Higher Secondary Examination from (M.P.Board or Equivalent) with Physics, Chemistry and Mathematics/ vocationalcourses such as Electronics, Radio and T.V. repairing, etc. with preferably 2 to 3 years experience in Government, Public Sector Undertakings, Private Ltd. Companies, Educational Institutes, etc. Preference will be given to Ist year B.Sc. Passed, I.T.I. certificate (Electrical or Electronics) holders or Diploma in Electrical or Mechanical Engineering.

4. Courses of Study and Eligibility for Passing

SEMESTER - I

GROUP : A

		Max.Marks	Min.Pass Marks
Course - I	Electronic Components, Devices and circuits	100	For qualifying in Group A, and going to II semester, candidate should secure atleast 40% marks in aggregate i.e., 180 marks out of 450.
Course - II	Pulse Circuits and Digital Electronics	100	
Course-III	Network Electronics and Measurements	100	
Course - IV	Radio Engineering	100	
Course - V	Viva-Voce Examination	50	

Total Marks - 450 Pass Marks 180

If a candidate fails to secure 180 marks, he/she will be allowed to appear in the first semester examination of the next academic session.

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SEMESTER - II

Group - B

			Max.Marks	Min.Pass Marks
Course	VI	Instrumentation and Industrial Electronics	100	For qualifying in Group - B, The candida should secure at least 40% marks in aggregate i.e., 180 marks out of 450.
Course	VII	Television Engineering, Microwave and Radar	100	
Course	VIII	Integrated Circuits and Microprocessors	100	
Course	IX	Computer Programming	100	
Course	- X	Viva-Voce Examination	50	

Total Marks 450 Pass Marks 180.

If a candidate fails to secure 180 marks, he/she will be allowed to appear in the second semester examination of the next session.

GROUP - C PRACTICALS

		Max.Marks	Min.Pass Mark
Course - XI	Long duration practical	100	For qualifying in Group - C the candidate should secure atleast 45% marksinaggregate, i.e., 135 marks out of 300 However, the minimum pass marks for sessional are 60%
Course - XII	Short duration practical	100	
Course -XIII	Sessional	100	

Total Marks-300 Pass Marks - 135.

If a candidate fails to qualify in Group - C, he/she will be allowed to appear in the practical examination of the next academic session. However, if the candidate has passed in sessional, these marks will be carried over.

FIRST DIVISION : 60% marks or more in aggregate (i.e. Groups A + B + C).

SECOND DIVISION: 45% marks but below 60% in aggregate (i.e. Groups A + B + C).

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NOTE : (i) If a candidate is unable to secure atleast 45% marks in aggregate he/she will be declared fail. He will have the option of appearing in Group - A or Group - B or in both simultaneously in the examinations of next academic session for securing the minimum aggregate of 45%.

(ii) The system of awarding grace marks for the award of division and passing as applicable in undergraduate examinations of the faculty of science will be applicable here also.

(iii) Each theory course will be divided in to FIVE UNITS In all nine questions would be set in each paper. Two questions would be set from Units I-IV. These questions would be divided into two parts : One for short answer/ numerical of 6 marks and the other of descriptive type carrying 14 marks. The question for Unit - V would have ten questions of multiple choice type and the student will have to answer all the ten.

(iv) The candidate whose attendence is less than 60% will not be allowed to appear in the examination at the close of the semester and he/she would be declared as having failed.

COURSE - I : ELECTRONICS COMPONENTS CIRCUITS AND DEVICES

UNIT - I

Resistor : Types of resistor, Carbon composition, metal film, wire wound type, Resistor colour code, power rating, Testing.

Capacitor : Types of capacitor : Mica, Paper, Ceramic, Polyester, Tantalum Electrolyte types, colour code voltage rating and Testing.

Transformer and Coil : Types of transformers step up, step down power transformer.

Vacuum Tubes : Vacuum tube/Diode, Triode, Tetrod and Pentode valve and there V-I characteristics. Tube parameter : and gm

UNIT - II

Semiconductor devices : N and P type semiconductors, P-N junction diode and forward and reverse biasing, Principle of operation, characteristics. Zener diode and its characteristics. half and full wave & Bridge rectifir

Biopolar transistors, P-N-P and N-P-N transistor, biasing technique, and characteristics, common base (CB), common emitter (CE) and common collector (CC) configurations.

Devices Elementry idea of JFET, UJT, and SCR.

UNIT - III

AMPLIFIER : Classification of amplifier, small signal low frequency R-C coupled, Transformer coupled amplifiers, Gain, Frequency response curve, Band width, Negative feedback and its types, voltage and current feedbacks Gain Band width,.

UNIT - IV

Transistor oscillators, classification of oscillators, Barkhausen criterion for oscillations possitive feedback. Oscillator : Hartly, and phase shift oscillators.

UNIT - V

The unit will have ten questions of multiple choice type. At least two multiple type questions should be compulsorily asked from each of the four units.

COURSE - II PULSE CIRCUITS AND DIGITAL ELECTRONICS

Unit - I

Wave shaping (Semiconductor)

Linear and non-linear wave shaping circuits, High pass R-C and low pass RC circuits; Response of sinusoidal wave, pulse squar wave inputs. and Differentiating. and Integrating circuits.

Clipping and clamping cirtuits sweep wave form, Miller. integrating sweep generator.

UNIT - II

Digital Electronics

Number systems - Binary number system, Boolean constant and variable; Binary to decimal and decimal to binary conversion, Hexadecimal number system, Binary addition, substration, multiplication and division, Binary and Gray code, Binary Coded decimal number, Boolean Algebra, De'Margans theorem, truth table.

UNIT - III

Logic Gates :

Fundamental logic gates - AND, OR, NOT, NOR and NAND, their operation and truth tables; Ex- OR gate,

Logic Families :

Logic families - RTL, DTL, DCTL, TTL, fundamental circuits and their comparative studies.

UNIT - IV

Multivibrators (Transistorised) :

Astable multivibrator, Monostable and Bistable multivibrators and Schmitt trigger.

Filp - Flop : R-S filp - flop, J-K filpflop, Binary counter, ripple counter.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE - III : NETWORK - ELECTRONIC AND MEASUREMENTS

UNIT - I

Kirchoff's laws, Branch current, loop current, four terminal Network, impedance matching, superposition, reciprocity, Maximum Power Transfer, Thevenin's and Norton's Theorems.

UNIT - II

Series and parallel resonant circuit, Idea of Q value, Resonant frequency, filter circuit, elementry filter theorem characteristics Impedence of T and π sections, low pass filter, high pass filter, Advantages and disadvantages of simple types of filter.

UNIT - III

PMMC : Permanent magnet moving coil meter, AC-DC voltmeter and current meter, volt-ohm meter, thermocouple based instruments and bridge type instruments.

Introduction to binary decade and ripple counters D/A convertors, single slop A/D convertors.

UNIT - IV

Receiver measurement; sensitivity, fidelity and selectivity, pulse characteristics, Introduction to cathode ray oscilloscope, operation of CRO with block diagram.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE : IV : RADIO ENGINEERING

UNIT - I

Principle of Radio Communication

Modulation, Amplitude, frequency and phase modulations, Linear series plate, and Square law Diode modulations, Balanced modulator

Amplitude demodulation, Square law detector, Linear diode detector, choice of RC time - constant in linear diode detector. General idea about transistorised circuits of modulation.

UNIT - II

AM Radio Transmitters : (Transistorised)

L - C and crystal controlled master oscillators, frequency drift and scintillation, Buffer amplifier, Harmonic generator, High level and low level modulation, class 'B' and Class 'C'.

VODAS and privacy devices, single side band transmission and its advantages and disadvantages, SSB transmitter.

UNIT - III

(Trans ~~istorised~~)

Antenna and FM Transmitters : Antenna action the radiation mechanism current voltage distribution, Antenna gain, Antenna resistance and band width advantages and disadvantages of FM.

FM transmitter : Advantages and disadvantages of FM transmission over AM transmission. Rectance tube modulation, FM transmitter.

UNIT - IV

AM Radio Receivers : Receiving aerials, Block diagram of super-hetrodyne receivers and its explanation RF amplifier, choice of IF, Detector and AVC, volume and Tone control, tunning control, AFC.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE - : V :: VIVA-VOCE EXAMINATION

This examination will cover all the four theory papers of Ist semester.

SEMESTER - II

COURSE -VI : INSTRUMENTATION AND INDUSTRIAL ELECTRONICS

UNIT - I

Measurement, significance of measurements, method of measurements, classification of instruments, Mechanical, electrical electronics, Analog and Digital instruments, Application of measurement system.

Introduction and classification of transducer and its advantages, Transducers : Active and passive transducers, analog and digital; use of transducer in : Measurement of pressure, measurement of temperature and measurement of light, ~~xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx~~

UNIT - II

Display devices : Digital display methods, Digital display units, segmental Displays : Seven Segmental Display, Fourteen Segmental Display.

Recorders: Necessity of recorder, Recording instruments : Analog Recorder, Graphic Recorder and X-Y Recorder,

UNIT - III

Industrial Electric Heating of Materials :

Industrial heating of conducting materials, Principle of Dielectric Heating of Non conducting materials and its application.

Resistance Welding : Principle of Resistance welding, Block diagram of welding machine, working of main parts of welding machine, Ignitron tube, Ignitron contactor, Weld Timer, Technical terms related to resistance welding, percent duty, averaging time.

UNIT - IV

Structure and characterstics of D.C. Motor, Armature control and field control of D.C. motor, speed control of small motor, speed regulation action, Introduction to electronic control of A.C. Motors.

Inverters : Inverters to supply large A.C. power uses of UJT in inverter s circuit, Two SCR inverter two phase inverter Mc Murray inverter, MC Murray Beford inverter Three phase inverter.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE - VII: TELEVISION ENGINEERING, MICROWAVES AND RADAR

UNIT - I

Scanning process, characteristics of human eye, resolution, Aspect ratio, persistence of vision and flicker, vertical resolution keel factor, horizontal resolution and video band width, interlaced scanning composite video signal, blanking, synchronizing and equalizing pulses. Video modulation, vesti-gial side band signal, standard channel characteristics. TV camera tubes, image orthicon and vidican.

UNIT - II

TV Transmitter and Receiver

Block diagrams and working of TV transmitter and receiver, response characteristics of receiver, Transmitting and receiving antennas, Duplexer, inter carrier sound. AGC, contrast and bright control.

UNIT - III

Colour Television

Three colour system, luminance and chrominance signal, colour TV camera shadow mask, trinitron and in-time colour picture tubes, colour transmission and reception , frequency interleaving NTSC.

UNIT - IV

Microwaves and Radar

Microwaves, characteristic features of microwaves, application of microwaves, limitation of conventional tubes, Klystron amplifier, Reflex Klystron oscillator,

Radar, basic arrangement of radar system, operating characteristics of radar system, Radar range equation, Basic pulse radar system.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE - VIII : INTEGRATED CIRCUITS AND MICROPROCESSORS

Linear Integrated circuits

Integrated cirauit (IC) Technology, basic idea of integrated circuit - its advantages and limitations. Linear Integrated circuits-classification - SSI, MSI, LSI, VISI.

Basic circuits for linear ICS - Biasing circuits, current and voltage sources, voltage references, D.C. Level shifting stages. Differential Amplifier (emitter coupled) Common Mode Rejection Ratio (CMRR).

UNIT - II

IC operational Amplifier

Basic building blocks of IC operational Amplifier (OP-amp) Inverting and non-inverting imputs characteristics of Op-amp open-Loop voltage gain, input and output offset voltages, input offset current slew rate.

Basic idea of IC op-amp as inverting non-inverting Basic, adder, subtractor, integrator and differentior.

UNIT - III

Voltage Regulator and Comparators

Basic idea of voltage regulator, parameters of voltage regulator, line regulation, Ripple rejection, standby current drain, short circuit current limit,

Basic idea of monolithic voltage comparator parameter of voltage comparator - logic threshold voltage, In-put offset voltage, input offset current, input bias current, Differential input voltage range, Application of voltage - comparator-zero crossing detector.

UNIT IV

Microprocessors

Semiconductor memories ROM and RAM. Organization and evaluation of microprocessors. Address, data and control buses, INTEL 8085 Microprocessors. Pin description, Register organization programm counter, stack pointer, Addressing. Modes and Instruction set of 8085. Elementary idea of Assembly language programming with few standard examples - Addition of two numbers, sum of a series of n number and multiplication of two numbers, finding a largest number in a series.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE - IX : COMPUTER PROGRAMMING

UNIT - I

Introduction to computer system : components of a computer system, MMU, ALU, CU, I/O Devices and their functions; Types of computers Micro, Mini, Mainframe and super computer; Use of computers ; Data and Information : Data field, Records and files; Data processing and its need ; A brief introduction to file organization; commonly used I/O Devices; Auxillary memory Devices and Data storage.

UNIT - II

Data representation of character, integer and fraction, Number system & their mathematic conversion of Number into Different Number system, ASCII, EBCDIC code and floating point Representation.

Problem solving and algorithm, Flow charts, Decision Tables, Data Input to object program, coding form, How the column are used, programm identification, sorting and Merging, sequencing, comments, Blank column, system programs and their uses.

UNIT - III

Computer programms and its developments, L.L.L. and H.L.L., Assembler, compiler and Interpreter, us of procedure-oriented language, A brief introduction to various programming languages and their purpose , (eg BASIC, PASCAL, COBOL, FORTRAN)(without programming) Operating System and its need , Batch, Multi programming and Time sharing O.S.

UNIT - IV

BASIC Language : Character set, constants, variables, Arithematic expressions, Boolean expressions, statement syntax, Assignment statement, conditional and control statements, Input and Output statements, library function, Nested Loops, uses defined function, General idea of files, simple programming for scientific calculation.

UNIT - V

This unit will have ten questions of multiple choice type. At least two multiple type questions would be compulsorily asked from each of the four units.

COURSE - IX : COMPUTER PROGRAMMING

COURSE - X : VIVA-VOCE EXAMINATION :

The 50 marks of the viva-voce examination in II-semester will be divided into two parts; (i) Oral Viva-Voce on all the theory courses of 30 marks (ii) Viva-Voce on the assembly fabricated by the student of 20 marks.

This examination will over all the four theory papers of IInd semester.

GROUP - C PRACTICALS :

COURSE - XI : LONG DURATION PRACTICAL (THREE HOURS DURATION)

1. Triode Valve characteristics.
2. Tetrode valve characteristics.
3. Pentode valve characteristics.
4. Semiconductor diode and Zener diode characteristics.
5. Optoelectronics Devices : LDR, Photodiode.
6. Diode clipper and clamper.
7. Half wave and full wave rectification with filter.
8. The Bridge Rectifier and over load protection.
9. Transistor characteristics CB, CE and CC.
10. R-C. Coupled Amplifier.
11. Push - Pull Amplifier.
12. Negative feed back amplifier.
13. Operational amplifier.
14. Multivibrator : Astable monostable and bistable.
15. Phase shift oscillator.
16. U.J.T. Characteristics and as an Oscillator.
17. JFET and MOSFET Characteristics..
18. Logic gates : OR, NOT, AND, NOR NAND, and EX-OR gates.
19. Digital Display system.
20. Radio Receiver.
21. Television Receiver.
22. Programming on Microprocessor.
23. Programming on Computer.

NOTE :- The other experiment related with the course may also be included.

COURSE - XII : SHORT DURATION PRACTICAL (TWO HOURS DURATION -2TESTS)

1. Study of various type of resistors.
2. Study of various type of capacitors.
3. Study of various type of transformers and coils.
4. Testing of semiconductor diodes and identification of Anode and cathode.
5. Testing of PNP and NPN transistor with the help of a multimeter and indentification of emitter, base and coll ctor.

6. Operation of Analog and Digital multimeters.
7. Operation of Oscilloscope.
8. Operation of various types of Oscillators.
9. Valves transistors and IC'S and study of their data from manuals.
10. Diode biasing.
11. Transistor biasing.
12. Tracing of Radio receiver circuit.
13. Tracing of Television circuits.
14. LED and LCD Display testing.

NOTE :- The other experiments related with the course may be included.

COURSE - XIII : SESSIONAL

The sessional marks will be awarded on the general performance, regularity in the practical classes, submission of records at appropriate times and completion of minimum number of experiments.

NOTE :- The Viva-Voce examination of both the semesters will be conducted by a board consisting of Head of the Department or his hominee and two teachers, teaching the course.

/Ansari/
/S.A. /

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