

**MANONMANIAM SUNDARANAR UNIVERSITY  
TIRUNELVELI**

**UG COURSES – AFFILIATED COLLEGES  
B.Sc. Physics**

**(Choice Based Credit System)**

**(With effect from the academic year 2017 -2018)**

<b>S e m e s t e r - I I I</b>	<b>Part I</b>	Tamil/Other Languages	6	4	3	25	75	100	30	40	
	<b>Part II</b>	English	6	4	3	25	75	100	30	40	
	<b>Part III</b>	<b><u>Core subjects</u></b> 5.Electricity		4	4	3	25	75	100	30	40
		Practical-III		2	1	3	50	50	100	20	40
		<b><u>Allied Subject-II</u></b> (for allied subjects with theory and practicals) 1.Theory- Paper-I		4	3	3	25	75	100	30	40
		2.Practicals-1		2	1	3	50	50	100	20	40
		<b><u>Allied Subject-II</u></b> (for allied subjects with theory alone) 1.Theory- Paper-I		6	3	3	25	75	100	30	40
		<b><u>Skill based subject</u></b> Any one a. Maintenance of Electrical appliances b. Astrophysics		4	4	3	25	75	100	30	40
		<b>Non-Major Elective</b> Paper-I		2	2	3	25	75	100	30	40
	<b>Part IV</b>	Common-Yoga *	2	2							
		<b>Total</b>	<b>30</b>	<b>23</b>							

<b>Semester IV</b>	<b>Part I</b>	Tamil/Other Languages	6	4	3	25	75	100	30	40	
	<b>Part I</b>	English	6	4	3	25	75	100	30	40	
	<b>Part III</b>	<b><u>Core subjects</u></b>		4	4	3	25	75	100	30	40
		6. Electromagnetism Practical-IV		2	1	3	50	50	100	20	40
		<b><u>Allied Subject-II</u></b> (for allied subjects with theory and practicals)		4	3	3	25	75	100	30	40
		1.Theory- Paper-II									
		2.Practicals-II		2	1	3	50	50	100	20	40
		<b><u>Allied Subject-II</u></b> (for allied subjects with theory alone)		6	3	3	25	75	100	30	40
		1.Theory- Paper-II									
	<b>Part IV</b>	<b><u>Skill based subject</u></b> <b>Any one</b> a. Maintanance of Electronic appliances b. Physics of Human Anatomy		4	4	3	25	75	100	30	40
		<b>Non-Major Elective</b> - Paper-II		2	2	3	25	75	100	30	40
	<b>Part V</b>	Common-Computer for Digital Era *		2	2						
	<b>Part V</b>	<b>Extension activity</b>		-	1	-	-	-	-	-	-
		<b>Total</b>		<b>30</b>	<b>24</b>						

<b>Semester -V</b>	<b>Part III</b>	<b>Core subjects</b>								
		7.Basic Electronics	4	4	3	25	75	100	30	40
		8.Programming in C++	4	4	3	25	75	100	30	40
		9.Atomic Physics	4	4	3	25	75	100	30	40
		<b>10.Major Elective I</b> (any one) a. Mathematical Physics b. Spectroscopy	4	4	3	25	75	100	30	40
		<b>11.Major ElectiveII</b> (any one) a. Communication Electronics b. Numerical Methods	4	4	3	25	75	100	30	40
		Practical-V-Non Electronics	4	2	3	50	50	100	20	40
	Practical-VI-Electronics	4	2	3	50	50	100	20	40	
	<b>Part IV</b>	Skill based subject(Common) -Personality development/Effective Communication/Youth Leadership	2	2	3	25	75	100	30	40
		<b>Total</b>	<b>30</b>	<b>26</b>						

<b>Semester VI</b>	<b>Part III</b>	<b>Core subjects</b>								
		12. Digital Electronics	5	4	3	25	75	100	30	40
		13. Quantum Mechanics	5	4	3	25	75	100	30	40
		14. Nuclear Physics	4	4	3	25	75	100	30	40
		15 Solid state Physics	4	4	3	25	75	100	30	40
		16. Major Elective (any one) a. Medical Physics b. Energy Physics	4	4	3	25	75	100	30	40
		Practical-VII-	4	2	3	50	50	100	20	40
		Practical-VIII- Computer Programming with C++	4	2	3	50	50	100	20	40
		<b>Total</b>	<b>30</b>	<b>24</b>						

**Total credits-141** (including extension activity)

- To be conducted outside class hour
- Credits not included

**SEMESTER- III  
PAPER -V**

L	T	P	C
4	0	0	4

**ELECTRICITY**

**Preamble:** Objective of the paper is to provide a basic knowledge about electricity and various methods of analyzing electric circuits with d.c. and a.c. sources. This paper does not require any special prerequisite except the basic ideas on electricity at the school level and learners are expected to gain knowledge to design and characterize electric circuits.

**UNIT-1: ELECTRIC FIELD AND POTENTIAL**

Introduction-electric charge- coulomb's law-electric field-lines of force-electric flux-Gauss's law-applications-coulomb's law from Gauss's law- electric field at a point due to point charge-line charge- spherically symmetric charge distribution-sheet of charge. -electric potential- relation connecting electric field and potential- equipotential lines and surfaces -potential at a point due to point charge-collection of charges-dipole and charged spherical shell-electric potential energy (12L)

**UNIT-II: THERMO ELECTRICITY**

Seebeck effect- laws of thermo e.m.f.— measurement of thermo e.m.f using potentiometer-Peltier effect-demonstration—Thomson effect- demonstration - thermodynamics of thermo couple –thermo electric power diagram –uses-applications-thermopile-Boy's radio micrometre –thermo-milli ammeter (11L)

**UNIT-III: CHEMICAL EFFECT OF ELECTRIC CURRENT**

Introduction -Faradays laws of electrolysis- electrical conductivity of an electrolyte-specific conductivity- Kohlrausch's bridge method of determining the specific conductivity of an electrolyte -Arrhenius theory of electrolytic dissociation- --mobility of ions- Secondary cells- Gibbs –Helmholtz equation for a reversible cell . (10L)

## UNIT-IV: STEADY CURRENT AND TRANSIENT CURRENT

Current and current density-ohm's law in vector form-conversion of galvanometer into voltmeter and ammeter-kirchoff's law-application to wheat stone's network

Growth and decay of current in a circuit containing L and R with d.c.voltages - growth and decay of charge in a capacitance ,resistance circuit-determination of high resistance by leakage –growth and decay of charge in LCR circuit-conditions for the discharge to be oscillatory –frequency of oscillation. (15L)

## UNIT-V: ALTERNATING CURRENT

Alternating Current- j operator method –use of j operator in the study of AC circuits-Resistance in an AC circuit-Inductance in an AC circuit- Capacitance in an AC circuit-AC through an inductance and resistance in series- capacitance and resistance in series – LCR series resonance circuit -sharpness of resonance-parallel resonance circuit -power in an AC circuit-power factor. (12L)

### **Books for study**

1. Electricity and Magnetism -R. Murugesan (S.Chand &Co.)

### **Books for Reference**

1. Electricity and Magnetism -D.N.Vasudeva (Twelfth revised edition)

2. Electricity and Magnetism - K.K.Tiwari (S.Chand &Co.)

3. Electricity and Magnetism -E.M.Pourcel,Berkley Physics Course, Vol.2 (Mc Graw-Hill)

4. Electricity and Magnetism - Tayal (Himalalaya Publishing Co.)

5. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker. Wiley NY 2001.

## SEMESTER- IV

### PAPER V

L	T	P	C
4	0	0	4

### ELECTROMAGNETISM

**Preamble:** This course facilitates an understanding of magnetic effects of electric currents and the basics of electromagnetic waves. The paper does not need any special pre requisite except the basic ideas on electricity and magnetism at the school level and the learners are expected to know the device applications of electromagnetic induction.

#### UNIT-1: ELECTROMAGNETIC INDUCTION

Faraday's laws of electromagnetic induction-self induction –self inductance of a long solenoid –toroidal solenoid-determination of  $L$  by Anderson's and Rayleigh's methods-Owen's bridge-mutual induction-experimental determination of mutual inductance between a pair of coils using BG-co efficient of coupling-energy stored in a coil-eddy currents-uses (13L)

#### UNIT-II: MAGNETIC EFFECT OF ELECTRIC CURRENT

Magnetic flux and magnetic induction-relation between them- Biot Savart law- magnetic induction at a point on the axis of a circular coil carrying current-amperes circuital law-magnetic field inside a long solenoid -toroid- Lorentz force on a moving charge- direction of force-torque on a current loop in a uniform magnetic field -Moving coil Ballistic galvanometer-theory -experiment to find charge sensitivity and absolute capacity of a capacitor-De sauty bridge. (14L)

### UNIT-1III: MAGNETIC FIELDS AND MAXWELL'S EQUATION

The three magnetic vectors  $M$ ,  $B$ , and  $H$  –relation between them- permeability and susceptibility- relation between them -B-H curve -Hysteresis- Energy loss-Displacement current-Maxwell's equations-Boundary conditions- Poynting vector-Electromagnetic waves in free space-Hertz experiment for production and detection of EM waves. (12L)

### UNIT-1V: ELECROMAGNETIC WAVES

Wave equations for Electric field and Magnetic field-monochromatic plane waves-EM waves in a matter-Reflection and Transmission at normal incidence and oblique incidence-Polarization by reflection. (10L)

### UNIT-V: APPLICATIONS OF ELECTROMAGNETISM

Earth inductor-uses of Earth inductor-measurement of horizontal component of the Earth's magnetic field-measurement of vertical component of Earth's Magnetic field-calibration of BG-measurement of intense magnetic field using search coil and BG-induction coil and uses. (11L)

#### **Books for study**

1.Electricity and Magnetism -R. Murugesan (S.Chand &Co.)

#### **Books for Reference**

1. Electricity and Magnetism -D.N.Vasudeva (Twelfth revised edition)

2. Electricity and Magnetism - K.K.Tiwari (S.Chand &Co.)

3. Electricity and Magnetism -E.M.Pourcel,Berkley Physics Course, Vol.2 (Mc Graw-Hill)

4. Electricity and Magnetism - Tayal (Himalalaya Publishing Co.)

5. Fundamentals of Physics, 6th Edition, by D Halliday, R Resnick and J Walker. Wiley NY 2001.

# SEMESTER-V

## PAPER VII

L	T	P	C
4	0	0	4

### BASIC ELECTRONICS

**Preamble:** This course facilitates an understanding of circuit analysis semiconductor diode and transistor circuits and the basics of operational amplifier. The paper does not need any special pre-requisite except the basic ideas on Electricity and Electronics at the school level and the learners are expected to gain knowledge to analyse and design electronic circuits

#### UNIT-I: LINEAR CIRCUIT ANALYSIS

Constant voltage source, constant current source, conversion of voltage source into current source - Maximum power transfer theorem - Thevenin's theorem - Norton's theorem - hybrid parameters - determination of h parameter - equivalent circuit - the h parameters of a transistor. (12L)

#### UNIT-II: SEMICONDUCTOR DIODES AND DEVICES

PN Junction - V – I characteristics - Crystal diode as a rectifier - Zener diode - V – I characteristics - Tunnel diode - Half wave rectifier - Centre tap full wave rectifier - Full wave bridge rectifier - Comparison of Rectifiers - Filter Circuits - Types (capacitor filter, choke input filter,  $\Pi$  filter) - Zener diode as voltage stabilizer. (11L)

#### UNIT-III: TRANSISTOR AMPLIFIERS

Transistor action - Transistor connections - common emitter - common base - common collector - analysis of amplifiers using h- parameters - RC coupled amplifier - transformer coupled amplifier - power amplifier - classification of power amplifiers (Class A, Class B and Class C) - Push pull amplifier - FET characteristics - JFET characteristics. (14L)

#### **UNIT-IV: OSCILLATORS AND WAVE SHAPING CIRCUITS**

Feedback principle and Barkhausen criterion - Hartley , Colpitt's, and Phase shift oscillators using transistors – Astable - Monostable and Bistable multi vibrators using transistors - Schmitt trigger - clipping and clamping circuits - Differentiating circuit - Integrating circuit. (10L)

#### **UNIT-V: OPERATIONAL AMPLIFIER**

Op-Amp - pin diagram- characteristics of ideal Op - Amp - DC and A.C analysis - bandwidth - slew rate - frequency response - Op- Amp with negative feedback - applications - Inverting amplifier - Non inverting amplifier - Voltage follower- Adder - Subtractor - Integrator – Differentiator- Low pass, High pass and Band pass filters -Wien bridge oscillator. (13L)

#### **Books for study**

1. Principles of Electronics - V.K.Mehta & Rohit Mehta-S.Chand &Co.

#### **Books for reference**

1. Electronic fundamentals and applications - John D. Ryder –Prentice Hall

2. Electronic principles - Malvino

3. Electronic devices and circuits - David Bell- Prentice Hall

4. Basic Electronics - B.Basavaraj, H.N.Shivashankar-2<sup>nd</sup> edition-University press

5. Physics of semiconductor devices - Dilip K.Roy - University press.

**PAPER VIII**  
**COMPUTER PROGRAMMING IN C<sup>++</sup>**

L	T	P	C
4	0	0	4

**Preamble:** Objective of the course is to provide knowledge about the basics of Computer programming in C<sup>++</sup> and to solve problems by writing programs. The paper does not need any special prerequisite and the learners are expected to come out with the ability to apply the computer language C<sup>++</sup> to solve problems .

**UNIT-I: WHAT IS C<sup>++</sup>**

Introduction - tokens - keywords - identifiers and constants - declaration of variables - basic data types - user defined data types-derived data types - symbolic constants - operators in C<sup>++</sup> -expressions and their type-hierarchy of arithmetic operators- scope resolution operator – declaring, initializing and modifying variables-special assignment operators - all control structures-structure of a simple C ++ program (11L)

**UNIT-II: ARRAYS AND FUNCTIONS IN C<sup>++</sup>**

Introduction - one dimensional and two dimensional arrays-initialization of arrays-array of strings

Functions-introduction-function with no argument and no return values-function with no argument but return value - function with argument and no return values- function with argument and return values- call by reference-return by reference- function prototyping - inline functions - local, -global and static variables- -function overloading - virtual functions-main function-math library functions. (13L)

### UNIT-III: CLASSES AND OBJECTS

Introduction - specifying a class - defining member functions-C<sup>++</sup> program with class - nesting of member functions - private member functions - objects as function arguments - arrays within a class-array of objects-static class members-friend functions-constructors - parameterized constructors-multiple constructors - constructors with default arguments - copy constructor. (15L)

### UNIT-IV: OPERATOR OVERLOADING, INHERITANCE AND POINTERS

Introduction -defining operator overloading - overloading unary operators - binary operators.

Inheritance - single inheritance - multiple inheritance - multilevel inheritance - hybrid inheritance - hierarchial inheritance-virtual base class-abstract class

Pointers- definition-declaration- arithmetic operations. (12L)

### UNIT-V: MANAGING CONSOLE I/O OPERATIONS

Introduction - C<sup>++</sup> stream - C<sup>++</sup> stream classes - unformatted I/O Operations - formatted console I/O operations - working with files - classes for file steam operations - opening and closing a file - file pointers and their manipulations. (9L)

#### **Books for study**

1. Object oriented Programming with C<sup>++</sup> - E.Balagurusamy, Tata Mc Graw-Hill publishing company Ltd. New Delhi

#### **Books for reference**

1. Programming with C<sup>++</sup> - D.Ravichandran, Tata Mc Graw-Hill publishing company Ltd. New Delhi .
2. Object oriented Programming in C<sup>++</sup>-4<sup>th</sup> Edn.Robert Lafore-Macmilan publishing company Ltd.
3. Fundamentals of Programming with C<sup>++</sup> -Richardl.Halterman

## **PAPER - IX (4X15=60 hours)**

### **ATOMIC PHYSICS**

L	T	P	C
4	0	0	4

**Preamble:** The course provides an introductory account about the atomic structure and the impact of X-rays. This paper does not need any special prerequisite except the basic understanding of materials at the school level and the learners are expected to know the various atom models and the importance of X-rays in exploring the atomic structure

#### **Unit I: BAND THEORY OF SOLIDS**

The free electron theory of metals – expressions for electrical conductivity – thermal conductivity – Wiedman-Franz's law-Hall effect-magnetoresistance-determination of electronic charge – Millikan's oil drop method – electron microscope – Band theory of solids – classification of solids on the basis of band theory. (10L)

#### **Unit II: POSITIVE RAYS:**

Discovery-properties- analysis – Thomson's parabola method – Aston's mass spectrograph – Bainbridge's mass spectrograph – Dempster's mass spectrograph – Dunnington's method of determining  $e/m$ . (11L)

#### **Unit III : ATOMIC STRUCTURE-1**

Early atomic spectra-Thomson model-Alpha particle scattering-Rutherford 's nuclear model-drawbacks-Bohr atom model –Bohr's interpretation of the Hydrogen spectrum-correction for nuclear motion-evidences in favour of Bohr's theory-Ritz combination principle-correspondence principle-Sommerfield's relativistic atom model-drawbacks- the vector atom model – Quantum numbers associated with the vector atom model — the Pauli's exclusion principle – periodic classification of elements (14L)

## Unit IV: ATOMIC STRUCTURE-II

Coupling schemes-L-S Coupling-j-j Coupling-Hund rules- magnetic dipole moment due to orbital motion of the electron-due to spin of the electron -Stern and Gerlach experiment-spin-orbit coupling-optical spectra-spectral terms-spectral notation-selection rules-intensity rules-interval rule-fine structure of sodium D line-hyperfine structure-Normal Zeeman effect-theory and experiment- quantum mechanical explanation -Larmor's theorem- Anomalous Zeeman effect-Paschen – Bach effect-Stark effect. (13L)

## Unit V: X-Rays:

Production of X-rays – properties-absorption of X-rays – X-ray absorption edges- Bragg's law – Bragg's X-ray spectrometer –the powder crystal method – Laue's method – Rotating crystal method –X-ray spectra- continuous spectra-characteristic spectra-Moseley's law -importance–width of spectral lines-Doppler broadening-collision broadening-X-ray Detectors-scintillation detector-semiconductor detectors (12L)

## **Books for study**

1.Modern Physics - R. Murugesan (S.Chand &Co.)

## **Books for Reference**

1.Modern Physics - R.Murugesan and Kiruthiga Sivaprasath, S. Chand & Co Ltd, New Delhi.

2.Modern Physics - B.S.Agarwal, Kedarnath Ramnath, Meerut, Delhi.

3.Atomic and Nuclear Physics - N.Subrahmanyam Brijal, S. Chand & Co Ltd, New Delhi

4.Modern Physics - B.V.N Rao, Wiley Eastern Ltd, New Delhi

5. Modern Physics-G.Aruldas and P.Rajagopal-PHI L

## PAPER X .MAJOR ELECTIVE

(Any one)

### a.MATHEMATICAL PHYSICS

L	T	P	C
4	0	0	4

**Preamble:** This course enable the students to understand the various mathematical methods used in Physics. The paper need a basic knowledge in mathematics and the learners are expected to come out with the ability to apply mathematics to solve problems in physics

#### UNIT I: VECTORS

Vectors and scalars-Vector algebra-The scalar product-The vector (cross or outer) product-The triple scalar product-The triple vector product-The linear vector space  $V_n$ - Vector differentiation -Space curves - Motion in a plane - A vector treatment of classical orbit theory - Vector differential of a scalar field and the gradient - Conservative vector field - The vector differential operator - Vector differentiation of a vector field - The divergence of a vector - The operator  $\nabla^2$ , the Laplacian - The curl of a vector. (11L)

#### UNIT II: DIFFERENTIAL EQUATION

First-order differential equations - Separable variables -Exact equations- Integrating factors -Bernoulli's equation- Second-order equations with constant coefficients - Nature of the solution of linear equations - General solutions of the second-order equations - Finding the complementary function - Finding the particular integral - Rules for D operators - The Euler linear equation - Solutions in power series. (12L)

### UNIT III: MATRIX

Definition of a matrix - Four basic algebra operations for matrices - Equality of matrices - Addition of matrices - Multiplication of a matrix by a number - Matrix multiplication - The commutator - Powers of a matrix - Functions of matrices - transpose of a matrix - Symmetric and skew-symmetric matrices - The matrix representation of a vector product - The inverse of a matrix - A method for finding  $A^{-1}$  - Systems of linear equations and the inverse of a matrix - Complex conjugate of a matrix - Hermitian conjugation - Hermitian/anti-Hermitian matrix - Orthogonal matrix (real) - Unitary matrix - Rotation matrices - Trace of a matrix.

(14L)

### UNIT IV: LAPLACE TRANSFORMATION

Definition of the Laplace transform - Existence of Laplace transforms - Laplace transforms of some elementary functions - Shifting (or translation) theorems - The first shifting theorem - The second shifting theorem - The unit step function - Laplace transform of a periodic function - Laplace transforms of derivatives - Laplace transforms of functions defined by integrals - A note on integral transformations.

(13L)

### UNIT V: PARTIAL DIFFERENTIAL EQUATIONS

Linear second-order partial differential equations - Solutions of Laplace's equation- separation of variables - Solutions of the wave equation: separation of variables - Solution of Poisson's equation. Green's functions - Laplace transform solutions of boundary-value problems

(10L)

#### **Books for study**

**1. Mathematical Methods for Physicists: A concise introduction, - TAI L. CHOW -CAMBRIDGE UNIVERSITY PRESS.**

#### **Books for Reference**

- 1. Mathematical physics-** Piyoosh kumar tyagi , RBSA Publishers
- 2. Mathematical physics-** Satya prakash-Sultan Chand & Co:
- 3. Mechanics and mathematical physics -R.Murugesan-** Sultan Chand & Co:4.
- Mathematical physics-Gupta-** Sultan Chand & Co:

## b.SPECTROSCOPY

L	T	P	C
4	0	0	4

**Preamble:** This course facilitates an understanding of atomic and molecular spectra and the instrumentations. The paper needs a basic knowledge about atomic structure and the learners are expected to gain knowledge to identify materials with the help of various spectra

### UNIT I: MICROWAVE SPECTROSCOPY

Rotation of molecules – Classification of molecules – Rotation spectra of diatomic molecules – Intensities of spectral lines – Effect of isotopic substitution – Non-rigid rotator – Spectrum of a non-rigid rotator – Polyatomic molecules – Symmetric top molecules – Asymmetric top molecules – Techniques and Instrumentation – Chemical analysis by microwave spectroscopy. (14L)

### UNIT II: INFRARED SPECTROSCOPY

I.R. spectroscopy – Vibrating diatomic molecules – Simple Harmonic Oscillator - Anharmonic oscillator – Diatomic vibrating rotator – IR spectrum of carbon monoxide - Interaction of rotations and vibrations – Vibration of polyatomic molecules – Analysis by IR techniques. (12L)

### UNIT III : RAMAN SPECTROSCOPY

Raman effect-discovery – Quantum theory of Raman effect – Classical theory of Raman Effect – Pure rotational Raman spectra- Linear molecules – Raman spectrum of symmetric top molecules - Vibrational Raman spectra – Rule of mutual exclusion – Overtone and combinational vibrations - Rotational fine structure – Polarization of light and the Raman Effect - Structure determination from IR and Raman spectroscopy. (13L)

## **UNIT IV: ELECTRONIC SPECTROSCOPY**

Born - Oppenheimer approximation – vibrational coarse structure- Progressions – Frank-Condon principle – Dissociation energy and Dissociation products – Rotational fine structure -Electronic vibration transitions - Fortrat diagram - Predissociation – Diatomic molecules. (11L)

## **UNIT V : INSTRUMENTATION**

Instrumentation and techniques in Infrared spectroscopy – Sources – Monochromators – Sample cells – Detectors – Single beam Infra red spectrometer – Double beam Infra red spectrometer (10L)

### **Book For Study**

1.Fundamentals Of Molecular Spectroscopy - Colin N Banwell Elaine- M Mccash  
Fifth Edition

### **Book For Reference**

- 1.Molecular structure and spectroscopy - G. Aruldas, PHI Learning Pvt. Ltd, India.
- 2.Hand book of Analytical Instruments -R.S. Khandpur, Tata MC Grow Hill Ltd.
- 3.Spectroscopy -G.R. Chatwal and S.K. Anand, Himalaya publishing House, New Delhi.

## **PAPER XI .MAJOR ELECTIVE-II**

**(Any one)**

### **a. COMMUNICATION ELECTRONICS**

L	T	P	C
4	0	0	4

**Preamble:** This course enable the students to understand various modulation and demodulation techniques used for communication. The paper needs a basic knowledge in electronics and mathematics and the learners are expected to come out with the ability to choose proper modulation techniques .

#### **UNIT I: AMPLITUDE MODULATION AND TRANSMISSION**

Introduction – amplitude Modulation – AM envelop – AM frequency spectrum and bandwidth – Phasor representation of AM with carrier – coefficient of modulation or percentage modulation or modulation index – degrees of modulation – AM power distribution – AM Current relation and efficiency - modulation by complex information signal - doubleside band suppressed carrier AM - single side band suppressed carrier AM – Vestigal side band amplitude modulation – AM modulator circuits – emitter modulations or low power AM – collector modulator or medium and high power AM modulator - AM transmitters – Broadcast AM transmitters – Low level of AM transmitter – High level AM transmitter. (15L)

#### **UNIT II: AMPLITUDE MODULATION -RECEPTION**

Comparison of AM system – Quadrature amplitude modulation – principles of AM detection – AM receivers – receiver parameters – Tuned radio frequency (TRF) receiver or straight receiver – principles of superhetrodyne –double frequency conversion AM receiver. (11L)

### **UNIT III: ANGLE MODULATION – TRANSMISSION**

Introduction – Frequency modulation – Phase modulation – Phase deviation and modulation index – Multitone modulation – Transmission band width of FM – conversion of PM to FM or frequency modulator – conversion of FM to PM / phase modulators – commercial broadcast FM – phasor representation of an FM and PM – average power of an AM/FM wave – generation of FM – direct method of FM generation – reactance tube modulator – indirect method of FM wave generation – FM transmitters – indirect method – Comparison of AM and FM. (13L)

### **UNIT IV: FM RECEPTION**

FM detectors – Balanced slope detector – Foster seely discriminator – ratio detector – FM super heterodyne receiver – FM noise suppression – threshold extension by FMFB technique. (11L)

### **UNIT – V: DIGITAL MODULATION TECHNIQUES**

Introduction – BFSK – Binary phase shift keying – Quadrature PSK – Differential PSK – Performance comparison of digital modulation schemes - M ary FSK – correlative coding – Duobinary encoding. (10L)

#### **Book For Study**

1.Principles Of Communication Engineering-Dr. K.S. Srinivasan, Second Edition : 2010.

#### **Book For Reference**

1.Electronic communication systems – George Kennedy & Bernard Davis, Tata Mcgraw Hills, 4<sup>th</sup> edition, 2008

2.Electronic communication Systems – Blake, Joseph J. Adams ki, Sun Yifeng, Delamer publication, 2<sup>nd</sup> edition, 2012 (Rupa Publication, India).

3.Fundamentals of Electrical engineering – Wayne tomasi

## **b.NUMERICAL METHODS**

L	T	P	C
4	0	0	4

**Preamble:** This course facilitates an understanding of various approximation methods. The paper needs knowledge in mathematics and the learners are expected to come out with the ability to use approximation methods to find solution to problems which do not have exact solutions.

### **UNIT-I: ERRORS AND ROOT OF EQUATIONS**

What is Numerical analysis-numbers and their accuracy-errors-measurement of errors-round off error-truncation error-absolute error-relative error-percentage error-inherent error-accumulated error-general error formulae -convergence

Roots of equations-Iteration method-Maclaurin's series method-Newton-Raphson method-Von-Moises formula-Bisection method (12L)

### **UNIT-II: MATRIX AND LINEAR EQUATIONS**

Introduction- pivotal condensation method- system of linear equations-Gauss Elimination method-Gauss Seidal Iteration method-Gauss Jordan elimination method- Matrix Inversion method (10L)

### **UNIT-III: INTERPOLATION AND APPROXIMATION**

Linear Interpolation –Quadratic Interpolation - Lagrange's Interpolation – Richardson's Extrapolation –Aitken's iterated Interpolation (13L)

## **UNIT-IV:NUMERICAL DIFFERENTIATION AND INTEGRATION**

Numerical differentiation-approximation of derivatives using interpolation polynomials-Taylor series method

Numerical Integration - trapezoidal rule-simpson's 1/3 and 3/8 rules (14L)

## **UNIT –V: DIFFERENTIAL EQUATIONS**

Introduction-Euler's method (Adams Bashforth first order method)- backward Euler method- Taylor's series method- Runge-kutta method - predictor corrector methods(11L)

### **Books for study and Reference:**

1. Introductory methods of numerical analysis – S.S. Sastry, Prentice Hall of India, New Delhi (2000)
2. Numerical methods – A. Singaravelu, Meenakshi Agency, Chennai (2001).
3. Numerical method in Science and Engineering – M.K. Venkataraman, PHI – New Delhi (1997).
4. Mechanics and Mathematical methods, R. Murugesan, S. Chand & Co, New Delhi (1999).

# SEMESTER-VI

## PAPER XII

### DIGITAL ELECTRONICS

L	T	P	C
3	2	0	4

**Preamble:** This course provides an understanding of Boolean algebra and digital circuits. The paper need a basic knowledge in solid state electronics and the learners are expected to gain knowledge to design electronic circuits

#### **UNIT I: NUMBER SYSTEMS, BINARY ARITHMETIC AND CODES**

Decimal, binary, octal and hexadecimal number systems and their inter-conversions -binary arithmetic-binary addition-subtraction-1's and 2's complements- BCD codes, ASCII code, Excess-3code, Gray code. (7L+5T)

#### **UNIT II: BOOLEAN ALGEBRA AND LOGIC GATES**

Boolean algebra-De Morgan's theorem –Positive logic and negative logic systems-Basic logic gates, OR, AND, NOT (symbol, Boolean equation, truth table, circuit diagram and working)-NAND, NOR, EX-OR (symbol, Boolean equation, truth table only)-NAND and NOR as universal building blocks. (8L+6T)

#### **UNIT III: ARITHMETIC CIRCUITS, FLIP-FLOPS AND MULTIVIBRATORS**

Half and full adders- Half and full subtractors-RS Flip-flop-clocked RS Flip-flop, JK Flip-flop, JK master slave Flip-flop, D Flip-flop, T Flip-flop

555 timer-Astable multivibrator, monostable multivibrator-Frequency divider(11L+7T)

## **UNIT IV: KARNAUGH MAP AND COMBINATIONAL CIRCUIT APPLICATIONS**

Karnaugh map - 2,3 and 4 variables –simplification-SOP and POS form of Boolean functions - Don't care conditions-Multiplexer, Demultiplexer, Encoder, Decoder, parity generator and checker. (10L+6T)

## **UNIT V : SHIFT REGISTERS AND COUNTERS**

Types of registers- Serial in –Serial out-Serial in-Parallel out- Parallel in- Serial out- Parallel in- Parallel out-Asynchronous and Synchronous counters- Ring counter- Binary counter- Up- Down counter- Mod-5 counter- Mod-10 counter (decade counter)-A/D and D/A converters(9L+6T)

### **Books for study**

1.Digital principles and applications - Albert Paul Malvino & Donald P.Leach

### **Books for reference**

1.Digital logic and computer design-Morris Mano-Prentice Hall of India,Pvt.Ltd.

2.Gothmann W.H.,Digital Electronics- Prentice Hall of India,Pvt.Ltd.

3.Metha V.K.Mehtha.R.Principles of electronics,S.Chand &Co.

4.Fundamentals of Digital Electronics and Microprocessors - Anokh singh, A.K.Chhabra, S.Chand &Co.

**PAPER XIII**  
**QUANTUM MECHANICS**

L	T	P	C
3	2	0	4

**Preamble:** Objective of this course is to introduce wave- particle duality of matter and the formation of Quantum mechanics. The paper need a basic knowledge in Mathematics and Modern physics and the learners are expected to know the application of basic equations in quantum mechanics to various states

**UNIT I: DEVELOPMENT OF QUANTUM MECHANICS**

Inadequacy of classical mechanics-Black body radiation – Theoretical laws of Black body radiation (Wein’s displacement law –Wein’s Radiation formula – Rayleigh Jeans law) – Planck’s Quantum hypothesis – photoelectric effect-Einstein’s explanation for photoelectric effect-Compton effect – Einstein’s quantum theory of specific heat-Quantum states of energy. (8L+5T)

**UNIT II : WAVE PROPERTIES OF MATTER**

Wave particle duality-Phase and Group Velocity – Analytical expression for a Group of waves – Wave packets formed by Superposition of Number of Plane waves – De Broglie Hypothesis – Derivation of De Broglie relation – Phase velocity of De Broglie Waves – Relation between De Broglie wave and Phase velocity – Davision and Germer’s experiment on electron diffraction-Diffraction of Atoms and Molecules (9L+6T)

**UNIT III : HEISENBERG UNCERTAINTY PRINCIPLE**

Uncertainty Principle - Elementary Proof of Heisenberg’s Uncertainty Relation and its Physical significance –Illustration by Thought experiments-consequences .(8L+5T)

## **UNIT IV: SCHRODINGER'S WAVE EQUATION:**

Basic postulates of Quantum mechanics –Schrodinger's equation – 1D and 3D wave equation into the Time-dependent and Time-independent part – Physical Interpretation of the Wave Function  $\psi$  – Operators in quantum Mechanics, Eigen Function, Eigen value and Eigen Value equation – Expectation values – Orthogonality of Energy Eigen function - Schrodinger's Wave equation for the Complex Conjugate Wave function  $\psi^*(x, y, z, t)$  – Probability current Density – Ehrenfest's Theorem – Momentum wave function for free particle – Momentum Eigen function – Exact statement and proof of Uncertainty principle for one dimensional wave packet (11L+8T)

## **UNIT V: APPLICATIONS OF QUANTUM MECHANICS**

Free particle – Potential step – Rectangular Potential barrier- Tunnel effect – emission of  $\alpha$  particles from Radioactive element - Square well potential- free states-Particle in 1D box – Particle in 3D box – Simple harmonic oscillator – 1D simple harmonic oscillator in quantum mechanics – Particle in 1 D square well potential of finite Depth. (9L+6T)

### **Books for Study**

1. Elements of Quantum Mechanics, Kamal Singh & S P Singh-Chand &Co;

### **Books for Reference**

- 1.Mathews P.M. and Venkatesh k. Quantum Mechanics Tata McGraw Hill Publishing Ltd.
- 2.Gipta,Kumar,Sharma -Quantum Mechanics-JaiPrakash Nath Company
3. Quantum Mechanics-G.Arul Das-PHI Private Learning Ltd.
4. Quantum Mechanics-V.Murugan-Pearson publication
5. Quantum Mechanics-Mahesh C.Jain- PHI Private Learning Ltd

## PAPER XIV

L	T	P	C
4	0	0	4

# NUCLEAR PHYSICS

**Preamble:** Objective of this course is to provide the basics of atomic nucleus and nuclear reactions. The paper needs a basic knowledge in modern physics and the learners are expected to know the impact of nuclear reactions to the environment.

### UNIT I: ATOMIC NUCLEUS

General properties of the nucleus- binding energy –mass defect -packing fraction— BE/A curve and its significance -proton electron hypothesis- proton neutron hypothesis -Nuclear forces –characteristics –Meson theory of nuclear forces –Nuclear models – Liquid drop model –Binding Energy formulae– Shell Model –magic numbers(12L)

### UNIT II RADIO ACTIVITY

Natural radio activity –alpha,beta and gamma rays-properties- radioactive series-laws of radioactive disintegration-half life period –mean life period –Radio carbon dating-law of successive disintegration– range of  $\alpha$  particle – Geiger Nuttal law-  $\alpha$  decay- theory- $\beta$ - decay –neutrino theory of  $\beta$  decay-neutrino and its properties-electron capture.  $\gamma$  decay- nuclear isomers- Mossabauer effect - applications-radio isotopes - uses. (14L)

### UNIT III: NUCLEAR REACTIONS

Kinematics of nuclear reaction-conservation of momentum - Q value of nuclear reaction-compound nucleus - nuclear energy level-Nuclear fission –energy released in fission-. Nuclear reactor-uses - Nuclear fusion –Thermo nuclear reactions-controlled thermo nuclear reaction-Principle and action of atom bomb - hydrogen bomb-fusion reactor –plasma confinement (11L)

## **UNIT IV: NUCLEAR DETECTORS AND PARTICLE ACCELERATORS**

Detectors-G.M.Counter-scintillation counter-bubble chamber-wilson cloud chamber-Accelerators-cyclotron-synchrocyclotron-betatron-synchrotrons (10L)

## **UNIT V: COSMIC RAYS AND ELEMENTARY PARTICLES**

Cosmic rays-introduction-discovery-latitude, altitude and azimuth effects-longitudinal effect-north –south effect-seasonal and diurnal changes-primary and secondary cosmic rays-nature of cosmic rays- cosmic ray showers-Van Allen belt-origin of cosmic radiation.

Elementary particles-introduction-particles and antiparticles-antimatter-the fundamental interaction-elementary particle quantum numbers-conservation laws and symmetry-the quark model (13L)

### **Book for study**

1. Modern Physics- R.Murugesan, S. Chand & Co

### **Reference Books**

1. Modern Physics- Seghal Chopra & Seghal, Sultan Chand 1998

2. Perspective of Modern Physics-Arther Beiser –Tata-Mc Graw Hill Publishing Company

3. Atomic and Nuclear Physics-Shatendra Sharma-Pearson Publications

4. Atomic Physics-Gupta and Kumar

5. Fundamental Physics-Halliday and Resnick

## PAPER XV (4X15=60 hours)

L	T	P	C
4	0	0	4

### SOLID STATE PHYSICS

**Preamble:** Objective of this paper is to introduce crystals and nanoparticles and to provide an understanding about different types of materials. The paper needs a basic knowledge of elements of modern physics and the learners are expected to get some ideas on Materials Research.

#### UNIT-I: CRYSTAL LATTICES

Introduction-seven classes of crystals - Bravais lattice in three dimensions - crystal structure - Simple cubic, Face centered cubic, Body centered cubic and Hexagonal close packed structure - Sodium Chloride, Zinc Blende and Diamond Structures.

Miller Indices and crystal planes - procedure for finding Miller Indices - interplanar spacing - Diffraction of X-Rays - Bragg's Law - reciprocal lattices - reciprocal lattice to SCC, BCC and FCC lattices. (13L)

#### UNIT-II: TYPES OF MAGNETIC MATERIALS

Introduction -classical theory of Diamagnetism - Langevin's theory of Paramagnetism - Weiss Theory of Para magnetism - Ferromagnetism - Explanation of Heisenberg's internal field and quantum theory of ferromagnetism - Domain theory of ferromagnetism - Anti ferromagnetism - ferrites - Fundamental Definitions of Dielectrics - Different types of Electric Polarizations- electronic, ionic, orientation and space charge Polarizations - Dielectric Loss - Internal Field - Clausius – Mosotti Relation(12L)

### UNIT-III: **BONDING IN SOLIDS**

Types of bonds in crystals - Ionic, covalent, Metallic, Vander waal's and Hydrogen Bonding - Bond energy of sodium chloride molecule - Comparison between ionic and covalent solids - variation of inter atomic force with inter atomic spacing - cohesive energy - cohesive energy of ionic solids - application to sodium chloride crystal - evaluation of Madelung constant for sodium chloride. (11L)

### UNIT-IV: **SUPER CONDUCTIVITY**

Introduction - General Properties of Superconductors - effect of magnetic field - Meissner effect - effect of current - thermal properties - entropy - specific heat - energy gap - isotope effect - London equations - AC & DC Josephson effects - applications - Type-I and Type-II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory - Application of Superconductors - High  $T_C$  superconductors. (14L)

### UNIT-V: **NANOTECHNOLOGY**

Nanomaterials-synthesis and classification --techniques used in synthesis of nanomaterials-chemical vapour deposition-sol-gel technique-electro deposition method-ball milling method- characterisation - properties and applications of nanomaterials- fullerene, graphene and carbon nanotubes (10L)

#### **Books for Study**

1. Solid State Physics - P.K.Palanisamy - SCITECH Publications pvt Ltd.Chennai
2. Nano-essentials and understanding - Pradeep.T.Mc-Graw-Hill Ltd.

#### **Books for reference**

1. Introduction to Solid State Physics - Kittel - Wiley and Sons, New Delhi
2. Material Science and Engineering - V. Raghavan - PHI
3. Introduction to Solids - Azaroff - TMH
4. Material Science - M.Arumugam - Anuradha Publishers
5. Solid State Physics - H.C.Gupta - Vikas publishing house pvt.Ltd.
6. Principles of Nanoscience and technology - Shah M.A.Ahmed, Narosha publishing house pvt.Ltd.

## **PAPER XVI: MAJOR ELECTIVE (Any one)**

- **a.ENERGY PHYSICS**

L	T	P	C
4	0	0	4

**Preamble:** Objective of the course is to provide an understanding of the present energy crisis and various available energy sources. The paper does not need require any special prerequisite and the learners are expected to know the use of alternate energy sources

### **UNIT I : INTRODUCTION TO ENERGY SOURCES**

World's reserve of Commercial energy sources and their availability-India's production and reserves-Conventional and non-conventional sources of energy, comparison – Coal- Oil and natural gas –applications - merits and demerits (10L)

### **UNIT II : SOLAR THERMAL ENERGY**

Solar constant -Solar spectrum-Solar radiations outside earth's atmosphere – at the earth surface- on tilted surfaces -Solar Radiation geometry-Basic Principles of Liquid flat plate collector –Materials for flat plate collector -Construction and working- Solar distillation–Solar disinfection - Solar drying-Solar cooker(box type)-Solar water heating systems – Swimming pool heating. (12L)

### **UNIT III : PHOTOVOLTAIC SYSTEMS**

Introduction-Photovoltaic principle-Basic Silicon Solar cell- Power output and conversion efficiency-Limitation to photovoltaic efficiency-Basic photovoltaic system for power generation-Advantages and disadvantages-Types of solar cells- Application of solar photovoltaic systems - PV Powered fan – PV powered area lighting system – A Hybrid System. (13L)

## **UNIT IV: BIOMASS ENERGY**

Introduction-Biomass classification- Biomass conversion technologies-Bio-gas generation-Factors affecting bio-digestion -Working of biogas plant- floating and fixed dome type plant -advantages and disadvantage of -Bio-gas from plant wastes-Methods for obtaining energy from biomass- Thermal gasification of biomass-Working of downdraft gasifier- Advantages and disadvantages of biological conversion of solar energy. (11L)

## **UNIT V : WIND ENERGY AND OTHER ENERGY SOURCES**

Wind Energy Conversion-Classification and description of wind machines, wind energy collectors-Energy storage-- Energy from Oceans and Chemical energy resources-Ocean thermal energy conversion-tidal power, advantages and limitations of tidal power generation-Energy and power from waves- wave energy conversion devices- Fuel cells- and application of fuel cells- batteries- advantages of battery for bulk energy storage- Hydrogen as alternative fuel for motor vehicles. (14L)

### **Books for study**

1. Kothari D.P., K.C. Singal and Rakesh Ranjan, Renewable energy sources and emerging Technologies, Prentice Hall of India, 2008.
- 2.Solar Energy-principles of thermal collection and storage-S.P.SUKHAME-tata-McGraw-Hill publishing company ltd.

### **Books for References**

1. Chetan Singh Solanki, Solar Photovoltaics Fundamentals, Technologies and Applications, 2ndEdition, PHI Learning Private Limited, 2011.
2. Rai G. D, Non conventional Energy sources, 4th Edition, Khanna Publishers, 2010.
3. Jeffrey M. Gordon, Solar Energy: The State of the Art, Earthscan, 2013.
4. Kalogirou S.A., Solar Energy Engineering: Processes and Systems , 2nd Edition, Academic Press, 2013.
5. Zobaa A.F.and Ramesh Bansal, Handbook of Renewable Energy Technology, World Scientific, 2011.

## **\*b.MEDICAL PHYSICS**

L	T	P	C
4	0	0	4

**Preamble:** This course facilitates an understanding of the basic concepts in Bio medical instrumentation and awareness regarding radiation hazards and safety.

### **UNIT-I: X-RAYS**

Electromagnetic spectrum - production of x-rays - x-ray spectra - Brehmsstrahlung process- Characteristic x-ray - X-ray tubes - Coolidge tube - X-ray tube design - tube cooling - stationary mode - Rotating anode X-ray tubes - Tube rating - quality and intensity of X-ray. X-ray generator circuits - half wave and full wave rectification - filament circuit - kilo voltage circuit - high frequency generator - exposure timers - HT cables. (12L)

### **UNIT –II: RADIATION SAFETY AND HEALTH PHYSICS**

Introduction to Radioactivity-Artificial and natural - radioactivity -Physical features of radiation-units of radiation- conventional sources of radiation, Interaction of different types of radiation with matter -penetration power in living cells-radiation damage to the cell-effect of radiation on cells-measurement of ionizing radiation- measurement of biological damage-Linear energy transfer(LET)-radiation risk-radiation dosimetry-security of radio active material-radio active waste management (14L)

### **UNIT –III: BIO MEDICAL INSTRUMENTATION**

Development of biomedical instrumentation-biometrics-introduction to the man-instrument system-components of man-instrument system-transducers for biomedical applications-biomedical computer applications-computer analysis of ECG-computerized axial tomography(CAT) Scanners (11L)

## **UNIT-IV: MEDICAL IMAGING PHYSICS**

Radiological imaging - Radiography - Filters - grids - cassette - X-ray film - film processing - fluoroscopy - computed tomography scanner - principle function -display - generations – mammography- ultrasound imaging - magnetic resonance imaging - thyroid uptake system - Gamma camera (Only Principle, function and display) (11L)

## **UNIT-V LASERS IN MEDICINE**

Introduction to laser-principle and production of laser- effects of laser radiation on tissues - photo thermal effects- photochemical effects –photodynamic therapy-Laser applications in therapy and diagnosis-opthalmology-Fibreoptic endoscopy and dentistry-Laser as a beautician's tool-laser hazards-biological effects. (12L)

### **Books for study and Reference**

1. Basic Radiological Physics Dr. K. Thayalan - Jayapee Brothers Medical Publishing Pvt. Ltd. New Delhi (2003)
2. The essential physics of Medical Imaging: Bushberg, Seibert, Leidholdt and Boone Lippincot Williams and Wilkins, Second Edition (2002)
- 3..Biomedical instrumentation-Leslie Cromwell,Fred J.Weibel-Erich A.Pfeiffer-Pearson Publications
- 4.Lasers in Medicine-R W Wayanant, Plenum Publishing Co
- 5.Nuclear medicine physics: Chandra - Lippincot Williams and Wilkins ( 1998)

**\* A visit to the related places is preferred for better understanding of these two papers.**

**PRACTICAL-III**

L	T	P	C
0	0	2	1

Preamble: To learn physical concepts through experiments

**(8 experiments compulsory)**

1. Ballistic Galvanometer- Figure of merit
2. Ballistic Galvanometer – Comparison of Capacitance ( $C_1/C_2$ )
3. Field along the axis of a coil carrying current– Deflection magnetometer- dipole moment of a bar magnet
4. Comparison of Magnetic Moments – Deflection Magnetometer (Tan A and Tan B position)
5. Series Resonance Circuit
6. De Sauty Bridge
7. Potentiometer- Calibration of Ammeter
8. Potentiometer-Calibration of low range Voltmeter
9. Carey Foster's Bridge – Specific Resistance
10. Spectrometer- i-d curve

## **PRACTICAL-IV**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **(8 experiments compulsory)**

1. Field along the axis of a coil carrying current– Vibration magnetometer
2. Potentiometer – Specific resistance
3. Potentiometer – EMF of a thermocouple
4. Ballistic Galvanometer – Comparison of EMF's – E1/E2
5. Ballistic Galvanometer – High resistance by leakage
6. Magnetic Moment of a bar Magnet – Tan C Position
7. Parallel Resonance Circuit
8. Owen's Bridge-inductance in series and parallel
9.  $M$  and  $B_H$ -Deflection and Vibration magnetometer
10. Spectrometer- critical angle of the prism and refractive index

## PRACTICAL-V

### NON ELECTRONICS

**(8 experiments compulsory)**

L	T	P	C
0	0	4	2

1. Conversion of Galvanometer into Voltmeter and Ammeter
2. Ballistic Galvanometer – Absolute Capacity of a Condenser
3. Ballistic Galvanometer – Absolute Determination & Comparison of Mutual Inductance.
4. Spectrometer – Cauchy's Constants
5. Young's Modulus and Poisson's ratio of glass – Elliptic Fringes
6. Potentiometer - Calibration of Volt meter (High Range)
7. Potentiometer-Temperature Coefficient of Resistance
8. Spectrometre- Biprism
9. Thevanin's and Nortan's theorem – Verification
10. Self inductance-Rayleigh's DC bridge method

## **PRACTICAL-VI**

L	T	P	C
0	0	4	2

### **ELECTRONICS**

**(8 experiments compulsory)**

1. V-I Characteristics of Junction diode and Zener diode
2. Transistor characteristics
3. Colpitt's and Hartley Oscillator
4. Single stage amplifier-with and without feedback
5. Full wave rectifier with filters and regulated using zener diode (Study the variation of output voltage without filter, with filter and with zener diode)
6. Astable multivibrator using transistor
7. OPAMP-Adder&Subtractor
8. OPAMP-Differentiator & Integrator
9. OPAMP -Low Pass And High Pass Filter
10. FET charecteristics

## PRACTICAL- VII

(8 experiments compulsory)

L	T	P	C
0	0	4	2

1. Spectrometre-Hartmann's interpolation formula
2. Spectrometre-  $i_1$ - $i_2$  curve
3. Mirror Galvanometer -Thermo EMF
4. Anderson's bridge-self inductance
5. Hyperbolic fringes
6. Arithmetic and Logic Units (ALU)
  - i. Half Adder
  - ii. Full Adder
  - iii. 4-bit Binary Adder.
7. Astable and Monostable multivibrator using 555 Timer
8. Combinational Logic
  - a) To design a combinational logic system for a specified Truth Table.
  - b) To convert a Boolean Expression into Logic Gate Circuit and assemble it using logic gate IC's
9. Analog/Digital Conversion
  - a) To design an analog to digital converter of given specifications.
  - b) To design a digital to analog converter of given specification
10. To build Flip-Flop Circuits using elementary gates (RS, Clocked RS, D-type, and JK Flip-Flop).

## PRACTICAL – VIII

L	T	P	C
0	0	4	2

### COMPUTER PROGRAMMING WITH C++

1. a. Arithmetic operations--use do while loop

b. To test the validity of any entered character whether it belongs to the alphabetical set or a number or a special character.

2. To find the sum of series using for loop.

a.  $\text{Sum} = 1+3+5+\dots+n.$

b.  $\text{Sum} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots + \frac{x^n}{n!}$

c.  $\text{Sum} = 1^2+2^2+4^2+\dots+n^2$

3. To find the factorial of a number by using function declaration with/without using the return statement.

4. To read a set of numbers from a standard input device and to find out the largest number in the given array using function declaration. Also sort them in the ascending or the descending order.

5. To read the elements of the given two matrices of order m\*n and to perform the matrix addition and display the transpose of the result.

6.a. To display the name of the day in a week depending upon the number entered through key board using Switch-Case statement

b) To read the data variables (such as Day, Month and Year) of the class by the member function and display the contents of class objects on the screen in the format DD/MM/YYYY.

7. To generate a series of Fibonacci numbers using constructor

8. To read the following information from the keyboard in which basic class consists of Name, Roll No. and Sex. The derived class contains the data members Height and weight. Display the contents of the class. Use inheritance concept.

9. a. An OOP to find the period of a pendulum of given length  $L$ , in a gravitational field. Accept the required values using the keyboard. Also display the results.

b. Develop a program in C++ to calculate the Young's modulus of a material from the data obtained from uniform bending method.

10. Solve Quadratic equation.

11. Matrix multiplication

12. Define a class to represent a bank account details

Data members

1. Name of the depositor

2. Account name

3. Type of account

4. Balance amount in the account

Member function

1. To assign initial values

3. To withdraw an amount

4. To display name and balance

**SKILLED BASED ELECTIVE  
SEMESTER-III  
(For Physics major students only)  
(Any one)**

**PAPER 1.a  
MAINTANANCE OF ELECTRICAL APPLIANCES**

L	T	P	C
4	0	0	4

**Preamble:** This course enable the students to understand the operations and safety handling of certain commonly used domestic appliances. The paper needs a basic knowledge in electricity and magnetism and the learners are expected to gain knowledge to design and trouble shoot electrical circuits .

**UNIT-I:**

Resistance - capacitance - inductance and its units - electrical charge - current - potential - units and measuring meters - Ohm's law - Galvanometer, ammeter, voltmeter and multimeter. Electrical energy - power - watt - kWh - consumption of electrical power. (12L)

**UNIT-II:**

Transformer - principle and working - classification of transformers - testing of transformers - Core, Shell and Berry types, auto transformer - construction and uses. Cooling of transformers - Losses in transformer.(10)

**Unit-III:**

Electric bulbs – Fluorescent lamps - Street Lighting - Electric Fans - Wet Grinder - Mixer - Water Heater - Storage and Instant types-electric iron box-microwave oven - Washing Machine - Stabilizer, Fridge and Air conditioner. (13L)

#### UNIT-IV:

AC and DC- Single phase and three phase connections - RMS and peak values-house wiring - Star and delta connection - overloading - earthing - short circuiting - colour code for insulation wires (13L)

#### UNIT-V:

Electrical protection - Relays - Fuses - Electrical switches - Circuit breakers-ELCB - overload devices - ground fault protection - Inverter - UPS - generator and motor(12L)

#### **Books for study and Reference**

1. A text book in Electrical Technology - B L Theraja - S Chand & Co.
2. A text book of Electrical Technology - A K Theraja
3. Performance and design of AC machines - M G Say ELBS Edn.
4. Semi conductor physics and opto electronics by P K Palanichamy
5. Basic Electronics - B L Theraja - S Chand & Co.
6. Principles of Communication Engineering - Arokh Singh and A K Chhabra - S Chand & Co.

## **PAPER1.b.**

### **ASTROPHYSICS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>4</b>	<b>0</b>	<b>0</b>	<b>4</b>

Preamble: This course provides an understanding of Astrophysics, Astronomical instruments and the Origin of the universe.. The paper needs a basic knowledge in optics and modern physics and the learners are expected to know celestial objects.

#### **UNIT-I : ASTRONOMICAL INSTRUMENTS**

Optical telescope - reflecting telescope - types of reflecting telescope - advantages of reflecting telescope - Radio telescopes - astronomical spectrographs – photographic- photometry - photo electric photometry - detectors and image processing. (12L)

#### **UNIT-II: SOLAR SYSTEM**

The sun-physical and orbital data - Photosphere - Chromosphere - corona - solar prominences - sunspot - sunspot cycle - theory of sunspots - solar flare - mass of the sun - solar constant - temperature of the sun - source of solar energy - solar wind. other members of the solar system - Mercury - Venus - Earth - Mars - Jupiter - Saturn - Uranus - Neptune - Pluto - Moon - Bode's law - asteroids - comets - meteors. (14L)

#### **UNIT-III: STELLAR EVOLUTION, BINARY AND VARIABLE STARS**

Birth of a star - Death of a star - Chandrasekhar limit - white dwarfs - Neutron stars - black holes - Quasars - Nebulae - Supernovae  
Binary stars - Origin of binary stars-variable stars - cepheid variables - RV Tauri variables - long period variables - irregular variables - flare stars. (10L)

## **UNIT-IV: MAGNITUDES, DISTANCE AND SPECTRAL CLASSIFICATION OF STARS**

Magnitude and brightness - apparent magnitude of stars - absolute magnitude of stars - relation between apparent magnitude and absolute magnitude of stars - Luminosities of stars - measurement of stellar distance - Geometrical parallax method - distance from red shift measurement - Harvard system of spectral classification . (11L)

## **UNIT-V: THEORIES OF THE UNIVERSE, GALAXIES AND STAR CLUSTERS**

Origin of the universe - the big bang theory - the steady state theory - the oscillating universe theory - Hubble's law.

Galaxies - types of galaxies - Milky Way - star clusters - open clusters - globular clusters. (13L)

### **Books for study and reference:**

1. K.S. Krishnasamy, 'Astro Physics a modern perspective,' Reprint, New Age International (p) Ltd, New Delhi,2002.
2. Baidyanath Basu, 'An introduction to Astro physics', second printing, prentice - Hall of India Private limited, New Delhi,2001.
3. R. Murugesan, ' Modern Physics', Eleventh revised edition, S. Chand & Company Ltd, New Delhi, 2003.
4. S. Kumaravelu, 'Astronomy, Janki calendar corporation, Sivakasi, 1993
5. Baker and Fredrick, 'Astronomy, ninth edition, Van No strand Rein hold, Co, New York - 1964.
6. Illustrated World of Science Encyclopedia - Vol I and Vol VIII - Creative world publication - Chicago.

**SKILLED BASED ELECTIVE**  
**SEMESTER-IV**  
**(Any one)**  
**PAPER 2.a**  
**MAINTANANCE OF ELECTRONIC EQUIPMENTS(4x15=60 hours)**

L	T	P	C
4	0	0	4

**Preamble:** Objective of this course is to provide a basic understanding of the commonly used electronic equipments .

**UNIT-I: ELECTRONIC COMPONENTS**

Study of electronic components - resistors - types - characteristics - colour coding – wattage rating-potential divider arrangement-capacitors - type - characteristics --working voltage-star and delta connection of resistors and capacitors -soldering and desoldering techniques-Groove board,bread board and printed circuit board (11L)

**UNIT-II: MEASURING INSTRUMENTS**

Practical uses of Multimeter (analog and digital) - CRO - Block Diagram - measurement of voltage, frequency and phase - waveforms and Lissajoue's figures- Digital Storage Oscilloscopes-LCD display for instruments -A/F and R/F oscillators. (10L)

**UNIT-III: TRANSDUCERS**

Classification of transducers-basic requirements/characteristics of Transducers-active and passive transducers, resistive (Potentiometer -Theory, temperature compensation &applications), Capacitive (variable air gap type), Inductive (LVDT) &piezoelectric transducers.  
Measurement of temperature (RTD, semiconductor IC sensors)-Light transducers (photo resistors & photovoltaic cells). (13L)

## **UNIT-IV: COMMUNICATION DEVICES**

Basic concepts of radio transmitter and receiver - TV antennas-resonance antennas and their characteristics - Dipole antenna - Folded dipole - Yagi antenna - Yagi antenna design - Dish antenna - DTH system - Mobile communication system - MODEM.

Telephone systems-cellular Telephone systems-mobile phone-principle of operation-integrated services-digital networks(ISDN) (15L)

## **UNIT-V: Photography**

Introduction to cameras-parts of camera and accessories—lens shutter-aperture-flash photography-filters-battery-tele and wide angle lens  
Digital formats-data transfer to computer-ISO speed-resolution(11L)

### **Books for Study and Reference**

1. Principles of Electronics by V K Mehta, S Chand & Co., 5th edition 2001.
2. Functional Electronics by Ramanan.
3. Elements of Electronics by Bagde and Singh
4. Monochrome and Colour TV by Gulati
5. Basic Electronics, 6th edition by B Grob, McGraw Hill NY 1
6. Integrated electronics-Millman and Halkias
7. Electronic principles-Malvino 6<sup>th</sup> edition
8. Operational amplifier-Gyakwar
9. Basic electronics-B.Basavaraj,H.N.Shivasankar-University press

## PAPER 2.b

### PHYSICS OF HUMAN ANATOMY(4x15=60 hours)

L	T	P	C
4	0	0	4

**Preamble:** Objective of this course is to provide an understanding of the physics of human anatomy

#### **UNIT-I: PHYSICS OF LIGHT AND ITS MEDICAL APPLICATION TO HUMAN BODY**

Properties of light – Measurement of Light – Energy of light – medical Application of Visible light, UV, IR and Laser in Human body. (12L)

#### **UNIT-II: PHYSICS OF BREATHING:**

Pressure – Typical pressure in Normal body – Gas transport in respiratory system – Definition of pressure-Volume in Lung-Thorax system – Resistance of air passage – Timing of breathing process – Work required for Breathing(14L)

#### **UNIT-III: ENERGY OF HUMAN BODY**

Heat loss of the body due to conduction, convection, evaporation, radiation-Wind chill – Mechanism to decrease body temperature – Medical implication of high temperature. (13L)

#### **UNIT-IV:THE ACOUSTICS OF BODY**

Sound – unit – wave equation – Unit of sound intensities for auditory system – production of speech – Physics of ear – outer ear – inner ear – ear drum – middle ear (10L)

#### **UNIT-V: PHYSICS OF EYE**

Optical system of the body structure of Eye – Refraction focusing of the eye system – Geometrical optics of the Eye – Structure of receptor system – Diffraction effects of Eye – Eye defects. (11L)

## **REFERENCES:**

1. [web.khu.ac.kr/~bil/lecture/MedicalPhysics/Ch14.PDF](http://web.khu.ac.kr/~bil/lecture/MedicalPhysics/Ch14.PDF)
2. [http://www.edb.utexas.edu/petrosino/Legacy\\_Cycle/mf\\_jm/Challenge2/physicsbreathing.pdf](http://www.edb.utexas.edu/petrosino/Legacy_Cycle/mf_jm/Challenge2/physicsbreathing.pdf)
3. <http://web.khu.ac.kr/~bil/lecture/MedicalPhysics/Ch8.PDF>
4. <https://www3.nd.edu/~nsl/Lectures/mphysics/Medical%20Physics/Part%20I.%20Physics%20of%20the%20Body/Chapter%203.%20Pressure%20System%20of%20the%20Body/Chapter%203.%20Pressure%20System%20of%20the%20Body.pdf>
5. <https://www3.nd.edu/~nsl/Lectures/mphysics/Medical%20Physics/Part%20I.%20Physics%20of%20the%20Body/Chapter%204.%20Acoustics%20of%20the%20Body/Chapter%204.%20Acoustics%20of%20the%20Body.pdf>
6. <https://www3.nd.edu/~nsl/Lectures/mphysics/Medical%20Physics/Part%20I.%20Physics%20of%20the%20Body/Chapter%205.%20Optical%20System%20of%20the%20Body/Chapter%205.%20Optical%20System%20of%20the%20Body.pdf>
7. <https://www3.nd.edu/~nsl/Lectures/mphysics/Medical%20Physics/Part%20I.%20Physics%20of%20the%20Body/Chapter%202.%20Energy%20Household%20of%20the%20Body/2.3%20Heat%20losses%20of%20the%20body/Heat%20losses%20of%20the%20body.pdf>
8. <https://www3.nd.edu/~nsl/Lectures/mphysics/Medical%20Physics>

## **NONMAJOR ELECTIVE**

**(for those who do not study Physics as Major/Allied Subject)**

L	T	P	C
2	0	0	2

### **SEMESTER-III**

**(Any one)**

#### **PAPER 1.a**

#### **BASICPHYSICS-1**

**Preamble:** Objective of the paper is to provide a basic knowledge in Physics for students who do not study physics as major/allied subject

#### **UNIT I: MECHANICS**

Motion-speed, velocity, acceleration- force –equations of motion- Newton's laws - momentum - work, power and energy -conservation of energy and momentum. (5L)

#### **UNIT II: PROPERTIES OF MATTER**

Three states of matter - binding forces - fluid pressure and thrust - applications - Pascal law - Archimedes principle – surface tension-capillary action - Bernoulli's principle – Viscosity-venturimeter-pitot's tube. (7L)

#### **UNIT III: HEAT AND SOUND**

Measurement of heat and temperature - clinical thermometer - heat transfer - thermos flask - change of state - effect of pressure on boiling point and melting point - heat engines - steam engine and diesel engine-sound and music - reverberation - acoustics of building - recording and reproduction of sound in film. (7L)

## UNIT IV: OPTICS

Reflection and refraction-concave and convex mirrors and lenses-dispersion-spectra- rainbow- interference-diffraction-polarization-concepts with examples-uses-double refraction-optical activity-quartz crystal(6L)

## UNIT V: ELECTRICITY

Electric field - potential - Ohm's law - electrical energy and power - resistance - types of resistance - fixed resistance - variable resistance.- resistance in series and parallel -Kirchoff's laws(5L)

### **Books for study and Reference**

1. Properties of matter by Murugesan R, S Chand & Co. Pvt. Ltd., New Delhi
2. Text book of sound by Brij Lal & Subramaniam, Vikas Publishing House, New Delhi, 1982
3. Electricity and Magnetism - R. Murugesan. (S.Chand &Co.)
4. Heat and thermodynamics - Brijlal and Subramaniam, S Chand & Co.
5. Optics by Subramaniam N & Brij Lal, S Chand & Co. Pvt. Ltd., New Delhi, 1990

## **PAPER 1.b.**

### **APPLIED PHYSICS(2x15=30 hours)**

**Preamble:** This paper enables the students to understand variable energy sources and the need for finding alternate energy source.

L	T	P	C
2	0	0	2

#### **UNIT-I: Conventional energy sources**

Conventional energy sources –world’s reserve of conventional energy sources–various forms of energy-renewable and conventional energy systems-comparison (5L)

#### **UNIT-II: Fossil fuels**

Fossil fuels – coal, oil and natural gas-availability-statistical details-applications-merits and demerits(7L)

**UNIT-III: Biomass energy:** Biomass energy-biomass classification-biomass conversion process-biogas plants-Deena bandhu model gas plant-wood gasification-advantages and disadvantages of biomass (6L)

#### **UNIT-IV: Renewable energy sources**

Renewable energy sources-solar energy - importance - storage of solar energy - applications of solar energy -solar pond - solar water heater-solar crop dryers-solar cookers- solar green house - solar cell (7L)

#### **UNIT-V: Geothermal energy**

Geothermal energy-Geothermal power plant-wind energy and wind farms-wind mills - types – ocean thermal energy conversion - energy from tides-energy from waves(5L)

#### **Books for study and Reference**

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand & Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd., New Delhi.

**PAPER 2.a**

**Preamble:** Objective of the paper is to gain knowledge on Basic principles of Physics

L	T	P	C
2	0	0	2

**BASICPHYSICS-II**

## UNIT I: Nuclear Physics

Introduction-nuclear structure-properties of nucleus-packing fraction-binding energy-nuclear forces- Radio activity-properties of alpha, beta and gamma rays-radio carbon dating-nuclear fission-nuclear fusion (7L)

## UNIT II: Magnetic Materials

Classification of magnetic materials-para-dia and ferromagnetic materials-properties –applications-crystalline and amorphous materials-conductors-insulators-superconductors- properties –applications (5L)

## UNIT III: Lasers

Introduction-absorption-spontaneous emission-stimulated emission-population inversion-general laser system-He-Ne laser-CO<sub>2</sub> laser-applications. (6L)

## UNIT IV: Relativity

Introduction -reference frames-postulates of the special theory of relativity-length contraction-time dilation(no derivation)

Quantum mechanics-dual nature of wave and radiation-de-Broglie waves(5L)

## UNIT V: Number Systems

Number systems in digital electronics-binary, decimal and hexadecimal numbers –inter conversions- binary addition and subtraction—binary coded decimal-logic gates(7L)

**Books for study and Reference**

1. Modern Physics- R.Murugesan, S. Chand & Co
2. Electricity and Magnetism -R. Murugesan (S.Chand &Co.)
3. Digital principles and applications - Albert Paul Malvino & Donald P.Leach
4. Mechanics and mathematical physics- R.Murugesan-S Chand & Co. Pvt. Ltd., New Delhi

## PAPER 2.b

L	T	P	C
2	0	0	2

### SPACE PHYSICS

Preamble: This course provides an understanding of celestial objects.

#### UNIT I : Universe

Planets - interior planets - exterior planets - crust, mantle and core of the earth - different region of earth's atmosphere - rotation of the earth - magnetosphere - Van Allen belts - Aurora. (7L)

#### UNIT II: Comets, Meteors, Asteroids

Composition and structure of comets - periodic comets - salient features of asteroids, meteors and its use. (5L)

#### UNIT III : Sun

Structure of photosphere, chromosphere, corona - sunspots - solar flares - solar prominence - solar plages - satellites of planets - structure, phases and their features of moon. (6L)

#### UNIT IV : Stars

Constellations - binary stars - their origin and types star clusters –

Globular clusters - types of variable stars - types of galaxies. (7L)

#### UNIT V: Origin of Universe

Big bang theory - pulsating theory - steady state theory - composition of universe expansion(5L)

#### Books for study and Reference

1. K.D. Abyankar, Astrophysics of the solar system, University press, India.
2. Baidyanath Basu, An introduction to Astrophysics, Prentice Hall of India, New Delhi.
3. Prof. P. Devadas, The fascinating Astronomy, Published by Devadas Telescopes, 2, Charkrapani Road, Guindy, Chennai.
4. Elements of Space Physics – R.P. Singhal, PHI.