GOVERNMENT COLLEGE FOR WOMEN
(AUTONOMOUS)
KUMBAKONAM-612 001

PG REVISED SYLLABUS
EFFECTIVE FROM 2018-2019 ONWARDS

DEPARTMENT OF PHYSICS

2018-2019

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS)

KUMBAKONAM – 612 001

P.G. – Revised Course Structure under CBCS

(For the Candidates admitted from the Academic year 2018 -19 onwards)

Semester	Course	Course Code	Course Title	Ins. Hrs./ Week	Credit	Exam Hrs	Marks		Total
							Int.	Ext.	
I	CC -I	P18PHC101	Classical DynamicsAnd Relativity	6	5	3	25	75	100
	CC-II	P18PHC102	Mathematical Physics	6	5	3	25	75	100
	CC III	P18PHC103	Statistical Mechanics	6	5	3	25	75	100
	CC IV	P18PHC104P1	General Experiments	6	4	6	40	60	100
	EC-I	P18PH1EC1:1 P18PH1EC1:2	1. Advanced Electronics 2. Advanced Microprocessor andits Applications	6	4	3	25	75	100
			Total	**30**	**23**				
II	CC-V	P18PHC205	Numerical Methods	6	5	3	25	75	100
	CC-VI	P18PHC206	Quantum Mechanics	6	5	3	25	75	100
	CC-VII	P18PHC207P2	Electronics Experiments	6	5	6	40	60	100
	CC-VIII	P18PHC208	Programming in C++	6	5	3	25	75	100
	EC-II	P18PH2EC2:1 P18PH2EC2:2	1. Experimental Techniques and Instrumentation 2. Data Acquisition and Control systems	6	4	3	25	75	100
			Total	**30**	**24**				
	NCGPA	INT	Internship	-	2	-	-	-	-
III	CC-IX	P18PHC309	Atomic and Molecular Physics	6	5	3	25	75	100
	CC-X	P18PHC310	Electromagnetic Theory	6	5	3	25	75	100
	CC-XI	P18PHC311	Nuclear and Particle Physics	6	5	3	25	75	100
	CC-XII	P18PHC312P3	Advanced Electronics-I	6	4	6	40	60	100
	EC-III	P18PH3EC3:1 P18PH3EC3:2	1. Communication Electronics 2.Integrated Electronics	6	4	3	25	75	100

		Total		**30**	**23**				
IV	CC-XIII	P18PHC413	Condensed Matter Physics	6	5	3	25	75	100
	CC-XIV	P18PHC414P4	Advanced Electronics II	6	5	6	40	60	100
	CC-XV	P18PWPH415	Project	12	6	-	25	75	100
	EC-IV	P18PH4EC4:1	1Crystal Growth, Thin film and Nano Science	6	4	3	25	75	100
		P18PH4EC4:2	Thin film Scienceand Technology						
		Total		**30**	**20**				
		Grand total		**120**	**90**				**1900**

Core Course	**14**
Elective Course	**04**
Project Paper	**01**
Internship	**01**

CORE COURSE-I -CLASSICAL DYNAMICS AND RELATIVITY

INS.HRS:6 **CREDIT: 5**

OBJECTIVES

- To introduce different formulations of classical dynamics with Linear and Non-linear Oscillations.
- To enhance the understanding of theory of relativity & nonlinear dynamics.

UNIT I: FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION

Mechanics of a particle and system of particles- Conservation laws-Constraints-Generalized coordinates-D'Alembert's principle and Lagrange's equation with holonomic constraints-Application-Atwood's Machine.

UNIT II: LAGRANGIAN FORMULATION: APPLICATIONS

a) Rigid body dynamics

Euler's angles- Moments and products of inertia-Euler's equations-Symmetrical top.

b) Oscillatory Motion

Theory of small oscillations-Normal modes and frequencies- Two coupled harmonic oscillators-Linear triatomic molecule.

Wave motion-Wave equation-Phase velocity-group velocity-Dispersion.

UNIT III: HAMILTON'S FORMULATION

Hamilton's canonical equations of motion-Hamilton's Principle -Hamilton's equations from variational principle-Principle of Least action-Canonical transformations -Poisson brackets-Hamilton-Jacobi method.

UNIT IV: NONLINEAR DYNAMICS

Dynamical systems-Mathematical implications of nonlinearity-Definition and defects of non linearity-regular and chaotic motion-linear and nonlinear oscillators, Phase trajectories-Classification of fixed points and limit cycles-Period doubling bifurcation and onset of chaos in Duffing oscillator.

Solitons-Derivation of cnoidal waves (solitary waves) of K-dv equation-AKNS eigen value problem &derivation of K-dV, MK-dV equation

UNIT V: RELATIVITY

Limitations of Lorentz transformation- need of special theory of Relativity- energy momentum four vectors- Minkowsi's four dimensional space-Lorentz transformation as rotation-Minkowski's space - Lagrangian formulation in relativistic mechanics – Invariance of Maxwell's equations under Lorentz transformation.

BOOKS FOR STUDY:

1. Classical Dynamics-Gupta Kumar, Pragati Prakashan Publication (2012).
2. Mathematical Physics with Classical Mechanics-Sathya Prakash, Sultan Chand & Sons Publication; Sixth edition (2014).
3. Non linear Dynamics - M.Lakshmanan,& S.Rajasekar, Springer edition (December 16, 2002) (2003)
4. Classical Mechanics – J.C.Upadhyaya
5. N.C.Rana and P.S.Joag.,Classical Mehanics,Tata Mc Graw Hill,New Delhi.
6. Dynamics – P.S.Puranik &R.G.Takwale,Tata Mc Graw Hill(1979).

BOOK FOR REFERENCE:

1. H.Goldstein, Classical Mechanics, Narosa Book Distributors, New Delhi(1980)

CORE COURSE-II-MATHEMATICAL PHYSICS

INS.HRS:6 **CREDIT:5**

OBJECTIVE

- To provide extensive mathematical formalism for understanding and interpreting various physical problems.

UNIT I: VECTOR FIELDS AND VECTOR SPACES

Gauss theorem, Green's Theorem, Stoke's Theorem and applications – Orthogonal curvilinear coordinates – Expressions for gradient, divergence, curl and Laplacian in cylindrical , spherical and rectangular co–ordinates. Definitions – Linear dependence and linear independence of vectors – change of Basis – Schmidt's orthogonalisation process– Schwartz inequality.

UNIT II: TENSORS AND MATRIX THEORY

Transformation of coordinates – Summation convention – Contravariant, covariant and mixed tensors – Rank of a tensor – Symmetric and antisymmetric tensors – contraction of tensor – Characteristic equation of a matrix – Eigen values and eigenvectors – Cayley – Hamilton theorem-Reduction of a matrix to diagonal form – Jacobi method – Sylvester's theorem.

UNIT III: COMPLEX ANALYSIS

Functions of complex variables – Differentiability - Cauchy-Riemann conditions – Complex integration – 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 IV: SPECIAL FUNCTIONS

Gamma and Beta functions– Legendre, Bessel, and Hermite differential equations: – Rodriguez formula – Generating functions – Orthogonality relations – Important recurrence relations.

UNIT V: GROUP THEORY

Basic definitions – Multiplication table – Subgroups, Cosets and Classes – Direct Product groups – Point groups -- Space groups – Representation theory – Homomorphism and isomorphism– Reducible and irreducible representations – Schur's lemma – The great Orthogonality theorem – Character table -- C3v and D3h as examples – Elementary ideas of rotation groups.

BOOKS FOR STUDY:

1. Mathematical Physics - Sathyaprakash, Sultan Chand and sons, 6th revised edition, New Delhi, (2014).
2. Mathematical Physics -H. K. Dass, S. Chand and Co., New Delhi, 2003.
3. Mathematical Physics - B.D.Gupta, Vikas publishing house Pvt.Ltd.(1995).
4. Mathematical Physics - B.S.Rajput, 20th Edition, Pragathi Prakashan (2008).
5. Matrices and Tensors in Physics - A.W.Joshi, Wiley Eastern Ltd., New Delhi, 1975.
6. Mathematical Physics - P.K.Chattopadhyay, Wiley Eastern Ltd., New Delhi (1990).
7. Chemical Applications of Group Theory – F.A.Cotton,(Wiley Eastern ,New Delhi, 1990,3rd Edition).

BOOKS FOR REFERENCE:

1. Mathematical Physics- Eugene Butkov, Addison Wesley, London (1973).
2. Applied Mathematics for Engineers and Physicists - L.A.Pipes and L.R. Harvill, McGraw Hill Company, Singapore (1967).
3. Mathematical Methods for Physicists - G.Arfken and H.J. 4thed. Physicists (Prism Books, Bangalore, 1995).
4. Mathematial Physics- V.Balakrishnan.

CORE COURSE-III- STATISTICAL MECHANICS

INS.HRS:6 **CREDIT: 5**

OBJECTIVES

- To study the consequences of laws of thermodynamics.
- To study principles and applications of classical and quantum statistical mechanics.

UNIT – I: THERMODYNAMICS

Energy and First law of thermodynamics – Heat content and heat capacity – Specific heat – Entropy and the second law of thermodynamics – Thermodynamic potentials and the reciprocity relations – Thermodynamic equilibrium – Nernst heat theorem.

UNIT – II: KINETIC THEORY

Postulates of kinetic theory of gases – Maxwell – Boltzmann's law of distribution of velocities – Experimental test of Maxwell's law – Width of spectral lines – Zartman and Ko's experiment – Transport phenomena – Boltzmann transport equation – Mean free path.

UNIT – III: CLASSICAL STATISTICAL MECHANICS

Phase space – Ensembles and their types – Density of distribution in phase space – Liouville's theorem – Statement and proof – Maxwell Boltzmann distribution equation – Partition function – Principle of equipartition of energy – Canonical and grand canonical ensemble – Connection between partition function and thermodynamic quantities – Gibb's paradox.

UNIT – IV: QUANTUM STATISTICAL MECHANICS

Basic concepts –Bose – Einstein and Fermi – Dirac statistics – Distribution laws – Bose – Einstein gas – Bose – Einstein condensation – Specific heat of solids – Einstein's theory – Debye's theory.

UNIT – V: APPLICATIONS OF QUANTUM STATISTICAL MECHANICS

Black body – Planck's radiation law – Impacts and utility of Planck's law – Liquid Helium and its properties – Liquid He^4 as an example of B – E condensation.

Ideal Fermi gas: Properties – Degeneracy – Electron gas – Pauli's theory of Para-magnetism

BOOKS FOR STUDY:

1. Statistical Mechanics. S.L. Gupta and V. Kumar, Pragati Prakashan, 2010.
2. Statistical Mechanics, B.K. Agarwal and Melvin Eisnor, New Age Publisher, 2011
3. Thermal and Statistical Physics, R.B. Singh, New Age International (P) Ltd., 2010.
4. Statistical Mechanics, Satya Prakash, Keedar Nath Ramnath Publishers, Meerut, 2009.
5. Statistical Mechanis- R.K.Pathira and Paul D.Beale (Academic Press,2011)

BOOKS FOR REFERENCE:

1. Fundamentals of Statistical Mechanics, Laud, New Age International (P) Ltd., 2009.
2. Statistical and Thermal Physics – F. Reif, Mc Graw Hill Book Co., 1992.

CORE COURSE-IV-GENERAL EXPERIMENTS

INS.HRS:6 **CREDIT: 4**

ANY 12 EXPERIMENTS

1. Determination of **q,η ,σ** - Elliptical Fringes.
2. Determination of **q,η, σ** - Hyperbolic Fringes.
3. Determination of Stefan's Constant.
4. 'g' factor Determination-ESR Spectrometer.
5. e/m – Magnetron method.
6. e/m – Thomson method.
7. Planck's constant – Photoelectric effect.
8. Bi prism – Wavelength determination – scale and Telescope method.
9. Spectrometer – Hydrogen Spectrum – Rydberg's constant.
10. Spectrometer – Polarizability of liquids.
11. Spectrometer – Charge of an electron.
12. Bi prism – Determination of Refractive index.
13. Polarimeter – Determination of Specific rotatory power of a liquid.
14. Four probe method – Determination of resistivities of the given samples.
15. Cu-Hg spectrum (visible region).
16. Cu-salt spectrum (visible region).
17. Iron arc spectrum.
18. Brass arc spectrum.
19. Michelson's interferometer – Determination of wavelength of monochromatic source.
20. Ultrasonic Interferometer
21. Determination of L of a coil using Anderson's method.
22. Susceptibility of salt solutions\ solids –Guoy's method.
23. Susceptibility of Liquid mixture- Quincke's method.
24. Hysteresis loop Tracer.
25. G.M counter – Absorption coefficient of a Foil.

BOOK FOR REFERENCE:

1.S.L.Gupta and V.Kumar, Practical Physics, Pragati Prakashan 25th

Edition(2002)

ELECTIVE COURSE-I - ADVANCED ELECTRONICS

INS.HRS:6 **CREDIT: 4**

OBJECTIVES

- To introduce some important solid state devices and their characteristics
- To enhance the knowledge about the architecture of microprocessors and interfacing devices.

UNIT- I: ANALOG CIRCUITS

Operational amplifier – Differentiator, Integrator, Comparator, log and antilog amplifiers –Wien bridge, Phase shift oscillators, Schmitt trigger, Mono-stable and Bi-stable multi-vibrator, D/A conversion [R-2Rdual slope]-A/D conversion – Successive approximation.

UNIT- II: MICROPROCESSOR 8085

Instruction set- Addressing modes- Timing and sequencing, Instruction and machine cycle, Timing diagrams, programming in 8085-16 bit addition and subtraction, Ascending and descending order, Square root of number, D/A and A/D conversion, Temperature conversion(^{0}C to ^{0}F and ^{0}F to ^{0}C),Display, Rolling and Flashing of a message.

UNIT-III: MICROPROCESSOR 8086

Internal architecture of 8086 - Software model - Internal registers - Minimum mode and Maximum mode system - Instruction set - Addressing modes – Data transfer, Arithmetic, Logical, Shift and rotate instruction – Compare, Jump, Loop, String, Processor control, CALL - RET and stack instructions - Procedures - Assembler Macros - Assembler directives.

UNIT-IV: MICROCONTROLLER 8051

Introduction to Microcontroller – Pin configuration, Architecture and Key features – Internal registers – Addressing modes – Assembly Language Programming – Arithmetic, Logic and Sorting operations.

UNIT-V: INTERFACING DEVICES

Memory mapped I/O-Types of interfacing devices-Data transfer schemes-Programmed and DMA data transfer schemes –programmable peripheral interface[8255A]-8253 Timer interface-DMA controller-Programmable interrupt controller [8259]-programmable communication interface [8251].

BOOKS FOR STUDY:

1. Op Amp and liner integrated circuits R.A.Gayakwad, Prentice Hall India Pvt Ltd (1999).
2. Microprocessor architecture, programming and Application- R.Goankar, (Wiley Eastern, New Delhi, 1985).
3. Fundamentals of Microprocessors and Microcomputers-B. Ram, Dhanpat Rai Publications, New Delhi.
4. The 8051 Microcontroller and Embedded Systems - Muhammed Ali Mazidi and Janice Gillespie Mazidi, 2004, Fourth Indian Reprint, Pearson Education.
5. Linear integrated circuit- Roy Choudry, and Nigam
6. Microprocessors – R.S.Goenkar
7. Advanced Microprocessors and Interfacing – Badri Ram, Tata Mc Graw Hill (2006)

BOOKS FOR REFERNCE:

1. Advanced Microprocessors and Interfacing - Badri Ram, Tata McGraw Hill (2006).
2. Microprocessor and its Applications - R. Thiagarajan, S. Dhanasekaran and S.Dhanapal, New Age International, New Delhi.
3. Microprocessors and Interfacing programming and Hardware Douglas V. Hall, (Tata Mc Graw Hill).
4. The 8051 Micro Controller Architecture, Programming and Applications-Kenneth J. Ayala –3rd Edition, Pen ram International.

ELECTIVE COURSE-I - ADVANCED MICROPROCESSOR AND ITS APPLICATIONS

INS.HRS:6 **CREDIT: 4**

OBJECTIVES

- The first module introduces architecture of 8085 and 8086 Microprocessors. The module-2 is compilation of information about I/O communication Interface.
- Microcontrollers (8051), its architecture and working is subject of module-3
- The 4th module contains Real time control sequences and programming of 8051-microcontroller.
- The AVR RISC microcontroller architecture is covered in module-5.

Unit I. **8086 Architecture**

Introduction to 8085 Microprocessor, 8086 Architecture-Functional diagram. Register Organization, Memory Segmentation. Programming Mode!. Memory addresses. Physical memory organization. Architecture of 8086, signal descriptions of 8086-common function signals. Minimum and Maximum mode signals. Timing diagrams. Interrupts of 8086. Instruction Set and Assembly Language Programming of 8086: Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

Unit - II: I/O and Communication Interface:

8255 PPI various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter. Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine, Introduction to DOS and BIOS interrupts, Interfacing Interrupt Controller 8259 DMA Controller 8257 to 8086. Communication interface: Serial communication standards, Serial data transfer schemes. 8251 USART architecture and interfacing, RS-232, IEEE-4-88, Prototyping and troubleshooting.

Unit -III : Introduction to Microcontrollers:

Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, simple program.

Unit - IV:48051 Real Time Control:

Interrupts, timer/ Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming the serial communication interrupts, programming 8051 timers and counters.

Unit –V: The AVR RISC microcontroller architecture:

Introduction, AVR Family architecture,Register File, The ALU. Memory
Access and Instruction execution. I/O memory. EEPROM. I/O ports.
Timers. UART. Interrupt Structure.

BOOKS FOR STUDY:

1 D. V. Hall. Micro processors and Interfacing, TMGH. 2'1 edition 2006.
2 Kenneth. J. Ayala. The 8051 microcontroller , 3rd edition, Cengage learning, 2010

BOOKS FOR REFERENCE:

1. Advanced Microprocessors and Peripherals -A. K. Ray and K.M. Bhurchandani, TMH, 2nd edition 2006.
2. The 8051 Microcontrollers, Architecture and programming and Applications -K.Uma Rao, AndhePallavi,,Pearson, 2009.
3. Micro Computer System 8086/8088 Family Architecture. Programming and Design -By Liu and GA Gibson, PHI, 2nd Ed.,
4 .Microcontrollers and application, Ajay. V. Deshmukh, TMGH. 2005.

CORE COURSE-V-NUMERICAL METHODS

INS.HRS:6 **CREDIT: 5**

OBJECTIVE

- To give a glimpse of the numerical methods to find the solution of algebraic and transcendental equations, interpolation, numerical integration and differentiation

UNIT I: METHODS OF CURVE FITTING

Principle of least Square method – Fitting a straight line, parabola, exponential curve. Errors and Their types- Approximation and residuals.

UNIT II: SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

Bisection method –Regula falsi method –Newton Raphson method -convergence of Newton Raphson method- matrix inversion method – Gauss elimination method – Gauss Seidal method.

UNIT III: INTERPOLATION

Newton forward interpolation-Newton Backward interpolation formula- Error in Newton forward interpolation formula- Gauss forward interpolation formula- Gauss Backward interpolation formula-Stirling's and Bessel's formula.

UNIT IV: NUMERICAL INTEGRATION AND DIFFERENTIATION

Newton forward difference formula and Newton backward difference formula- Trapezoidal rule-Simpson rule – Simpson's 1/3 rule and 3/8 rule.

UNIT V: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Euler's method -Modified Euler's method- second and fourth order Runge Kutta method.

BOOKS FOR STUDY:

1. Numerical Method in Science and Engineering, M.K. Venkatraman, National Publishing Company-Chennai.
2. Introductory methods of Numerical Analysis- S.S. Sastry. Prentice Hall, (2005).
3. Numerical methods for Scientific and Engineering Computation, M.K.Jain, S.R.K.Iyangar and R.K.Jain, 3rd Edition, Willey Easterm Ltd., (1993).
4. Numerical Methods – Dr.P.Kandasamy, Dr.K.Thilagavathi and Dr.K.Gunavathi (2014), S.Chad Publishing, New Delhi.

BOOKS FOR REFERENCE:

1. Numerical Method in Scientists and Engineers (Dover Books on mathematics), R.W. Hamming, Dover Publication, (1987).
2. Numerical solution of Engineering Problems, K.Nandakumar, University of Alberta, (1998).
3. Numerical Analysis for Engineering, Douglas W. Harder, Richard Khoury, University of Waterloo, (2010).

CORE COURSE VI: QUANTUM MECHANICS

INS.HRS:6 **CREDIT: 5**

OBJECTIVE

- To understand the fundamental concepts of quantum mechanics and its applications.

UNIT – I: SCHRODINGER EQUATION AND GENERAL FORMULATION

Schrodinger Equation – Physical meaning and conditions on the wave function – Expectation values and Ehrenfest's theorem – Hermitian operators and their properties – Commutator relations – Uncertainty principle – Bra and Ket vectors – Hilbert space – Schrodinger, Heisenberg and interaction pictures

UNIT – II: EXACTLY SOLVABLE SYSTEMS

Linear harmonic oscillator – Solving the one dimensional Schrodinger equation – Zero point energy – Particle in a box – Square well potential – Rectangular barrier potential – Rigid rotator – Hydrogen atom.

UNIT – III: APPROXIMATION METHODS

Time independent perturbation theory: Non-degenerate perturbation and degenerate perturbation theories, (first order) – Stark effect – WKB approximation – Application to tunneling problem.

Time dependent perturbation theory: Harmonic perturbation-transition probability - Fermi golden rule.

UNIT – IV: SCATTERING THEORY AND ANGULAR MOMENTUM

Scattering theory: Scattering cross section – Green's function approach – Born Oppenheimer approximation – Particle wave analysis.

Angular momentum: Angular momentum of system of particle – Commutations rules – Matrix representation of J^2 and Jz - Spin angular momentum – Pauli's spin matrices – Eigen values of J^2 and Jz – Addition of angular momenta – Clebsch-Gordan coefficients (basic ideas only).

UNIT – V: RELATIVISTIC QUANTUM MECHANICS

Klein-Gordan equation for a free particle and in an electromagnetic field – Partial wave solutions – Dirac equation for a free particle – Probability and current densities – Dirac matrices – Plane wave solutions – Negative energy states – Spin angular momentum – Spin – Orbit coupling.

BOOKS FOR STUDY:

1. Quantum Mechanics – V. Devanathan –Wily Eastern, (2005).
2. Quantum Mechanics – V.K. Thankappan –II edition – New Age International (P) Ltd. Publishers, (1996).
3. Advanced Quantum Mechanics – Sathyaprakash –Pragathi Prakasam Publishing Ltd. Meerut, (1996).
4. Quantum Mechanics – G. Aruldhas –Prentice Hall of India, (2002).
5. Quantum Mechanics- Gupta, Kumar, Sharma-Jayaprakash Nath Publications, Meerut.

BOOKS FOR REFERENCES:

1. A text book of Quantum Mechanics – P.M. Mathews and K. Venkatesan –Tata McGraw Hill Publishing Company, New Delhi, 2002.
2. Fundamentals of Quantum Mechanics – Y.R. Weghmare –Wheeler Publishing Chennai, (1974).
3. Quantum Mechanics – G.S. Chandra –New Age International, (2005).
4. Quantum Mechanics – L.I. Schiff –McGraw Hill – Tokyo – (2000).
5. Quantum Mehanics A.Zettili (Wiley India, 2016)

CORE COURSE-VII-ELECTRONICS EXPERIMENTS

INS.HRS:6 **CREDIT: 5**

ANY 12 EXPERIMENTS

1. Dual power supply-Construction.
2. Common Source FET amplifier.
3. Operational amplifier filters.
4. Operational Amplifier –Parameters(Input impedance, Output impedance, Offset voltage)
5. Operational Amplifier – (Mathematical Operations -I) – Inverter, Multiplier, Divider, Adder and Averager.
6. Operational Amplifier – (Mathematical Operations -II) - Subtractor, Differentiator, Integrator and voltage follower.
7. Characteristics of UJT.
8. SCR characteristics.
9. Phase shift Oscillator.
10. Feed –back Amplifier.
11. Characteristics of LDR.
12. Wein's Bridge Oscillator - Op-amp.
13. Relaxation Oscillator – UJT
14. Astable Multivibrator using IC 555
15. Astable Multivibrator -IC 741
16. R-C Coupled amplifier -BJT
17. Solving simultaneous equations

Book for Reference**:**

1. Electrical and Electronic Science Laboratory Experiments(Narosa Publishing Home, 2011)

CORE COURSE-VIII -PROGRAMMING IN C++

INS.HRS:6 **CREDIT: 5**

OBJECTIVE

- To introduce the basics of C++ programming and its applications.

UNIT I:

Principles of Procedure oriented Programming (POP)-Principles of object oriented programming (OOP)-Software Evolution-object oriented programming paradigm-Basic concepts of oops :Introduction to C++-Tokens-Keyword's-Identifiers-variables-Operators-Manipulators Expressions.

UNIT II:

Control structural in C++-Functions in C++-Main function-Function Prototyping-Call by Reference-Return by Reference-Function overloading.

UNIT III:

Classes and objects: Passing objects as function arguments -Friend functions-Constant member functions Special member function constructors-Destructors-Operator overloading-Rules for overloading operator-Type conversions.

UNIT IV:

Inheritance: Single Inheritance-Multilevel Inheritance-Multiple Inheritance-Hierarchal Inheritances.

Pointers-Virtual function and polymorphism-Managing console I/O Operators. Working with files: Classes for file stream operators-Opening and Closing a file-End of file.

UNIT V: PROGRAMS

1. Arranging words in alphabetical order
2. Picking largest and of a set of numbers
3. Solving Quadratic equation
4. Multiplication of two square Matrix
5. Least square curve fitting
6. Integration-Simpson's rule
7. Trapezoidal Rule
8. Euler's Rule
9. Solution of differential equation by runge kutta 4^{th} order method
10. To solve simultaneous equation by Gauss Elimination method

BOOKS FOR STUDY:

1. Object oriented Programming in C++-Balagurusamy
2. Object oriented Programming in C++-Schmum Series.

BOOK FOR REFERENCE

1. Object oriented Programming in C++-Yashwant Kanetkar

ELECTIVE CORE- II- EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION

INS.HRS:6 **CREDIT: 4**

OBJECTIVE

- To highlight the concept of instrumentation and functioning of various analytical instruments in diversified fields.

UNIT-I: TRANSDUCERS

Inductive, Capacitive and Resistive transducers - Force, Pressure, Temperature, Humidity, Light, Magnetic and Ultrasonic flow sensors. [Principle and working of LVDT, Potentiometer, High pressure sensor, Thermocouples, Thermistor, Piezoelectric transducer, Flow sensor, Hall probe, Solar cell and Photodiode].

UNIT-II: DIGITAL INSTRUMENTATION

Principle, block diagram and working of Digital frequency counter, digital multimeter, digital pH meter, digital conductivity meter, digital storage oscilloscope and Q meter.

UNIT-III: MATERIALS CHARACTERIZATION

Structural analysis-Single crystal XRD, Micro hardness, Thermal analysis- Thermo gravimetric analysis (TGA), Differential Thermal Analysis (DTA), Optical analysis- FTIR-UV Absorbance, Transmittance and reflectance, Morphological analysis- SEM.

UNIT-IV: BIOMEDICAL INSTRUMENTATION

Bio potentials- Measurements- Resting and Action potentials- Characteristics of resting potentials. Bioelectric potentials- Types of bioelectric signal and their characteristics.
Component of the biomedical instrument system-Electrodes: Equivalent circuit-Theory-Types. Principle, Block diagram and functioning of ECG, EEG, EMG. and MRI.

UNIT-V: RECORDERS AND PRINTERS

Different types of Recorders- Pen and Strip chart recorders-XY recorders-Digital recorders- Printers - Printer mechanism – Classification - Dot matrix, Ink jet and laser printers.

BOOKS FOR STUDY:

1. Electrical and Electronic measurements and Instruments- A.K.Sawhney, Dhanpath Rai and Co.Pvt.Ltd., (2000)
2. Instrumentation Measurements and Analysis- B.C. Nakra, and K. K. Chaudry.
3. Electronic Measurements and Instrumentation- Dr. Rajendira Prasad, Khanna Publishers, (2002).
4. Biomedical Instrumentation-M. Arumugam, Anuradha Publishers, (2001).
5. Electronic Measurements and Instrumentation- S.Ramabhadran, Khanna Publications.
6. Engineering Physics-V. Rajendran.
7. Spectroscopy-B.K.Sharma (Krishna prakasham publications,1981)

BOOKS FOR REFERENCE:

1. Instrumental Methods of Analysis- Willard.D.Merritt et.al.,CBS Publisher, (2004).
2. Modern electronic Instrumentation and Measurement Techniques- Aslber D. Helfrock and William D cooper, Prentice Hall of India, (2005).
3. Hand Book of Bio medical Instrumentation- R. S. Khandpur, TMH, (2004).
4. Biomedical Electronics and Instrumentation, S.K.Venkata Ram, Galgotia Publications Pvt. Ltd. (2001).
5. Electronics and Instrumentation- S.M. Dhir, Khanna Publishers, Khandpur.

ELECTIVE CORE- II- DATA ACQUISITION AND CONTROL SYSTEMS

INS.HRS:6 **CREDIT: 4**

OBJECTIVE

- To enable the students for acquiring knowledge on storing, visualizing and processing data

UNIT I- BASICS OF PLC

Definition and History of PLC-PLC advantage and disadvantages- Over all PLC systems CPU and Programmer/Monitors-PLC input and output models – Architecture- PLC Programming language – Relay logic – Ladder logic – Programming of Gates – Flow charting as a programming method – connecting PLC to computer - PLC Troubleshooting and Maintenance.

UNIT II - PLC PROGRAMMING

Programming of Timers – Introduction - ON delay, OFF delay, Retentive Timers – PLC Timer functions – Examples of timer function Industrial application. Programming Counters – up/down counter – Combining counter - Examples of counter function Industrial application.PLC Arithmetic Functions – PLC number Comparison function.

UNIT III - PLC DATA HANDLING FUNCTIONS

PLC Program Control Instructions: Master Control Reset - Skip – Jump and Move Instruction. Sequencer instructions - Types of PLC Analog modules and systems, PLC analog signal processing – BCD or multi bit data processing – Case study of Tank level control system, bottle filling system and Sequential switching of motors.

UNIT IV - COMPUTER CONTROL – INTRODUCTION

Need of computer in a control system-Functional block diagram of a computer control system-Data loggers- Supervisory computer control- Direct digital control-Digital control interfacing-SCADA.

UNIT V - DATA ACQUISITION SYSTEMS

Sampling theorem – Sampling and digitizing – Aliasing – Sample and hold circuit – Practical implementation of sampling and digitizing – Definition, design and need for data acquisition systems – Interfacing ADC and DAC with Microprocessor / Multiplexer - Multiplexed channel operation – Microprocessor/PC based acquisition systems.

BOOKS FOR STUDY:

1. Electronic Instrumentation -H. S. Kalsi, Tata McGraw-Hill Education, 2010
2. Electronic Instrumentation -W. Bolton

BOOKS FOR REFERENCE:

1. Instrumentation: Electrical and Electronic Measurements and Instrumentation - A. K. Sawhney,
2. Modern Electronic Instrumentation & Measurement Techniques -Helfrick& Cooper.

EXTRA CREDIT COURSE

INTERNSHIP

SUBJECT CODE: INT Credit: 2 credits (Extra credits)

The curriculum includes the internship for students for 30 hours during the summer vacation after the second semester of all PG programs.

OBJECTIVES

The following are the intended objectives of internship training:

- To Enhance the employability skills of the students.
- To expose students to the industrial/Societal environment, which cannot be simulated in the classroom hence creating competent professionals for the industry and other organizations.
- To Provide possible opportunities to learn, understand, and sharpen the real-time technical/managerial skills required at the job.

Duration: 30 hours at the minimum

Period: During the summer vacation which could be completed within the third semester.

Assessment:

1. The assessment of the internship will be based on the feedback given by the internship provider and the report submitted by the student by the mentor.
2. After completion of the internship, the mentor has to make arrangements to get a proper training certificate from the industry/institution.
3. An abstract on the details of the internship in the prescribed format has to be submitted by the Departments to the COE on time.
4. Two credits are provided for the Internship as extra credits included under the Non-CGPA course for all PG programs.

LETTER FORMAT

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM

REQUEST LETTER FROM THE COLLEGE TO INTERNSHIP PROVIDER

To

……

.....

.....

Subject: REQUEST FOR INSTITUTIONAL/INDUSTRIAL TRAINING of M.A./M.Com/M.Sc Degree Programme,

Dear Sir/Madam,

You must be aware that our College has made internship mandatory for all M.A./M.Com/M.Sc students.

In view of the above, I request you to allow the following students of our college for practical training in your esteemed organization. Kindly accord your permission and give at least 30 hours of training for the students to complete the internship.

S.NO	NAME OF THE STUDENT	REG.NO	DISCIPLINE

If vacancies exist, kindly plan for Campus/Off Campus Interviews for_____ batch passing out students in above branches.

A line of confirmation will be highly appreciated.

With warm regards,

Yours sincerely,

Head of the Department.

GOVERNMENT COLLEGE FOR WOMEN (AUTONOMOUS), KUMBAKONAM

REQUEST LETTER FROM THE COLLEGE TO INTERNSHIP PROVIDER

To

……

.....

.....

Subject: REQUEST FOR INSTITUTIONAL/INDUSTRIAL TRAINING of M.A./M.Com/M.Sc Degree Programme,

Dear Sir/Madam,

Our Students have undergone internship training in your esteemed Organization in the previous years. I acknowledge the help and the support extended to our students during training in previous years.

In view of the above, I request you to allow our following students for practical training in your esteemed organization. Kindly accord your permission and give at least 30 hours of training for the students to complete internship.

S.NO	NAME OF THE STUDENT	REG.NO	DISCIPLINE

If vacancies exist, kindly do plan for Campus/Off Campus Interview for_____ batch passing out students in above branches.

A line of confirmation will be highly appreciated.

With warm regards,

Yours sincerely,

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Head of the Department.

FORM - 1

INTERNSHIP DETAILS (THIS WILL BE PREPARED IN CONSULTATION WITH FACULTY MENTOR AND TO BE MAINTAINED BY tHe department)

Student

Name:_____Reg.No._____Class_____

Campus Address: _____

_____

Phone:_____Email: _____

Internship Provider

Name:_____

Title:_____

Company/Organization:_____

Internship Company Adress_____

_____

_____

Phone:_____Email:_____

Faculty Mentor

Name:_____Phone: _____

Designation:_____Department:_____

Academic Credit Information

Internship Title: _____

Date of Initiation:_____Date of Completion: _____

Total Hours: _____

FORM - 2

STUDENT'S DAYWISE LOG ENTRY

Name and Reg.No. of the Student: Name and address of the Internship Provider:

Period of Internship: From:		**To:**		
Date	**Hours**	**Details of work done**	**Signature of the Student**	**Signature of the Supervisor**

Signature of the Mentor: Signature of the Internship Provider:

FORM -3
SUPERVISOR EVALUATION OF CANDIDATE
Student Name: _____ Date:_____
Work Supervisor:_____Title:_____
Company/Organization:_____
Internship Address:_____
Dates of Internship: From _____To_____
Please evaluate your candidate by indicating the frequency with which you observed the following behaviors:

Parameters	**Needs improvement**	**Satisfactory**	**Good**	**Excellent**
Interest in work				
Punctuality				
Reliability				
Responsibility				
Communication				
Team work				
Overall performance				

Additional comments, if any:

\
Signature of Internship Provider

FORM - 4

STUDENT FEEDBACK OF INTERNSHIP (TO BE FILLED BY STUDENTS AFTER INTERNSHIP COMPLETION)

Student Name:_____ Class: _____

Internship Provider: _____

Address: _____

Title of Internship :_____

Supervisor Email:_____

Faculty Mentor:_ _____

Indicate the degree to which you agree or disagree with the following statements.

This experience has	**Strongly Agree**	**Agree**	**Disagree**
Given me the opportunity to explore a career field			
Allowed me to apply classroom theory to Practice			
Expanded my knowledge			
Helped me develop my written and oral communication skills			
Given me a chance to improve my interpersonal skills			
Provided me with contacts which may lead to future employment			
Helped me clarify my career goals			

Considering your overall experience, how would you rate this internship?
(Tick one).(Satisfactory/ Good/ Excellent)

Signature of the Student

FORM – 5
EVALUATION SHEET (FOR MENTOR)

S.NO	NAME OF THE STUDENT	REG.NO	NO. OF ACTUAL INTERNSHIP HOURS	GRADE*

* Evaluation based on report submitted by the student and evaluation by Internship provider. (Excellent/ Very good/ Good)

Signature of the Head of the Department

Signature of the Mentor

CORE COURSE-IX- ATOMIC AND MOLECULAR PHYSICS

INS.HRS:6 **CREDIT: 5**

OBJECTIVES

- To understand the atomic spectra and Quantum Chemistry of molecules.
- To study the principles of Microwave, Infrared, Raman and Resonance spectroscopy and its application.

UNIT I: ATOMIC SPECTRA

Quantum states of electron in an atom – Electron spin – Stern Gerlach experiment – Spin orbit interaction – Two electron systems – LS and JJ coupling schemes – Spectrum of alkali atom – Doublet fine structure of alkali metals – Selection rule of doublets – Intensity rule for doublets – Spectrum of He – Atom.

UNIT II: ATOMS IN EXTERNAL FIELDS AND QUANTUM CHEMISTRY

Quantum chemistry of molecules: covalent, ionic and Vander Waals interactions – structions- Born-Oppenheimer approximation- Heitler- London and molecular orbital theories of H2 – Bonding and Antibonding – molecular orbital – Hartree fock equation self consistent field – Application to Butadiene and Benzene

UNIT III: MICROWAVE AND IR SPECTROSCOPY

Rotational spectra of diatomic molecule – Non rigid rotator – rotational spectra of polyatomic molecules – liner and symmetric top molecules – Vibrating diatomic molecules – Diatomic vibrating rotator – Linear and symmetric top molecules analysis by IR techniques – Experimental techniques.

UNIT IV: RAMAN SPECTROSCOPY AND ELECTRONIC SPECTROSCOPY OF MOLECULES

Raman spectroscopy: Raman Effect – Quantum theory of Raman Effect –Rotational and vibrational Raman spectra of Diatomic Molecules – Selection rules – Experimental techniques of Raman spectroscopy.

Electron spectroscopy: Electronic spectra of Diatomic molecules – The Franck Condon principle – Dissociation energy and Dissociation products – Rotational fine structure of electronic vibrational transitions.

UNIT V: RESONANCE SPECTROSCOPY

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

ESR: Basic principles – ESR spectrometer – Nuclear interaction and hyper fine structure – Relaxation effects – G factor – Characteristics – Free radical and Biological applications – Mossbauer spectroscopy and its applications.

BOOKS FOR STUDY:

1. Spectroscopy (Atomic and Molecular) - Gurdeep Chatwal and Sham Anand, Himalaya Publication House, (2004).
2. Elements of Spectroscopy, S.L. Gupta-V. Kumar and R.C. Sharma, Pragathi and Prakasham Publication Company, Meerut, (2006).
3. Molecular structure and spectroscopy - G. Aruldhas, PHI Learning (P) Ltd., New Delhi, (2007).
4. Vibrational Spectroscopy - D.N. Sathyanarayana, New Age International (P) Ltd., (1996).

BOOKS FOR REFERENCE:

1. Spectroscopy (Vol. I & II) - Stanley, D. Walker, H. Straw, Macmillan, (1962).
2. Spectroscopy and Molecular structure, G.W. King, Holt, Rinehart and Wonton, New York, (1964).
3. Fundamental of Molecular Spectroscopy - C.N. Banwell, Tata McGraw Hill, (1972).
4. Spectroscopy (Vol. II) - B.P. Straughan and S. Walker, Chapman and Hall, (1976).

CORE COURSE-X- ELECTROMAGNETIC THEORY

INS.HRS:6 **CREDIT: 5**

OBJECTIVES

- To study the laws associated with electromagnetism and its application.
- To study the nature of electromagnetic wave propagation in different medium.

UNIT I: ELECTROSTATICS

Coulomb's law – Electric field –Electrostatic Potential- Electric field and potential of a Dipole-Gauss Law – determination of electric field intensity due to infinite line charge distribution - Poisson and Laplace Equations in differential form–Method of Images – Illustration: Point charge in the presence of (i) a grounded conducting Sphere –Boundary condition for D vector and E vector.

UNIT II: MAGNETOSTATICS

Amphere's Force Law-Biot and Savart law and its Applications-Long straight wire- Ampere's Circuital Law – Amperian loop - application to Magnetic flux density due to infinite current carrying sheet - Magnetic scalar potential-Magnetic Vector potential – Boundary conditions on B and H – Dirichlet and Neumann conditions.

UNIT III: ELECTRODYNAMICS

Equation of Continuity- Maxwell's displacement current – Maxwell's equations –differential and integral forms - Poynting theorem-differential form of Poynting theorem -Electromagnetic Potential (A&Φ)– Maxwell's equations in terms of Electromagnetic Potential- Gauge transformations – Lorentz gauge.

UNIT IV: PLANE ELECTRO MAGNETIC WAVES AND WAVE PROPAGATION

Plane wave equation – Propagation of electromagnetic waves in free space - in a nonconducting isotropic medium – in a conducting medium- Reflection and refraction of electromagnetic waves (Snell's Law) – Propagation of electromagnetic waves in a rectangular wave guide -TM and TE modes.

UNIT V INTRODUCTION TO ANTENNAS

Radiation by an oscillating dipole – Skip distance – Radiation patterns of antennas – Directional characteristics – Gain of an antenna – Linear Array of Antennas (N-arrays) –Qualitative analysis of a dipole antenna.

BOOKS FOR STUDY:

1. S.L.Gupta and V.Kumar, Electrodynamics,Pragati Prakashan Publications(2004).
2. K.K.Chopra and G.C.Agarwal,Electromagnteic Theory,K.Nath & Co(1993).
3. Sathya Prakash,Electromagnetic Theory, Sulthan Chand and Sons, New Delhi (2005).
4. S.K. Dash and S.R.Khunita – Fundamentals of Electromagnetic Theory, PHI publications – New Delhi – 2011.

BOOKS FOR REFERENCE:

1. J. D. Jackson, Classical Electrodynamics (Wiley Eastern Ltd., New Delhi, 1993).
2. D. Griffiths, Introduction to Electrodynamics (Prentice-Hall, New Delhi, 1995).

CORE COURSE-XI-NUCLEAR AND PARTICAL PHYSICS

INS.HRS:6 **CREDIT:5**

OBJECTIVES

- To introduce the fundamental characteristics of nucleus, nuclear reactions and radioactive decay.
- To impart knowledge about various classification of elementary particles.

UNIT – I: NUCLEAR PROPERTIES, TWO BODY PROBLEM AND NUCLEAR FORCES

Basic ideas of Nuclear size – mass – charge distribution – spin and parity – Binding energy – semi empirical mass formula – Nuclear stability – Mass parabola of nucleus

Ground state of Deutron – Meson theory of Exchange forces - Scattering cross section -Neutron – proton scattering at low energies.

UNIT II: RADIOACTIVE DECAYS

Alpha emission – Giger – Nuttal law – Gamow's theory – Neutrino hypothesis – Fermi theory of beta decay – Curie point – Energies of beta spectrum selection rules – Non conversation of parity – Gamma emission selection rules – Transition probability – Internal conversion – Nuclear isomerism.

UNIT III: NUCLEAR MODELS

Conservation of energy – Q-values of nuclear reaction – Energies of nuclear reaction – Reciprocity theorem – Breit wigner Formula – Compound nucleus – Resonance theory – Collective model – Optical model.

UNIT IV: NUCLEAR REACTORS

Characteristics of fission – Mass distribution of fragments – Fission cross section – Energy in fission – Bohr Wheeler theory of nuclear Fission – Fission reactors – Generation of electric power – Fast Breeder reactor – Basic fusion process – Characteristics of Fusion - Laser fusion – Plasma confinement.

UNIT V: ELEMENTARY PARTICLES

Building blocks of nucleus – Nucleons, leptons, mesons, baryons, hyperons, strange hadrons – Classification of fundamental forces and elementary particles – Basic conservation laws – Quantum numbers – Gell– Mann- Nishijima formula – invariance under time reveals(T) charge conjugation(C) and parity(P) – CPT theorem – Parity and conservation in weak interaction – SU(3) symmetry – Meson Octet – Basic Quarks.

BOOKS FOR STUDY:

1. Basic Nuclear Physics – D.N. Srivastava, Experimental and Theoretical Pragati Prakashan, Meerut.
2. Basic Nuclear Physics – D.C. Tayal.
3. Nuclear physics – R.K Sharma.
4. Nuclear physics - Pandya & Yadav.
5. Nuclear physics – C.L.Arora.
6. Nuclear Physics – S.K. Pandey.
7. Nuclear physics – S.N. Ghoshal – S. Chand Publishers
8. Nuclear physics – Roy &Nigam, Wiley Eastern

BOOKS FOR REFERENCE:

1. Introductory Nuclear Physics – K.S. Krane, John – Wiley, New York, (1987).
2. Nuclear Physics an introduction – S.B. Patel, Wiley Eastern, New Delhi, (1991)
3. Concepts of Nuclear Physics – B.L.Cohen,Tata McGraw Hill, New Delhi,(1998).
4. Nuclear Physics - H.S. Hans, New Age international Publishers, New Delhi
5. Elementary Particle Physics an introduction – D.C Cheng & G.K. O'Neill, Addition – Wesely, (1979).
6. Introduction to elementary Particles – David J. Griffiths Publisher Science,New York(1987)
7. The Atomic Nucleus – R.D. Evans, Tata McGraw Hill.

CORE COURSE-XII -PRACTICAL III

ADVANCED ELECTRONICS-I

INS.HRS:6 **CREDIT:4**

ANY 12 EXPERIMENTS

1. Schmitt trigger using IC 555.
2. Half and Full wave precision rectifier using IC 741.
3. Digital to Analog convertor-Binary Weighted network method and R- 2R method.
4. Function of decoders and Encoders.
5. Function of multiplexer and demultiplexer.(1:8,1:4,8:1,4:1)
6. Flip flops-Clocked RS, Clocked D and RS flip flop.
7. Full adder and Full Subtractor (using NAND and NOR only)
8. BCD seven segment display
9. Study of counter using IC 7490 (0-9 &0-99)
10. Verification of Karnaugh maps-Reduction & Logic circuit implementation.
11. Set IC 7490 as a Scalar.
12. Synchronous and Asynchronous Counter – IC 7473.
13. Shift Left Register –IC 7474
14. Shift Right Register –IC 7474
15. Ring counter
16. Digital comparator (using NAND and NOR only)

BOOKS FOR REFERENCE:

1. Practical Physics, R.P.Jain (Mc Graw Hill.,)

2. Digital Electronics Practices using Integrated Circuits – R.R.Jain, Mc Graw Hill Publications New Delhi (1991)

ELECTIVE COURSE-III-COMMUNICATION ELECTRONICS

INS.HRS:6 **CREDIT: 4**

OBJECTIVE

- To expose the students to the latest techniques in data communication.

UNIT I: TRANSMISSION SYSTEMS

Non resonant antenna – loop antenna – Radiation fields – Polarization – Isotropic radiator – Power gain – Effective parameters of an antenna – Dipole arrayed antenna – VHF, UHF and microwave antennas – Thin linear antenna.

UNIT II: MICROWAVES AND COLOUR TELEVISION

Microwave Generation and Applications

Klystron – Magnetron – Microwave propagation through wave guides – Crystal detection – measurement of SWR – Transmitters and receivers.

Colour Television

Introduction – Perception – Three colour theory – Luminescence – TV camera – Image Orthicon – Vidicon – LCD Colour Television.

UNIT III: FIBER STRUCTURE AND PROPERTIES

Fiber structure – Fiber materials – Fiber fabrication – Mechanical properties of fibers – Attenuation – Single distortion in optical waveguides – mode coupling.

UNIT IV: SATELLITE COMMUNICATIONS

Ground station – Antenna angle of elevation and transmission path – Height of Geo-station orbits – Problems – Satellite works – Frequency allocation and polarization – Various blocks of equipment about the satellite – Transmit and receive contour – Block diagram of network control station (NCS).

UNIT V: CELLULAR COMMUNICATIONS

Basic ideas of Cellular network – Operational principles of WDM – the 2*2 fiber Coupler – Fiber grating filters – Erbium Doped fiber Amplifiers – Amplification mechanism – EDFA architecture – Performance of WDM+EDFA system – Link Bandwidth – Optical power requirements for a specific BER – Cross talk – Optical CDMA – Interconnecting telephone traffic between remote stations.

BOOKS FOR STUDY:

1. Optical fiber Communication – G. Keiser, McGraw Hill – New Delhi 1991.
2. Electronic devices and circuits – J. Millman & C. Halkias. McGraw Hill Singapore 1972.
3. Electronic communication system – G. Kennedy, Tata McGraw Hill – New Delhi 1995.

BOOKS FOR REFERENCE:

1. Optical fiber Communication – Principles and practice – J.M. Senior, Prentice Hall, New Delhi 1996.
2. Fiber Optics technology and applications – S.D. Personick, Khanna Publishers, New Delhi 1996.
3. Communication systems and techniques – M. Schwarits, W.R. Bannet (JIEE press, New York).
4. Electronic communication – D. Roddy and Coolen.

ELECTIVE COURSE-III INTEGRATED ELECTRONICS

INS.HRS:6 **CREDIT: 4**

OBJECTIVE

- To understand the basic concepts of semiconductor devices, operational amplifiers, counters and oscillators

UNIT 1: SEMICONDUCTOR DEVICE PHYSICS

Energy distribution of electrons in a semi conductors, The Fermi Dirac function, The density of states, Carrier concentration in an intrinsic semiconductor, Fermi level in a semiconductor having impurities, Band structure of open circuit p-n junction, Basic semiconductor equations, The PN diode volt-ampere equation.

UNIT 2: DIGITAL CIRCUITES SEMICONDUCTOR DEVICE PHYSICS:

Concept of Binary and Hexadecimal number systems, BCD codes, Introduction to RTL, DTL, TTL and CMOS logic families, Boolean algebra, De Morgan's theorem, Karnaugh mapping, Half adder, Full adder and subtractor. Flip Flop circuits, RS, J-K, Master slave, D type and T type FF circuits.

UNIT 3: COUNTERS & SHIFT RESISTORS:

COUNTERS: Asynchronous and Synchronous (up and down) Mod-N-counters, ring counters and counters as frequency dividers. SHIFT RESISTORS: Basic shift resisters, Left right shift resistor, serial in and parallel out, Parallel in and serial-out, Parallel-in and Parallel-out shift resistors, Multiplexers and De-multiplexers, Encoders, Decoders, and Buffers

UNIT 4: APPLICATION OF OPERATIONAL AMPLIFIER:

Review of fundamentals (Inverting and non-inverting amplifier), Analog Amplifier- adder, Subtractor and Multiplication, Voltage to current, current to voltage converter, Integrator, differentiator and comparators, Schmitt, trigger. Amplifiers: Two stage RC coupling (Potential), Inductive Coupling, Transformer Coupling, Class A amplifier, efficiency and push pull operation, AC load line and Q point, power output, Class B push pull amplifier, Cascaded stages, Tuned class C amplifier

UNIT 5: OSCILLATORS

Theory of oscillators, Hartley / Collpitts oscillators, phase shift oscillators, crystal oscillators, Wein Bridge oscillators. UJT Characteristics, relaxation oscillator and as a switch. FET, MOSFET (P-Type and N-Type) characteristics, FET as an amplifier

BOOKS FOR STUDY

1. Herbert Taub, Donald L. Schilling, Digital Integrated Electronics, McGraw-Hill, 1977
2. S.M. Sze, Ed, Modern Semiconductor Device Physics, Wiley, New York
3. S.M. Sze and K.K. Ng, Physics of Semiconductor Devices, 3rd Ed, Wiley, Hoboken.
4. S. Wolf and R.N. Tauber, Silicon Processing, vol. 1, (Lattice Press).

BOOKS FOR REFERENCE:

1. S.Wolf and R. N. Tauber, Silicon Processing for the VLSI Era. (Lattice Press, 2000)
2. Streetman, B.G. Solid State Electronic Devices, Prentice Hall, Fifth Edition, 2000
3. R. D. Doering and Y. Nishi, Handbook of Semiconductor Manufacturing Technology, CRC Press, Boca Raton.

CORE COURSE-XIII: CONDENSED MATTER PHYSICS

INS.HRS:6 **CREDIT: 5**

OBJECTIVE

- To introduce the fundamental theories of Semiconductors, Magnetism, Dielectrics and modern Engineering materials.

UNIT I: CRYSTAL STRUCTURE AND DEFECTS

Crystal lattice – Primitive and unit cell- seven classes of crystals- Bravais lattice – Miller indices – Reciprocal lattice – structure of simple cubic structure(SC) – Body centered cubic(BCC) – Face centered cubic (FCC) and Hexagonal closed packed structure (HCP)- lattice defects – point, line and plane defects- schottky and Frenkel defects – vacancies – colour centres- Edge and screw dislocation – Grain boundaries .

UNIT II: FREE ELECTRON THEORY, ENERGY BANDS

Energy levels and density of orbitals – Fermi-Dirac distribution – Free electron gas in three-dimensions – Heat capacity of the electron gas – Electrical conductivity and Ohm's law – Motion in magnetic fields – Hall effect – Thermal conductivity of metals – Nearly free electron model – Kronig Penny model– Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration.

UNIT III: MAGNETISM

Weiss theory of Paramagnetism- Quantum theory of Paramagnetism -Diamagnetization of a paramagnetic salt – Paramagnetic susceptibility of conduction electrons - Hund's rules - Ferromagnetic order – Curie point and the exchange integral – Temperature dependence of saturation magnetization – Magnons –Antiferromagnetic order –Ferromagnetic domains – Origin of domains and hysteresis-Introduction to Ferrites.

UNIT IV: DIELECTRICS AND FERROELECTRICS

Macroscopic electric field – Local electric field at an atom – Dielectric constant and polarizability –Types of Polarizability-temperature and frequency dependency-Determination of Dielectric constant- Clausius-Mossotti equation-Polarization catastrophe-Ferroelectric Domains.

UNIT V: MODERN ENGINEERING MATERIALS

Polymer, Ceramics, Super strong materials – Electrets – cermets- nuclear engineering materials – Thermo electric materials – metallic glasses – fiber reinforced plastics – metal matrix composities – High temperature materials – Soft and Hard magnetic materials – Basics ideas of Nanomaterials.

BOOKS FOR STUDY:

1. Solid State Physics - S. O. Pillai, New Age International, New Delhi, 1995.
2. Solid State Physics – Singhal.
3. Solid State Physics – Gupta, Kumar and Sharma.

BOOKS FOR REFERENCE:

1. Introduction to Solid State Physics -C. Kittel Wiley Eastern, New Delhi.
2. Solid State Physics - N. W. Ashcrof and N. D. Mermin. Half, Rineharf and Winston Philadelphia.
3. Solid State Physics- J. S. Blakemore, Cambridge University Press.
4. Solid State Physics-A. J. Dekker, McMillion, Madras, 1971.
5. An Introduction to X-ray Crystallography- M. M. Woolfron, Cambridge University Press 1991.

CORE COURSE-XIV-PRACTICAL IV

ADVANCED ELECTRONICS II

INS.HRS:6 **CREDIT: 5**

Microprocessor Practical (Any twelve experiments)

1. 8 Bit addition, subtraction, Multiplication and division using 8085.
2. 16 bit addition, 2's complement and 1's complement subtraction using 8085.
3. Conversion from decimal to Octal and Hexadecimal systems.
4. Conversion from octal, Hexadecimal to decimal systems.
5. Largest and Smallest element of N numbers.
6. Ascending and Descending order of N numbers using 8085.
7. Square, square root and factorial of a given number using 8085.
8. Study of DAC interfacing.
9. Study of ADC interfacing.
10. Traffic control system using microprocessor.
11. Stepper motor control using microprocessor.
12. Square wave, Triangular wave generation using microprocessor.
13. Character words display using microprocessor.
14. Micro Controller 8051- Arithmetic operations.
15. Micro Controller 8051- Logical operations.
16. Micro Controller 8051- DAC interfacing.
17. Micro Controller 8051-Ascending and Descending order of numbers.

Computer Practical by C++ Programming (Any six of the following)

1. Roots of algebraic equations – Newton Raphson method.
2. Least square curve fitting – Straight line.
3. Lagrangian interpolation method.
4. Numerical integration – Trapezoidal rule.
5. Numerical integration – Simpson's rule.
6. Numerical integration – Euler's rule.
7. Solution of differential equations- Runge Kutta 2^{nd} order method.
8. Solution of differential equations – Runge Kutta 4^{th} order method.
9. Calculation of Hartmann's constant.
10. Transpose of matrix.

BOOKS FOR REFERENCE:

1. Microprocessor architecture, programming and Application- R.Goankar, (Wiley Eastern, New Delhi, 1985).
2. Object oriented Programming in C++-Balagurusamy

CORE COURSE – XV PROJECT / DISSERTATION WITH VIVA VOCE

Objectives:

To promote original thinking, insemination of knowledge, modulation and innovation of thought, as an exercise, in order to transport the young minds to the expanding horizon of their chosen area of knowledge and transform them into knowledge generators.

Project / Dissertation 80 Marks

2 Reviews	20+20 = 40marks
Report Valuation	40 Marks

Viva voce **20 Marks**

ELECTIVE COURSE-IV- CRYSTAL GROWTH, THIN FILM AND NANO SCIENCE

INS.HRS:6 **CREDIT: 4**

OBJECTIVE

- To give exposure to students on some of the recent trends in the fields of Crystal growth, Thin film and Nano science.

UNIT I: BASICS OF CRYSTAL GROWTH AND THIN FILM

Nucleation – Different kinds of nucleation – Formation of crystal nucleus – Energy formation of a nucleus – Classical theory of nucleation - Gibbs Thomson equations for vapor and solution- spherical and cylindrical nucleus – Thin films –Thermodynamics of nucleation - Growth kinetics of Thin film – Crystal growth process in thin films - Epitaxial growth of thin films (basic concept only).

UNIT II: CRYSTAL GROWTH TECHNIQUES

Classification of crystal growth methods -Growth from low temperature solutions: Meir‟s solubility diagram – Growth by restricted evaporation of solvent, slow cooling of solution and temperature gradient methods - Basics of melt growth – Czochralski pulling method – Verneuil flame fusion method – Hydrothermal growth method. Growth by chemical vapor transport reaction: Transporting agents, Sealed capsule method, Open flow systems.

UNIT III: THIN FILM PREPARATION TECHNIQUES

Thin films – Introduction to vacuum technology – Deposition techniques - Physical methods – Resistance heating – Electron beam method - Sputtering – Reactive sputtering – RF sputtering - DC planar magnetron sputtering - Pulsed laser deposition – Chemical methods – Chemical bath deposition – Electro deposition – Electro plating and Electroless plating – Deposition mechanisms - Spin and Dip coating –Spray pyrolysis deposition.

UNIT IV: SYNTHESIS OF NANOMATERIALS

Top down Approach, Grinding, Ball Milling, Melt mixing, and Photolithography. Bottom Up Approach, Wet Chemical Synthesis Methods, Micro emulsion Approach, Synthesis of metal & semiconductor nanoparticles by colloidal route, Langmuir-Blodgett method, Sol Gel Methods, Sonochemical Approach, Microwave and Automization, Gas phase Production Methods: Chemical Vapor Depositions.

UNIT V: CHARACTERIZATION TECHNIQUES

Thin Film thickness measurement – Microbalance method – Optical interference method, Four probe method to determine film resistivity. Atomic force microscopy (AFM) - Transmission electron microscopy (TEM) - Electron micro probe analyzer (EPMA) – X-ray photoelectron spectroscopy (XPS) - Elemental analysis – Atomic absorption spectrometer (AAS) - inductively coupled plasma mass spectrometry (ICP-MS).

BOOKS FOR STUDY:

1. P.Santhana Raghavan & P.Ramasamy, Crystal Growth Processes and methods, KRV Publication, Kumbakonam, (2000).
2. A.Goswami, Thin film fundamentals, New age international (P) Ltd., New Delhi, (2006).
3. Poole & Owners, Introduction to Nanotechnology, Wiley India Pvt. Ltd, (2007).
4. Chattopadhyay & Banerjee, Introduction to Nano science and Nanotechnology, PHI Learning Pvt. Ltd., (2009).
5. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, Instrumental Methods of Analysis, 7th edition, CBS publishers and Distributors, New Delhi, (1986).

BOOKS FOR REFERENCE

1. LI Maissel and R Clang, Hand book of Thin films Technology, McGraw Hill, New York, (1970).
2. K L Chopra, Thin film Phenomena, McGraw Hill, New York, (1990).
3. M. Ohring, Materials science of Thin films, 2nd Edition, Academic press, Elsevier, New Delhi (2002).
4. J.W.Mullin, - Crystallization, Elsevier Butterworth-Heinemann, London, (2004).
5. A.W.Vere - Crystal Growth: Principles and Progress- Plenum Press, New York, (1987).

ELECTIVE COURSE-IV- THIN FILM SCIENCE AND TECHNOLOGY

INS.HRS:6 **CREDIT: 4**

OBJECTIVES:

- To familiarize with preparation and properties of Thin films
- To understand the preparation and characterization of Thin films.
- To apply the knowledge of Thin film technology into applications.

UNIT I: REPARATION OF THIN FILMS

Kinetic aspects of gases in a vacuum chamber – classifications of vacuum ranges – production of vacuum - pressure measurement in vacuum systems – thin film (epitaxy) – definition – types of epitaxy. Different Growth Techniques: Liquid phase epitaxy – vapor phase epitaxy – molecular beam epitaxy – metal organic vapor phase epitaxy – sputtering (RF & DC) – pulsed laser deposition. Thickness Measurement: Microbalance technique – photometry- ellipsometry – interferometry.

UNIT II: KINETICS OF THIN FILMS

Nucleation Kinetics: types of nucleation – kinetic theory of nucleation – energy formation of a nucleus – critical nucleation parameters; spherical and non spherical (cap, disc and cubic shaped) Growth Kinetics: Kinetics of binary (GaAs, InP, etc.), ternary ($Al_{1-x}Ga_xAs$, $Ga_{1-x}In_xP$, $InAs_{1-x}Px$, etc.) and quaternary ($Ga_{1-x}In_xAs_{1-y}P_y$, etc.) semiconductors – derivation of growth rate and composition expressions.

UNIT III: CHARACTERIZATION

X-ray diffraction – photoluminescence – UV-Vis-IR spectrophotometer – Atomic Force Microscope – Scanning Electron Microscope – Hall effect – Vibrational Sample Magnetometer – Secondary Ion Mass Spectrometry – X-ray Photoemission Spectroscopy.

UNIT IV: PROPERTIES OF THIN FILMS

Dielectric properties – experimental technique for the determination of dielectric properties – optical properties – experimental technique for the determination of optical constants – mechanical properties – experimental technique for the determination of mechanical properties of thin films – magnetic and superconducting properties.

UNIT V: APPLICATIONS

Optoelectronic devices: LED, LASER and Solar cell – Micro Electromechanical Systems (MEMS) – Fabrication of thin film capacitor – application of ferromagnetic thin films; data storage, Giant Magnetoresistance (GMR) – sensors – fabrication and characterization of thin film transistor and FET – quantum dot.

BOOKS FOR STUDY:

1. Goswami. A, Thin Film Fundamentals, New Age International (P) Limited, New Delhi, 1996.
2. AichaEishabini-Riad, Fred D. Barlow and ISHN, Thin film Technology Handbook, McGraw-Hill Professional Publishers, 1997.

BOOKS FOR REFERENCE:

1. Krishna Seshan, Handbook of Thin Film Deposition, William Andrew Publishers, 2012.
2. Donald Smith, Thin-Film Deposition: Principles and Practice, McGraw-Hill Professional Publishers, 1995.

LIST OF ELECTIVE PAPERS

I semester

1. Advanced Electronics.
2. Advanced Microprocessor and its applications.

II semester

1. Experimental techniques and instrumentation
2. Data Acquisition and control systems

III semester

1. Communication Electronics
2. Integrated Electronics

IV Semester

1. Crystal growth, Thin Film and Nano Science
2. Thin Film Science and Technology

QUESTION PAPER PATTERN

Maximum Marks 75

Exam Duration **:** 3 hours

Part A **:** 10 × 2 = 20 Answer **ALL** Questions (Two Questions from each unit)

Part B **:** 5× 5 = 25 Answer **ALL** Questions (Either or Type – Two Question From (Each Unit))

Part C **:** 3 × 10 = 30 Answer Any **Three** (One Question from each Unit)