FIVE YEAR INTEGRATED M.Sc. PHYSICS
(CHOICE BASED SEMESTER SYSTEM)

REGULATIONS

Common to all Departments of Studies in the Faculty of Science


ELIGIBILITY FOR ADMISSION

Candidates for admission to the first year of the Five Year Integrated M. Sc. Degree Courses shall be required to have passed the final examination of +2/Higher Secondary Course or Equivalent thereto with a minimum pass under academic stream with Physics as one of the papers in the examination conducted by the Board of Secondary Education, Tamilnadu Government or an examination of any other authority accepted by the Syndicate of this University. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

MASTER'S PROGRAMME

A Master's Programme consists of a number of courses, which include a set of Language papers, core, optional and ancillary papers.

Each course may consist of Lectures / Tutorials / Laboratory work / Seminar / Project work / Practical training report / Viva voce etc.

COURSE DURATION

The duration for completion of a Five Year Integrated M.Sc. Programme in any course is Ten Semesters.

An academic year is divided into two Semesters, Odd Semester and Even Semester.

The normal semester periods are:
Odd semester: July to November (90 working days)
Even semester: December to April (90 working days)

CREDITS

The term credit is used to describe the quantum of syllabus for various program in terms and hours of study. It indicates differential weightage given according to the contents and duration of the courses in the Curriculum design.

The entire programme carries credit system. The number and distribution of credits for the courses will be deciided by the respective faculties.

Normally, in each of the courses, credits will be assigned on the basis of the Lectures / Tutorials / Laboratory work and other form of learning in a 18 weeks schedule.

The minimum credit requirement for the award of the degree of a Five Year Master's Programme shall be 225.
ATTENDANCE

Every teaching faculty handling a course shall be responsible for the maintenance of Attendance Register for candidates who have registered for the course.

The teacher of the course must intimate the Head of the Department at least Seven Calendar days before the last instruction day in the semester about the particulars of all students who have secured an attendance of less than 75%.

A candidate who has secured the attendance less than 75% shall not be permitted to sit for the End-Semester examination. However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 75% attendance for valid reasons on medical grounds upto 65%.

EXAMINATIONS

The internal assessment for each theory course carries 25% of marks and practical course carries 40% of marks which is based on two sessional tests and a variety of assessment tools such as seminar and assignment. The pattern of question paper will be decided by the respective faculties. The tests are compulsory. If for any valid reason, the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department. But the student cannot repeat the internal assessment tests.

There will be an End Semester Examination for 75% of marks for 3 hours duration for each theory course and 60% of marks for practicals. The pattern of question paper will be decided by the respective faculties.

EVALUATION

The performance of a student in each course is evaluated in terms of Percentage of Marks (PM) with a provision for conversion to Grade Point(GP). The sum total performance in each semester will be rated by Grade Point Aggregate (GPA) while the continuous performance from the 2nd Semester onwards will be marked by Overall Grade Point Aggregate (OGPA).

MARKS AND GRADING

A student is deemed to have passed a particular paper provided he has secured a minimum of 50% in the end semester examination and an aggregate of 50% of marks in both sessional and end semester examination put together.

The percentage of marks obtained by a candidate in a course will be indicated in a letter grade. The term Grading system indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class for each course and overall grade for the Master's Programme.
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<tr>
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The successful candidates in the Core Subjects are classified as follows.

I - Class 60% marks and above in over all percentage of marks (OPM).

II - Class 50-59% marks in over all percentage of marks.

Candidates who obtained 75% and above but below 90% of marks (OPM) shall be deemed to have passed the examination in First Class (Distinction) and who obtained 90% and above (OPM) shall be deemed to have passed the examination in First Class (Exemplary) provided he / she passes all the course prescribed for the programme at the first appearance.

Only the candidates who obtained the highest OPM in all examinations at the first appearance are considered for ranking.

A student is considered to have completed a course successfully and earned the credits if he / she secures over all grades other than F. A letter grade F in any course implies a failure in that course. A course successfully completed cannot be repeated for the purpose of improving the Grade Point.

The F Grade once awarded stays in the grade card of the student and is not deleted even when he / she completed the course successfully later. The grade acquired later by the student will be indicated in the grade sheet of the Odd / Even semester in which the candidate has appeared for clearance of the arrears.

If a student secures F grade in the Project Work / Field Work / Practical Work / Dissertation, either he / she shall improve it and resubmit it if it involves only rewriting incorporating the clarification of the evaluators or he / she can re-register and carry out the same in the subsequent semesters for evaluation.

**TRANSITORY REGULATIONS**

Wherever there had been change of syllabi, examinations based on the existing syllabus will be conducted for three consecutive years after implementation of the new syllabus in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent subjects, as per the new syllabus, on the recommendations of the Head of the Department concerned.
Details of Course With Credit
(2014 – 2015)

Total Credits up to three years: 135
Total Credits up to five years : 225

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**SIXTH SEMESTER**

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**SEVENTH SEMESTER**

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<th>Internal Assessment Marks</th>
<th>End Semester Examination Marks</th>
<th>Total Marks</th>
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<td>P</td>
<td>C</td>
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### OPTIONAL COURSES OFFERED TO OTHER SCIENCE DEPARTMENTS

**IN THE VIII, IX and X SEMESTERS**

<table>
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<tr>
<th>Subject Code</th>
<th>Theory</th>
<th>Credit</th>
<th>Internal Assessment Marks</th>
<th>End Semester Examination Marks</th>
<th>Total Marks</th>
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<tbody>
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<td>C</td>
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<td>OIPHT 01</td>
<td>Physics of Earth</td>
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<td>Energy Physics</td>
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<td>Bio Physics</td>
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### INTERNAL ASSESSMENT MARKS

**THEORY**

- Internal Assessment Test-I : 10
- Internal Assessment Test-II : 10
- Assignment/Seminar : 05

Total 25

**PRACTICAL**

- Test I : 15
- Test II : 15
- Record : 10

Total 40
SYLLABUS
FIRST YEAR: FIRST SEMESTER
Part – I : Language - Tamil - jkpo; jhs; - 1
ITAC- 11 – nra;ASk; ciueilAk;

myF - 1 - FWe; njhif
ghly; vz;fs;: - 3 6 16 18 24 28 32 37 40 54 57 60 69 74 77 83 85 93 97 99
(UgJ ghly;fs; kl;Lk;)

myF - 2- GwehD}W
ghly; vz;fs;: - 9 19 27 34 38 45 51 55 66 71 76 82 86 92 96
(gjpide;J ghly;fs; kl;Lk;)

myF - 3 - jpUf;Fws;
md;Glik> nra;ed;wp mwpjy;> mlf;fKilik> Gwq;$whik> <if> mUSilik (MW mjpfhuq;fs;
kl;Lk;)
ehybahH - fy;tp> mwpTilik (ehybahH)

myF - 4 - fk;guhkazk;
Ffg;glyk; (mNahj;jpah fhz;lk;)

myF - 5 - ciueil
kh. nghparhk J}ud; - rpw;gp. ghyRg;gpukzpad;
fhg;gpaj;jpwd; - Nrhk. ,stuR

ghHit E}y;fs;
1. FWe; njhif - c. Nt. rh. gjpg;G
2. GwehD}W - c. Nt. rh. gjpg;G
3. jpUf;Fws; - ghpNkyofH ciu
4. fk;guhkazk; - mz;zhkiyg; gy;fiyf;fofg; gjpg;G
5. FWe; njhifr; nrhw;nghopTfs;
6. FWe; njhif; jpwdha;T - Nrh. e. fe;jrhkp
7. vl;Lj;njifr; nry;tk; - ny. g. fU. ,uhkehjd; nrl;bah
8. kh. nghparhk J}ud; - rpw;gp. ghyRg;gpukzpad;> rhfpj;a mfhnjkp> Kjw;gjpg;G-2000
9. fhg;gpaj;jpwd; - Nrhk. ,stuR – kzpthrfH gjpg;gfk;> nrd;id.

IENC 12 - ENGLISH THROUGH LITERATURE – I : PROSE

Unit -I
Bonnie Chamberlain “The Face of Judas Iscariot”
Swami Vivekananda “Speech at World Parliament of Religion”

Unit -II
Stephen Leacock “My Financial Career”
Bhimrao Ambedkar “Speech on 4th November 1948 in the Constituent Assembly”

Unit -III
Robert Lynd “On Forgetting”
Nirad C. Chaudhuri “Indian Crowds”
ICEC 13 - CIVICS, ENVIRONMENTAL AND HEALTH SCIENCES

(A) Civics

Unit–I: Introduction
Indian Constitution, Preamble – Basic Features – Citizenship – Fundamental Rights – Fundamental Duties.

Unit–II: Political System

Reference Books
3) R.C. Agarwal, Indian Political System. New Delhi, S. Chand & Company, 2000

(B) Environmental Sciences

Unit–I: Ecosystems :

Unit–II: Environment

Reference Books

(C) Health Sciences
Unit–I

Physical Health – Introduction to health – Food, Meaning of balanced diet, Sources, Common nutritional deficiencies and prevention.

Personal Health – Cleanliness of body, Care of Skin, Nails, Eye, Hair, Oral Health, Clothing, Body Posture and good habits such as exercises – Importance of avoiding smoking, alcoholism, drugs etc.

Population explosion and Family Planning – Importance, Common Methods of family planning for Men & Women.

Mothers and Children – Immunisation of children (importance, schedule) care of mothers during pregnancy and after delivery.

Communicable Diseases – Symptoms and prevention.

Unit–II


Reference Books

IPHT 14 - PROPERTIES OF MATTER

Objective: To make the students understand the basic knowledge about, properties of matter which is applicable in day- to- day life.

Unit I : Gravity and Gravitation

Kepler’s law - Newton’s law of gravitation – Determination of ‘G’ by Boy’s method - Simple pendulum, Bar pendulum - Variation of g with altitude and latitude - Gravitational potential and field due to a spherical shell - Solid sphere - Hollow sphere and thin circular plate.

Unit II : Elasticity


Unit III : Surface Tension

Definition and dimensions of surface tension – Excess of pressure over curved surfaces – Variation of surface tension with temperature – Jaeger’s experiment – Quincke’s method– Vapour pressure over a liquid surface – Determination of surface tension by ripples method–
Factors affecting surface tension.

**Unit IV: Viscosity**

**Unit V: Diffusion and Osmosis**

**Text Books and References:**

**IPHA 15 - MATHEMATICS – I**

**Unit – I**
Series, Comparision test, Integral test, Comparision of ratios, D’Alembert’s ratio test, Cauchy’s root test, Alternating series, Convergence of exponential series, Uniform convergence.

**Unit – II**
Matrix operations, Rank of a matrix, Normal form of a matrix, Inverse of a matrix, Eigen values and Eigen vectors, Caley-Hamilton theorem, Reduction to a diagonal form.

**Unit - III**
Expansion of sin nθ, cos nθ, tan nθ in powers of sin θ, cos θ and tan θ, Exponential function of a complex variable, circular function of a complex variable, Hyperbolic functions, Inverse hyperbolic functions.

**Unit - IV**
Differentiation, Successive differentiation, Meaning of derivative.

**Unit – V**
Maxima and minima, Rolle’s theorem and Mean value theorem, Expansions of functions, Partial differentiation.

**Text Book:**
Unit I Chapter 9 Sections 9.3 to 9.17 except 9.14
Unit II Chapter 2 Sections 2.5 to 2.9 and 2.14 to 2.17
Unit III Chapter 19 Section 19.6 to 19.11

   Unit IV Chapters 2, 3 and 4
   Unit V Chapters 5, 6, 7 and 8 (Sections 1.1 to 1.7)

Reference Books:

FIRST YEAR : SECOND SEMESTER
Part – I : Language - Tamil - jkpo; jhs; - 2
ITAC- 21 – gad;ghL;jkpOk; nrk;nhkop tuyhWk;;

Nehf;fk;:: nhkopaikg;gpsh; tpsf;Fjy;:: nhkopg; gad;ghL;by; cUtdh – cUthFk; khw;wq;fisg; Gyg;gLj;jLy; jpir nhkopfs; fp;gpshy; jkpo; nhkopapy; Vw;gLk; khw;wq;fis tpsf;Fjy; nhkopf; FLk;gg;fs; Fwpj;Jk; nrk;nhkopj; jkpod; rpwg;Gfs; Fwpj;Jk; nrk;nhkop Vw;Gf; Fwpj;Jk; tpsf;Fjy;.

myF - 1
  vOj;Js;gspd; vz;zpifAk; tiffSk;> vOj;Js;gspd; khj;jpiu> fhy ,ilepiyfs;> %tifg; Nghypfs;>; ,Utifg; gjq;fs;> GzHrrfps;.

myF - 2
  nrhw;nwhLH tiffs; (%tif nhkop) njhlhpuf;fzj;jpy; fhzg;ngWk; tOTk;>
tO mikjpkAk; gj;jpiaik;igAk; epWw;jw; FwpapLfs; gad;ghLk;. Ciueil vOjK; NghJ Nkw;nfhs;s Ntz;ba tpjpkWafs;.

myF - 3 Nkij;jkpo;
  ePq;fSk; Ngr;rhsH Mfyhk; - Fkhp mde;jd; Nkijg;Ngr;Rf;F jahH nra;jy;-
  Ngr;rhsUf;Fhpa jFjps;= NgRk; Kiwfs; - gof;f tof;fq;fs;.

myF - 4 gilg;Gj;jpwd;
  rpWfij- ftpij- fl;Liu- Xuq;f ehlfk;= E}y; Fwpj;j jpwdha;T vOjg; gapw;rpuhy;.

myF - 5 gad;ghL;jLj; jkpOk; nrk;nhkop tuyhWk;
  nhkop- tpsf;fk;= nhkopf;FLk;gg;fs; cyfr; nrk;nhkopfs; ,ejpar; nrk;nhkopfs;-
  nrk;nhkopj; jFjps;= tiuajfs;- thOk; nrk;nhkopj; jkpO;= jkpod; njhd;ik- jkpod; rpwg;Gfs;-
  jkpo;r; nrk;nhkop E}y;fs;= jkpo; nrk;nhkop mwpe;Njw;G- ghpjpkhw;flyQH Kjy; jw;fhy
  mwpQHfs; tiu (mwpQHfs;= mikg;Gfs;= epWtdq;fs;= af;f;fs; njhlH Kaw;rpf;-

11
IENC 22 – ENGLISH THOROUGH LITERATURE – II : POETRY

Unit - I
1. William Shakespeare “Sonnet 29”
2. William Blake “A Poisdon Tree”
3. Robert Bridges “A Red, Red Rose”

Unit - II
4. PB Shelley “Ozymandias”
5. Alfred Tennyson “The Brook”
6. HillaireBellock “Matilda”

Unit - III
7. Robert Fros “Stopping by Woods on a Snowy Evening”
8. Walt Whitman “O Captain, My Captain”
9. Sylvia Plath “Mirror”

Unit - IV
10. Toru Dutt “The Lotus”
11. A. K. Ramanujan “A River”
12. Keki N. Daruwalla “Pestilence in Nineteenth Century Calcutta”

Unit - V
13. Gabriel Okara “Once Upon a Time”
14. Maki Kureishi “The Kittens”
15. Robert Finch “Peacock and Nightingale”

Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers.

Input, output devices, data storage devices, software, the definition, the role of software, housekeeping.

Unit – II

The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software.

Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, browsing and managing windows explorer, setting, Taskbars and creating shortcuts.

Unit – III

Introduction to internet, client server basics, E-mail, Telnet and Archie, FTR – Gopher, Jughead and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

Unit – IV

Issues involved in web site management, addressing, designing web sites with front page.

Unit – V

Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies, fundamental and use of hyperlinks, hypermedia, sound, images, animation, video.

Using multimedia, multimedia interface, planning and development of multimedia projects.

Text Books & References


IPHT 24 - HEAT AND THERMODYNAMICS

Objective: This paper aims to gain depth of knowledge regarding the properties of thermodynamics and also it deals with the methods and applications of heat radiation.

Unit I : Thermometry and Calorimetry
Thermometry - Types of thermometers, liquid and gas thermometers - Platinum resistance thermometer - Seebeck effect – Thermo electric thermometer - Low temperature measurement - Liquefaction of helium and adiabatic demagnetization – Calorimetry - Specific heat - Methods of mixtures – Copper block calorimeter - Newton’s law of cooling - Joules electrical method - Two specific heats of a gas - Joly’s differential steam calorimeter and Regnault’s method - Bunsen’s ice calorimeter.

**Unit II : Thermal Expansion**


**Unit III : Thermal Conductivity**


**Unit IV : Radiation**


**Unit V : Thermodynamics**


**Text Books and References:**


**IPHP 26 - PRACTICAL –I**

(Any Ten experiments out of Sixteen)

1. Surface Tension – Capillary rise method.
2. Young’s modulus – Non uniform bending (pin and microscope).
3. Young’s modulus –uniform bending (pin and microscope).
4. Young’s modulus – Koenig’s method.
5. Potentiometer – Low range voltmeter.
7. Compound pendulum- Determination of g and k.
8. Coefficient of viscosities- Hare’s apparatus.
10. Thermal conductivity -Forbe’s method.
13. Quinck’s drop – Surface tension of Mercury.
15. Rigidity Modulus – Static torsion.
16. q, n, σ – Searle’s method.

**IPHA 25 - CHEMISTRY - I**

**Unit–I : Basic Organic Chemistry**

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene -
Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of
reactions - addition, substitution (nucleophilic & electrophilic) , elimination, condensation and
polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect.

**Unit–II : Chemistry of Some Useful Organic Compounds**

Structure and uses of the following:
Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF₂Cl₂.
Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6

**Unit–III : Acid-Base Equilibria**

Bronsted definition, Lewis definition, Kₐ Kₖₖ, pKₐ and pKₖ for Bronsted acids and bases.
Relative strengths of Bronsted acids and bases. pH Buffer solution. Henderson’s equation.
Theory of acid-base indicators.

**Unit–IV : Coordination Chemistry**

Definition of terms-classification of ligands-chelation- Nomenclature of coordination
compounds. Effective Atomic Number and its application to Ni(CO)₄, [Ni(CN)₄]²⁻, [Co(CN)]₆³⁻
Role of metal ions in biological systems such as Hemoglobin, Vitamin B12.

**Unit–V : Chemical Kinetics and Photochemistry**

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated
rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature
on reaction rate - Activation energy. Arrhenius equation, Catalysis - Homogeneous and
heterogeneous catalysis.

**Text Books and References**

**IPAP 27 - ANCILLARY CHEMISTRY PRACTICAL – I**

**Titrimetric Analysis**

1) Estimation of sodium hydroxide with standard sodium carbonate using HCl as a link solution
2) Standardization of given sodium hydroxide solution using potassium hydrogenphthalate.
3) Estimation of commercial caustic soda for carbonate and hydroxide content.
4) Titration involving KMnO$_4$ and standard sodium oxalate.
5) Estimation of Mg$^{2+}$ using EDTA and EBT as indicator.
6) Estimation of Zn$^{2+}$ using EDTA and EBT as indicator.

**SECOND YEAR: THIRD SEMESTER**

Part – I : Language - Tamil - jkpo; jhs; - 3
ITAC- 31 - ciueilAk; ehlfKk;

Nehf;fk;: ,yf;fpaq;fspd; rpwg;GfisAk; fUj;JfisAk; ciueil topahfg; Gyg;gLj;jy; - ciueil jpwid vLj;Jiu;jy;

myF– 1
,yf;fpaf;fki; - MrphpaH (t. R. g. khzp;fk;)
,yf;fpb; tpsf;fk; - ,yf;fzf; Fws;fs; - thpirg;ghl;L – tho;thq;F– Jja ,yf;fpak; - eiKiw mwq;fs; - ,yf;fpaf;fly

myF– 2
Fwszpfs; - ,yf;fpb nts;sk; - jd;neQ;rk; - ,yf;fpajjsk; - Fws; tpsf;fk; - ek;gf;pif E}y; -
**IENC 32 - ENGLISH THROUGH LITERATURE – III : DRAMA**

**Unit -I**
Stanley Houghton  “The Dear Departed”
Kenneth Sawyer Goodman  “The Game of Chess”

**Unit -II**
A. A. Milne  “The Princess and the Woodcutter”
Anton Chekhov  “A Marriage Proposal”

**Unit -III**
Arnold Bennett  “The Stepmother”
Arthur Miller  “Grandpa and the Statue”

**Unit -IV**
William Shakespeare  King Lear (Act I, Scene i)
William Shakespeare  Julius Caesar (Act III, Scene ii)

**Unit -V**
Frances Goodrich & Albert Hackett  The Diary of Anne Frank (Act I)
Betty Keller  “Tea Party”


**IPHA 33 - MATHEMATICS – II**

**Unit - I  Integration**
Introduction, Definite integral, Methods of integration, Integrals of the form

\[
\int \frac{f'(x)}{f(x)} \, dx \quad \text{(i)} \hspace{1cm} \int F(f(x))f'(x) \, dx \quad \text{(ii)} \hspace{1cm} \int \frac{dx}{ax^2 + bx + c} \quad \text{(iii)}
\]
Unit - II Integration

Properties of definite integrals, Integration by parts, Reduction formula for the following types

(i) \( I_n = \int x^n \, dx \), \( n \rightarrow +ve \) integer

(ii) \( I_n = \int \cos^n x \, dx \), \( n \), positive integer

(iii) \( I_n = \int \sin^n x \, dx \)

(iv) \( I_{mn} = \int \sin^m x \cos^n x \, dx \) Bernoulli’s formula.

Unit - III

Area under plane curves, Area of a closed curves, Area between two intersecting curves, Areas in polar coordinates, Volume of the solid of revolution, Length of a curve, Area of surface of revolution.

Unit – IV

Vector differentiation, Scalar functions, Vector functions, Differentiation of a vector, Differentiations formulas, Differentiation of dot and cross products, The Vector differential operator Del, Gradient of a scalar function, Directional derivatives, Divergence of a vector, Curl of a vector, Expansion formulae, Second order differential operators, Solenoidal and irrotational fields.

Unit – V

Vector integration, The line integral, Green’s theorem in two dimensions-verification, Gauss divergence theorem (without proof)-verification and evaluation of integrals, Stoke’s theorem (without proof)-verification and evaluation of integrals.

Text Book:


Unit I Chapter 1 Sections 1 to 8
Unit II Chapter 1 Sections 11 to 15.1
Unit III Chapter 2 Sections 1.1 to 1.4, Sections 3 to 5


Unit IV Chapter 2 Sections 2.2 to 2.4, 2.6, 2.7.
Chapter 3 Sections 3.2, 3.3, 3.4, 3.7, 3.9, 3.11, 3.12, 3.15.
Unit V Chapter 4 Sections 4.1, 4.3, 4.9 and 4.12

Reference Books:


Objective:
To train the students in aspects related to projectile, impulse, impact, concepts of hydrodynamics, dynamics of charged bodies and relativity.

Unit I: Projectile, Impulse, and Impact

Unit II: Dynamics of Rigid Bodies
- Rigid body - Moment of inertia - Radius of gyration - Moment of inertia - Solid cylinder - Cylindrical shell - Solid sphere - Spherical shell - Hollow sphere - Compound pendulum - Theory - Equivalent simple pendulum - Reversibility of centers of suspension and oscillation - Determination of g and k - Kater’s pendulum.

Unit III: Statics, Centre of Gravity and Hydrodynamics
- Centre of gravity of a solid and hollow cone – Solid and hollow hemisphere – Thrust – Centre of pressure – Vertical rectangular lamina.

Unit IV: Basic Concepts of Classical Mechanics
- Mechanics of single and system of particles - Conservation law of linear momentum, angular momentum and mechanical energy for a particle and a system of particles - Centre of mass and equation of motion – Constraints - Classification - Degrees of freedom and Generalized coordinates – Principle of virtual work.

Unit V: Relativity

Text Books and References:
IPHT 35 - OSCILLATIONS, WAVES AND ACOUSTICS

Objective: This paper makes the students to understand the various kinetics involved in oscillations, waves and various acoustical parameters.

Unit I: Oscillations and Vibrating systems

Unit II: Wave propagation

Unit III: Acoustics

Unit IV: Ultrasonics

Unit V: Fourier analysis
Fourier theorem – Fourier coefficient – Definition - Evaluation of Fourier coefficients – Analysis of (i) Square wave (ii) Saw tooth wave (iii) Half and Full wave rectifiers output.

Text Books and References:

**IPHP 36 -PRACTICAL –II**
(Any Twelve experiments out of Sixteen)

2. Sonometer – Verification of laws.
5. Spectrometer – Hollow prism.
10. Newton’s rings.
11. Coefficient of viscosities- Ostwald’s apparatus.
12. Rigidity modulus by torsional pendulum (with symmetric masses).
13. Potentiometer – Comparison of e.m.f of the cells.
15. Latent heat of Ice (Half time cooling correction)
16. Latent heat of Steam (Half time cooling correction)

**SECOND YEAR: FOURTH SEMESTER**

**Part – I : Language - Tamil - jkpo; jhs; - 4**

ITAC- 41 - jkpo; ,yf;fpa tuyhw

Nehf;fk: ; jkpo; ,yf;fpa tsHr;rp tuyhw;wpid tpthpj;J jkpo; ,yf;fpaq;fs; Fwpj;J mwpKfk; nra;jy;

myF– 1 : rq;f fhyk;> rq;f kUtpa fhyk;
   njhy;fhg;gpak; - rq;f fhyk; - Kw;rq;fq;fs; - ghLk; njhifAk; - njhFg;G Kiw–rpwg;Gfs;-
   rq;fg; GytHfs; njhy;fhg;gpak; - gjpndz;fPo;f;fzf;F E}y;fs;> Kw;fhg;gpq;fs;.

myF– 2 : gy;yth;> NrhoH fhyk;
   irt ,yf;fpaq;fs; - gd;dpU jpUKiwfs; - itzt ,yf;fpaq;fs; - ehyhapu jpt;tpagpuge;jk; -IQ;rpW
   fhg;gpq;fs; - fk;guhkHazk; - nghpaGuhzk; - gpw ,yf;fpaq;fs;

myF– 3 : ehaf;fH fhyk;
   rpw;wpfy;fpaq;fs; - me;jhjp J}J – khiy – Nfhit – guzp – fyk;gfk; - cyh –gps;isj;jkpo; -
IENC 42 – ENGLISH THROUGH LITERATURE – IV: SHORT STORY

Unit - I
1. O’ Henry “After Twenty Years”
2. Ernest Hemingway “A Day’s Wait”

Unit - II
1. Flora Annie Steel “Valiant Vicky”
2. Oscar Wilde “The Selfish Giant”

Unit - III
2. Shashi Deshpande “I Want”

Unit - IV
1. Leo Tolstoy “Where Love is God is”
2. Somerset Maugham “The Ant and the Grasshopper”

Unit - V
1. Chinua Achebe “Marriage is a Private Affair”
2. Bessie Head “Heaven is not Closed”

Objective: To understand the concepts of dispersion, intensity, diffraction and polarization of light waves and their applications.

Unit I: Geometrical Optics

Unit II: Eye-Piece and Dispersive Power


Unit III: Interference

Unit IV: Diffraction

Unit V: Polarization

Optical activity – Fresnel’s explanation of rotation – Specific rotation – Determination of specific rotator power by Laurent’s half-shade polarimeter.
Text Books and References:


IPHT 44 - SEMI CONDUCTOR THEORY AND DEVICES

Objective: This paper provides the basic ideas of semiconductor and properties of semiconductor devices.

Unit I : Semi Conductor Theory

   Band formation in simple conductors – Insulators and Semiconductors – Intrinsic and Extrinsic semiconductors - Band model – N-type and P-type semiconductors – Fermi Dirac distribution applied to semiconductors - Fermi level as a function of temperature - Carrier densities in terms of Fermi level shift.

Unit II : Junction Diode


Unit III : Bipolar Junction Transistor (BJT)


Unit IV : Field Effect Transistor (FET)

   Classification and fabrication of FET – JFET – Drain characteristics of JFET - Biasing of JFET - Depletion MOSFET - Enhancement MOSFET - Construction, working and characteristics of UJT.

UNIT V : Optoelectronic Devices

   Photodiode – Photo transistors – LED, LCD and LDR – Opto couplers. Special semiconducting devices: Tunnel diode, Gunn diode, SCR and their applications.

Text Books and References:

**IPHP 45 - PRACTICAL – III**

(Any Twelve experiments out of Sixteen)

1. Spectrometer – Cauchy’s constant.
2. B.G. – Figure of merit.
3. Field along the axis of a circular coil - Determination of H (Using Vibration Magnetometer).
5. Potentiometer – Calibration of an Ammeter.
6. Internal resistance of a cell – using B.G.
7. Thermo e.m.f using B.G.
8. Series and parallel resonance circuits.
10. B.G. – Absolute capacity of a condenser.
12. Anderson’s bridge.
13. Resistance by Post Office box.
15. Dead beat (aperiodic) Galvanometer – figure of merit.
16. Field along the axis of a circular coil – deflection magnetometer.

**IPHA 46 - CHEMISTRY - II**

**Unit–I : Chemistry of Natural Products**

Terpenoids: Structure and uses – Camphor, vetivones.
Alkaloids – Structure and uses, papavarine, cocaine
Structures and important biological properties

**Unit–II : Electrochemistry**


**Unit–III : Industrial Chemistry**

Production and uses of gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas and compressed natural gas - Fertilizers-manufacture and uses of urea, ammonium
sulphate, superphosphate, Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light - Definition and determinations of BOD and COD.

**Unit–IV : Analytical Chemistry-I**


**Unit–V : Analytical Chemistry-II**

Colorimetric methods, Beer’s law and its validity, estimation of fluoride ion by photocolorimeter, flame photometry and atomic absorption spectroscopy- NMR spectroscopy: Nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non-equivalent protons, position of NMR signals, shielding, de-shielding, chemical shift – δ and τ scales, peak area and number of protons – splitting of NMR signals – spin-spin coupling.

**Books for Reference**


**IPAP 47 - ANCILLARY CHEMISTRY PRACTICAL - II**

**Organic Analysis**

Detection of Elements (N,S, Halogens)
To distinguish between aliphatic and aromatic Saturated and unsaturated compounds. Functional group tests for phenol, acids (mono, di) aromatic primary amine, amide, aldehyde & Carbohydrate Glucose. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory test. (Phenol/cresol, cinnamic acid, benzoic acid, phthalic acid, Succinic acid, benzamide, ureaS, glucose, benzaldehyde & aniline).

Reference

THIRD YEAR: FIFTH SEMESTER

IPHT 51 - ELECTRICITY AND MAGNETISM

Objective: To make the students understand the basic concepts of electric and magnetic effects and their behaviour in a variety of materials.

Unit I: Electrostatics
Electric intensity - Intensity due to a point charge - Electric potential - Relation between potential and intensity.
Unit of Capacity - Capacity of a spherical, parallel plate and cylindrical capacitors - Energy of a charged capacitor.

Unit II: Thermoelectricity
Definition of ampere and the value of permeability of free space - emf and internal resistance of a cell - Calibration of ammeter and voltmeter (high and low range).
Thermoelectricity - Measurement of thermo emf using potentiometer - Peltier and Thomson coefficients - Applications of thermodynamics to thermocouple - Determination of the coefficients - Thermoelectric diagrams.

Unit III: Magnetic Properties of Materials
Electron theory of matter - Magnetic properties due to circulating electronic currents in atoms - Explanation of dia and para magnetism on the basis of electron theory - Domain theory of ferromagnetism - Curie temperature.

Unit IV: Electromagnetic Induction
Force on a current carrying conductor (straight) in a magnetic field - Moving coil ballistic galvanometer - Theory and uses.
Unit V: Transient Currents

Growth and decay of current in a circuit having L and R - Time Constant - Growth and decay of charge in a circuit having C and R - High resistance by leakage - Growth and decay of charge in a circuit containing L, C and R - Condition for discharge to be oscillatory - Frequency of oscillation.

Theory, construction and working of transformers – Losses - Skin effect.

Text Books and References:

1. Electricity and Magnetism, Sehagal and Chopra, S. Chand and Sons, 2005.
2. Electricity and Magnetism, D.N. Vaudeva, S. Chand and Co., 2012.

IPHT 52 - MODERN PHYSICS

Objective:
1. To study the aspects related to discharge of electricity through gases.
2. To study the principles, applications of photoelectric effect and various atom models and their importance.
3. To understand the concepts of dualistic nature of matter.

Unit I: Cathode rays and Positive rays

Unit II: Photoelectric Effect

Unit III: Atomic Structure

Unit IV: Ionisation Potential and Splitting of Energy Levels
Excitation and ionization potential – Frank and Hertz’s experiment - Davis and Goucher's method- Spectral terms and notations - Selection rules - Intensity rule and interval rule - Fine

**Unit V : Dual Nature of Matter**


**Text Books and References:**


**IPHT 53 - NUMERICAL METHODS**

**Objective:** This paper explains the topics such as the solution of algebraic and transcendental equations, interpolation, numerical integration and differentiation.

**Unit I : Algebraic and Transcendental Equations**


**Unit II : Interpolation**


**Unit III : Numerical Differentiation and Integration**


**Unit IV : Numerical Solution of Ordinary Differential Equations**

Kutta methods - Second and fourth order.

**Unit V : Curve Fitting**

**Text Books and References:**

**IPHT 54 - DIGITAL ELECTRONICS**

**Objective:** This paper highlights the concept of digital electronics and functioning of various digital devices.

**Unit I : Number System and Logic Gates**


**Unit II : Simplification of Logic Expressions**
Introduction to combinational logic – SOP and POS forms of expressions – Minterms and Maxterms – Reducing Boolean expressions using Boolean laws – Karnaugh map – Karnaugh map simplification.

**Unit III : Combinational Logic Circuits (CLC)**

**Unit VI : Sequential Logic Circuits**

**Unit V : D/A and A/D Converter**
Construction and working of D/A Converter: Binary ladder – Weighted resistor

**Text Books and References:**


**IPHT 55 - COMMUNICATION SYSTEMS**

**Objective:** To make the students understand the basic knowledge about various communication systems.

**Unit I : Communication Systems**

**Unit II : Modulation and Demodulation**

**Unit III : Antenna**

**Unit IV : Digital Communication**
Pulse amplitude modulation - Pulse code modulation - Delta modulation - Pulse frequency modulation - Pulse time modulation - Pulse position modulation - Pulse width modulation – Digital carrier systems – Amplitude shift keying - Frequency shift keying - Phase shift keying - Differential and quadrapol phase shift keying - Error control coding - Multiplex
transmission - Frequency and time division multiplexing.

**Unit V : Forms of Communication Systems**

Communication systems: Fiber optic communication - Satellite communication - Microwave communication - Mobile communication - Introduction to cordless telephone - Cellular mobile communication (Basic ideas only).

**Text Books and References:**


**IPHP 56 - PRACTICAL –IV**

1. V-I characteristics of junction diode.
2. Characteristics of Transistor CB and CE Configuration.
3. Characteristics of UJT.
4. R-C Coupled amplifier - Single stage.
5. Characteristics of FET.
6. Hartley oscillator - BJT.
7. Colpitt’s oscillator - BJT.
9. Half wave and full wave rectifier.
11. Regulated power supply - Zener diode.
14. Basic logic gates using transistors.
15. NAND and NOR as universal building blocks.
16. Adder and Subtractor.

**THIRD YEAR: SIXTH SEMESTER**

**IPHT 61 - LASER PHYSICS**
Objective: This paper aims to provide in depth knowledge regarding Laser and its applications.

Unit I: Basic Theory

Unit II: Laser Beam Characteristics

Unit III: Types of Lasers

Unit IV: Techniques for Control of Laser Output

Unit V: Applications of Lasers

Text Books and References:


IPHT 62 - ANALOG ELECTRONICS

Objective: This paper aims at providing extensive analog operations for understanding and interpreting various analog circuit problems.

Unit I: Amplifiers
Small signal amplifiers – Load line concepts – Selection of operating point – RC coupled amplifiers – Feedback concept – Gain with feedback – General characteristics of negative feedback amplifiers - Types of feedback and their effect on gain – Multistage feedback amplifiers.

Unit II: Power Amplifiers
Power BJT – Class A, Class B, Class AB and Class C amplifiers – Efficiency and figure

**Unit III : Oscillators and Multivibrators**


**Unit IV : IC Fabrication**

Monolithic integrated circuit technology – Epitaxial growth, Masking and Etching – Diffusion of impurities – Monolithic diodes – Integrated resistors, capacitors and inductors – Bipolar transistor fabrication - Fabrication of FET.

**Unit V : Linear Analog Circuits**


**Text Books and References:**


**IPHT 63 - SOLID STATE PHYSICS**

**Objective:** This paper provides the elementary ideas about the crystalline structure of solids and the physical properties of solids.

**Unit I : Elements of Crystal Structure**

Crystalline structure – Non crystalline structure – Crystal translational vector - Unit cell – Lattice - Basis - Symmetry operations - Bravais lattices two dimensional and three dimensional - Crystal planes and Miller indices - Simple crystal structure: BCC, FCC and HCP.

**Unit II : Diffraction of X-Rays by Crystals**


**Unit III : Crystal Types and Bonding**
Ionic crystal, covalent crystal, metal crystal, molecular crystal, hydrogen bonded crystal – Calculation of binding energy of ionic, covalent and metal crystals - Crystals of inert gases.

**Unit IV : Elastic Constant of Crystal**

**Unit V : Lattice Vibrations**
Concept of lattice mode of vibration – Phase velocity and group velocity of harmonic waves – Dynamics of monatomic and diatomic lattices – Concept of phonon – Momentum of phonons – Inelastic scattering: Photons by phonons and Neutrons by phonons.

**Text Books and References:**


**IPHT 64 - NUCLEAR PHYSICS**

**Objective:** This paper is designed to impart knowledge on general properties of nuclei and their mass measurements. It also provides knowledge on particle accelerators, detectors and nuclear models.

**Unit I : General Properties of Nuclei**
Scattering of alpha particles - Nuclear radius, mirror nuclei, nuclear mass - Constituents of nuclei – Proton - Electron hypothesis, proton - neutron hypothesis - classification of nuclei - Atomic mass and binding energy of stable isotopes - Packing fraction - Mass defect - Binding energy of nucleus.

Mass Spectrometers: Doublet method of measurement of mass – Bainbridge, Bainbridge and Jordan mass spectrograph - Determination of charge by Mosley’s laws.
Unit II : Radioactivity

Cosmics rays - Nature, properties, effect of latitudes, altitudes and longitudes.

Unit III : Particle Accelerators

Unit IV : Gamma Decay and Detection of Nuclear Radiations
Gamma decay - Properties, interaction of gamma rays with matter - Photoelectric absorption - Compton scattering - Pair production.


Unit V : Nuclear Models and Nuclear Energy
Liquid drop model - Semi empirical mass formula - Merits and Demerits - Basic ideas of shell model-(spin -orbit coupling) - Predictions of the shell model and Collective model.

Basic ideas of nuclear fission - Types of fission - Nuclear fusion - Thermo nuclear reactions in Sun and Stars- P-P and C-N cycle - Controlled thermo nuclear reactions.

Text Books and References:

Objective: To make the students understand the nonlinear behaviour in optical materials.

Unit I: Introduction to Nonlinear Optics

Unit II: Multiphoton Processes

Unit III: Nonlinear Optical Materials

Unit IV: Nonlinear Optical Susceptibility

Unit V: Fiber Optics

Text Books and References:

IPHP 66 - PRACTICAL – V
1. RC coupled amplifier – Two stage - BJT.
2. Feedback amplifier – BJT.
FOURTH YEAR : SEVENTH SEMESTER

IPHT 71 - CLASSICAL AND STATISTICAL MECHANICS

Objective: Classical Mechanics is a handy tool in denoting that part of mechanics where the objects are too big or too small. The most important aspect of statistical mechanics is its correlation with thermodynamics.

Unit-I: Mechanics of a Particle and System of Particles

Unit-II: Canonical transformations

Unit-III: Maxwell – Boltzmann Statistics

Unit-IV: Equipartition of Energy and Partition Function
Principle of equipartition of energy – Partition function and their properties – Connection
between the partition function and thermodynamic quantities – Mean values obtained from
distribution law – Gibb’s paradox – Explanation and proof for occurrence of paradox – Sackur –
Tetrode equation and its significance.

Unit-V: Quantum statistics

Differentiation of B-E and F-D particles – Derivations of B-E and F-D distributions –
Comparison of M-B,B-E and F-D statistics – Black body radiation and the Planck radiation law –
Derivation with explanation – Ideal Bose gas – Gas degeneracy – Derivation - Bose Einstein
Condensation – Derivation with explanation (Example: Liquid Helium)

Text Books and References:

1. Introduction to Classical Mechanics, R.G.Takwale and P.S.Puranik, Tata Mc Graw Hill,
   New Delhi, 1979.
3. Classical Mechanics, B.D.Gupta and Satya Prakash, Keder Nath Publishers, Meerut,
   2004.
   India Ltd., 1976.
7. A Text Book of Quantum Mechanics, P.M. Mathews and Venkatesan, Tata Mc Graw
8. Classical Mechanics, H.Goldstein, Addision Wesley Publishing Company,
   Massachusetts, 1961.

IPHT 72 - ATOMIC AND MOLECULAR PHYSICS

Objective: To understand the concept of atomic and molecular model through different theories.
It also helps to understand the interaction between electromagnetic radiations such as
microwave, IR and X rays with matter.

Unit-I: Atom Model for Two Valence Electrons.

Sommerfield’s elliptical orbits and space quantization – Total energy of a stationary state –
Hydrogen fine structure – Dirac electron – Fine structure and the spinning electron – Doublet
fine structure alkali metals – Selection rules for doublet – Intensity rules for fine structure
doublet – Spinning electron and the vector atom model – Electron spin – Orbit interaction –
Penetrating and non-Penetrating orbits, Atom model for two valence electrons – Coupling
schemes for two electrons – Interaction energies for LS coupling – Lande’s interval rule – j-j
coupling in the carbon group of elements – Branching rule – Selection rule – Intensity relations.

Unit-II: Magnetic and Hyperfine Structure

Zeeman Effect in single and two valent atomic systems – Influence of varying magnetic

Unit-III: Microwave and Infrared Spectroscopy


Unit-IV: Vibrational Raman Spectroscopy


Unit-V: Photoelectron and Photo Acoustic Spectroscopy.

Basic principles – Photoelectron spectroscopy – Design of X-ray PES and UV PES – Chemical information from PES - Basic concept of Auger electron spectroscopy – Principle of PAS – Block diagram of PAS – Different types of detecting systems – Application of PAS

Text books and References:


IPHT 73 - MATHEMATICAL PHYSICS – I

Objective: Mathematics has become an integral part of physics. This paper aims to provide extensive mathematical formalism for understanding and interpreting various physical problems.

Unit-I: Vector Analysis and Vector Spaces

Concept of gradient, divergence and curl - Gauss’s divergence theorem, Green’s theorem
and Stoke’s theorem (statement and proof) - Orthogonal curvilinear coordinates - Expression for gradient, divergence, curl and Laplacian in cylindrical and spherical co-ordinates (Theory).

Linearly dependent and independent sets of vectors - Inner product (problems)- Schmidt’s orthogonalization process.

Unit-II: Special Functions

Beta and Gamma functions - Power series techniques in solving Bessel, Legendre, Hermite’s and Laguerre differential equations - Generating functions - Recurrence relations - Rodrigue’s formula - Orthogonal properties.

Unit-III: Partial Differential Equations

Solution of Laplace Differential Equation - Two dimensional flow of heat in cartesian and cylindrical co-ordinates. Solution of heat flow equation in one dimension - Solution of wave equation - Transverse vibrations of a stretched string (Theory).

Unit-IV: Fourier Analysis

Definition - Dirichlet’s theorem – Properties-convergence, integration, differentiation. Fourier sine and cosine series - Problems using the sine and cosine series. Physical applications - Full wave rectifier and forced vibration (Theory) - Complex form of Fourier series (Theory) - Expression for Fourier- Integrals.

Unit-V: Group Theory

Definition - Subgroups - Cyclic groups and abelian groups - Homomorphism and isomorphism of groups - Classes - Symmetry operations and symmetry elements - Representations of groups - Reducible and irreducible representations - Character tables for simple molecular types ($C_{2v}$, and $C_{3v}$ point group molecules)

Text Books and References:


IPHP74 - PRACTICAL – VI
(Any Sixteen Experiments)

1. Young’s modulus of a specimen plate- by Newton’s interference method.
2. Bi-prism on spectrometer- Wavelength ($\lambda$) and Refractive index ($\mu$) of a liquid-using Laser source.
3. Charge of an electron- Spectrometer
4. Study of Hall effect in semiconductors.
5. Polarizability of Liquids- Hollow prism on spectrometer.
6. Hg-Cu spectrum- Hartmann’s constants and wavelength.
7. Planck’s constant.
8. Zeeman Effect.
9. Thermoluminescence
11. Microprocessor 8085 - Addition, Subtraction, Multiplication & Division
12. Microprocessor 8085 - Logical operation
13. Microprocessor 8085 - Solving expression, Factorial of N Numbers
14. Microprocessor 8085 - Code conversion
15. Microprocessor 8085 – Flashing and Rolling of Name display
16. Microprocessor 8085 – Stepper Motor
17. Microprocessor 8085 – ADC Interfacing
18. Microprocessor 8085 – DAC Interfacing
19. Microprocessor 8085 – Biggest and Smallest Numbers
20. Microprocessor 8085 – Ascending and Descending Order

FOURTH YEAR : EIGHTH SEMESTER

IPHT 81 - MATHEMATICAL PHYSICS – II

Objective: To bring exposure to the mathematical concepts and interpreting various physical problems

Unit - I: Matrices
    Rank and inverse of a matrix - Symmetric and antisymmetric matrices - Hermitian and Skew Hermition matrices - Orthogonal and unitary matrices - Eigen values and Eigen vectors of the matrices - Cayley - Hamilton’s theorem (statement, proof and problems using the above methods)

Unit - II: Tensor Analysis
    Law of transformation of tensors - Algebraic operations - Rank of a tensor - Contravariant, covariant and mixed tensors - Symmetric and anti symmetric tensors - Kronecker delta (theory)
Application of Tensor:
    Tensor forms of gradient, divergence, Laplace operator and curl - Application of tensor - dynamics of a particle - Stress and strain tensors (theory)

Unit - III: Complex Variables
    Complex analysis - Function of complex variables - Analytic function - Cauchy Riemann conditions - Cauchy’s integral theorem (statement and proof) - Residues and singularities - Cauchy’s residual theorem (statement and proof) - Evaluation of simple standard integral
Unit - IV: Integral Transforms
Fourier transforms - cosine and sine transforms - Linearity theorem - Parseval’s theorem - solution of differential equation. Laplace transforms - Definition - Linearity, shifting and change of scale properties. Inverse Laplace transforms – Definition - Problems - Solution of differential equation (problems using the above methods)

Unit - V: Green’s function
Green’s function - Definition -Green’s function for one-dimensional case - Properties of Green’s function - Solution of inhomogeneous differential equations $\psi''=f(x)$ - Subject to the homogeneous boundary conditions and subject to the inhomogeneous boundary conditions (without involving derivatives) - Subject to the homogeneous boundary conditions and subject to the inhomogeneous boundary conditions (with involving derivatives).

Text Books and References:

IPHT 82 - CONDENSED MATTER PHYSICS

Objective: This paper provides the basic elements of the Physics of Solids and in particular the study of structure of crystalline solids and their physical properties.

Unit – I: Thermal Properties and Transport Properties
Specific heat of solids – Dulong and Petit’s law - Einstein theory and Debye’s theory – Conductivity due to electrons and phonons.

Unit – II: Free Electron Theory of Metals
Free electron gas model– Free electron gas in one dimensional box and three dimensional box – Effects of temperature on the parameters of the free electron gas.
Static properties of the metal: Thermionic emission and photoelectric effect. Transport properties of metals: Drude Lorentz theory of electrical conductivity and thermal conductivity.

**Unit – III: Energy Bands in Solids**
Wave functions in periodic lattice and Bloch theorem – Kronig Penny model – Motion of electron in one dimension – Negative effective mass and holes – Physical basis of the effective mass values – Easy limiting cases of the true periodic potential- Nearly free electron approximation – Tight - binding approximation – Constant energy curves and surfaces – Overlapping of allowed zones – Distinction between metals, insulators and semiconductors.

**Unit – IV: Dielectrics**

**Unit – V: Superconductivity**

**Text Books and References:**

**IPHT 83 - ELECTROMAGNETIC THEORY AND MODERN OPTICS**

**Objective:** In this paper the ideas of electromagnetic theory and modern optics are integrated within a unfired framework using electromagnetic theory as its foundation, to make the students aware of the most important methods of optical analysis.

**Unit – I: Maxwell’s Equations and E.M. Waves**
Maxwell’s equation and their empirical basis - Derivation and physical significance - Electromagnetic energy - Poynting theorem - Poynting vector - The wave equation - Plane electromagnetic waves in free space - Non-conducting( isotropic dielectric) and conducting medium.
Unit – II: Reflection and Refraction of E.M Waves
Boundary conditions at the surface of discontinuity - Reflection and refraction of e.m waves at the interface of non-Conducting media - Kinematic and dynamic properties - Fresnel’s equation - Electric field vector ‘E’ parallel to the plane of incidence and perpendicular to the plane of incidence - Reflection and transmission co-efficients at the interface between two non-Conducting media - Brewster’s law and degree of polarization - Total internal reflection.

Unit – III: Application of E.M Waves
Dispersion - Normal and anomalous dispersion - Various dispersion relations - Dispersion in gases, liquids and solids - Scattering - Theory of scattering of e.m waves to determine scattering parameter (Rayleigh, Resonance and Raman).

Relativistic Electrodynamics
Lorentz transformation - Consequences - Transformation of differential operators - Invariance of D’Alembert’s operator - Four vector - Lorentz transformation of space and time in four vector form - Transformation of e.m potential A and φ - Lorentz condition in covariant form - Invariance of Maxwell’s field equation in vector form.

Unit – IV: Interference
Two beam interferometry - Michelson’s interferometer - Theory – Applications

Multi beam Interferometry
FP Etalon - LG plate - Theory, expression for resolving power - Determination of specific charge of an electron.

Coherence
Types of coherence - Holography - Principle of holography - Characteristics - Recording and reconstruction - Classification - Applications - Non - Destructive testing.

Unit – V: Diffraction
Fresnel, Fraunhoffer diffraction (brief explanation) - Application of Fraunhoffer - Diffraction to rectangular and circular aperture - Fersenel’s diffraction by rectangular aperture - Babinet’s Principle.

Plasma Physics

Text Books and References:
IPHT 84 - MICROPROCESSORS AND INTERFACING DEVICES

Objective: This paper presents an extensive knowledge about the architecture, assembly language and interfacing of Intel 8085 and Advanced microprocessors.

Unit-I: Introduction to 8085

Unit-II: Introduction to Assembly Language Program
Instruction set: Data transfer instructions - Addressing modes – Arithmetic operations – Logical operations – Branching and machine control operations. Writing assembly language programs: Looping, counting and indexing. Translation from assembly language to machine language – 16 bit data transfer and arithmetic instructions – Arithmetic operations related to memory. Vectored and non-vectored interrupts.

Unit-III: Introduction to 8086

Unit – IV: Introduction to High End Processor

Unit – V: Introduction to Interfacing Devices
Basic concepts of programmable device - 8255 Programmable Peripheral Interface (PPI) – 8254 Programmable Interval Timer (PIT) – 8257 Direct Memory Access (DMA) controller – 8259 Interrupt controller. Basic concepts of serial I/O and data communication – 8251 Universal Synchronous Asynchronous Receiver Transmitter (USART).

Text Books and References:


IPHP 85 - PRACTICAL – VII
(Any Sixteen Experiments)

1. Michelson Interferometer – Wavelength Determination
2. Energy gap – Four Probe Apparatus.
3. Elastic constants of Glass- Cornu’s interference method (Hyperbolic fringes).
4. Solar Spectrum
5. Thermistor characteristics-Band gap energy
6. Reflection grating-Spectrometer
7. Ultrasonic diffractometer – Velocity and compressibility of liquids
10. Magnetostriction
11. Numerical Aperture and Acceptance Angle-Fibre Optics
12. Microprocessor 8086 I – Addition and Subtraction (16 & 32 bits)
13. Microprocessor 8086 II – Multiplication and Division (16 & 32 bits)
14. Microprocessor 8086 - Biggest and Smallest Numbers
15. Microprocessor 8086 - Code conversion
16. Microprocessor 8086 - Solving expression, Factorial of N Numbers
17. Microprocessor 8086 – Sum of elements in an array and factorial
18. Microprocessor 8086 – Sorting of N Elements (Ascending and Descending Order)
19. Microprocessor 8086 – String Operations
20. Wave form generations using 8086.

FIFTH YEAR : NINTH SEMESTER

IPHT 91 - QUANTUM MECHANICS – I

Objective: This paper makes the students to understand the various kinetics involved in advanced physics using approximation methods.

Unit – I: Discrete Eigen Values: Bound States
Linear Harmonic Oscillator – Solution – Properties of Stationary states – Zero point energy – Three dimensional harmonic oscillator – Spherically symmetric particles – Angular

Unit – II: Representation Theory


Unit – III: Approximation Methods: Perturbation


Unit – IV: Approximation Methods: Variation and WKB Approximation


Unit – V: Scattering Theory


Text Books and References:

3. Quantum Mechanics, G.S. Chadda, New age International, 2005
4. Quantum Mechanics, V. Devanathan, Weily Eastern, 2005
IPHT 92 - MATERIALS SCIENCE

Objective: To make the students to understand the properties of materials with their structure at the electronic, atomic and micro level as well as their behaviour of variety of materials.

Unit – I: Crystal Growth and Thin Films


Unit – II: Defects

Phase diagram – Basic principle – Simple binary systems – Solid solutions -Eutectic systems – Application


Point defects - Schottky and Frenkel defects – Number of defects as a function of temperature – Diffusion in metals – Diffusion and ionic conductivity in ionic crystals.


Unit – III: Optical Properties and Ferro Electrics


Unit – IV: Magnetism


Unit – V: Elastic Behaviour, Polymer and Ceramics
Anelastic and viscoelastic behaviour – Atomic model of elastic behaviour – Rubber like elasticity – An elastic deformation - Relaxation process – Model for viscoelastic behaviour.
Ceramic: Ceramics phases – Structure of ceramics phases – Classes – Effect of structure on the behaviour of ceramic phases – Composites.

Text Books and References:


IPHT 93 - MICROCONTROLLER AND ITS APPLICATION

Objective: This paper gives a systematic, step by step approach to cover various uses of microcontroller 8051, assembly language programming and interface

Unit – I: Introduction to Microcontroller
Introduction to microcontroller and embedded system – 8051 microcontroller : Pin configuration, Architecture and Key features.

Unit – II: Assembly Language Programming
8051 data types and directives - Data transfer instructions - Addressing modes – Jump, Loop and Call instructions and programs - Arithmetic instructions and programs – Logical instructions and programs – Single bit instructions and programs.

Unit – III: 8051 Serial Communication
Basics of serial communication – Half and full duplex transmission- Asynchronous serial communication –Data communication classification.

Unit – IV: Interfacing to External Memory
Semiconductor memory-memory capacity-Organization-Speed-ROM-PROM-EPROM-Flash memory EPROM-Mask ROM. RAM-Static RAM- Dynamic RAM-Non-volatile RAM.
Unit – V: Applications of 8051 Microcontroller


Text Books and References:


IPHP 94 - PRACTICAL – VIII

(Any Sixteen Experiments)

1. Low field Hysteresis
2. Susceptibility of liquids using Guoy-Balance
3. Susceptibility of liquids by Quinke’s method
4. Photo elastic constant
5. Hysteresis loop tracer
6. Cu-Salt (visible) Spectrum
7. Molecular constants-CN Band
8. Channel Spectrum
10. Ultrasonic velocity of liquid mixtures- Interferometer
12. G.M. Counter characteristics
13. Microcontroller 8051 Experiment-I (Addition and Subtraction and Logical operations)
14. Microcontroller 8051 Experiment-II (Multiplication and Division and Solving expressions)
15. Microcontroller 8051 Experiment-III (Logical operations, 1’s and 2’s compliment)
16. Array Operations-I Microcontroller 8051 (Sum of elements, biggest and smallest numbers)
17. Array Operations-II Microcontroller 8051 (Ascending and descending order)
18. Microcontroller 8051 - Code conversion
19. Microcontroller 8051 – ADC interfacing
20. Microcontroller 8051 - Stepper motor interfacing

FIFTH YEAR : TENTH SEMESTER
Objective: To bring exposure to the kinetics of relativistic and non-relativistic concept.

Unit – I: Time Dependent Perturbation


Unit – II: Theory of Angular Momentum

Angular momentum of system of particle – Commutation rules – Eigen value spectrum – Matrix representation of J in the Jm> basis – Pauli’s spin matrices – Spinars density matrix – Addition of angular momentum – Triangular rule – Coupled and uncoupled representation – CG coefficient for \( j_1=j_2=\frac{1}{2} \).

Unit – III: Quantum Theory of Valency


Unit – IV: Relativistic Quantum Mechanics


Unit – V: Field Quantization


Basic ideas of Feynman diagram – World line – Space – Time - Feynman graph for scattering of an electron by a potential.

Text Books and References:

IPHT 102 - NUCLEAR AND PARTICLE PHYSICS

Objective: This paper is designed to impart the general properties of nuclei, nuclear forces and various models developed. It also provides the knowledge on the nuclear reactions, nuclear energy, elementary particles and symmetry schemes.

UNIT – I: Nuclear Properties and Mass Spectrographs
Nuclear mass and binding energy- Variation of binding energy with mass - Spin and parity - Isospin- Semi empirical mass formula - Stability of nuclei - Mass parabolas for different types of nuclei.

UNIT – II: Nuclear Force and Models
Characteristics of nuclear force - Meson theory and Yukawa’s potential -n-p scattering at low energies (scattering length, phase shift, spin dependence, coherent scattering, shape independent effective range theory)-similarity between-n-n and p-p forces- exchange forces- non-central forces- theory of ground state of deuteron.
Nuclear models: Degenerate gas model- liquid drop model - Shell model and collective model.

UNIT – III: Nuclear Reactions and Neutron Physics
Types of nuclear reactions - Conservation laws for nuclear reactions - Kinematics of nuclear reactions- Q-value-nuclear reaction cross section- Compound nucleus theory - Breit-Wigner one level formula for scattering.

UNIT – IV: Nuclear Energy
Nuclear fission- Energy release in fission reaction - Distribution of fission products-neutron emission in fission - Fissile and fertile materials - Nuclear fission and liquid drop model
-Bohr Wheeler theory.
   Nuclear chain reaction - Four factor formula - Nuclear reactors - Critical size of a reactor
- Reactor materials - Classification of reactors.

UNIT – V: Elementary Particles and Symmetry Schemes
   Classification of elementary particles - Fundamental particle interactions - Conservation
laws - CP and CPT invariance - CP violation in neutral K-decay, hyper nuclei-strangeness and
associated production - Gell-Mann-Nishijima formula - Gellmann-okubo mass formula.
   Quark model, flavours and colours - Isospin and SU(2) symmetry - Eight-fold way and
supermultiples- SU(3) symmetry schemes for boson octet, baryon octet and baryon decuplet.

Text Books and References:

6. Theoretical Nuclear Physics, John. M. Blatt and Victor V. Weisskopf, John Wiley and
Sons, 1952.

IPHT 103 - SPECTROSCOPY

Objective: This paper deals with the different regions of the electromagnetic spectrum for
understanding the symmetry of molecular groups, molecular structure, the nature of bonding and
its utility in conformation analysis.

Unit-I: Group Theoretical and Force field studies of polyatomic molecules.
   Symmetry of polyatomic molecules and molecular vibrations - Selection rules for Raman
and IR vibrational normal modes - calculation of normal modes for Raman and IR active to C_{2V}
and C_{3V} point groups by group theoretical methods.
   Representations for molecular vibrations in internal and symmetry coordinates -
calculation of F and G matrices - Normal coordinate analysis for simple polyatomic molecules
(H_{2}O and NH_{3}).

Unit-II: NMR and NQR Spectroscopy
   Nuclear Magnetic Resonance Spectroscopy: General principles of NMR - Quantum
theory of NMR - design of CW NMR spectrometer - chemical shift - application of chemical
shift to molecular structure.
   Nuclear quadrupole resonance spectroscopy - Definition of Nuclear quadrupole moment -
asymmetry parameter-Integral spins - Fundamental requirements of NQR spectroscopy - Block diagrams of NQR Spin spectrometer-continuous wave oscillators-principle of super regenerative oscillators - pulsed RF detector - Application of NQR with special reference to chemical bonding.

**Unit-III: ESR Spectroscopy.**

Origin of electron spin resonance and resonance condition – Thermal equilibrium and relaxation – Quantum mechanical theory of ESR – Representation of ESR spectrometer – Requirements of ESR spectrometer – Block diagram of a simple ESR spectrometer – Hyper fine structure splitting in isotropic systems involving more than one nucleus – contributions to hyperfine coupling – ESR of triplet states – application of ESR to Solid State Physics (crystal defects) Biological applications.

**Unit-IV: Mossbauer Spectroscopy.**


**Unit-V: Fluorescence and Phosphorescence Spectroscopy.**


**Text Books and References:**


**IPHT 104 - PHYSICS OF NANOMATERIALS**

**Objective:** Nano Sciences, the emerging area of science brings together physics, chemistry and biology to create a scientific discipline of almost infinite potential. Physics of nano materials is concerned with the study, creation, manipulation and applications of materials at nanometer scale.
Unit – I: Introduction

Unit – II: Special Nanomaterials

UNIT – III: Properties

UNIT – IV: Synthesis

UNIT – V: Characterization and Applications

Text Books and References:

IPHP 105 - PRACTICAL – IX

(Any Sixteen experiments)

1. Spectrophotometer
2. Co-efficient of linear expansion-Interference Method.
3. R.F. Oscillator- Dipolemoment of Liquids
4. Susceptibility of Salt solutions/ Solids-Guoy method
5. Susceptibility of liquid mixture- Quinckes method-Calculation of Bohr magneton.
6. Phase diagram-Two component system.
7. Molecular constants –ALO Band
8. Molecular constants- CN Band.
10. Optical rotation of quartz.
11. G.M. Counter -Absorption co-efficient of a foil.
12. F.P. Etalon.
13. Dielectric of Solidsm
15. Stark Effect.
17. 8051 Micro controller - Setting bits and Masking bits in an 8-bit number.
18. Microcontroller 8051 - Generate a delay.

OPTIONAL COURSES OFFERED BY THE DEPARTMENT

OPTIONAL III

IPHTO 96.1 : INSTRUMENTATION

Objective: This paper highlights the concept of instrumentation and functioning of various analytical instruments in diversified fields.

Unit – I: Transducers

Basic functional elements of a measuring system-Transducers: Definition-Parts-Classification-Types of primary sensing element.
Piezo electric transducers: Principle, theory and working of piezo electric crystals.
Unit – II: Digital Instrumentation

Unit – III: Analytical Instrumentation
Principle, working, Instrumentation and applications of UV-Vis Spectrophotometer, ICP-AES, (Inductive coupled plasma-Atomic emission spectroscopy), SEM (Scanning Electron Microscope) and AFM (Atomic Force Microscopy).

Unit – IV: Bio-Medical Instrumentation
Principle, block diagram and functioning of ECG, EEG and EMG.

Unit – V: Medical Imaging Instrumentation
Computed Tomography: Principle-CAT scanning-Instrumentation-Contrast scale-Scanning components.

Text Books and References:
2. Electronic measurements and Instrumentation, Dr.Rajendra Prasad, Khanna Publishers, 2002

IPHTO 96.2 : BIOPHYSICS
**Objective:** This paper helps to understand the applications of various microscopic tools in cell biology. This paper helps the reader to understand the fundamentals of macromolecular structure and the analytical techniques in characterizing biomolecular interactions and its structure.

**Unit I: Cell Organization**

Cell as the basic structural unit- Origin & organization of Prokaryotic and Eukaryotic cell- Cell size & shape- Fine structure of Prokaryotic & Eukaryotic cell organization (Bacteria, Cyanobacteria, plant & Animal cell)- Internal architecture of cells- cell organelles- compartment & assemblies membrane system- Ribosome- Polysomes- Lysosomes- Peroxisomes- Connection between cell & its environment- Extracellular Matrix.

**Unit II: Tools in Cell Biology**


**Unit- III: Macromolecular structure**

Nucleic acid structure: Chemical structure of the nucleic acid - Conformational possibilities of monomers and polymers- Double helix structure of DNA- Polymorphism of DNA- DNA nanostructures and the structure of transfer RNA.


**Unit-IV: Seperation Techniques**


**Unit V: Optical & Diffraction Techniques.**

Circular Dichroism and optical rotator dispersion:- Plane, circular and elliptical polarization of light- Absorption by oriented molecules- Dichroic ratio of proteins and nucleic acids- Circular dichroism (CD) - optical rotatory dispersions (ORD) - Relation between CD and ORD- Application of ORD in conformation and interactions of biomolecules.

Text Books and References:


OPTIONAL IV

IPHTO 106.1 : PETRO PHYSICS

UNIT – I


UNIT – II

Geomagnetic elements of the earth – Field variation and detection - The Magnetic observatory – mapping of secular variations. Diurnal variation of magnetic disturbances – initial susceptibility of rocks – single and multidomain cases – Curie point determination and its importance.

Laboratory and field instruments for magnetic measurements – Astatic magnetometer – spinner magnetometer – Fluxgate magnetometer, Proton procession magnetometer – Theory, practice and applications.

UNIT -III

Classification of rock forming minerals – physical properties of minerals with special reference to optical properties – elementary details of a polarizing microscope and petrographic analysis.


UNIT – IV

UNIT – V

Text Books and References:

IPHTO 106.2 : MEDICAL PHYSICS

Objective :
To understand the working principles of various instruments in medicine and to update the knowledge of various techniques for the reader.

Unit – I: Bio-Electric Potentials


Unit – II: Digital X-ray imaging and Computed Tomography

Unit – III: Imaging with Ultrasound and MRI

**Unit – IV: Physics of Nuclear Medicine and Biological effects of Radiation**


**Unit – V: Medical Imaging Instrumentation**


**Text Books and References:**


**OPTIONAL COURSES OFFERED TO OTHER SCIENCE DEPARTMENTS**

**IN THE II, III and IV SEMESTERS**

**OPTIONAL – I**

**OIPHT 01 : PHYSICS OF THE EARTH**

**Objective:**

To understand the physical structure and behavior of the earth as well as geomagnetic properties of rocks in the Earth’s crust.

**Unit – 1: Solar System**
The earth and the solar system – Important physical parameters and properties of the planet earth; Stress and Strain, Wave and motion, Seismic waves. Travel time Tables and Velocity – Depth curves – Variation of Density within the Earth.

**Unit – 2: Gravitation**


**Unit – 3: Thermal history of earth**


**Unit – 4: Elastic properties**


**Unit – 5: Geomagnetism and Palaeomagnetism**


**Text Books and Reference:**


**OPTIONAL – II**

**OIPHT 02 : BIO-MEDICAL INSTRUMENTATION**

**Objective:**

To understand the working principles of various instruments in medicine and to update the knowledge of various imaging techniques and physiological parameters for the readers.
UNIT – I: Bio-Electric Potentials
  Resting and action potentials – Propagation of action potentials – Bioelectric potentials-
  Electrocardiogram (ECG) – Electroencephalogram (EEG) – Electromyogram (EMG) –
  Electroretinography (ERG) - Electrooculography (EOG)

UNIT – II: Bio-Potential Electrodes
  Biopotential Electrodes – Types of Electrodes - Microelectrodes – Body surface
  electrodes – Depth and Needle electrodes- Chemical electrodes – Distortion in measured
  bioelectric signals using electrodes-Electrode paste

UNIT – III: Imaging Equipments
  Ultrasonic Imaging-Reflection-Scattering-A mode display-B mode display-T-M mode
  display-Ultrasonic imaging instrumentation-Biomedical applications- Magnetic Resonance
  Imaging (MRI)-Principle-Instrumentation-Advantages of MRI over other medical imaging
  techniques- Thermography-Endoscopy

UNIT – IV: Measurement of Physiological Parameters
  Blood Pressure Measurement-Introduction-Direct Measurement using Catheters-Advance
  of Direct Method-Indirect Method-Oscillometric measurement method-
  Electromagnetic Blood Flow Meters-Ultrasound Blood Flow Meter-transit time method-
  Doppler effect based ultrasonic blood flow meter-laser Doppler Blood Flow Meter-NMR Blood
  Flow Meter

UNIT – V: Laser in Medicine
  Introduction- Characteristics of laser light- Generation of laser- Components of laser-
  of laser in Medical field.

Text Books and References:

OPTIONAL – III
OIPHT 03 : ENERGY PHYSICS

Objective: This paper deals with the practical usage of solar energy in various forms and other
alternative energy sources.

UNIT – I: Conventional Energy Sources
Energy sources and their availability – Various forms of energy – Renewable and conventional energy systems – Comparison – Coal, oil and natural gas.

UNIT – II: Solar Energy

UNIT – III: Thermal Energy Storage

UNIT – IV: Photo Conversion
Photovoltaic conversion - Principle and working of solar cells - Conversion efficiency - Single crystal and Polycrystalline silicon - Cadmium sulphide - Cadmium telluride.

UNIT – V: Other Forms of Energy

Text Books and References


OPTIONAL – IV
OIPHT 04 : BIOPHYSICS

Objective: This paper is aimed at to studying the analytical separation and spectroscopic techniques for characterizing biomolecular interactions.
Unit – I: Separation Technique

Electrophoresis-Moving boundary electrophoresis- Zone electrophoresis- Low voltage electrophoresis- High voltage electrophoresis- Gel electrophoresis- Poly acrylamide gel electrophoresis (PAGE) - Sodium dodecyl sulphate poly acrylamide gel electrophoresis (SDS-PAGE) - Iso electric focusing electrophoresis- Continuous flow electrophoresis.

Unit – II: Centrifugation and Laser
Centrifugation- Basic principles of sedimentation - Relative centrifugal force (RCF)- Sedimentation Rate - Svedberg unit or Sedimentation Coefficient - Types of Centrifugation - Analytical Centrifugation - Ultra centrifugation - Preparative centrifugation Differential centrifugation – Density gradient centrifugation-Rate zonal centrifugation - Isopycnic centrifugation.


Unit – III: Tools in Cell Biology
Light microscopy- elementary geometrical optics, Limits of resolution. Types of microscopy- Bright field microscopy- Phase contrast microscopy-Fluorescence microscopy-Polarising Microscopy- Electron Microscopy- Scanning electron microscope (SEM) - Transmission electron microscope (TEM) - Preparation of the specimen for electron microscopy - Atomic force microscope.

Unit – IV: Spectroscopy-I
 Electromagnetic radiation- Beer-Lambert’s law- Calorimeter- Spectrometer- Single and Double beam Spectrophotometer- Ultraviolet and visible Spectroscopy-Origin and theory of UV Spectra–Instrumentation- Applications

Fluorescence spectroscopy- Principles- Single and Double beam spectrofluorimeter – Applications.

Unit –V: Spectroscopy-II
Introduction - Basic concept of IR spectroscopy-IR spectrometer- Infrared Spectroscopy Basic concept of IR Spectroscopy - IR Spectrometer- Principle and instrumentation- Sample handling techniques- FTIR- principle –Instrumentation –Applications

Introduction-Basic concept of Raman Spectroscopy-Raman Spectrometer- Instrumentation and working – Applications
Text Books and References

1) Biophysics, Vasantha Pattabhi, N. Gautham, Narosa Publishing, 2009
2) Biophysics P.S. Mishra, VK Enterprises, 2010
3) Biophysics, M.A. Subramanian, MJP Publishers, 2005
4) Bioinstrumentation, L. Veerakumari, MJP Publishers, 2006