MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI
PG - COURSES – AFFILIATED COLLEGES
Course Structure for M.Sc Physics
(Choice Based Credit System)
(with effect from the academic year 2016- 2017 onwards)
(44th SCAA meeting held on 30.05.2016)

Sem	Sub 'Pr. No.	Subject status	Subject Title	Hrs/ week	Cre - dits	Marks				
						Maximum			Passing minimum	
						Int.	Ext	Tot.	Ext.	Tot
III	12	Core – 7	Quantum Mechanics I	6	5	25	75	100	38	50
	13	Core – 8	Electromagnetic Theory	6	5	25	75	100	38	50
	14	Core - 9	Statistical Mechanics	6	5	25	75	100	38	50
	15	Core - 10	Research Methodology	6	5	25	75	100	38	50
	16	Practical – III	General Physics Experiments II	6	--	--	--	--	--	--
IV	17	Core – 11	Quantum Mechanics II	6	4	25	75	100	38	50
	18	Core - 12	Spectroscopy	6	4	25	75	100	38	50
	19	Core - 13	Nuclear and Particle Physics	6	4	25	75	100	38	50
	20	Project		6	4	50	50	100	25	50
	21	Practical – III	General Physics Experiments II	--	4	50	50	100	25	50
	22	Practical - IV	Microprocessor and C++ Programming	6	6	50	50	100	25	50

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Quantum Mechanics I

UNIT I

Fundamentals of wave mechanics

Heisenberg uncertainty principle- The classical uncertainty relation- Illustration of uncertainty relation- Phase and Group velocities- Wave packets and uncertainty principle- Gaussian wave packet- Stern Gerlach experiment

Construction of Schrodinger equation- Solution of time dependent equation- Parseval's theorem -physical interpretation of $\psi^*\psi$ - conditions for allowed wave functions- Box normalization- Conservation of probability- Expectation values- Basic postulates- Time evolution of stationary states- conditions for allowed transitions- orthogonality of two states- phase of the wave function.

UNIT II

Operators and matrix mechanics

Introduction- linear operators- commuting and noncommuting operators- Self adjoint and Hermitian operators- discrete and continuous eigen values- meaning of eigenvalues and eigenfunctions- parity operator- matrix representation of operator and wave function- Schrodinger wave equation and other quantities in matrix form- matrix theory of harmonic oscillator- Dirac's BRA and KET vectors- Linear vector space and Hilbert space- Projection and Displacement operators-Momentum eigen function- Tranformation between momentum and coordinate representation-operators in momentum representation- momentum function of some systems

Unit III

Equation of motion and density matrix

Introduction- Schrodinger picture- Heisenberg picture- Interaction picture- Poisson bracket and commutator bracket- evaluation of commutator bracket- Density operator- Density matrix for a single system- Density matrix for an ensemble -Time evolution of Density operator- spin ½ system

UNIT IV

Exactly soluble systems

Bound states: Simple Harmonic oscillator- Schrodinger equation- eigen values, energy eigen function- Three dimensional Square Well potential- Solution in interior region, exterior region and matching—Rigid rotator- wave equation- eigen values and eigenfunction for the rotator- Hydrogen atom-solution of radial equation- energy levels- stationary state wave function- discussion of bound states. Scattering states: Potential barrier- Tunnel effect- finite square well potential-potential step- locally periodic potential- reflectionless potentials.

Unit V

Theory of angular momentum

Introduction: Scalar wave function under rotation- orbital angular momentum- Eigen pairs of L^2 and L_z - properties of components of L and L^2 - eigen spectra through commutation relations- matrix representation of L^2, L_z and $L_\pm$ - spin states of an electron- spin orbit coupling- rotational transformation- rotational properties of operator- addition of angular momenta- Clebsch- Gordan coefficients

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Books for Study:

1. Quantum Mechanics - L. Schiff- Third Edition (Tata Mc-Graw Hill, New Delhi)

Books for Reference:

1. Quantum Mechanics I: Fundamentals- S. Rajasekar and R. Velusamy (CRC Press, Taylor and Francis group- Boca Raton, London)
2. A Text Book of Quantum Mechanics- P. M. Mathews and K. Venkatesan (Tata McGraw Hill, New Delhi, 1987)
3. Quantum Mechanics - S. Devanarayanan (Sci. Tech. Publications Pvt Ltd, Chennai, 2005)
4. Quantum Mechanics- G. Aruldhas (Prentice Hall of India, New Delhi, 2003)

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Electromagnetic Theory

Unit I

Electrostatics

Coloumb's law – Gauss law – Poisson's equation and Laplace's equation – work done to move a point charge – energy of a point charge and continuous charge distribution – methods of images – electric field in dielectric materials – induced dipoles and polarizability – connection between polarizability and susceptibility – susceptibility, permittivity and dielectric constant of linear dielectric.

Unit II

Magnetostatics

Lorentz force law – Biot-savart's law and Ampere's law – magnetic vector potential multipole- Expansion of the vector potential – Effects of a magnetic field on atomic orbits – magnetic energy – Dia, Para, Ferro magnetism – magnetic susceptibility and permeability in linear and non linear media.

Unit III

Electrodynamics

Electromagnetic induction – Faraday's law – Maxwell's equation differential and integral form – Boundary conditions on field vectors D, E, B and H – Scalar and vector potentials – Gauge transformations – Lorentz and coloumb gauge – pointing vector and pointing theorem – Maxwell's stress tensor – Conservation of momentum.

Unit IV

Electromagnetic waves

The wave equation for E and B – Monochromatic plane waves – energy and momentum in EM waves in linear media – Reflection and transmission at normal and Oblique incidence – EM waves in conductors wave guides – TE waves in rectangular wave guides – the coaxial transmission line.

Unit V

Electromagnetic radiation

Retarded potential – Lenard – Wiechart potential – Electric dipole radiation – magnetic dipole radiation – power radiated by a point charge – amour formula – Abraham Lorentz formula for the radiation reaction – physical origin of radiation reaction**.**

Book for Study:

1. Introduction to Electrodynamics, David J Griffiths. Prentice Hall of India. II Edition, 1989**.**

Books for Reference:

1. Classical electrodynamics, J.D.Jackson., Wiley Eastern Publication. Second edition, 1975
2. Foundation of electromagnetic theory, J.R. Reitz, E.J Milford and R.W Christy
3. Electromagnetic fields and waves, P.Lorrain and D.Corson. CBS Publishers and distributors, 1986
4. Electrodynamics, B.P Laud, New Age International Pvt. Ltd. 1987

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Statistical Mechanics

Unit I

Basic concepts

Phase space-phase-space diagram of an oscillator-Volume in phase space-Ensembles-Microcanonical ensemble-Canonical ensemble-Grand canonical ensemble-Density of distribution in phase space-Liouvilles theorem-Postulate of equal a priori probability-statistical,mechanical and thermal equilibriums-connection between statistical and thermodynamical quantities.

Unit II

M-B Distribution law

Microstates and macro states-Stirling's approximation-Thermodynamic probability-General statistical distribution law-Classical Maxwell-Boltzmann distribution law-Evaluation of constants in the Maxwell Boltzmann distribution law-Maxwell's law of distribution of velocities-principle of equipartition of energy-Boltzman entropy relation-Probability of magnetic moment distribution of independent atoms.

Unit III

Quantum statistics

Postulatory foundations of quantum mechanics-Transition from classical statistical mechanics to quantum statistical mechanics-Indistinguishability and quantum statistics-Exchange symmetry of wave functions-Bose-Einstein Statistics-Fermi-Dirac statistics-Maxwell-Boltzmann statistics-Results of three statistics-Thermodyanamic interpretation of the parameters α and β-Black body radiation and the Planck radiation law

Unit IV

Applications of quantum statistics:

Specific heat of solids-Dulong and Petit law-Einstein theory of specific heat of solids-Debye theory of specific heat of solids-Criticism of Debye's theory-Ideal Bose Einstein Gas-Energy and pressure of the Gas-Gas degeneracy-Bose-Einstein Condensation-Thermal properties of Bose Einstein Gas-Ideal Fermi Dirac gas- Energy and pressure of the Gas-Thermodynamics functions of degenerate Fermi-Dirac gas-Electron Gas

Unit V

Phase transitions

Phase transition-Phase transitions of first and second kind-critical exponent-Yang and Lee theory-Phase transitions of second kind: the Ising model-Braggs-Williams approximation-One dimensional Ising mode

Book for Study:

1. Elementary statistical Mechanics Dr.S.L.Gupta & Dr. V.Kumar,Pragati Prakasan,Meerut 22nd Edition 2008

Books for Reference:

1. Fundamentals of statistical mechanics B B Laud New age international Publishers 2005
2. An Introductory course of Statistical Mechanics Palash B.Pal Narosa First reprint 2009
3. Statistical Mechanics by Kerson Huang
4. Statistical Mechnics by Sears and Salinger.

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Research Methodology

Unit I

Fundamentals of research

Definitions and characteristics of research - Research process and steps in it - Areas of research –Research methods vs Methodology -Characteristics of scientific method - Motivation and objectives - Bias and Prejudice in research - Types of research – Descriptive vs. Analytical, Applied vs.Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Unit II

Formulation of research

Defining and formulating the research problem -Selecting the problem - Necessity of defining the problem - Importance of literature reviewin defining a problem – Literature review – Primary, secondaryand tertiary sources – reviews,treatise, monographs-patents – web as a source – searching the web - Critical literaturereview – Identifying gap areas from literature review.

Unit III

Research design

Basic Principles- Need ofresearch design – Features of good design – Important concepts relating to researchdesign – Observation and Facts, Laws and Theories, Prediction and explanation,Induction, Deduction, Development of Models. Developing a research plan - Exploration,Description, Diagnosis, Experimentation. Determining experimental and sample designs.

Unit IV

Execution and reporting research

Observation and Collection of theoretical & experimental data - Methods of data collection – Comparison of Data - Generalization and Interpretation.Structure and components of scientific reports -Types of report – Technical reports and thesis –Different steps in thepreparation – Layout, structure and Language of thesis – Illustrations, figures and tables- Quotation and footnotes - Bibliography, referencing.

Unit V

Research ethics and publication of results

Environmental impacts - Ethical issues -Plagiarism – Research Journals – Impact Factor – Citation Index – Reporting to Journals - Commercialization – Copy right – royalty - Intellectual property rightsand patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material - Reproducibility andaccountability.

Books For Study:

1. C.K.,Research Methodoloy2nd Edn, – Methods and Techniques, New Age International, New Delhi(2004).
2. Garg, B.L., Kothari Karadia, R., Agarwal, F. and Agarwal, An introduction to Research Methodology, RBSA Publishers.U.K. (2002).
3. Sinha, S.C. and Dhiman, A.K., Research Methodology2 volumes, EssEssPublications, New Delhi (2002).
4. Trochim, W.M.K., Research Methods: the concise knowledge base, Atomic Dog Publishing, OH US(2005).
5. Wadehra, B.L. Law relating to patents, trade marks, copyright designs and geographical indications, Universal Law Publishing. New Delhi (2000).

Books For Reference:

1. S. Rajasekar, P. Philominathan and V. Chinnathambi, Research Methodology
2. Anthony, M., Graziano, A.M. and Raulin, M.L., Research Methods: A Process of Inquiry, Allyn and Bacon, Boston,US (2009).
3. Day, R.A., How to Write and Publish a Scientific Paper, Cambridge University Press. U.K (1992).
4. Leedy, P.D. and Ormrod, J.E., Practical Research: Planning and Design 10th Ed., Pearson New International Edn, USA.(2014)

General Physics Experiments II
Any 10 Experiments

1. Guoy's Balance
   Determination of Magenetic Susceptibility (Volume and Mass) of the given sample. (use a specimen in the form of a long rod or tube filled with power or liquid)

2. Elliptical Fringes
   Determination of Young's modulus, Bulk modulus, Rigidity modulus , poisson's ratio and compressibility of the given material by forming Elliptical fringes.

3. Temperature co-efficient and Band Gap
   Determination of Temperature co-efficient and band gap of a given Semiconductor Thermistor using Carey-Foster Bridge.

4. Hall Effect
   a. Definition of Hall effect and its application
   Determination of
   b. Hall voltage
   c. Hall coefficient
   d. Carrier density
   e. Mobility of charge carriers
   f. Resistivity

5. Four Probe
   a) Four Probe principle
   b) Measurement of Resistivity and Energy band gap of a given semiconductor material
   c) Measurement of Resistivity of a large sample using Four Probe mapping.

6. Equipotential lines
   a) Formation of equipotential lines for a) parallel plates b) circular plates c) plates of irregular shape.
   b) Determination of Electric field between the equipotential lines.
   c) Mapping of Electric field vector between the plates.

7. Ultrasonic Diffraction
   Formation of acoustic grating in a given liquid using a crystal to determine the velocity of ultrasonic wave in the liquid and compressibility of the liquid.
   Repeat for another liquid and hence find the ratio of compressibility and velocity.

8. Temperature co-efficient of a forward biased diode
   Measure the resistance of a forward biased diode at three different temperature and hence find the temperature co-efficient. Also plot variation of I with respect to T.

9. Phototransistor Characteristics
   Characteristic Study of Phototransistor using
   a) light sources of different wave length b) light sources of different intensities
   Plots for a) Spectral response b) Sensitivity c) Linearity

10. LCR circuit
    a) Determination of dielectric constant of a liquid using LCR circuit
    b) Determination of dielectric constant of a given crystal using LCR meter.

11. Hysteresis
    Formation and tracing of magnetic hysteresis loop for the given specimen to determine
    a) Coercivity
    b) Retentivity and
    c) Energy loss per unit volume per cycle of the specimen
12. Two Probe
    Determination of resistivity of the given samples

13. Calibration of Hall Probe into Gauss meter
    a) Calibration of Hall probe into Gauss meter using a Search coil and
    b) Determination of calibration curve for a two axis Hall probe in radial mode

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Quantum Mechanics II

Unit I

Approximation Methods I

Time Independent Perturbation Theory: Introduction- Theory for non degenerate case- Application to non degenerate levels- Theory of degenerate levels- First order Stark effect in Hydrogen atom

Time Dependent Perturbation Theory: Introduction- Transition probability- constant perturbation-Harmonic perturbation- adiabatic perturbation- sudden approximation- application to semi classical theory of radiation- calculation of Einstein coefficients

Unit II

Approximation methods II

WKB method: Introduction- principle of WKB method- applications of WKB method- WKB quantization with perturbation- asymptotic method

Variational approach: Introduction- calculation of ground state energy- trial eigen functions for excited states- application to hydrogen molecule- Hydrogen molecule ion

Unit III

Scattering theory

Kinematics of scattering process- wave mechanical picture- Green's functions - Born approximation and its validity- Born series- screened columbic potential-scattering from Born approximation.-Partial wave analysis: asymptotic behavior- phase shift- scattering amplitude in terms of phase shifts-differential and total cross sections- optical theorem- low scattering- resonant scattering- nonresonant scattering- scattering length and effective range- Ramsauer Townsend effect- scattering by square well potential

Unit IV

Identical particles

Identical particles- Introduction- symmetric and anti-symmetric wave functions- The exclusion principle- spin eigen function of two electrons- exchange interaction- excited states of Helium atom- collision between identical particles

Symmetry in Quantum Mechanics: Conservation laws and degeneracy associated with symmetries - Continuous symmetries- Space and time translations- Rotations- Group theory applied to symmetries - Wigner-Eckart theorem - Discrete symmetries - Parity and Time reversal

Unit V

Relativistic quantum theory

Schroedinger relativistic equation- Klein-Gordon equation- charge and current densities- interaction with electro magnetic field- Hydrogen like atom-nonrelativistic limit.

Dirac's relativistic Hamiltonian- probability density- Dirac matrices- plane wave solution- eigen spectrum- spin of Dirac's particle- significance of negative energy states- concept of anti particles- electron in a magnetic field- spin magnetic moment- spin orbit energy

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1. Quantum Mechanics - L. Schiff Third Edition (Tata McGraw Hill, New Delhi)

Books for Reference:

1. Quantum Mechanics I: The Fundamentals- S. Rajasekar and R. Velusamy- (CRC Press, Taylor and Francis group- Boca Raton, London)
2. A Text Book of Quantum Mechanics- P. M. Mathews and K. Venkatesan, (Tata McGraw Hill, New Delhi, 1987)
3. Quantum Mechanics - S. Devanarayanan, (SciTech Publications Pvt Ltd, Chennai,
4. Quantum Mechanics - V. Devanathan, (Narosa Publishing House, New Delhi, 2006)

Spectroscopy

Unit I

Microwave Spectroscopy

Classification of molecules based on moment of inertia – rotational spectra of rigid and non-rigid diatomic molecules – Isotopic effect – intensities of spectral lines and information from them – linear polyatomic molecule - symmetric top molecule – chemical analysis – microwave spectrometer.

Unit II

Infrared Spectroscopy

Vibrating diatomic and polyatomic molecules – Simple harmonic oscillator – anhormonicity – Hydrogen bonding – Fermi resonance – rotation vibration spectra of polyatomic molecule – information from IR spectra – IR spectrometer – FTIR.

Unit III

Raman Spectroscopy

Theory of Raman scattering – rotation vibration Raman spectra – mutual exclusion principle – Raman spectrometer – polarization of Raman scattered light – structure determination using IR and Raman spectrum – phase transition – resonance Raman scattering.

Unit IV

Resonance Spectroscopy

Magnetic properties of nuclei – resonance condition – relaxation time – Chemical shift – application to molecular structure – Bloch equation – NMR instrumentation – NMR imaging – ESR theory and hyperfine structure ESR spectra of hydrogen atom and anisotropic systems – triplet state analysis – crystal defects and biological studies – ESR spectrometer.

Unit V

Surface spectroscopy

Electron Energy Loss Spectroscopy EELS – Reflection – absorption IR spectroscopy RAIRS – Surface Enhanced Raman Scattering SERS – Inelastic Helium Scattering – X-Ray Photoelectron Spectroscopy XEPS – Ultraviolet PES – Auger Electron Spectroscopy AES – Extended X-ray absorption fine Structure EXAFS.

Book for Study:

1. N.Banwell and E.M.Mc Cash, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill.
2. G.Aruldhas, Molecular Structure and Spectroscopy, Prentice Hall India.

Book for Reference:

1. B.P.Strughan and S.Walker, Spectroscopy, John Wiley.
2. Peter J.Larkin, IR and Raman Spectroscopy Principle and Spectral Interpretation, Elsevier.
3. Gordon M. Barrow, Introduction to Molecular Spectroscopy, McGraw-Hill .

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Nuclear and Particle Physics

Unit I

Nuclear Forces

Ground and excited states of deuteron – magnetic dipole and electric quadrupole moments of deuteron – n-p scattering at low energies – scattering length – phase shift analysis – shape independent effective range theory of np scattering – pp scattering at low energies – exchange forces –meson theory of nuclear force.

Unit II

Nuclear Decays

Gamow's theory of alpha decay – line and Continuous spectrum of β decay - Fermi theory of beta decay – Fermi and Gamow-Teller selection rules – parity violation – detection and properties of neutrino – Gamma decay – multipole transitions in nuclei – selection rules – internal conversion – nuclear isomerism.

Unit III

Nuclear Models

Liquid drop model – Weizsackers mass formula – mass parabola – nuclear stability – Bohr Wheeler theory of nuclear fission -magic numbers -evidence for magic numbers – shell model – spin orbit coupling – angular momenta and parities of nuclear ground states – magnetic moments -schmidt line - collective model.

Unit IV

Nuclear reactions and Nuclear reactors

Types of nuclear reactions – Q-equation – solution of the equation – compound nuclear theory – reciprocity theorem – nuclear cross section – resonance scattering– Breit - Wigner dispersion formula – nuclear chain reaction – four factor formula – critical size of a reactor – reactor buckling – classification of nuclear reactor based on fuel and moderator.

Unit V

Elementary Particles

Classification of elementary particles - fundamental interactions conservations laws – CPT theorem - SU(3) multiplet – meson octet – baryon octet and baryon decouplet – Gellmann-Okubo mass formula - Quark theory.

Books For Study:

1. Nuclear Physics, D. C. Tayal, Himalaya Publications.
2. Elements of Nuclear Physics, M. C. Pandia and R. P. S. Yadav Kedarnath.

Books For Reference:

1. Concepts of Nuclear Physics, Bernard L Cohen, Tata Mc Graw-Hill
2. Nuclear Physics an Introduction, S. B. Patel, Wiley Eastern Ltd.
3. Nuclear Physics, R. R. Roy and B. P. Nigam, New Age International Ltd.

Project

General Physics Experiments II

Any 10 Experiments

14. Guoy's Balance
    Determination of Magenetic Susceptibility (Volume and Mass) of the given sample. (use a specimen in the form of a long rod or tube filled with power or liquid)

15. Elliptical Fringes
    Determination of Young's modulus, Bulk modulus, Rigidity modulus , poisson's ratio and compressibility of the given material by forming Elliptical fringes.

16. Temperature co-efficient and Band Gap
    Determination of Temperature co-efficient and band gap of a given Semiconductor Thermistor using Carey-Foster Bridge.

17. Hall Effect
    a. Definition of Hall effect and its application
    Determination of
    b. Hall voltage
    c. Hall coefficient
    d. Carrier density
    e. Mobility of charge carriers
    f. Resistivity

18. Four Probe
    d) Four Probe principle
    e) Measurement of Resistivity and Energy band gap of a given semiconductor material
    f) Measurement of Resistivity of a large sample using Four Probe mapping.

19. Equipotential lines
    d) Formation of equipotential lines for a) parallel plates b) circular plates c) plates of irregular shape.
    e) Determination of Electric field between the equipotential lines.
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20. Ultrasonic Diffraction
    Formation of acoustic grating in a given liquid using a crystal to determine the velocity of ultrasonic wave in the liquid and compressibility of the liquid.
    Repeat for another liquid and hence find the ratio of compressibility and velocity.

21. Temperature co-efficient of a forward biased diode
    Measure the resistance of a forward biased diode at three different temperature and hence find the temperature co-efficient. Also plot variation of I with respect to T.

22. Phototransistor Characteristics
    Characteristic Study of Phototransistor using
    a) light sources of different wave length b) light sources of different intensities
    Plots for a) Spectral response b) Sensitivity c) Linearity

23. LCR circuit
    c) Determination of dielectric constant of a liquid using LCR circuit
    d) Determination of dielectric constant of a given crystal using LCR meter.

24. Hysteresis
    Formation and tracing of magnetic hysteresis loop for the given specimen to determine
    d) Coercivity
    e) Retentivity and
    f) Energy loss per unit volume per cycle of the specimen
25. Two Probe
    Determination of resistivity of the given samples

26. Calibration of Hall Probe into Gauss meter
    b) Calibration of Hall probe into Gauss meter using a Search coil and
    c) Determination of calibration curve for a two axis Hall probe in radial mode

Microprocessor and C++ Programming

(*Any 12 programs with a minimum of 5 from each PART. For University examination, questions will be either from* Microprocessor or from C++ Programming)

PART A: Microprocessor Programming
(All programs must have Algorithm and Flow chart)

1. Arithmetic Operations
   a) Addition of two 8 bit and two 16 bit numbers
   b) Subtraction of two 8 bit and 16 bit numbers
   c) Multiplication of two 8 bit numbers – 16 bit result.
   d) Division of 16 bit by an 8 bit number.

2. Data Manipulation
   a) Arrange the given data items in Ascending or Descending order
   b) Finding the Minimum and Maximum value in the given data set.
   c) Search of a given character/number in the given data set.

3. System Call and Counters
   a) Display a character/number on the 7 segment display of the Kit using Monitor Call.
   b) Calculation of Time delay for a given interval.
   c) Up-Counter to count from 00 upto 'nn' with 1 sec time interval.
   d) Down counter to count from 'nn' to 00 with specified counting interval.

4. Block Move and Series Generation
   a) Moving a block of data from memory xxxx to yyyy.
   b) Fibonacci series generation
   c) Tribonacci series generation

5. System Call and Rolling character
   a) Calculation of time delay for a given interval.
   b) Display a Character on the 7 segment display of the Kit using Monitor Call.
   c) Roll a given character from Left to Right / Right to Left on the 7 segment displays with the specified time interval.

6. ADC and DAC conversion
   a) Interfacing ADC with 8085 – ADC chip Block diagram – 8085- ADC interfacing diagram
   b) Conversion of analog input to digital – Resolution – Graph between input and output.
   c) Interfacing DAC with 8085 –DAC chip Block diagram – 8085 DAC interfacing diagram.
   d) Conversion of digital input to analog – Resolution – Graph between input and output.

7. DAC interfacing and Wave form generation.
   Interfacing DAC with 8085 – DDC Chip Block diagram – 8085- DAC-8085 interfacing diagram and Wave Form generation using DAC
   a) Square wave with the specified period
   b) Rectangular wave with the specified period
   c) Ramp Wave with the specified period
   d) Triangular Wave

PART B: C++ programming
(All programs must have Algorithm and Flow chart)

1. Curve Fitting – Fitting a straight line.
   a) Principle of least Square and fitting a straight line.
   b) Principle of linear interpolation
   c) C++ program to fit a straight line using the data obtained from Cauchy's Constant Experiment and Interpolation using the fitted equation

2. Solution of simultaneous equations - Gauss Elimination method.
   a) Procedure to solve Simultaneous equations using Gauss Elimination Method
   b) Solving unknown branch currents in Wheatstone's bridge using GE method manually.
   c) C++ program to solve the equations.

3. Numerical Differentiation.
   a) Derivation of Exponential law of Radio active decay.
   b) RK 4^{th} order method of solving a given 1^{st} order differential equation.
   c) Analytical computation of the mass of the given radioactive sample after a specified period (Given: activity or half life period).
   d) C++ program using RK method to solve radio active problem – Compare output with the analytical result.
4. Area under the Curve
   a) Numerical integration – derivation of Simpson's rule
   b) C++ programs for Simpson $1/3^{rd}$ rule, Simpson 3/8 rule and Montecarlo integration.
   c) Comparison of the program output with direct integration.

5. Eigen Value and Eigen Vector.
   a) Explanation of Eigen Values and Eigen Vectors.
   b) Calculation of Eigen Values and Eigen Vectors using analytical method.
   c) C++ program to calculate Eigen values and Eigen vectors of a give matrix – Comparison with analytical result.
6. Matrix Multiplication
   a) Multiplication of given matrices
   b) Rotation matrix definition.
   c) C++ program to rotate the given point about the origin using rotation matrix by the given angle.
7. Numerical Differentiation
   a) Numerical differentiation – related to any physical problem
   b) Derivation of Newton's law of cooling – equation
   c) C++ program to verify the Newton's law of cooling from the given experimental data.

8. Solution of Algebraic and Transcendental equations.
   a) Solution of the given equations using Newton Raphson Method – manual calculation.
   b) C++ program to find the solution using N-R method and verification.