GOVERNMENT ARTS COLLEGE (AUTONOMOUS),
KARUR – 639 005.
(Reaccredited with A Grade status by NAAC)
(Affiliated to Bharathidasan University, Tiruchirappalli.)

PG & RESEARCH DEPARTMENT OF PHYSICS

M. Sc., Physics

Programme Outcomes (POs)

1. Graduates are to be exposed to various branches of physics.
2. Graduates are to be exposed with recent field in physics.
3. Graduates are to be trained with recent and advanced experiments for employability.
4. Graduates are to be motivated to take research profession.
5. Graduates are to be made to develop communicating skill and handle project work.

Programme Specific Outcome (PSOs)

1. To take research as career.
2. Exposed to various mathematical methods to understand physics concept.
3. Good experimental skill.
4. Development of projects and model designing skill.
5. Higher Education toward society development.

GOVERNMENT ARTS COLLEGE,(AUTONOMOUS), KARUR-639 005.
PG COURSE STRUCTURE UNDER CBCS SYSTEM
(For the candidates admitted from the year 2016-17 onwards)

SEMESTER	COURSE	SUBJECT TITLE	SUBJECT CODE	INSTR.HOUS/ WEEK	CREDIT	EXAM HOURS	MARKS		TOTAL
							INT	EXT	
I	Core Course-I	Mathematical Physics – I	P16PH1C1	6	4	3	25	75	100
	Core Course-II	Classical Dynamics and Relativity	P16PH1C2	6	4	3	25	75	100
	Core Course -III	Analog and Digital Electronics	P16PH1C3	5	4	3	25	75	100
	Elective Course -I	Condensed matter Physics	P16PH1E1	5	4	3	25	75	100
	Core Practical–I	Basic Practical lab (General and Electronics)	-	4	-	-	-	-	-
	Core Practical -II	Advanced General Experiments Lab	-	4	-	-	-	-	-
II				**30**	**16**				**400**
	Core Practical–IV	Basic Practical lab (General and Electronics)	P16PH2C4P	4	4	4	40	60	100
	Core Practical- V	Advanced General and Microprocessor Lab	P16PH2C5P	4	4	4	40	60	100
	Core Course –VI	Mathematical Physics-II	P16PH2C6	5	5	3	25	75	100
	Core Course- VII	Quantum Mechanics	P16PH2C7	6	5	3	25	75	100
	Core Course –VIII	Electromagnetic Theory	P16PH2C8	6	5	3	25	75	100
	Elective Course- II	Microprocessor and Microcontroller	P16PH2E2	5	5	3	25	75	100
				30	**28**				**600**
III	Core Course –IX	Thermodynamics and Statistical Mechanics	P16PH3C9	6	5	3	25	75	100
	Core Course- X	Nuclear and Particle Physics	P16PH3C10	6	5	3	25	75	100
	Core Course - XI	Communication Electronics	P16PH3C11	5	5	3	25	75	100
	Elective Course-III	Crystal growth and Thin Film Physics	P16PH3E3	5	5	3	25	75	100
	Core Practical -III	Advanced General & Electronics Lab - I	-	4	-	-	-	-	-
	Core Practical-IV	Advanced General & Electronics Lab – II	-	4	-	-	-	-	-
				30	**20**				**400**
IV	Core Practical -XII	Advanced Electronics Lab - I	P16PH4C12P	4	4	4	40	60	100
	Core Practical-XIII	Advanced Electronics Lab -II	P16PH4C13P	4	4	4	40	60	100
	Core Course-XIV	Molecular Spectroscopy	P16PH4C14	4	4	3	25	75	100
	Elective Course-IV	Nano science and Nanotechnology	P16PH4E4	6	5	3	25	75	100
	Elective Course-V	Bio medical Instrumentation	P16PH4E5	5	5	3	25	75	100
	Project	Project		7	4	-	-	-	100
				30	**26**				**600**
TOTAL				**120**	**90**				**2000**

** Dissertation-80 marks and Viva - voce Examinations- 20 marks

CHAIRMAN
BOARD OF STUDIES

CONTROLLER OF EXAMINATIONS

Sl. No.: [ ] **Subject Code:** [P16PH1C1]

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-05 M.Sc.,
PHYSICS – I SEMESTER – CORE COURSE - I
(For the candidates admitted from 2016-17 onwards)
MATHEMATICAL PHYSICS -I

Course outcome:

1. Vector fields describing many physical concepts.
2. Tensor is an algebraic object related to vector space.
3. Matrix to represent linear maps between finite dimensional vector space.
4. ODE powerful tool to study in the natural sciences and technology.
5. PDE are used to mathematically formulate the solution of physical and other problems.

UNIT- I: VECTOR FIELDS

Concept of vector and scalar fields–Vector identities–addition, multiplication, orthogonal resolution vectors, product of two, three and four vectors – Gradient, Divergence, Curl and Laplacian Line integral, Surface Integral and Volume integral – Gauss theorem, Green's theorem, Stoke's theorem - Orthogonal curvilinear coordinates-Expressions for Gradient, Divergence, Curl and Laplacian for cylindrical and spherical coordinates.

UNIT- II:VECTOR SPACE AND TENSORS

Definitions – Linear independence of vectors – Bilinear and quadratic forms – Change of basis – Schmidt's orthogonalisation process – Schwartz inequality - introduction to tensors-n-dimensional space -superscripts and subscripts- Transformation of coordinates – Summation convention-dummy and real indices – Contra variant, covariant and mixed Tensors – Rank of a tensor – Symmetric and anti-symmetric tensors – Contraction of tensor – Raising and Lowering of suffixes – Metric tensor.

UNIT-III: MATRIX THEORY

Introduction-Solution of linear algebraic equations –sub matrices- partitioning of matrices- Transpose of a matrix- The conjugate of a matrix- The conjugate of a transpose-Symmetric and anti-symmetric matrices- Hermitian and skew-Hermitian matrices-Minors, Adjoint, Inverse and Determinant of a matrix- Orthogonal matrix- Unitary matrix and Trace of a matrix- Rank of a matrix- – characteristic equation of a matrix- Cayley – Hamilton theorem – Eigen values and Eigen vectors – similarity transformation-Diagonalization of a matrix.

UNIT-IV:ORDINARY DIFFERENTIAL EQUATIONS

Linear I, II order homogenous differential equations and linear I, II order inhomogeneous differential equations-Linear ordinary differential equations of first order-Solution of second order differential equations with constant co-efficients- Power series solutions: Frobenius method –Linear independence of solutions- Orthogonal set of functions and expansion theorem – Sturm – Liouville differential equation

UNIT-V: PARTIAL DIFFERENTIAL EQUATIONS

Solution of Laplace Equation in Cartesian co-ordinates – Partial differential equations in physics problems -Wave equation – Equation of vibrating string – One dimensional heat flow – Two dimensional heat flow -Laplace equation- D' Alembert's solution- Fourier series solution.

BOOKS FOR STUDY:

1. Mathematical Physics – Sathya Prakash.
2. Mathematical Physics – B.D. Gupta Vikas Publishing House (P) Ltd. Noida-(2008).
3. A.W. Joshi - Matrices and Tensors in Physics - Wiley Eastern Ltd., New Delhi (1975).
4. P.K. Chattopadhyaya - Mathematical Physics - Wiley Eastern Ltd., New Delhi, (1990).

BOOKS FOR REFERENCE:

1. Eugene Butkov - Mathematical Physics - Addison Wesley, London (1973).
2. L.A. Pipes and L.R Havil - Applied Mathematics for Engineers and Physicists - McGraw Hill Company, Singapore (1967).
3. H.K.Das & Dr. Rama Verma- Higher Mathematical Physics-S.Chand& Company Pvt Ltd., New Delhi, 2014.
4. G. Arfken and H.J. Weber - Mathematical Methods for Physicists, 4thcd. Prism Books, Bangalore, (1995).
5. M.D. Greenberg - Advanced Engineering Mathematics, 2nd ed. International ed., Prentice – Hall International NJ, (1998).
6. E. Kreyszig - Advanced Engineering Mathematics, 8th ed. Wiley, NY, (1999).
7. Differential equations - Simons

CHAIRMAN-BOS

COE

Sl. No.: | | **Subject Code:** | **P16PH1C**2 |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,
PHYSICS – I SEMESTER – CORE COURSE – II
(For the candidates admitted from 2016-17 onwards)

CLASSICAL DYNAMICS AND RELATIVITY

Course outcome:

1. Necessity of Lagrangian and Hamiltonian formulations.
2. Essential features of a problem like motion under central force, rigid body dynamics, periodic motions.
3. Theory of small oscillations which is important in several areas of physics e.g., molecular spectra, acoustics, vibrations of atoms in solids.
4. 4.Relativity explains behavior of objects in space and time.

UNIT – I : FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION

Mechanics of a particle and system of particles – Conservation laws – constraints – Generalized co–ordinates – D'Alembert's principle and Lagrangian equation – Hamilton's principle – Langrange's equations – Applications: simple pendulum – compound pendulum – Atwood's Machine – Deduction of Hamilton's Principle.

UNIT –II: TWO BODY CENTRAL FORCE PROBLEMS

Reduction of Two –Body central Force problem to the Equivalent one – Body problem. Central force and motion in a plane-Equations of motion under central force and first integral differential equation for an orbit- Inverse square law of force-Kepler's law of planetary motion and deduction –Virial theorem –Scattering in a central force field- Scattering cross section – Rutherford scattering.

UNIT – III: HAMILTON'S FORMULATION

Cyclic co-ordinates and conservation theorems- Hamilton's equation from variational principle – principle of least action- canonical transformation - Identity transformation and inverse transformation- Lagrange and Poisson brackets – Hamilton Jacobi method – Action angle variables – Kepler's problem in action angle variable –one dimensional Harmonic oscillator.

UNIT –IV: RIGID BODY DYNAMICS AND OSCILLATORY MOTION

Principle axis transformation-angular momentum-kinetic theory-Degrees of freedom of a rigid body-Euler angles – Moments and products of inertia –Euler's equation – symmetrical top – heavy symmetrical top-Theory of small oscillations and normal modes – Frequencies of free vibration and normal co–ordinates – Linear triatomic molecule

UNIT – V: RELATIVITY

Postulates of Special theory of relativity - four vectors in special theory of relativity – Lorentz transformation in real four dimensional spaces – Minkowski space- covariant four dimensional formulations – force and energy equation relativistic mechanics – Lagrangian and Hamiltonian of relativistic mechanics.

BOOKS FOR STUDY:

1. Classical Mechanics: Herbert Goldstein, 3rd Edition, New Delhi, Narosa publishing House.
2. Classical Mechanics: S.L. Gupta, V. Kumar, Pragati Prakashan, 2013.
3. Classical Mechanics: J. Upadhyaya, Himalaya, 2010.
4. Theory of Relativity: R.K.Pathira, Dover Pub., Inc., New York 2003.

BOOKS FOR REFERENCE:

1. Classical Mechanics: N.C.Rana and P.S.Joag, Tata McGraw Hill.
2. Introduction to Classical Mechanics: R.G.Takwalcal P.S.Puranik, TMGH.
3. Lagrangian and Hamiltonian: M.G.Calkin, Scientific Pub. Co., Ltd.,
4. Introduction to general Relativity: S.K Bose, Wiley and Sons.
5. Classical dynamics by Goldstein's

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH1C3** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,
PHYSICS-I SEMSTER – CORE COURSE-III
(For the candidates admitted from 2016-17 onwards)

ANALOG AND DIGITAL ELECTRONICS

Course outcome:

1.To know applications of thyristors and acting as a switch.
2. Transducers measure the pressure of the gas and liquid by converting it into an electrical signal.
3.Enables elimination of noise from an input signal operating as filter.
4.Binary codes to design of computers and related technologies.

UNIT- I: THYRISTORS AND THEIR APPLICATIONS

Silicon control rectifier – operation –equivalent circuit –V-I Characteristics- 90^0 variable half wave rectifier -180^0 variable half wave rectifier –SCR-full wave rectifier - TRIAC – operation –V-I Characteristics - TRIAC power control –TRIAC phase control - Unijunction transistor – construction – equivalent circuit – operation – V-I characteristics -DIAC – V-I characteristics – DIAC Phase control.

UNIT-II:TRANSDUCERS AND INSTRUMENTATION AMPLIFIERS

Transducers: Displacement Transducer – Capacitive Transducer –Inductive Transducer- Variable Differential Transformer Transducer (LVDT) –Oscillation Transducer – Piezo electric Transducer – Potentiometer Transducer – Velocity Transducer.

Instrumentation amplifiers: Introduction to instrumentation amplifier-requirements of good instrumentation amplifier-difference amplifier using one op-amp-modified difference amplifier-instrumentation amplifier using transducer bridge-application of instrumentation amplifier.

UNIT-III: OP-AMP FILTERS AND OSCILLATORS

Active filters: First and second order low and high pass Butter worth filter – band pass filter- Log and antilog amplifiers – solving second order differential equations - Oscillators: Phase shift oscillator - Wien bridge oscillator- square wave generator – triangular wave generator- saw tooth generator – voltage controlled oscillator.

UNIT –IV: BINARY CODES AND LOGIC HARDWARE

Binary codes:Weighted Binary Codes - non weighted codes – error deducting codes – error correcting codes- Logic hardware:Diode as a DC switch – Diode as a AC switch – Bipolar Transistor as a DC switch – Bipolar Transistor as a AC switch – Logic families: Resistor Transistor Logic (RTL) - Diode Transistor Logic (DTL) – Transistor - Transistor Logic(TTL)

UNIT –V: SEQUENTIAL AND MEMORY CIRCUITS

Sequential circuits:Ripple Counters – Up/Down Counters – type T design - Non sequential counting– Type D design - Shift Register – Ring Counters – type JK design – Cycle Counters - Memory circuits:Introduction to memories – Read only memories – Bipolar ROMs – MOSROMs - Applications of ROM – Static Random Access Memories – Bipolar RAMs – MOS RAMs - Dynamic Random Access Memories.

BOOKS FOR STUDY:

1. A Text book of applied electronics – Dr. R.S. Sedha- revised edition 2013 – S.Chand Company limited **(For Unit I)**
2. Modern electronic instrumentation and measurement techniques – A.D Helfrick and W.D Cooper – PHI Private Ltd. **(For unit-II)**
3. OPAMPs and linear integrated circuits – Ramakant A Gayakwad 3rd edition PHI private ltd. New Delhi. **(For unit-II and III)**
4. Digital electronics – William H.Gothman - 2nd edition PHI private limited New Delhi (**For unit IVand V**)

BOOKS FOR REFERENCE:

1. Digital Principles and Applications- A.P. Malvino and D.P. Leach- McGraw Hill Publications.
2. Digital Design-M.Morris Mano- 3rd Edition- PHI (P) Ltd., New Delhi.

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH1E1** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR-5.
M.Sc. PHYSICS–I SEMESTER –ELECTIVE COURSE–I
(For the candidates admitted from 2016-17 onwards)
CONDENSED MATTER PHYSICS

Course outcome:

1. Structures in solids and their determination using XRD.
2. Behavior of electrons in solids including the concept of energy bands and effect of the same on material properties.
3. Electrical, thermal, magnetic and dielectric properties of solids.
4. Semiconductors play an important role in a modern electronics.
5. Superconductors the special metals that can conduct electrical current with no loss of energy.

UNIT - I: RECIPROCAL LATTICE AND X-RAY DIFFRACTION TECHNIQUES:

Reciprocal lattices and their applications to diffraction techniques- Ewald Sphere-interaction of X-Rays with matter-absorption of X-rays- experimental diffraction techniques-Laue's diffraction technique- Powder X-ray Diffraction Technique- indexing of powder photographs and lattice parameter determination-applications of powder X-ray diffraction method-general concept of atomic scattering factor and structure factor.

UNIT – II: DEFECTS IN SOLIDS AND NON-DESTRUCTIVE TESTING (NDT)

Defects in Solids:Point defects- line defects (slip, plastic deformation, edge dislocation, screw dislocation, Burger's vector, concentration of line defects, and estimation of dislocation density), surface (Planar) defects- grain boundaries and stacking faults.Non-Destructive Testing: X-Ray Radiography Technique and displacement method – X-ray fluoroscopy – merits and demerits of X-Ray Radiography – liquid penetrate method - Ultrasonic flaw detector - merits and demerits of Ultrasonic testing.

UNIT - III: LATTICE VIBRATIONS AND THERMAL PROPERTIES

Vibration of mono atomic lattices - Lattices with two atoms per Primitive cell - Quantization of lattice vibrations - Phonon momentum –Inelastic scattering of neutrons by Phonons-Lattice heat capacity - Classical theory of lattice heat capacity - Einstein model - Density of modes in one dimension and three dimension - Debye model of lattice heat capacity-Thermal conductivity

UNIT – IV: ENERGY BANDS IN METALS AND SEMICONDUCTOR MATERIALS

Energy levels and density of states – Fermi-Dirac distribution – Free electron gas in three dimensions – Heat capacity of the electron gas – Kronig Penny model– Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration - derivation- Fermi level- variation of Fermilevel with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration - derivation – Hall effect in semiconductors

UNIT V:SUPER CONDUCTIVITY AND ADVANCED MATERIALS

Introduction – Meissner effect – Thermo dynamical properties - London equation – BCS theory – Type-I & Type-II superconductors – Josephson effect (Both AC & DC) – High $T_c$super conductors – SQUIDS –Metallic glasses: Preparation- properties - uses -Shape Memory Alloys (SMAs) - Characteristics – Properties of Ni-Ti alloy - applications – advantages and disadvantages of Shape Memory Alloys .

BOOKS FOR STUDY:

1. Introduction to Solid State Physics, C. Kittel, Wiley Eastern- New Delhi.
2. Solid State Physics, A.J. Dekker, Macmillan, India.
3. Solid State Physics, S.O. Pillai, Wiley Eastern Ltd.
4. Solid State Physics, B.S. Saxena, R.C. Gupta & P.N. Saxena Pragati Prakashan, Meerut.
5. Crystallography for solid state physics, A.R. Verma and O.N. Srivastava, Wiley.
6. Elements of X-ray crystallography, L.V. Azaroff, McGraw-Hill.

BOOKS FOR REFERENCE:

1. Solid State Physics – S.L.Gupta & Dr.V.Kumar.
2. Fundamentals of Solid State Physics – Saxena Gupta and Saxena.
3. N.W.Asherof and N. D. Mermin, Solid State Physics, Holt, Rinehart and Winston, International Edition, Philadelphia.
4. J. S. Blakemore, Solid State Physics, Second edition Cambridge University press, Cambridge, London (1974)
5. M. M. Woolf son, An Introduction to X-ray Crystallography, Vikas publishing Ltd. (1978).

CHAIRMAN-BOS **COE**

Sl. No.: **Subject Code:** **P16PH2C4P**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,
PHYSICS – II SEMESTER – CORE PRACTICAL – I
(For the candidates admitted from 2016-17 onwards)
BASIC PRACTICAL LAB(GENERAL AND ELECTRONICS)

(Any Fifteen experiments)

Course Outcome:

1. Practical knowledge about Young's modulus, Hall co-efficient, spectrometer and optical instrumentation.
2. Practical knowledge about analog circuits such as FET, UJT, oscillator, etc.

A General Experiments (Minimum six)

1. Determination of Co-efficient of coupling by ac Bridge Method.
2. Determination of q, n,σ by Elliptical fringes Method.
3. Determination of q, n, σ by Hyperbolic fringes Method.
4. Determination of Stefan's Constant.
5. Determination of Dielectric Constant at high frequency by Lecher Wire.
6. Determination of e/m of an Electron Magnetron Method.
7. Determination of L of a coil by Anderson's Method.
8. Photo Electric Effect (Planck's Constant Determination).
9. Determination of numerical aperture of an optical fiber.
10. Diameter of a thin wire & pin hole using laser.
11. Determination of particle size & verification of Malus law.
12. B-H loop – Energy loss of a magnetic material Anchor ring using BG
13. Determination of dielectric constant of a liquid by R.F oscillators.

B. Electronics experiments (Minimum six)

14. Design and study of monostable Multivibrator using IC.
15. Design and study of Astable Multivibrator using IC.
16. UJT Characteristics and Relaxation oscillator using UJT.
17. Common Drain Amplifier using FET.
18. FET Amplifier design.
19. Construction of Dual regulated power supply.
20. Design and study of Wien bridge oscillator using IC 741.
21. Design and study of Phase shift oscillator using IC 741.
22. Filters using IC 741.
23. Solving simultaneous and differential equations using IC 741.

CHAIRMAN-BOS **COE**

Sl. No.: [ ] **Subject Code:** [P16PH2C5P]

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc., PHYSICS – I & II SEMESTER – CORE PRACTICAL – II
(For the candidates admitted from 2016-17 onwards)
ADVANCED GENERAL AND MICROPROCESSOR LAB

(Any Fifteen experiments)

Course outcome:

1. Measure the dielectric constant of a dielectric material.
2. Determine the Young's modulus of a given metal/metal alloy using ultrasonic interferometer.
3. Practical knowledge of various measurement methods using lasers and optical fibers.
4. Ability to set up experiments like holography using lasers.
5. Experimental skill development by performing basic spectroscopic Measurements.
6. Write and execute programs for solving simple problems using 8085 microprocessor.

A. Advanced general experiments (Minimum six)

1. Four Probe Method-Determination of resistivity of a sample
2. Determination of Carrier concentration and Hall Co-efficient in Semiconductors
3. Determination of Magnetic Susceptibility of liquid by Guoy's Method
4. Determination of Magnetic Susceptibility of Quincke's Method
5. Determination of Wavelength and thickness of a film using Michelson's Interferometer.
6. Charge of an electron by Spectrometer.
7. Polarizability of liquids by finding the refractive indices at different wavelengths by spectrometer.
8. Refractive Index of Transparent Solids, Liquids and Brewster's angle using laser.
9. Rydberg's constant by spectrometer.
10. Wavelength calculation using Hartmann's formula by constant deviation spectrograph.
11. Determination of specific rotatory power of a liquid using Polarimeter.
12. Determination of wavelength of monochromatic source using biprism.
13. Determination of compress ability using a liquid by ultrasonic method.

B. Microprocessor experiments (Minimum six)

1. To find the largest and smallest number
2. To find the sum of series
3. Interfacing - LED
4. Interfacing – A/D converter
5. Interfacing – D/A converter
6. Interfacing – Relay
7. Interfacing – Stepper Motor
8. Interfacing – Temperature Measurement
9. Interfacing – Traffic control system.
10. Interfacing – Seven Segment Display add on board

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH2C6** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05

M.Sc., PHYSICS-II SEMSTER – CORE COURSE IV
(For the candidates admitted from 2016-17 onwards)
MATHEMATICAL PHYSICS – II

Course outcomes :

1. Various techniques to solve differential equations
2. How to use special functions in various physics problems?
3. Analytic functions are basic objects in computer variables.
4. Integral forms are tools to make analysis easier.
5. Green functions to make homogeneous boundary value problems.
6. Group theory is the study of symmetry.

UNIT- I: COMPLEX ANALYSIS

Complex numbers- Complex conjugates-Modulus and argument of a complex number-Functions of complex variables-Limit, Continuity and Differentiability – Cauchy –Riemann conditions – Complexintegration – Cauchy's integral theorem and integral formula – Taylor's and Laurent's Series–Residues and singularities – Cauchy's residue theorem – Evaluation of definite integrals.

UNIT- II: INTEGRAL TRANSFORMS

Fourier series – Uses - Dirichlet's theorem: Dirichlet's conditions- change of Interval form- Physical examples of Fourier series- Properties of Fourier series- Determination of Fourier coefficients – Fourierintegrals – Faltung theorem – Application to heat and wave Equations –Laplace transform – Convolution theorem.

UNIT-III: GREEN'S FUNCTION TECHNIQUES AND INTEGRAL EQUATIONS

Green's functions – Properties – Green's function for one dimensional case- Green's function for Poisson's equation and solution– Methods of solutions in one dimension – Applications of linearintegral equations – Fredholm and Volterra type - Neumann series – Eigen functionexpansion – Applications.

UNIT-IV: SPECIAL FUNCTIONS

Gamma and Beta functions- Symmetry property of beta functions- Evaluation of beta function-– Legendre, Bessel, Laugerre and Hermite differential equations: Series solution – Rodrigue's formulagenerating functions – Orthogonality relations – importance of recurrence relations.

UNIT-V:GROUP THEORY

Concept of a group- Abelian group- The generators of a finite group- The cyclic group-Multiplication table – Subgroups, cosets and classes – Direct productgroups – Point groups – Space groups – Representation theory –Homomorphism andisomorphism – Reducible and irreducible representations –The unitary and point groups- Schur's lemma – The greatOrthogonality theorem – Character table – C_{3V} and D_{3H} as examples – Elementary ideas ofrotation groups.

BOOKS FOR STUDY:

1. Mathematical Physics – Sathya Prakash.
2. Mathematical Physics – B.D.Gupta- Vikas Publishing House (P) Ltd., Noida-2008.
3. A.W. Joshi - Elements of Group Theory for Physicists (Wiley Eastern, New Delhi, 1971).
4. E. Kreyszig - Advanced Engineering mathematics (Wiley Eastern, New Delhi, 1983).
5. G. Arfken and H.J. Weber - Mathematical Methods for Physicists (Prism Books, Bangalore, 1995).

BOOKS FOR REFERENCE:

1. H.K.Das& Dr. Rama Verma- Higher Mathematical Physics- S.Chand& Company Pvt Ltd., New Delhi, 2014.
2. A.K. Ghatak, I.C. Goyaland A.J. Chua - Mathematical Physics (McMillan, New Delhi,1995).
3. P.K. Chattopadhyaya - Mathematical Physics (Wiley, Eastern, New Delhi, 1990).
4. W.W.Bell- Special Functions for Scientists and Engineers (Van Nostrand, New York, 1968).
5. L.A.Pipes and L.R. Harvil - Applied Mathematics for Engineers and Physicists (McGraw Hill, Singapore, 1970)
6. F.A. Cotton - Chemical Applications of Group theory (Wiley Eastern, New Delhi, 1987).

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH2C7** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,

M.Sc., PHYSICS-II SEMSTER – CORE COURSE IV
(For the candidates admitted from 2016-17 onwards)

QUANTUM MECHANICS

Course outcomes:

1. Importance of quantum mechanics compared to classical mechanics at microscopic level.
2. Various tools to calculate Eigen values and total angular momentum of particles.
3. Application of approximation methods and scattering theories.
4. Description of the nature of the particle that make up matter and the forces with their interact.
5. Schrodinger equation gives a detailed form of the wave functions that control the motion of the smaller particle.
6. Chemical bond deals with behaviour of electrons in molecules.
7. To know about nuclei and elementary particles discovered in scattering experiments
8. (RQM) theory is applicable to massive particles propagating at all velocities to the speed of light.

UNIT – I: MATRIX FORMULATION AND REPRESENTATION THEORY

Dirac's bra and ket notation – Hilbert space - Dynamical Variables and linear Operators; projection operators, unitary operator, matrix representation of an operator – Unitary transformation: Change of basis– Significant properties of unitary transformations –Matrix theory of Harmonic oscillator – Schrodinger, Heisenberg and Interaction pictures

UNIT–II:TIME INDEPENDENT,TIME DEPENDENTPERTURBATION THEORY AND WKB APPROXIMATION

Non-degenerate energy levels-effect of electric field on the ground state of hydrogen-Stark effect-Zeeman effect-transition to continuum state-Fermi's Golden rule-selection rules-WKB method –validity of WKB method

UNIT –III: MANY ELECTRON ATOMS AND CHEMICAL BONDING

Indistinguishable particles-Pauli principle-inclusion of spin-spin functions for two and three electrons- central field approximation-Thomas –fermi model of the atom-Hartee equation-Hartee-Fock equation-Born –Oppenheimer approximation – molecular orbital method- Heitler – London theory of hydrogen molecule

UNIT-IV: SCATTERING THEORY AND ANGULAR MOMENTUM

Scattering amplitude –Born approximation and its validity –orbital angular momentum-spin angular momentum-total angular momentum-operators-commutation relations of total angular momentum with components - Ladder operators – Commutation relationof J_z with J_+ and J_-– Eigen values of J^2 and J_Z– Addition of angular momenta – Clebsh–Gordanco-efficients (basic ideas only). Pauli's spin matrices

UNIT-V: RELATIVISTIC QUANTUM MECHANICS

Klein–Gordan equation for free particle – Equation of continuity, probability density and probability current density for Klein–Gordan equation – Dirac's relativistic wave equation for free particle– Dirac Matrices – Plane wave solution of Dirac's relativistic wave equation – Negative energy states – Equation of continuity, probability density and probability current density for Dirac equation – spin–orbit coupling.

BOOKS FOR STUDY:

1. P.M. Mathews& K.Venkatesan, *A Text Book of Quantum Mechanics* – TMH, New Delhi – 2008
2. G.Aruldas, *Quantum Mechanics*, PHI, New Delhi -2006.
3. Satyaprakash, *Quantum Mechanics*, Kedar Nath Ram Nath & Co, Meerut, 2006.
4. B.S. Rajput*Advanced Quantum Mechanics*, Pragati Prakashan, Meerut, 2008.
5. Manas Chanda, *Atomic Structures and chemical bond* – TMH, New Delhi, 1991
6. Peter W. Atkins, Ronald S Friedman, *Molecular Quantum Mechanics*, Oxford University Press, IV Edition, 2007

BOOKS FOR REFERENCE:

1. Sujaul Chowdhury, *Quantum Mechanics* – Narosa publishing House, New Delhi, 2014
2. V.Devanathan, *Quantum Mechanics* – Narosa publishing House, New Delhi, 2011
3. V.K.Thankappan, *Quantum Mechanics*, New Age International publishers, New Delhi, 2006.
4. Lenord I Schiff, *Quantum Mechanics*, TMH, New Delhi, III Edition, 2010

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH2C8** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,

M.Sc., PHYSICS-II SEMSTER – CORE COURSE IV
(For the candidates admitted from 2016-17 onwards)

ELECTROMAGNETIC THEORY

Course outcome:

1. Time-varying fields and Maxwell equations.
2. Various concepts of electromagnetic waves.
3. Radiation from localized time varying sources, and the charged particle dynamics.
4. Charged particle is subjected to the electrostatic force in the vicinity of a material surface.
5. Macroscopic field by integrating the polarization over the volume the dielectric.
6. Magneto statics is the study of magnetic fields in systems where the currents are steady.
7. Knowledge about current induced in the conductor by the magnetic field.
8. Propagate waves in varying intensity as per the material properties, density and other factors.

UNIT – I:INTRODUCTION TO ELECTROSTATICS

Coulomb's law – Electric field – Gauss law – Scalar potential – Poisson and LaplaceEquation – Green's theorem – Dirichlet and Neumann boundary conditions – Electrostaticboundary value problems: Solution using Green's function – Method of images illustrations:point charge in the presence of (i) a grounded conducting sphere, (ii) a charged, insulated andconducting sphere, (iii) near a conducting sphere at fixed potential and (iv) conducting spherein a uniform electric field – Green's function for the sphere.

UNIT – II:ELECTROSTATICS OF MACROSCOPIC MEDIA

Multipole expansion – Boundary value problems with dielectrics – Illustrations: (i) pointcharge embedded at a distance away from a dielectric interfaced, (ii) dielectric sphere in auniform electric field and (iii) spherical cavity in a dielectric medium with applied electric field – Molecular Polarizability and Electric Susceptibility – Electrostatic energy in dielectricmedia.

UNIT – III:MAGNETOSTATICS

Biot and Savert's law –Divergence and Curl of Magnetic Induction- Force between current carrying conductors – Differential equationsof Magnetostatics– Magnetic Vector potential –- Magnetic field of a localized current distribution –Magnetic moment and force on a current distribution in an external field – Magnetostatic energy- Magnetic Field of boundaryconditions on B and H – Methods of solving boundary value problems in Magnetostatics –Uniformly magnetized sphere.

UNIT – IV:ELECTROMAGNETIC INDUCTION

Faraday's law of induction – Maxwell's displacement current – Maxwell equations – Maxwell equations in terms of vector and scalar potentials – Gauge transformation – Lorentzgauge- Coulomb gauge – Poynting's theorem – Conservation of energy and momentum fora system of charged particles and electromagnetic fields.

UNIT – V:PLANE ELECTROMAGNETIC WAVES AND WAVE PROPAGATION

Plane waves in a non-conducting medium – Linear and circular polarization, Stokesparameters – Reflection and refraction of electromagnetic waves at a plane interface betweendielectrics – Propagation of electromagnetic waves in hollow metallic cylinders - cylindrical and rectangular wave guides – TM and TE modes.

BOOKS FOR STUDY:

1. David J Griffths-Introduction to Electromagnetics- III edition, Prentice Hall of India Pvt., Ltd.,- New Delhi (2000).
2. Classical Electrodynamics – John David Jackson-III Edition, John Wiley & co., (2000).
3. Electromagnetic theory – SathyaPrakash- Kedar nath Ramnath Publishing Co.,
4. Electromagnetic theory – Chopra Agarwal – K.Nath & Co.,(1984).

BOOKS FOR REFERENCE:

1. N.Narayana Rao- Basic Electromagnetics with Applications- , Prentice Hall of India Pvt., Ltd., - New Delhi (2002).
2. Umesh Sinha-Electromagnetic theory and applications- Technology India Publications, New Delhi, (2000).
3. Edward C. Jordan and Keith G. Balmain- Electromagnetic Waves and radiating systems- III Edition-, Prentice Hall of India Pvt., Ltd., - New Delhi (2000).
4. John R. Reitz- Foundations of Electromagnetic Theory- VI Edition, Narosa Publishing House, New Delhi.

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH2E2** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M.Sc., PHYSICS – II SEMESTER – ELECTIVE COURSE – II
(For the candidates admitted from 2016-17 onwards)

MICROPROCESSOR AND MICROCONTROLLER

Course outcome:

1. Microprocessor is an important part of architecture to perform anything on your computer system.
2. I/O device is selected by a decoding circuit. Interfacing process includes matching the memory requirements with the microprocessor signals.
3. Microcontroller are embedded on any device.
4. SFRs are used program and control different hardware peripherals like timers, serial port, I/O ports.
5. Microcontroller with relatively large number modes of operation.

UNIT-I:MICROPROCESSOR ARCHITECTURE, INSTRUCTION SET AND INTERFACING:

Intel 8085 Microprocessor Architecture- Pin configuration- Instruction cycle- Instruction and data formats- Addressing modes- Status flags- Intel 8085 instructions-Address Space partitioning- Memory and I/O Interfacing- Data transfer schemes,-Interrupts of Intel 8085-Generation of control signals for memory and I/O devices.

UNIT-II: INTERFACING MEMORY AND I/ODEVICES:

Interfacing memory and devices – I/O and Memory mapped I/O– Type Of interfacing devices- Data transfer schemes – Programmed and DMA data transfer schemes- Programmable Peripheral Interface (8225A)- Timer Interface- DMA Controller – Programmable Interrupt Controller (8259) – Programmable Interface (8251)

UNIT – III: MICROCONTROLLER

Introduction-comparison between microprocessors and microcontrollers-features of 8051-8051 microcontroller hardware-pin out of 8051- internal RAM-internal ROM-input/output ports-register set of 8051 –memory organizations in 8051-external memory-addressing modes – Data transfer instructions- PUSH and POP instructions-logical instructions-jump and call instructions

UNIT-IV: MICROCONTROLLER SFRS AND PROGRAMMING:

Counter / Timer - Counter Programming - Basics of Serial Communication - RS232 Connections and ICs Max 232 - 8051 Serial Communication Registers - Serial Communication Programming - Interrupts - Interrupts Registers - Internal and External Interrupt Programming

UNIT-V:ASSEMBLY LANGUAGE PROGRAMS AND INTERFACING APPLICATIONS:

8 bit addition, subtraction, multiplication and division programs-sum of series-block transfer-largest, smallest ascending and descending order programs-interfacing LED display-interfacing DAC 0808 with 8051-interfacing 0809/0809 with 8051-stepper motor interface-traffic light control system

BOOKS FOR STUDY:

1. B. Ram, Fundamentals of Microprocessors and Microcomputers,Dhanpat Rai Publications (P) Ltd., New Delhi (2005).
2.A.P.Godse and D.A.Godse, Microprocessors and its applications (Firstedition), Technical Publications, Pune, 2006.
3. The 8051 Microcontroller Architechture Programming and Applications Kenneth J.Ayla.

BOOKS FOR REFERENCE:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi - The 8051 Microcontrollerand Embedded Systems, Pearson Education, Delhi, Seventh IndianReprint 2004

2. A.Nagoor Kani, Microprocessors & Microcontrollers, 1st edition, RBAPublications, Chennai,2006

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH3C**9 |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,
PHYSICS – III SEMESTER – CORE COURSE –IX
(For the candidates admitted from 2016-17 onwards)
THERMODYNAMICS AND STATISTICAL MECHANICS

Course outcome:

1. Knowing the factors causing the rise of temperature and the major role of heat transfer: conduction, convection, radiation.
2. Statistical thermodynamics provides a microscopic basis of thermodynamics.
3. Description of the statistical distribution of the energies of the molecules of a classical gas.
4. Statistical ensemble probability distribution over possible quantum states.

UNIT- I: THERMODYNAMICS

Thermodynamic coordinates- First law of thermodynamics: Applications –Adiabatic and Isothermal processes - Applicationof second law of thermodynamics: Carnot's theorem, Entropy disorder,Nernst's heat theorem -Clausius inequality-Entropy changes in irreversible and reversible process- Applicationof third law of thermodynamics: Gibbs- Helmholtz equation-Expression for C_V and C_p– Mayer's relation - Clausius -Clapeyron Equation.

UNIT- II: CLASSICAL STATISTICAL BASIS OF THERMODYNAMICS

Phase space - Volume in Phase space, Number of phase cell in given energy range of harmonic oscillator and 3D free particles-Ensembles –uses - Statistical postulates–Boltzmann's theorem- Liouville's Theorem –ideal gas Bose –Einstein –Energy and pressure gas -degeneracy

UNIT –III: CLASSICAL STATISTICAL DISTRIBUTION LAW

Macroscopic and Microscopic states- Stirling's approximation- classical Maxwell Boltzmann distribution law-function - velocities in ideal gas – Partition function for a gasmolecule- Partitionfunction and thermodynamic quantities – Translational, rotational, Vibrational partition function- Equation of Canonical and Micro Canonical Ensembles – Grand Canonical partition function and thermodynamical quantities.

UNIT-IV: QUANTUM STATISTICAL MECHANICS

Ideal Bose-Einstein gas-energy and pressure of gas-gas degeneracy-Bose-Einstein condensation-Thermal properties of Bose –Einstein gas-Ideal Fermi Dirac gas –Energy and Pressure of gas –Slight degeneracy –strong degeneracy –Thermodynamic function of degeneracy Fermi-Dirac gas –Liquid helium –London theory

UNIT-V:APPLICATIONS OF QUANTUM STATISTICAL MECHANICS

Black body and Planck's radiation- Photons- Specific heat of solids- Pauli's Paramagnetism - Ising and Heisenberg models-Transport properties –Boltzmann transport equation for electrons and Lorentz solution

BOOKS FOR STUDY:

1. Elementary Statistical Mechanics – Gupta and Kumar, Pragati Prakashan, Meerut, 8th Edition.
2. Statistical and Thermal physics – F. Reif, , McGraw Hill, International Edition, Singapore (1979)
3. Statistical Mechanics – B.K. Agarwal and M. Eisner, New Age International Publishers, 2nd Edition.

BOOKS FOR REFERENCE:

1. Fundamentals of Statistical Mechanics – B.B.Laud, New Age International Publishers, New Delhi, 2007.
2. Statistical Mechanics – Kerson Huang, Wiley eastern Ltd., New Delhi, 1983.

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH3C**10 |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc.,
PHYSICS – III SEMESTER – CORE COURSE – X
(For the candidates admitted from 2016-17 onwards)
NUCLEAR AND PARTICLE PHYSICS

Course outcome:

1. Basic properties of nucleus and nuclear models to study the nuclear structure properties.
2. Nuclear decay deals about the nucleus of the atom is unstable and spontaneously emits the energy in the form of radiation.
3. Nuclear reactions are process in which one or more nuclides are produced from a sub-atomic particle.
4. Particle physics has revolutions in our understanding world around us.

UNIT – I: NUCLEAR PROPERTIES AND FORCE BETWEEN NUCLEONS

Nuclear radius, mass and abundance of nuclides - binding energy - nuclear angular momentum and parity- nuclear electromagnetic moments- nuclear excited state –Van-Waizacker's semi empirical mass formula- Deutron - nucleon – nucleon scattering - proton–proton and neutron-neutron interaction - properties of nuclear forces -Yukawa hypothesis.

UNIT- II:NUCLEAR DECAY

Alpha Decay : properties– Gamow's Theory of α -Decay – Geiger-Nuttal law – α -ray Energies – Fine Structure of α- rays – α-disintegration Energy – long range α- particle - Beta decay : Properties– General feature of β ray Spectrum – Neutrino theory of Beta Decay – Fermi's Theory of β- Decay – forms of interaction and selection rule - Gamma Decay : Properties-Absorption of ν-rays by matter – interaction of ν rays with matter- Measurement of ν-ray Energies – internal conversion.

UNIT-III: NUCLEAR MODELS AND ACCELERATORS

Nuclear Models: Liquid Drop model : Bohr-Wheeler Theory of fission – condition for spontaneous fission - Shell model:Explanation of magic numbers – prediction of nuclear spin and parity – nuclear statistics – magnetic moment of nuclei – nuclear isomerism optical model-Collective model: Explanation of quadruplemoment - Particle accelerators and Detectors:semiconductor detector

UNIT- IV : NUCLEAR REACTIONS

Kinds of nuclear reactions and conservation laws – Q-value - energy of nuclear reactions – continuum theory of reaction – Resonance – Breit-Wigner dispersion formula – stages of a nuclear reaction – statistical theory of nuclear reaction – kinematics of stripping and pick up reaction .

UNIT-V:PARTICLE PHYSICS

Building blocks of nucleus – Nucleons, Leptons , Mesons, Baryons, Hyperons, Hadrons, strange particles – classification of fundamental forces and elementary particles – basic conservation laws – additional conservation laws : baryonic , leptonic , strangeness and isospin charges /quantum numbers– Gell-Mann – Nishijima formula – multiplets – invariance under time reversal (t) charge conjugation (c) and parity (p) – CPT theorem – parity - non conservation in weak interaction - CP violation –Parity violation – Quark model.

BOOKS FOR STUDY:

1. D.C.Dayal – Nuclear Physics.
2. R.C. Sharma – Nuclear Physics
3 .T.C Tayal – Nuclear Physics-Umesh Prakashan –Gujarat
4.D.C.Cheng and G.K.O'Neil – Elementary Particle Physics.

BOOKS FOR REFERENCE:

1. K.S. Krane – Introductory Nuclear Physics – John – Wiley, New York -1897
2. Griffths – Introduction to Elementary Particle Physics.
3.R.D.Evans- Atomic nucleus, McGraw – Hill, New York-1955.
4.I. Kaplan- Nuclear Physics, Narosa, New Delhi- 1989.
5.B.L.Cohen -Concepts of Nuclear physics, TMH, New Delhi-1971.

CHAIRMAN-BOS **COE**

Sl. No.: **Subject Code:** **P16PH3C**11

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05 M.Sc., PHYSICS – III SEMESTER –CORECOURSE –XI
(For the candidates admitted from 2016-17 onwards)
COMMUNICATION ELECTRONICS

Course outcomes:

1. Information is a valuable commodity to many organisation.
2. To detect the range,speed and other characteristics of remote objects.
3. RADAR is widely used as a navigation of ships, air traffic control and speed limit.
4. Fiber optic communications has enabled much higher data rates to be accomodated.
5. Satellite system offers a broader coverage than cellular networks.

UNIT- I: ANTENNAS & WAVE PROPAGATION

Radiation field and radiation resistance of a short dipole antenna- grounded λ/4 antenna- unground λ/2 antenna- antenna arrays- broadside and end side arrays- antenna Gain- directional high frequency antennas- Ionosphere-Ecles and Larmor Theory- Magneto ionic theory- ground wave propagation.

UNIT- II: ANALOG AND DIGITAL COMMUNICATION

Modulation-definition- types of modulation – Expression for amplitude modulated voltage- AM transmitter: block diagram and explanation _ Expression for amplitude modulated voltage - Pulse Modulation: definition, types- Pulse amplitude modulation- Pulse Code Modulation - Delta modulation – Data transmission: ASK, FSK, PSK - Multiplex transmission - Frequency and Time Division Multiplexing.

UNIT –III: MICROWAVES AND RADAR COMMUNICATION

Generation of microwaves – Klystron- Reflex Klystron - Magnetron - Detection of microwaves: TWT, IMPATT, TRAPATT and Gunn diodes - Radar – Principle- Radar equation - Pulse and CW Radar - MTI and Automatic Tracking Radar - uses.

UNIT-IV: OPTIC FIBER COMMUNICATION

Fiber optics - Different types of fiber: Step index and graded index fibers - Signal degradation fibers: Absorption, attenuation, scattering losses and dispersion - Optical sources and detectors (Quantitative only) - Power launching and coupling: Source to fiber launching - Fiber joints - Splicing techniques - General optical communication system.

UNIT-V: SATELLITE AND CELLULAR COMMUNICATION

Satellite links - Eclipses - Orbits and Inclination - Satellite construction - Satellite communication frequencies - Different domestic satellites-INTELSAT system - MARISAT satellites - Telemetry cellular concept - Multiple access cellular systems - Cellular systems operation and planning general principles - Analog cellular systems - Digital cellular mobile systems - GSM - CDMA cellular standards.

BOOKS FOR STUDY:

1. Dennis Reddy and John Coolen, Electronic Communication - Fourth Edition, PHI Private Ltd., (1999).
2. Hand book of Electronics by Gupta & Kumar-2008 Edition
3. *G.* Kennedy and Davis, Electronic Communication System, TMH, New Delhi 1999.
4. Gerd Keiser, Optical Fiber Communication Third Edition, McGraw - Hill, Singapore 2000.
5. Raj Pandya, Mobile and Personal Communication Services and System, Prentice Hall of India, Private Ltd, New Delhi, 2003.

BOOKS FOR REFERENCE:

1. Sanjeev Gupta, Electronic Communication Systems, Khanna Publications, New Delhi,
2. N.D. Despandae, P.K. Rangole, Communication Electronics, Tata McGraw Hill Pvt. Ltd., (1998)
3. M. Arumugam, Optical Fiber Communication and Sensors, Anuradha Agencies, Kumbakonam, (2002).

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH3E3** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M.Sc., PHYSICS – III SEMESTER – ELECTIVE COURSE – III
(For the candidates admitted from 2016-17 onwards)

CRYSTAL GROWTH AND THINFILM PHYSICS

Course outcomes:

1. Nucleation and growth important for phase transition, precipitation, cryatallization of classes and many other phenomena.
2. Crystallization is a technique to purify solid components and based on the principle of solubility.
3. Melt and vapour growth and the subsequent polymerization are summarised and understand different crystal growth techniques.
4. Thinfilm place an important role in the development in the study of material with unique properties
5. The characterization technique optical microscopy showing the micron scale of the material structure and properties.

UNIT – I: BASIC CONCEPTS,NUCLEATION AND KINETICS OF GROWTH

Ambient phase equilibrium-super saturation-equilibrium of finite phases-equation of Thomson-Gibb's - types of nucleation-formation of critical nucleus-classical theory of nucleation-Homo and heterogeneous formation of 3D nuclei-rate of nucleation –growth from vapour phase,solutions and melts-epitaxial growth-growth mechanism and classification-kinetics of growth of epitaxial films-mechanisms and controls for nanostructures in 0 and 1 dimensions.

UNIT – II: CRYSTALLIZATION PRINCIPLES AND GROWTH TECHNIQUES

Classes of crystal system-crystal symmetry-solvents and solutions-solubility diagram-super solubility-expression for super saturation- metastable zone and induction period- Miers TC diagram-slow cooling and solvent evaporation methods –constant temperature bath as crystallizer.

UNIT – III: GEL, MELT AND VAPOR GROWTH TECHNIQUES

Principle of gel technique-various types of gel-structure and importance of gel-methods of gel growth and advantages-melt technique-Czochralski growth –floating zone-Bridgeman method-horizontal gradient freeze-flux growth-hydrothermal growth –vapor phase growth-physical vapor deposition-chemical vapor deposition-stoichiometry

UNIT – IV: THINFILM DEPOSITION TECHNIQUES

Vacuum evaporation-hertz-Knudson equation-evaporation from a source and film thickness uniformity-E-beam, pulsed laser and ion beam evaporations –glow discharge and plasmas-mechanisms and yield of sputtering processes-DC RF, magnetically enhanced, reactive sputterings –spray pyrolysis-electro deposition-sol-gel technique

UNIT – V: CHARACTERIZATION TECHNIQUES

X – Ray diffraction (XRD) - Powder and Single crystal – Fourier transform Infrared and Raman analysis (FT-IR) - Elemental dispersive X-ray analysis (EDAX) –Transmission and scanning electron microscopy - UV-Vis-NIR spectrometer – Vickers's micro hardness study Photoluminence study -thermal study -dielectric study.

BOOKS FOR STUDY :

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York(1986).
2. P. Santhana Ragavan and P. Ramasamy,Crystal Growth Processes and Methods, KRU Publications, Kumbakonam(2001)
3. A. Goswami, Thin film fundamentals, New Age International(P) Limited, New Delhi (1996)

BOOKS FOR REFERENCE:

1. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS, Publishers and Distributors, New Delhi.
2.M.William and D. Steve, Instrumental Methods of Analysis(CBS Publishers, New Delhi)

CHAIRMAN-BOS **COE**

Sl. No.: | | **Subject Code:** | **P16PH4C12P** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M.Sc., PHYSICS – III& IV SEMESTER – CORE PRACTICAL – III

(For the candidates admitted from 2016-17 onwards)

ADVANCED ELECTRONICS – LAB - I
(Any Fifteen Experiments)

Course outcome:

1. Design and evaluate various Op-Amp circuits for mathematical operations.
2. Design and evaluate various counters and registers.
3. Evaluate basic components of the digital circuits like flip-flops, adder, encoders etc.

A. ADVANCED ELECTRONICS

1. Half Adder-Full Adder (using NAND gates).
2. Half Subtractor & Full Subtractor (using NAND gates).
3. Flip Flop – (RS, JK, D,T – F/F)
4. Study the function of Encoder and Decoder.
5. Study the function of Multiplexer and Demultiplexer.
6. D/A Converter: i) R-2R resistor network , ii)weighted resistor network
7. Digital Comparator using EX OR and NAND gates.
8. Study of the counter using IC 7490 (0 - 9 and 00 – 99)
9. 7 Segment display.
10. Laser diode characteristics.
11. Determination of wavelength of a laser source by using diffraction grating.
12. Diffraction of Light by single slit, Double slit and Grating using LASER.
13. Characteristic study ofLED, LDR and Photo Diode using Laser.
14. Determination of Bending Losses and Attenuation by Fiber Cut-Back Method using laser.
15. Absorption of Light on Various Filters.
16. Michelson's Interferometer using LASER source.
17. Gaussian Nature of the LASER beam & Evaluation of Beam spot size.
18. DIAC, TRIAC – characteristics and applications.
19. Shift register and ring counter.
20. BCD adder.

CHAIRMAN-BOS **COE**

Sl. No.: [ ] **Subject Code:** **P16PH4C13P**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) KARUR-05
M.Sc., PHYSICS – III& IV SEMESTER – CORE PRACTICAL – IV

(For the candidates admitted from 2016-17 onwards)

ADVANCED ELECTRONICS – LAB - II
(8051 Microcontroller and Interfacing Lab)
(Any fifteen experiments)

Course outcome:

A practical knowledge of the working principles of the microcontroller and draw a flowchart and execute the mnemonics of the assembly language program

1. Interfacing – A/D converter.
2. Interfacing – D/A converter.
3. Interfacing – LED.
4. Interfacing – Printer.
5. Real time clock.
6. Six letter word display.
7. Rolling Display.
8. Traffic control system.
9. Studies of Seven Segment Display add on board.
10. Interfacing – Stepper Motor.
11. Interfacing – Temperature Measurement.
12. 16 bit Addition, 2's Complement and 1's Complement Subtraction (8086/8088)
13. Conversion from Decimal to Octal and Hexa systems.
14. Conversion from Octal, Hexa to Decimal system.
15. Generation of Square, Triangular, Sawtooth, Staircase and Sine waves using DAC 0800.
16. Ascending order Descending order.
17. Microcontroller Programming with C simulator –I.
18. Square wave generator.
19. Ramp wave generator.
20. Block of data transfer.
21. Program with subroutine.
22. Program using interrupt.

CHAIRMAN-BOS

COE

Sl. No.: **Subject Code:** **P16PH4C14**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR -05.
M.Sc., PHYSICS –IV SEMESTER –CORE COURSE –XIV
(For the candidates admitted from 2016-2017 onwards)

MOLECULAR SPECTROSCOPY

Course outcomes:

1. Spectroscopy deals with production, measurement and interpretation of spectra.
2. Microwaves deals with the wavelengths ranging roughly between one meter and one millimeter.
3. Raman techniques widely used in chemical analysis, bio molecules and solids.
4. Resonance spectroscopy exploits the magnetic properties of certain atomic nuclei.
5. NQR and NGR techniques are highly sensitive tools in studies of local electronic structure and symmetry in solid materials.

UNIT – I: PRINCIPLES OF SPECTROSCOPY

Electromagnetic radiation – wave theory of e.m radiation - interaction of e.m radiation with matter – Born-Oppenheimer approximation – types of molecular spectra – characteristic features for absorption and emission of e.m radiation - spectral band – Doppler broadening – intensity of spectral lines and transition probability – energy dissipation from excited states.

UNIT –II: MICROWAVE AND IR SPECTROSCOPY

Rotational spectra of Diatomic molecules –Effect of isotopic substitution –Non- rigid rotator –Rotational spectra of polyatomic molecules –Linear, symmetric top and Asymmetric top molecules –Experimental techniques –Vibrating diatomic Molecule –Diatomic vibrating rotator –Linear and symmetric top molecules -Analysis techniques –Characteristic and group frequencies.

UNIT –III: RAMAN SPECTROSCOPY AND ELECTRONIC SPECTROSCOPY OF MOLECULES

Raman spectroscopy: Raman effect–Quantum theory–Raman shifts of diatomic molecules - rotational and vibrational spectra–selection rules.

Electronic spectroscopy of molecules: electronic spectra of diatomic molecules – Franck –Condon principle –dissociation energy and dissociation products –rotational fine structure of electronic vibration transitions.

UNIT –IV: RESONANCE SPECTROSCOPY

NMR: Basic principles –Classical and Quantum mechanical description –Bloch equations–Spin-spin and Spin –lattice relaxation time–Chemical shift and coupling constant – Experimental methods –Single coil and double coil methods –High resolution methods.

ESR: Basic principles –ESR spectrometer –Nuclear interaction and Hyperfine structure - relaxation effects –g-factor- characteristics –Free radical studies and biological applications.

UNIT – V: NQR & MOSSBAUER SPECTROSCOPY

NQR Spectroscopy: Fundamental Requirements- Principle – Experimental detection of NQR Frequencies – Interpretation and chemical Explanation of NQR Spectroscopy.

Mossbauer Spectroscopy: Mossbauer Effect-Recoilless Emission and Absorption – Mossbauer Spectrum- Experimental Methods – Hyperfine Interaction-Chemical Shift- Magnetic Hyperfine and Electric Quadruple Interaction.

BOOKS FOR STUDY:

1. C.N Banwell _ Fundamentals of Molecular Spectroscopy –TMH-4thEdition.
2. G.Aruldas – Molecular Structure and Spectroscopy –Prentice Hall of India.

BOOKS FOR REFERENCE:

1. Arthur Beiser –Concept of Modern Physics-Tata McGraw Hill Publication.
2. D.N. Satyanarayana –Vibrational Spectroscopy and Applications –New AgeInternational.

CHAIRMAN-BOS

COE

Sl. No.: | | **Subject Code:** | **P16PH4E4** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR -05.
M.Sc., PHYSICS –IV SEMESTER –ELECTIVE COURSE –IV

(For the candidates admitted from 2016-2017 onwards)

NANOSCIENCE AND NANOTECHNOLOGY

Course outcome:

1. The unique quantum and surface phenomena the matter exhibits at the nanoscale.
2. Nucleation is the process to determine the self organized structure appears.
3. Nanostructures are enhance optical responses of surface enhanced spectroscopies.
4. A nanomaterial have different properties compared to the same substance in bulk form.
5. Sampling of the rapidly growing list of benefits and applications of nano technology.

UNIT – I: BACK GROUND TO NANOTECHNOLOGY

Scientific revolution-Atomic structures-Molecular and atomic size –Bohr radius – Emergence of Nanotechnology-Challenges in Nanotechnology-Carbon age-New form of carbon (from grapheme sheet to CNT).

UNIT – II: NUCLEATION

Influence of nucleation rate on the size of the crystals-macroscopic to microscopic crystals and nanocrystals-large surface to volume ratio-top down and bottom up approaches-self-assembly process-grain boundary volume in nanocrystals –surface effects on the properties.

UNIT –III: TYPES OF NANOSTRUCTURES

Definition of a Nano system-Types of nanocrystals –One dimensional (1D)-Two dimensional (2D)-Three dimensional (3D) nanostructured materials-Quantum dots –Quantum wire - core/shells structures

UNIT –IV: NANOMATERIALS AND PROPERTIES

Carbon nanotubes(CNT)-Metals(Au,Ag) – Metal oxides(Tio2,Ceo2,ZnO)-Semiconductors(Si,Ge,CdS,ZnSe)-Ceramics and composites –Dilute Magnetic Semiconductor-Biological system –DNA and RNA-Lipids –Size dependent properties-Mechanical, Physical and chemical properties

UNIT-V APPLICATIONS OF NANOMATERIALS

Molecular electronics and nano electronics-Quantum electronic devices-CNT based transistor and Field Emission display-Biological applications-Biochemical sensors-Membrane based water purification

BOOKS FOR REFERENCES:

1. M.Wilson, K.Kannangara, G.Smith, M.Simmons,B.Raguse-Nanotechnology:Basic Science and Emerging technologies –Overseas press India Pvt Ltd.-New Delhi –First edition -2005

2. C.N.R Rao, A.Muller,A.KCheetahm (eds)-The chemistry of nanomaterials: Synthesis, properties and applications –Wiley VCH Verlag Gmbh &Co. Weinheim-2004

3. Kenneth J.Klabunde (Eds)-Nanosclae material science –john Wiley &sons Inc-2001

4. C.S.S.R Kumar, J.Hormes, C.Leuschner-Nanofabrication towards biomedical applications-Wiley VCH Verlag Gmbh &Co. Weinheim-2004

5. W.Rainer-Nanoelectronics and information technology-Wiley -2003

6. K.E.Drexler –Nano systems –Wiley-1992

7. G.Cao-Nanostructures and nanomaterials: Synthesis, properties and applications-Imperial college press-2004

CHAIRMAN-BOS

COE

Sl. No.: | | **Subject Code:** | **P16PH4E5** |

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KARUR -05.
M.Sc., PHYSICS –IV SEMESTER –ELECTIVE COURSE –V

(For the candidates admitted from 2016-2017 onwards)

BIOMEDICAL INSTRUMENTATION

Course Outcomes

1. Synchronize physiological response with behavioral coding.
2. Measure the internal state of ECG, EEG, skin conductance, respiration and more.
3. Technology advances tightly integrated into patient care.
4. Bio instrumentation is used to monitor the health status of the crew.
5. An MRI- directed ultra sound is utilized to find co related for a lesion detected.

UNIT – I HUMAN PHYSIOLOGICAL SYSTEMS AND BIOSIGNAL ACQUISITION

Introduction – cells and their structures – different systems of human bodies – physiological signal amplifiers – Isolation amplifiers – medical pre amplifier – Biosignal analysis.

UNIT – II DIAGNOSTIC DEVICES

Electrocardiography (ECG) – analysis of recorded ECG signals – Electro encephalography (EEG) – Electromyography (EMG) – Electroretinography (ERG) – Electrooculography (EOG).

UNIT – III SPECIALIZED MEDICAL EQUIPMENTS

Pacemaker – methods of stimulation – Ventricular synchronous/asynchronous pacemaker – blood cell counter – Photometers – Calorimeters – Filter photometer – spectrophometer – disorders of hearing – audiometers.

UNIT – IV ADVANCED BIOINSTRUMENTATION

Computer in medicine – Laser in medicine photo thermal applications of tomography – Tomography – Principle – application of tomography – Thermography – IR and liquid crystal thermography.

UNIT – V MRI AND ULTRASOUND IMAGING SYSTEMS

Magnetic resonance imaging (MRI)- magnetic resonance phenomenon – Fourier transform NMR – Chemical shift – Imaging process and instrumentation – Ultrasonic imaging system – Ultrasonic scanning A mode – B mode and M-mode.

BOOKS FOR STUDY:

1. Biomedical Instrumentation – Dr.M.Arumugam – Anuradha publications – 2008 Reprint.

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Sl. No.: | | **Subject Code:** | **P16PH4PW**

GOVERNMENT ARTS COLLEGE (AUTONOMOUS): KARUR-05

M.Sc. PHYSICS – IV SEMESTER – PROJECT WORK

(For the candidates admitted from the year 2016-17 onwards)

PROJECT WORK

SL.	Area of Work	Maximum Marks
1.	**PROJECT WORK:** **(i) Plan of the Project** **(ii) Execution of the plan / Collection of data / Organization of materials/ Fabrication Experimental study / Hypothesis, Testing etc., and Presentation of the report.** **(iii) Individual Initiative**	**20** **45** **15**
2.	**VIVA VOCE EXAMINATION**	**20**
	TOTAL	**100**

PASSING MINIMUM – 50 MARKS

CHAIRMAN – BOS **COE**