MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

(MODIFIED) REVISED SYLLABUS FOR B.Sc., (Physics) under CBCS
(With effect from the academic year (2018-2019)

1. **Objectives:**

   The Syllabus for B.Sc., Physics degree under semester system has been designed on the basis of Choice Based Credit System, (CBCS) which would focus on job oriented programmes and values added education. It will effect from June 2018 onwards.

2. **Eligibility :**

   A pass in +2 examination conducted by the Board of Higher Education, Govt of Tamil Nadu with Physics & Mathematics OR anyother examination accepted by the syndicate, as equivalents thereto are eligible to join this course.

3. **Duration of the course :**

   The students who are joining the B.Sc., (Physics) degree shall undergo a study period of three academic years – Six Semesters.

4. **Subjects of study and scheme of examination :**

   The subjects offered in major physics for six semesters and the scheme of examination are given.

5. **Question Paper Pattern :**

   The Internal and External marks is 25:75

External

The pattern of Question paper will be as follows:

Time : 3 hrs **Max.Marks:75**

Section : A (10 X1 =10 Marks)

Question No. 1 to 10 (Multiple Choice)

1. Two questions from each unit
2. Four choices in each question
3. No ‘ none of these ‘ choice

Section B : (5 X 7 = 35 marks)

Answer all questions choosing either (a) or (b)

Answer not exceeding two pages.

(One question from each unit)

Question No : 11 – 15	11	(a)	or	11	(b)
	12	(a)	or	11	(b)
	13	(a)	or	11	(b)
	14	(a)	or	11	(b)
	15	(a)	or	11	(b)

Section C : (3 X 10 = 30 marks)

Answers not exceeding four pages.

Answer any three out of five (Question from each unit)

Questions 16 -20

There must be **atleast one problem in section B and section C**

Internal

1. The Pattern for internal valuation may be : two tests – **15 marks** each : **average 15marks**
2. Group Discussion / Seminar / Quiz – **5 marks**
3. 2 Assignments : 5 mark each ; average **5 marks**
4. 3rd test may be allowed for absentees of any one of the two tests.
5. For Quiz, 2 Quiz should be conducted.

Blue Print of the Question Paper external – Core Subjects

Maximum Marks : 75

Section	Types of questions	No. of questions	No. of Questions to be answered	Marks For Each question	Total Marks
A	Multiple Choice Two questions from each unit	10	1	1	10
B	Not exceeding 2 Pages (either or type) – One from each unit *	5	5	7	35
C	Not exceeding 4 Pages (any three out each unit	5	3	10	30

***** There must be atleat one problem in Section B and Section C

6. **There will be Two Allied subjects to fulfill the course during three years.**

Subject	Maximum marks	Year of study
Mathematics	600	I & II
Chemistry / Applied Electronics	600	I & II

- The syllabus for the ancillary subjects can be got from the Ancillary Department of Mathematics, Chemistry / Applied electronics.

- Practicals : Record Note Book / Internal 10 + 30 = 40
  Examination external = 60

  Total 100
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7. Eligibility of the degree:

i. A candidate will be eligible for the B.Sc., degree by completing three years (six semesters) and passing all the prescribed examinations.

ii. A candidate shall be declared as passed the course, if he/she scored a minimum of 35% marks in each paper of all the subjects.

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

***Basic Physics – I as NME for those who study other than Physics.**

B.Sc., Semester – II

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – II

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – III

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – IV

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – V

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				

Total				

B.Sc., Semester –V I

Part	Study Component	No.of Course	Credit	Hours
I				
II				
III				
IV				
Total				

B.Sc., Semester – 1

S. No	Part	Subject	Hours	credit
1	III	Mechanics and Properties of matter – **CS1**	**4**	**4**
2	III	Physics Practical – I	**2**	**-**
2	III	Allied Paper – Mathematics 1	**6**	**4**
3	IV	Introduction to computers & C Programming – **SB1**	**2**	**2**
4	IV	Solar Energy – **SB2**	**2**	**2**
5	IV	Non Major Elective – **NME I**	**2**	**2**

* Fundamentals of Physics – I as NME I for students studying other than physics.

B.Sc., Semester – 2

S. No	Part	Subject	Hours	credit
1	III	Thermal Physics and And Acoustics – **CS2**	**4**	**4**
2	III	Physics Practical – I	**2**	**2**
3	III	Allied Paper – Mathematics 2	**6**	**5**
4	IV	Astrophysics – **SB3**	**2**	**2**
5	IV	Medical Physics – **SB4**	**2**	**2**
6	IV	Non Major Elective – **NME II**	**2**	**2**

Basic Physics – II as NME for those who study other than physics.

B.Sc., Semester – 3

S.No	Part	Subject	Hours	credit
1	III	Electricity and Electromagnetism – **CS3**	**4**	**4**
2	III	Physics Practical – II	**2**	**-**
3	III	Allied Paper – Mathematics 3	**6**	**4**
4	III	Allied Paper – Chemistry 1 / Applied Electonics 1	**4**	**4**
5	III	Allied Paper – Chemistry 1 / Applied Electonics 1 Practical – I	**2**	**-**

B

.Sc., Semester – 4

S. No	Part	Subject	Hours	credit
1	III	Optics and Spectroscopy – **CS4**	**4**	**4**
2	III	Physics Practicals – II	**2**	**2**
3	III	Allied Paper – Mathematics 4	**6**	**5**
4	III	Allied Paper – Chemistry 1 / Applied Electonics 1	**4**	**4**
5	III	Allied Paper – Chemistry 1 / Applied Electonics 1 Practical - I	**2**	**1**

B.Sc., Semester – 5

S. No	Part	Subject	Hours	credit
1	III	Atomic Physics and Quantum Physics – **CS5**	**4**	**4**
2	III	Nuclear Physics – **CS6**	**4**	**4**
3	III	Analog Electronics – **CS7**	**4**	**4**
4	III	Physics Practicals – III	**2**	**-**
5	III	Physics Practicals – IV	**3**	**-**
6	III	Physics Practicals – V	**3**	**-**
7	III	Allied Paper – Chemistry 1 / Applied Electronics 1	**4**	**4**
8	III	Allied Paper – Chemistry 1 / Applied Electronics 1 Practical - I	**2**	**-**
9	IV	Nano Physics – **SB5**	**2**	**2**
10	IV	Environmental Studies	**2**	**2**

B.Sc., Semester – 6

S.No	Part	Subject	Hours	credit
1	III	Classical and Statistical Mechanics – **CS8**	**4**	**4**
2	III	Solid State Physics – **CS9**	**4**	**4**
3	III	Digital Electronics – **CS10**	**4**	**4**
4	III	Physics Practicals – III	**2**	**5**
5	III	Physics Practicals – IV	**3**	**5**
6	III	Physics Practicals – V	**3**	**5**
7	III	Allied Paper – Chemistry 1 / Applied Electronics 1	**4**	**4**
8	III	Allied Paper – Chemistry 1 / Applied Electronics 1 Practical - I	**2**	**1**
9	IV	Optoelectronics – **SB6**	**2**	**2**
10	IV	Value Education	**2**	**2**

SEMESTER – 1 Mechanics and Properties of matter – Core Subject 1 Credit -4

Objective:

- To study the motion of objects, understand the laws of motion and laws of gravitation. To know the principle of conservation of momentum, energy and their consequences.
- To identify the characteristics of solids and fluids interms of their properties

Unit I: Laws of motion

Newton's laws of motion – Force- Impulse of a force - law of conservation of linear momentum – centre of mass – motion of centre of mass of a system of particles - Collision – Elastic and in elastic collision – (Fundamental laws of impact) – Newton's law of impact – coefficient of restitution – Impact of a smooth sphere on a fixed plane – Direct impact between two smooth spheres – Oblique impact between two smooth spheres – Calculation of final velocities of the spheres – Loss of K.E due to impact.

Unit : II Dynamics of rigid body

Moment of inertia – Theorems of perpendicular and parallel axex – M.I of a circular ring, disc, solid sphere, hollow sphere and cylinder about all axes – angular velocity, angular momentum and K.E of rotation – Torque and angular acceleration – Relation between then – Expression for a acceleration of a body rolling down an inclined body without slipping.

Unit – III Gravitation

Newton's law of gravitation – G by Boy's method – Mass and density of earth – Accelaration due to gravity – Variation of g with altitude , depth and rotation of earth - Value of g at poles and equator.

Gravitational field – Gravitational potential – Gravitational potential due to spherical shell – Gravitational potential due to a solid sphere (inside and outside)

Unit IV Elasticity

Elasticity – Stress, Strain - Hooke's law – Elastic moduli – Poisson's ratio – Beams – bending of beams – Expression for bending moment – Theory of uniform and non – uniform bending - Determination of young 's modulus by uniform and non- uniform bending methods – Torsion of a body – Expression for couple per unit twist – Work done in twisting a wire – Torsional oscillations of a body - Rigitity modulus by dynamic torsion method (Tortional pendulum)

Unit V Surface tension and viscosity

Surface tension – definition – Molecular forces – Explanation of surface tension on kinetic theory – Surface energy – work done in increasing the area of a surface – Excess pressure inside a curved liquid surface – Excess pressure inside a liquid drop and soap bubble.

Viscosity – Co efficient of viscosity – Streamlined and turbulent motion – critical velocity – Bernaillis theorem – Proof – Applications – Venturimeter – Pitottube

Books for study

1. Mechanics : D.S. Mathur S.Chand & Co, Edition 2002.

2. Elements of properties of matter – D.S. MAthur – S. Chand & Co., 2004.
3. Properties of matter – Murugesan – S. Chand & Co., 2004.

Reference Books

1. Mechanics Part I and Part II, Narayanamoorthy National Publishing Company, 2001.

2. Fundamental of Physics, D. Hallidary , Resnick and J Walker, 6th Edition, Wiley, NewYork 2001.

4. Properties of matter – Brijlal and Subramanian S. Chand & Co., 2006.

SEMESTER I **Programming in c – I** **(2Hours/Week)** **Skill based -1** **credit -2**

Objective: The purpose of this course is to introduce students about the key features an implementation of C , which is a powerful general purpose programming language available in all platforms and provide an indepth knowledge and skill in it. C is a good choice to start programming journey to students.

Unit :I **Introduction to C:** Basic structure of C programs –Character set – C tokens – keyword and identifiers – Constants – Variables – Data types – Declaring variables – Initializing variables – type conversions.

Operators and expressions : Introduction – types of operators – Arithmetic operators - Relational, logical, and assignment operators - Increment and decrement operators – Conditional operators – Bit wise and special operators – arithmetic expressions – Mathematical functions – priority of operators.

Unit : II **Input and output functions & Control Statements:** Data input and output – Unformatted function , getchar( ), putchar ( ) , gets( ) , puts( ) - formatted input and output – scanf( ), printf( ),escape sequence – Simple IF statement – Simple IF, ELSE statement – Block IF Statement – Block IF ELSE statement – looping operation using while statement – for statement – Break statement – continue statement - Switch statement – Goto statement

Unit : III **Functions :** Defining a function – Accesing a function – Category of function – Passing arguments to function –Recursion- Library function .

Unit :IV **Arrays:** Defining an Array – Processing an array – one, two dimensional arrays – Simple programming using arrays: - Simple program (addition of two matrices - subtraction of two matrices - ascending and descending order .)

Unit : V

Programs using Control statements & loops – To find the quadratic equation - To find a Fibonacci series – biggest of three nos, factorial of a no, odd or even.

Programs using functions – Binomial coefficient, Sin series, Summing the nos (1-n) using recursion

Book for study

1. Theory and problems of programming with C – By Byron Gottfried Second edition – Tata Megraw Hill, 2004.

Reference Books

1. Programming in C – By E. Balagurusamy – Third Edition – Tata Megraw Hill, 2004.
2. Programming in C by S. Ramasamy and P. Radhaganesan, Scitech Publications (India) Private Limited, Chennai and Hyderabad, 2006.

SEMESTER – I **Solar Energy** **(2Hours/Week)** **Skill based -2** **credit -2**

Unit :I

Various forms of energy – renewable and non renewable energy system – Coal , oil and natural gas – availability – Merits and demerits .

Unit: II

Solar energy – Nature of solar radiation – Components – Solar heaters – Crop dryers – space cooling.

Unit : III

Solar ponds – Solar cooker – Water desalination – Photo voltaic basics – merits and demerits.

Unit : IV

Geo thermal energy – Wind energy – Ocean thermal energy conversion (OTEC) – Energy from waves and tides – (Basic ideas, nature, application, merits & demerits.

Unit : V

Biomass energy – Classification – Photo synthesis – Bio mass conversion – Gobar gas plants – ethonal from wood.

Books for study

1. Non – conventional enegy resources
   - B.. Khan – Tata Megraw Hill – 2000.

Reference Books:

1. G.D. Rai – solar energy utilization – Edn – 1995.
2. S.P. Sukhetme – Solar Enegy Tata Megraw – Edn II 1995
3. G.D.Rai – Edn VI 1997
4. Godfrey Byle – Renewable Energy Power for a sustainable nature: Alden oess limited oxford 1996.

SEMESTER –I NON MAJOR ELECTIVE – 1 (2Hrs) BASIC PHYSICS –I CREDIT – 2

Unit – 1

S.I. Units – measurements of length, mass time and othe physical quantities – Dimensional formula for area, volume, density and force – Uses of dimension.

Unit – II

Matter – Solid, Liquid, Gas and Plasma – Application of Plasma – change of state – specific heat capacity – specific latent heat of ice and steam.

Unit - III

Kinds of energy – Mechanical energy, Thermal energy, Optical energy, Sound energy, Electrical energy, Atomic and Nuclear energy, (Examples) – Conservation of energy.

Unit - IV

Renewable and non – renewable energy – Fossil fuel – coal Oil – Solar – Wind – Biomass – OTEC.

Unit - V

Mirror – Laws of reflection – Image formation (Concave and Convex mirror) Lens – Law's of refraction – Image formation (Concave and Convex lens) – Defects of eye and rectification.

Book for Study

1. First Year B.Sc Physics – B.V. Narayan Rao, New Age International (P) Lt, 1998.

Reference Books

1. Mechanics – D.S. Mathur – S.Chand & Co., 2002.
2. Properties of matter – D.S. Mathur – S. Chand & Co., 2002.
3. Properties of matter – Brijlal Subramanian – S. Chand & Co., 2006.

Second Semester **Thermal Physics and Acoustics** **Hours:4; Credit:4**

Unit - I : Elasticity

Elasticity -stress,strain-Hooke's law-Poisson's ratio- Young's modulus-bending of beam-bending moment-Theory of Uniform and non-uniform bending-Rigidity modulus- Torsional oscillations of a body-Expression for rigidity modulus using Torsion pendulum-I section girders.

Unit - II : Gravitation

Newton's law of Gravitation- Kepler's law of planetary motion- Variation of 'g' with depth, altitude- mass of earth- gravitational field-gravitational potential -gravitational potential at a point inside and outside a spherical shell.

Unit - III : Surface Tension and Viscosity

Surface tension definition- Capillarity- Theory- Determination of surface tension of water-viscosity-coefficient of viscosity-streamline and turbulent motion critical velocity- Stoke's law to determine coefficient of viscosity- Poiseuille's method for coefficient of viscosity.

Unit - IV : Thermodynamics

Thermodynamics-Zeroth law-I,II and III law of thermodynamics-Entropy-change of entropy in reversible and irreversible process-change of entropy in converting ice to steam.

Unit -V : Black Body Radiation

Black body radiation- Stefan's law of radiation- derivation of Newton's law from Stefan's law-distribution of energy in black body-Wien's displacement law-solar constant-temperature of sun-Angstrom's Pyrheliometer.

Books for study:

1. Properties of matter : Brijlal & Subramanyam, Chand & co
2. Elements of Properties of matter : D.S. Mathur , Chand & co.
3. Heat and Thermodynamics : Brijlal & Subramanyam, Chand & co.
4. Heat and Thermodynamics : D.S Mathur , Chand & co
5. Heat and thermodynamics : R. Murugesan , S.Chand & co

SEMESTER – III <u>ELECTRICITY AND ELECTROMAGNETISM</u> CS-3 CREDIT -4

Unit – I

Faraday's laws of Electromagnetic induction, - Lenz's law – self inductance – energy stored in an inductance – Experiment to determine self inductance by Rayleigh method with theory – Mutual inductance – Determination of Mutual inductance using B.G. (with theory) Coefficient of Coupling – Eddy Currents.

Unit –II

Growth & decay of current in LR circuit – Growth and decay of charges in CR circuit – Growth and decay of charge in a circuit with inductance, capacitance and resistance in series – Determination of high reistance by Leakage (B.G).

Unit – III

Mean value of alternating e.m.f – RMS value of the alternating current/voltage- Alternating current applied to LR, Cr and LCR circuits – Series Resonance Circuit – Parallel Resonance Circuit – Power in an A.C. Circuit – Wattless Current – Power factor – Q factor – choke – skin effect – A.C. bridges – Maxwell's bridge – Anderson's bridge and owen's bridge.

Unit – IV

Definition of ,H, M and magnetic succebitlity – magnetic materials & magnetization – Hysterics – workdone in taking unit volume of magnetic materials through complete cycle of magnetization – Area of Hysterisis loop – Ballistic method. Ferro magnets, ferri ,magnets and determination of Susceptibility – Guoy's method.

Unit V

Derivations of Maxwell's equations – types of currents – displacement current – significance of displacement current – Maxwell's equation in material media andfree space – Electromagnetic waves in free space – electromagnetic waves in isotropic non conducting media.

Book for Study

1. Electricity and Manetism by Sehgal, Chopra & Sehgal Sultan, Chand & Sons. 1998.

Reference Books

1. Electricity and Magnetism 20th revised edition – Brijlal & Subramaniyam , Ravi Offset Printers & Publishers Pvt., Ltd., 1997.
2. Electricity and Magnetism 2nd revised edition – Narayanamoorthy & Nagarathinam , National Publishing & Co. 1997.
3. Electricity & Magnetism 2nd Edition by Tiwari K.K.S. Chand & Co Edition (2002)
4. Electricity & magnetism – Murugesan R.S.Chand & Co., New Delhi 2004.

SEMESTER – II ASTROPHYSICS SKILL BASED – 3 CREDIT - 2

Unit :I

Birth of Modern Astronomy – Geocentric and Heliocentric — Celestial sphere – Kepler's laws of planetary motion – Newtonian gravitation- Planets-Terrestrial and Jovian planets (Planets individual description is not required in detail) - Asteroids- Meteoroids- Comets.

Unit :II The orientation of Earth in space- Arc and time units- local time-Standard time Elements of the telescope-Properties of images - Kinds of Optical telescopes- Refracting and Reflecting telescopes- Radio telescope-Spectrograph – Limitations.

Unit:III

Sun-Physical properties-Composition-Core-Nuclear Reactions -Photosphere-Chromosphere- Corona- Sunspots-Sunspot cycle-Solar Wind-Auroras.

Unit:IV

Classification of Stars-The Harvard Classification system-Hertzprung-Russel Diagram-Luminosity of a Star-Stellar Evolution-White Dwarfs-Neutron stars-Black holes-Physics of Black Holes.

Unit : V

Galaxy nomenclature-Types of Galaxies-Spiral-Elliptical-irregular galaxies- Milky Way and its structure- Star clusters-Galactic clusters-Pulsars.

TEXT BOOKS:

1. Niclolas.A.Pananides and Thomas Arny, 1979, Introductory Astronomy, Addison Wesley Publ. Co.
2. A. Mujiber Rahman, (In Press), 2018, Text book of Astronomy and Astrophysics.

REFERENCES:

1. Abell, Morrison and Wolf, 1987, Exploration of the Universe, 5th ed., Saunders College Publ.
2. Carrol and Ostlie, 2007, Introduction to Modern Astrophysics, 2nd ed., Pearson International.
3. William J. Kaufmann, III, 1977, Macmillan Publishing company, London.
4. Abhyankar, K.D., Universities Press.

SEMESTER – II **Medical Physics** **SKILL BASED – 3** **CREDIT - 2**

Objective: To understand the basics about the biological systems in our body, their behavior, and the ethical issues in medical science.

Unit: I

Introduction: Terminology, Modeling and Measurement – Forces on and in the Body – Physics of the Skeleton – Heat and Cold in Medicine.

Unit :II

Physics of CVS : - Energy work and Power of the Body- Pressure – Physics of Cardiovascular system – Sound in Medicine – Physics of the Ear and Hearing.

Unit :III

Physics of Eye and Vision: Light in Medicine – Physics of Eyes and Vision – Electricity within the Body – Applications of Electricity and Magnetism in Medicine.

Unit :IV

Nuclear Medicine : Physics of X-rays Diagnostic – Physiotherapy and Electrotherapy.

Unit – V

Ethical Issues: Ethical issues in the progress of medical science – Informed consent – Animal testing – Ethical principles of humans used in medical research trials – Human cloning – HIV/AIDs and ethics – Euthanasia – Brain death – Organ donation – SARS.

Text Books

1. John R. Cameron and James G.Skofronick, 1978, Medical Physics, John Willy & Sons. (Unit I – Ch.1,2,3,4, Unit II – Ch. 5,6,8,13, Unit III – Ch.14,15,9,11, Unit IV – Ch.16).
2. Tharien, A.K., Ethical issues in the progress of medical science, Voluntary Health Association of India (VHAI), New Delhi (Unit V – all).

SEMESTER –II BASIC PHYSICS –II (2Hrs) NON – MAJOR ELECTIVE -2 CREDIT -2

Unit – I

Electric current – Voltage and resistance- Ohm's law and Kirchoff's law – Resistance in series and parallel.

Unit – II

DC Source – Primary cells – Leclanche and Daniel cell – Secondary cells – Lead Acid Accumulator – DC generator.

Unit – III

Alternating current generating by hydro, thermal and atomic power stations – RMS value – Peak value – (Quantitative) – AC generator – no derivation.

Unit – IV

Measurement of Electric power by Wattmeter – simple calculations – Induction coil – Wattless current – Power factor.

Unit – V

Simple electrical circuits – resistor, capacitor and inductor connected to AC source (independently) – Relationship between emf and current in each case. Diode – Bridge Rectifier.

Reference Books

1. Electricity and Magnetism – R. Murugesan – S. Chand & Co 2004.

DIGITAL ELECTRONICS

SEMESTER VI **HOURS:4; CREDIT:4**

UNIT I Number System& Boolean Algebra

Number system-Binary,decimal,octal,hexadecimal(conversion from one to another)-binary addition,subtraction-binary subtraction by 1's and 2's complement-basic laws of Boolean Algebra-properties-Principle of duality-DeMorgan's theorem-proof.

UNIT II Logic Gates

Positive and negative logic-logic gates-OR,AND,NOT,NAND and EX-OR-DRL-OR gate, AND gate-RTL NOT gate-DTL NOR gate- DTL NAND gate-universal NAND-universal NOR-Sum of products(SOP)-Karnaugh map-2 variable,3 variable and 4 variable-simplification using k-map.

UNIT III Arithmetic circuits

Half adder- full adder- 4 bit binary adder- half subtractor- full subtractor- 4 bit binary subtractor- Multiplexer(MUX)- 4 to 1 MUX- Demultiplexer(DMUX)- 1 to 4 DMUX- Encoder- 8 to 3 encoder- decimal to BCD encoder- decoder- 3 to 8 decoder- BCD to decimal decoder- BCD to seven segment decoder.

UNIT IV Timers,Flipflops and registers

Timer- IC 555 monostable and astablemultivibrators- flip flops- RS flip flops (using NAND and NOR)- edge triggered RS flip flop- JK flip flop- JK master slave flip flop- D flip flop- register- serial in serial out shift register.

UNIT V Counters, memories and data converters

Counters- Ring counter- decade counter-semiconductor memories- ROM-PROM- applications- RAM- Dynamic RAM (DRAM)-Digital to analog converter(D/A)- binary ladder type-analog to decimal converter(A/D)- parallel A/D converter.

Books for study:

1. Digital principles and applications : Albert Paul Malvino , Donald P. Leach , Tata McGraw Hill
2. Digital logic circuits : P. Raja (second ed), Scitech Publications Pvt. Ltd.
3. Digital electronics and logic design :JaydeepChakravorty , University Press.

4.

Laser and Spectroscopy

Objectives:

To understand the basic information in laser
To learn the properties and various application in laser
. To perceive the basic concept of spectroscopy
To gain the theory concept of photo electricity and related applications

UNIT I Introduction – characteristics of laser – Difference between light and laser – Principle of laser action – population inversion – pumping methods – Optical resonator.

UNIT II Types of Laser – Ruby laser – construction and its application – He – Ne laser – construction and its application – Theory of LED – LED materials – Laser diode – Homo junction semiconductor laser (Ga As laser)

UNIT III Application of lasers – Holography – Theory and its application –Difference between holography and photography.

UNIT IV Introduction – Electromagnetic spectrum – IR radiations – properties, production, detection and uses – UV radiations – properties, production, detection and uses – Raman effect – Theory and experimental study – Applications.

UNIT V Photo electricity – Laws of photo electricity – Einstein's photo electric equation – photo electric cells – Types – application of photo electric cells

BOOKS FOR STUDY:

Engineering Physics – I by G.Senthilkumar VRB publishers (p) ltd; Unit I to III

Unit: 1. Chapter. 2.1, 2.2, 2.3, 2.6, 2.7, 2.8, 2.9

Unit: 2. Chapter. 2.11, 2.13, 2.16

Unit: 3. Chapter. 2.19, 2.20, 2.21

Unit: 4. Chapter. 5.1, 5.2, 5.3, 5.5

Unit: 5. Chapter. 4.9,4.10,4.11,4.12,4.13,4.14

2. Optics and Spectroscopy by R.Murugeshan, S.Chand & Sons,New Delhi ,Unit IV
3. Modern Physics R.Murugeshan, S.Chand & Sons, New Delhi, Unit V

REFERENCE BOOKS:

1. Optics and Spectroscopy By Brijlal and Subramanian, S.Chand &Sons.New Delhi

2. Engineering Physics –I by Dr. P. Mani Dhanam Publications, Chennai.

Atomic Physics & Quantum Physics

Objectives:

1. To give an introductory account of the basic principles of atomic physics.
2. To impart knowledge on the structure of the atom.
3. To introduce the origin of Quantum theory.

Unit I

Introduction – Thomson's atom model – Rutherford model of the atom – Theory of alpha particle scattering – Rutherford scattering formula - Bohr atom model –Bohr's theory of Hydrogen atom – Energy levels and Excitation potential and Ionization potential – Davis and Goucher's method –Bohr Sommerfield theory - Sommerfield's relativistic atom model – Explanation for the fine structure of Hα line – vector atom model - Relativistic variation of atomic mass – application to fine structure of spectral lines – Vector atom model– Quantum numbers – coupling schemes – Pauli's exclusion principle – Arrangement of electrons in atoms

Unit II

Magnetic dipole moment due to orbital motion of the electron – magnetic dipole moment due to electron spin - Stern and Gerlach experiment - Optical spectra – spectral terms and notations – selection rules -Fine structure of sodium D lines –Zeeman effect – theory and experiment – quantum theory of Zeemann effect – Anamolous Zeemann effect – Stark effect – Paschen Back effect

Unit III

Planck's quantum theory of radiation – Dual nature of matter and radiation – De-Broglie's hypothesis of matter waves – Expression for wavelength – Davisson's and Germer experiment – G.P.Thomson experiment with relativistic correction – concept of wave packet –

Group velocity and wave velocity and their relation – Heisenberg's Uncertainty principle – Experimental illustration – Determination of position with γ – Ray microscope- Diffraction of an electron beam by a single slit.

Unit IV

Basic postulates of quantum mechanics – Derivation of time dependent and time independent Schrodinger's equations –properties of wave function - Physical significance of wave function– orthogonal and normalized wave functions– Eigen functions and Eigen values.

Unit V

Simple applications of Schrodinger wave equation- The particle in a Box – Infinite square well potential – The Barrier penetration problem - Linear harmonic oscillator – The rigid rotator .

Text Book:

Modern Physics (sixth revised edition 1998 – S.Chand & Company Ltd.) by R.Murugeshan

Unit: 1. Chapter.4 Sections (4.1 to 4.5, 4.8, 4.10(2), 4.11 to 4.16)

Unit: 2. Chapter.4 Sections (4.18 to 4.20, 4.22, 4.23, 4.26 to 4.28)

Unit: 3. Chapter. 7 Sections (7.1 to 7.4)

Unit: 4. Chapter. 7 Sections (7.7 to 7.9)

Unit: 5. Chapter. 7 Sections (7.10, 7.12, 7.13, 7.15)

Reference Books:

1. Modern Physics by Seighal Chopra and Seighal
2. Quantum Mechanics by Satyaprakash

NUCLEAR & PARTICLE PHYSICS

Course objective: The student must be able to

- Understand the basic properties of nuclei and the atomic nucleus
- Describe radioactivity and related phenomena

- Explain the various interactions of nuclear radiation with matter
- Understand the fission and fusion reactions and their applications
- Understand nuclear interactions and elementary particles involved in the interactions

Unit I- General Properties of Nuclei:

Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. (10 Lectures)

Unit II- Nuclear Models:

Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. (12 Lectures)

Unit III- Radioactivity decay:(a) **Alpha decay:**

Basics of α-decay processes, theory of α- emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) **β-decay:** energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) **Gamma decay:** Gamma rays emission & kinematics, internal conversion. (10 Lectures)

Unit IV-(a) Nuclear Reactions:

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering). (8 Lectures) Interaction of Nuclear Radiation with matter: Energy loss due to ionization (BetheBlock formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. (8 Lectures)

(**b**) **Detector for Nuclear Radiations:**

Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation 33 Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si & Ge) for charge particle and photon detection (concept of charge carrier and mobility). (8 Lectures)

Unit V - a) **Particle physics:**

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. (14 Lectures)

b) Particle Accelerators:

Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons. (5 Lectures)

Text Book:

Nuclear and Particle Physics by D.C.Tayal(Himalaya Publications)

Reference Books:

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998)
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004)
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons
5. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi
6. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP- Institute of Physics Publishing, 2004).
7. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000). • Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991)

8. ANALOG ELECTRONICS

SEMESTER V **HOURS:4 ; CREDIT:4**

UNIT I – Semiconductors

Semiconductor theory- n type and p type- PN diode characteristics- half wave, full wave rectifiers-zener diode characteristics- transistors-CE,CB,CC configuration-relation between α,β,and γ –load line (DC &AC)- biasing circuits.

UNIT II - FET

FET construction – n channel, p channel –biasing-difference between FET and transistor-characteristics- drain resistance, transconductance and amplification factor- MOSFET characteristics.

UNIT III - Amplifiers

Amplification – single stage transistor amplifier- voltage gain- multistage amplifier- gain, frequency response, decibel gain, bandwidth- push pull amplifier- opamp characteristics-application as adder, subtractor, integrator and differentiator.

UNIT IV - Oscillators

Feedback-positive & negative feedback –Barkhausen criteria- transistor oscillatorsHartley, Colpitt's, Phase shift oscillators.

UNIT V Communication

Modulation-Types of modulation- Modulation Factor-Amplitude modulation-power in AM wave-block diagram of AM transmitters and receivers-Frequency modulation-block diagram of FM transmitters and receivers-Digital modulation(qualitative)-Pulse amplitude modulation-Pulse time modulation.

Books for study:

1. Principles of electronics - V.K.Mehta ; S.Chand &co
2. A textbook of applied electronics -R.S.Sedha ;S.Chand & co
3. Basic electronics -B.L. Theraja; S.Chand & co
4. Electronic devices and circuits - Salivahanan, Sureshkumar, Vallavaraj; Tata Mcgraw Hill
5.Electronic communication system - George Kennedy
6. Basic electronics and linear circuits - N.N. Bhargava, D.C. Kulshreshtha,S.C. Gupta : Tata McGraw Hill
7. Basic electronics - J.J.Brophy ; McGraw Hill
8. Communication systems : B.P.Lathi ; Wiley Eastern Limited

Nano Physics

OBJECTIVES

- To create the basic knowledge in nanomaterials.
- To understand the scientific perspective of nanomaterials.
- To identify the techniques suitable for nanomaterial synthesis.
- To know the significance of nanomaterials.
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Unit I Introduction to Nanomaterials

History of Nanoscience – Definition of Nanometer, Nanoscience and Nanotechnology – Classification of Nanomaterials – Examples of nanostructured materials - Wigner-Seitz cell – Two dimensional lattice type – Primitive cells of three dimensional lattices.

Unit II Nano scale properties:

Effect of size reduction on Bulk properties – Opto electronic property of bulk and nanostructures – Electronic structure of Nanomaterials and the Fermisurface – Fermisurface – Size effect on Electron- Phonon coupling – Size effect on physical properties.

Unit III Synthesis and Processing of nanomaterials

Synthesis techniques for the preparation of nanoparticles – Bottom-up approach – Sol-Gel synthesis – Hydrothermal Growth – Thin film growth – Physical Vapour Deposition (PVD) – Chemical Vapour Deposition (CVD) – Top-Down approach – Ball Milling – Microfabrication – Lithography.

Unit IV Characterization tools

Introduction – X-ray diffraction and Scherrer method – Calculation of lattice parameter – Size/Strain analysis: Peak broadening – Scanning Electron Microscopy (SEM) – Electron interaction with matter – Mechanism involved in imaging with SEM – Transmission Electron Microscopy (TEM) – Stoichiometry study by Energy-Dispersive X-ray analysis (EDAX).

Unit V Application of nano materials

Introduction – Applications in Materials Science – Applications in Biology and Medicine – Biocompatibility and toxicity in nanoparticles – Cytotoxicity in Nanoparticles – Neurotoxicity in nanoparticles – Applications in surface science – Applications in Energy and Environment – Applications in nanostructured thin film.

Book for study:

Nanoscience and Nanotechnology: Fundamentals to Frontiers by M.S. Ramachandra Rao, Shubra Singh, Wiley India pvt. Ltd., New Delhi. (2013).

Unit: 1 **Chapter 1:** Sections (1.1, 1.2, 1.3, 1.3.1)

Chapter 2: Sections (2.2.2, 2.2.3, 2.2.4)

Unit: 2 **Chapter 2:** Sections(2.7, 2.8, 2.9, 2.9.1, 2.9.2, 2.9.3)

Unit: 3 **Chapter 4:** Sections (4.4, 4.4.1, 4.4.1.1, 4.4.1.2, 4.4.1.3, 4.4.2, 4.4.2.1, 4.4.2.2, 4.4.2.3)

Unit: 4 **Chapter 8**: Sections (8.1, 8.2, 8.2.1, 8.2.2, 8.3, 8.3.1, 8.3.2, 8.4, 8.5)

Unit: 5 **Chapter 10**: Sections (10.1, 10.2, 10.3, 10.3.1, 10.3.2, 10.3.3, 10.4, 10.5, 10.6)

Reference:

1) T. Pradeep, Nano: The Essentials, Tata Mc.Graw Hill company Ltd (2007)

2) C. N. R. Rao, A. Mu¨ller, A. K. Cheetham, *The Chemistry of Nanomaterials :Synthesis, Properties and Applications*, Volume 1, Wiley-VCH, Verlag GmbH, Germany (2004).

Classical and Statistical Mechanics

Objective: (i)To understand the mechanics of systems of particles and their equations of motion.

(ii) To study the concept of statistics of molecules.

Unit 1 **Mechanics of a System of Particles** **(12 hours)**

External and Internal force, Centre of Mass – Conservation of Linear momentum – Conservation of Angular momentum –Conservation of Energy (K.E., P.E.) - Conservation theorem – (Example :Box Train, Atwood's Machine)

Constraints: Types of Constraints - Examples – Generalized Coordinates (Transformation Equations), Principle of Virtual Work – D'Alembert's Principle.

Unit 2 Lagrangian Formulation (12 hours)

Lagrangian Equations from D'Alembert's Principle (Derivation) – Applications- Newton's equation of motion, Simple Pendulum, Atwood's Machine, Compound Pendulum, L-C circuit, Motion under central force, Lagrangian Equations in presence of Non-Conservative force.

Unit 3 HAMILTONIAN FORMULATION (12 hours)

Hamiltonian Function H and conservation of energy(Jacobi's Integral) – Physical significance, Hamilton's Equations (Derivation) –Applications Harmonic oscillator, motion of a particle in central force field, Charged particle moving in an electromagnetic field, Compound Pendulum, Two Dimensional Harmonic Oscillator ,Simple Pendulum.

Unit 4 Classical Statistics (12 hours)

Statistical Equilibrium – Probability Theorems in Statistical Thermodynamics – Maxwell Boltzmann Distribution Law - Maxwell Boltzmann Distribution in terms of Temperature - Maxwell Boltzmann Distribution and Ideal Gas.

Unit 5 Quantum Statistics (12 hours)

Introduction – Phase Space – Fermi Dirac Distribution Law – Electron Gas – Bose Einstein Distribution Law – Photon Gas - Comparison of the three Statistics.

TEXT BOOKS:

1. J.C. Upadhyaya, July 2005, Classical Mechanics, Published by Himalya Publishing House, Mumbai

   Unit1:1.7.1, 1.7.2, 1.7.3, 1.7.5, 1.7.8- (a, b, c)(Example 1, 2) 2.3, 2.4, 2.5, 2.6

   Unit2: 2.7, (Example1, 2, 3, 5,7, 8), 2.9, 2.14 (2 only)

   Unit3: 3.4, 3.5, 3.7 (Example 1, 2,3, 4, 5& Ex-1)

2. Brijlal & Subramaniam, Reprint 1998, Heat & Thermodynamics, S. Chand & Company Ltd

   Unit – IV: Ch. 9.1- 9.6,

   Unit – V: Ch. 9.7- 9.13)

REFERENCES:

1. Gupta,B.D., Satyaprakash, 1991, Classical Mechanics, 9th ed., Kadernath Ramnath Publ., Meerut

2. Gupta, Kumar, Sharma, 2005, Classical Mechanics, PragatiPrakashan Publ., Meerut.

3. Murray R.Spiegal, 1981, Theoretical Mechanics, Schaum's outline series, Mc Graw Hill Publ. Co., New Delhi.

4. Goldstein, 2001, Classical Mechanics, II Edition, Narosa Publishing Co.

5. French, A.P., Special theory of relativity, Van Nostran Rainhold Company.

6. J.K.Sharma and K.K.Sarkar, 1988, Thermodynamics and Statistical Mechanics– (2nd enlarged Edition.), Himalaya Publishing House, New Delhi.

7. Agarwal and Eisner, Statistical Mechanics – New Age International Publ.

Opto Electronics

Unit – I

Introduction – PN junction as a Light Source (LED) – LED materials – Advantages – LCD _ Characteristics and action of LCD – Advantages.

Unit – II

Laser - Introduction – characteristics of Laser – Spontaneous and stimulated emission – Einestein coefficients- condition for population inversion – three level scheme – semi conductor.

Unit III

Photo detector – characteristics of photodetectors – PN junction photo detector – PIN photo diode – Avalanche photo diode – Photo transistor.

Unit IV

Introduction – principle of optical fibre – light transmission in a optical fibre – Acceptance angle – Numerical aperture.

Unit V

Fibre index profiles – Step index, graded fibre (transmission of signals) – Advantages of fibre oprtic communications, optical switching – Logic gates.

Book for study

1. Semiconductor physics and opto electronics – P. K. Palanisamy, SCITECH Publication, Chennai 2002.
2. Optical fibres and Fibre Optic Communication – Sabir Kumar Sarkar IV Revised Edition 2003.

Reference Books

1. Opto Electronics – Wilson & Hawker, Prentice Hall of India 2004.