INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH THIRUVANANTHAPURAM

An autonomous institution of the Ministry of Human Resource Development under the Government of India

IISER
THIRUVANANTHAPURAM

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IISER
THIRUVANANTHAPURAM

GUIDE BOOK OF CURRICULUM AND REGULATIONS FOR INTEGRATED MS PROGRAMME 2008 - 2009

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Contents:

1. Preamble

The Indian Institute of Science Education and Research (IISER) is an Institution conceived and established by the Ministry of Human Resources Development (MHRD) of the Government of India. The mission of the Institute is to offer postgraduate level teaching of the highest international standards to school leaving (+2) students and also to conduct frontline research leading to Ph.D. Degree, in basic sciences like Biology, Chemistry, Physics, Mathematics and other Interdisciplinary Science subjects.

The five IISERS established by MHRD are at Kolkota, Pune, Mohali, Bhopal and Thiruvanthapuram.

2. Profile of IISER-TVM

IISERT-TVM started functioning in August 2008 at the transit campus at the Department of Computer Science of the College of Engineering, Thiruvanthapuram (CET).
The Institute is residential. This means all students will reside in the Institute hostels.
The permanent campus of IISER-TVM is coming up at Vithura, about 40 km from Thiruvanthapuram City, at the foothills of the Ponmudi Hills.

3. The MS Programme

The barrier between the traditional disciplines are fast disappearing. Modern research problems span a wide range of areas. It helps to have basic training in a range of disciplines to suceed in modern research. Accordingly, IISER-TVM MS curriculum is designed to be dominantly interdisciplinary.

- The MS programme is of 10 semesters duration.
- Each academic year has 2 semesters of roughly 16 weeks each.
  - (a) Varsha Semester : August- December.
  - (b) Vasanth Semester : January- May.
- The first 2 years (i.e. the first 4 semesters) will consist of CORE courses common to all students.
- 3rd and 4th year courses will be specialized in one Major (Biology, Chemistry, Physics or Mathematics) and one or more Minors.
- The fifth year will be devoted to a thesis by research.

4. Registration

- Every student must register for the courses of a semester on the first day (registration day) of the semester.
- The courses are chosen in consultation with the student adviser and with his approval.
- Registration involves payment of the prescribed fees for the semester.
- A fine of Rs.100/- per day will be levied for late registration
- Registration is not possible after the first week of the semester.

5. Student Adviser

Every student is assigned a Faculty Adviser who will guide the student in all academic and personal matters

6. Assessment and Grading

6.1 Continuous assessment will be adopted for all courses.

Theory Course :	Assignments	: 10%
	Two Mid semester Exams	: 20 % each
	End semester Exam	: 50%
Practical Course:	10 Class experiments	: 7%
	Final Exam	: 30%

6.2 Grading: Relative grading will be adopted.

(a) The letter Grade and Grade Points are as follows:

Grade	Grade #
A	10
B	8
C	6
D	4
F	0
I	Incomplete

(b) Semester Grade Point Average (SGPA) is calculated as:

$$SGPA = \sum_i C_i G_i / \sum_i C_i$$

Where, C_i=Credit for i^{th} course; G_i=Grade point secured by the student.
Summation is over all the courses credited by the student in the semester.

c) Cumulative Grade Point Average is calculated as

$$CGPA = \sum_k C_k G_k / \sum_k C_k$$

Where, C_k=Credit for k^{th} course; G_k=Grade point secured by the student.
Summation is over all the courses credited

7. Minimum Grade and Attendance Requirements

- The minimum CGPA required for award of the MS degree is 5. (The total course credits required will be decided when the complete curriculum is finalized)

- The minimum CGPA required to continue in the programme at any time is 4.0. Failure to maintain the minimum CGPA in any two subsequent semesters will lead to automatic removal of the student from the rolls.

- Full attendance in all courses is compulsory. A student with less than 75% attendance in any course will not be permitted to take the Final Exam of that course and will be awarded an I Grade in that course.

- Make up examinations may be given to those who missed the mid semester or end semester examinations due to genuine reasons as determined by the Instructor/Director.

- The student with an F grade in the core course may be given a repeat final examination in the first two weeks of the following semester. If the resulting score is above the cut-off stipulated for F grade in the course, atmost a D grade will be awarded. If not, the student must repeat the course when offered next. Two successive F grade in the same core course will result in the removal of the student from the MS programme.

8. Library Regulations:

- A student may be issued two books at a time for a fortnight.
- A fine of Rs. 1/- per day for the first week of delayed return and Rs.10/- per day thereafter will be levied.
- A student who loses or mutilates a book will have to replace the book in addition to paying any extra fine that may be imposed.

9. Conduct Regulations

A.) The student must sign and submit to the Institute the following Honour Pledge at the time of admission.

IISER-TVM Student Honour Pledge

a. *I promise, on my honour, that I will conduct myself in the Institute and outside , with decorum and decency befitting the high moral and ethical standards expected of the members of the National Institute, IISER-TVM.*

b. *I will not engage in ragging. I understand that ragging is unlawful and liable to prosecution by law enforcement authorities of the State besides any disciplinary action the Institute may take which may include dismissal from the Institute.*

c. *I will not engage in overt / covert sexual harassment.*

d. *I will not resort to any dishonest practice in examinations / assignments.*

e. *I will not engage in plagiarism in my writings and will acknowledge the work of other authors according to international practices.*

f. *I understand that violation of this pledge makes me liable to disciplinary action by the Institute.*

Signature

Date and Place: *Student's Name*

B.) Use of mobile phones in the library, class rooms and laboratories is prohibited.

10. COURSE STRUCTURE – FIRST FOUR SEMESTERS

(core courses, common to all streams)

Table 1

COURSES / SEMESTER	BIOLOGY	CHEMISTRY	MATHEMATICS	PHYSICS	INTERDICIPLNARY	HUMANITIES/ COMP. SCI	PRACTICALS
SEMESTER I	BIO 111: CELL BIOLOGY (2103)	CHY 111: PRINCIPLES OF CHEMISTRY (2103)	MAT 111: CALCULUS AND LINEAR ALGEBRA (2103)	PHY 111: MECHANICS (2103)	IDC 111: SCIENTIFIC COMPUTING (2103)	HUM 111: READING, LISTENING AND WRITING SKILLS (0101)	CHY 112 (0031) PHY 112 (0031) BIO 112 (0031)
SEMESTER II	BIO 121: BIOCHEMISTRY (2103)	CHY 121: KINETICS AND MECHANISMS (2103)	MAT 121: MULTI VARIATE CALCULUS (2103)	PHY 121: ELECROMAG NETISM ANS OPTICS (2103)	IDC 121: THERMODYNAMICS (2103)	HUM 121: APPRECIATION OF ARTS AND HUMANITIES (0101)	CHY 122 (0031) PHY 122 (0031) BIO 122 (0031)
SEMESTER III	BIO 211: EVOLUTION AND ECOLOGY (2103)	CHY 211: REACTIVE INTERMEDIATES MACROMOLECULES AND ELECTROCHEMISTRY (3103)	MAT 211: COMPLEX FUNCTIONS (2103)	PHY 211: QUANTUM MECHANICS (2103)	IDC 211: ELECTRONICS (2103)	HUM 211 : ECONOMICS AND SOCIOLOGY (0101)	CHY 212 (0031) PHY 212 (0031) BIO 212 (0031)
SEMESTER IV	BIO 211: GENETICS AND MOL. BIOLOGY (2103)	CHY 221 : QUANTUM CHEMISTRY AND PHOTOCHEMISTRY (2013)	MAT 221: PROBABILITY AND STATISTICS (2103)	PHY 221: STATISTICAL MECHANICS (2103)	IDC 211: SYMMETRY AND SPECTROSCOPY (2103)	CSA 221 : COMPUTER SCIENCE (2103)	CHY 222 (0031) PHY 222 (0031) BIO 222 (0031)

Notes

11. Syllabi for Varsha Semester

BIO 111 Cell Biology [2103]

Introduction
Reductionism vs. holistic view of living system; debate about the definition of life.

Molecules of life
Water. Sugars. Lipids. Amino acids and proteins (including protein structure and Ramachandran Plot). Enzymes; classification and kinetics. Nucleic acids; DNA and RNA structure, DNA replication, Transcription and RNA translation.

Cell as the unit of life
Development of the Cell Theory. Prokaryotes vs. eukaryotes. Single cell to multi-cellular organism. prokaryotic cell: structure, cell wall and related molecules; flagella; motility; inclusion bodies; gas vesicles; endospores. Eukaryotic cell: structure of animal and plant cells; serial endosymbiosis theory. Virus, viroids and prions.

Cell Membrane
Structure and Function. Fluid mosaic model, diffusion, osmosis, membrane transport, ion channels and electrical properties.

Cell architecture
Cytoskeleton: Microtubules, intermediate filaments and microfilaments; motor proteins. Extracellular matrix.

Organelles
Cell nucleus; endomembrane system including endoplasmic reticulum, Golgi complex, endosomes and lysosomes: mitochondria and plastids.

Energy transduction and bioenergetics
ATP, electron transport chain, respiration and photosynthesis.

Cell signaling
Messengers and Receptors.

Birth and death
Cell cycle and control; Mitosis & Meiosis; Cellular death.

Textbooks

1. B. Alberts, D. Brey, K. Hopkin, A.Johnson, J. Lewis, M.Raff, K. Roberts, Essential cell biology, 2nd Edition, Galvin Science.
2. L.M.Presscott, D.A.Klein and J.P Harley Microbiology 5th edition Mc Grew-Hill New York.
3. W.Becker, L.Kleinsmith and J.Hardin World of the cell 6th Edition Pearson.
4. D.L.Nelsonand M.M.Cox, Lehringer, Principles of Biochemistry 4th edition
5. Molecular Biology of the cell, Garland Press, 5th Edition, B.Alberts, D.Bray, K.Hopkin, A.Johnson, J.Lewis, M.Raff, K. Roberts and P.Walter.

CHY 111 Principles of Chemistry [2103]

1. Periodicity and Atomic Structure: Outer Electronic Configuration and properties of elements- Periodicity- Classification into metals, nonmetals, insulators, inert gases, The quantum mechanics of binding, energy levels.

2. Concepts of Chemical Bonding: Structure and bonding, VSEPR theory, Molecular Orbital Theory, Concepts of reactivity, Acids and Bases, Redox reactions, Hard-Soft Acid Bases (HSAB theory), Bonding between elements-ionic, Covalent, Metallic, Hydrogen bonding, van der Waals, Multi-centered bonding, Rare-gas chemistry.

3. Chemistry of Elements: Main group elements, Structure-property-reactivity, Transition metal chemistry, Coordination chemistry, Introduction to crystal field theory.

5. Concepts in Organic Chemistry: Stereochemistry, Optical activity and Conformational analysis.

6. Structure and reactivity: Inductive, mesomeric and steric effects; Aromaticity and Stability, Linear free energy relationships, Nucleophilic addition reactions of aldehydes and ketones and related name reactions.

7. Modern Materials: New forms of Carbon, Metal and Semi-conductor nanoparticles.

Text books:

1. D. A. McQuarrie and J. D. Simon, Physical Chemistry : A Molecular Approach, Viva Books (1997) [Indian Low-Priced Edition].
2. J. E. Huheey, R L Keiter and E A Keiter, Inorganic Chemistry, Harper Collins (1993) [Indian Low-Priced Edition].
3. A. K. Das, Fundamental Concepts of Inorganic Chemistry, CBS, New Delhi (2006)
4. D. Nasipuri, Stereochemistry of Organic Compounds: Principles and Applications, Oscar Publications (1994).
5. P. Sykes, A Guidebook to Mechanism in Organic Chemistry, Addison-Wesley.
6. F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Advanced Inorganic Chemistry, John Wiley, Chichester (1999).

MAT 111 Calculus and Linear Algebra [2103]

Real Number System
Introduction to the real number system.

Sequence and series
Convergence of a sequence, Cauchy's criterion; limit of a sequence, supremum and infimum; absolute and conditional convergence of an infinite series, tests of convergence, examples.

Continuity
Formal definition, continuity and discontinuity of a function at a point; left and right continuity, examples of continuous and discontinuous functions, intermediate value theorem, boundedness of a continuous function on a domain that is a closed set, uniform continuity.

Differentiation
Definition and basic properties, Rolle's theorem, mean value theorem, Leibnitz's theorem on successive differentiation, Taylor's theorem. Partial differentiation; applications.

Integration
Riemann integral viewed as an area, partitions, upper and lower integrals, existence of the Riemann integral, basic properties, fundamental theorem of integral calculus, integration by parts, applications.

Linear Algebra
Definition of a linear vector space and examples; linear independence of vectors, basis and dimension; scalar product, orthogonal basis, Gram-Schmidt orthogonalization process; linear operators, matrix representation of operators, change of basis; orthogonal, unitary and hermitian matrices, eigenvalues and eigenvectors of a matrix and matrix diagonalization.

Textbooks:

1. G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, 9th edition, Pearson Education, New Delhi, 2005.
2. E. Kreyszig, Advanced Engineering Mathematics, 8th edition, Wiley & Sons, 2006.
3. S. Lang, First Course in Calculus, 5th edition, Springer (India), New Delhi, 2006.
4. W. Rudin, Principles of Mathematical Analysis, 3rd edition, McGraw-Hill India, 1953.
5. Apostol, Calculus, Vol. 1, 2nd edition, John Wiley, New York, 2006.
6. K. Hoffman, Linear Algebra, 2nd edition, Pearson Education, New Delhi, 2006.

PHY 111 Mechanics [2103]

Introduction to essential mathematical tools.

Newton's laws - A Recapitulation
Structure and validity of the laws. The concept of inertial reference frames and Galilean relativity. Non-inertial frames and pseudoforces.

Systems in one dimension
Conceptual issues. Illustrations of various methods of solving the EOMs. Work energy theorem and energy conservation in ID motion. The use of potential energy graphs to understand motion. The small amplitude approximation and oscillations: The simple harmonic oscillator; the damped oscillator; the forced harmonic oscillator; nonlinear oscillators.

Motion in three dimensions
Equations of motion in Cartesian and Polar Coordinates. The work energy theorem in 3D; conservative and non-conservative forces; force as the gradient of potential energy Conservation of angular momentum for a point particle.

Applications: The projectile; charged particle in a uniform electromagnetic field. Central force field motion; equations for the orbit. The Kepler problem. The effective potential and the stability of circular orbits.

Systems of particles

Conservation laws for linear momentum, angular momentum and energy. Center of mass. The concept of equivalent forces. Collisions. Two-body systems and the concept of reduced mass. Coupled oscillations.

Rigid bodies

The angular velocity vector. Rotating reference frames and pseudo-forces. The moment of inertia tensor: Connection between angular momentum and angular velocity; brief discussion on scalars and vectors; calculation of moment of inertia for simple bodies; principal axes.

Special Theory of Relativity

The principle of relativity. Lorentz transformations. Kinematic effects of STR. The concept of 4-vectors. The energy-momentum 4-vector. Applications.

Textbooks

1. C.Knight, W.D. Ruderman, M.A. Helmholz, C.A. Moyer and B.J.Kittel; Berkeley Physics Course: Vol. I-Mechanics; McGraw-Hill (1965).
2. D.Kleppner and R.Kolenkow : An introduction to Mechanics, McGraw-Hill Science/Engineering/Math (1973).
3. R.Feynman, R.B.Leighton and M.Sands, Feynman Lectures in Physics – Vol.I, Addison Wesley (2005).
4. J.R.Taylor, Classical Mechanics, University Science Books (2005).
5. L.D. Landau and E.M.Lifschitz. Course of theoretical physics Vol-Mechanics, Butterworth-Heinemann: 3rd edition (1982).

IDC 111 Scientific Computing [1203]

1. Introduction to computers & computations.
2. Principles of programming and scientific computing.
3. Introduction to Mathematica/Matlab/Scilab.
4. Applications from Chemistry, Physics and Mathematics involving:
   Regression analysis: polynomial and spline fitting of data.
   Systems of simultaneous equations
   Differential equations: Classical dynamics (planetary motion, pedulum)

   Schrodinger equation (harmonic oscillator, hydrogen atom)
   Matrix algebra: Secular equations, Huckel theory for cyclic polyenes.
   Difference equations: population biology; logistic equation, chaos, attractors.
   Random Phenomena: random walk, polymer growth, modeling epidemic. Spectral analysis: Fourier transform.
5. Graphics: 2D and 3D plots, animations

Textbooks:

1. A first course in scientific computing, Rubin H Landau, Princeton University Press, 2005.
2. Introduction to Computational Science. Modeling and Simulation for the Sciences. Angela B Shiflet, Princeton University Press.
3. Scientific Computing: An introductory Survey. Michael T. Heath, McGraw-Hill, NY.
4. Scientific Computing with MATLAB, Alfio Quarteroni and Fausto Saleri, Springer 2003.
5. Guide to Scientific Computing, Peter R Turner, Macmillan Press 2000.
6. Exploring Numerical Methods: An introduction to Scientific Computing using MATLAB Exploring Numerical Methods: An introduction to Scientific Computing using MATLAB Peter Linz.
7. First Course in Mathematical Modeling, Frank R. Giordano, Mauarice D. Wei, William P. Fox, Vikas Publishing House.
8. Computational Science, D. Kiryanov and E. Kiryanova, Firewall Media, Bangalore, 2007.

Notes

12. Syllabi for Vasanth Semester

BIO 121 Biochemistry [2103]

Molecules and Energetics of Life
Water, Carbohydrate structure and stereochemistry, functions of sugars in biosystems, mono-,di-, polysaccharides, storage function of lipids fatty acids, phospho-lipids, steroids, alkaloids, liposomes, micelles, planar bilayer, spherical bilayer, vesicles, glycoproteins, Structure of nucleic acids, amino acids, peptide bonds, Ramachandran plot, Primary, Secondary, tertiary, quaternary structure of proteins, Enzymes: classification, kinetics, hormones, antibodies, metalloenzymes, multi-enzyme complexes.

Biochemical Pathways
Examples: Glycolysis, aminoacid and fatty acid biosynthesis.

Biochemical Thermodynamics
Biology as an Open system, Steady State as opposed to Equilibrium, Chemiosmotic Theory

Energy Transduction and Bioenergetics
Mitochondria, ATP, Chemiosomes, ATPase, Gap junctions Chloroplast–photosynthetic electron transport, Calvin cycle, Energy pathways.

Cell Signaling
Messenger and receptors, structure of receptors, signal transduction cascades.

TextBooks:

1. B. Alberts, D. Brey, K. Hopkin, A.Johnson, J. Lewis, M.Raff, K. Roberts, Essential cell biology, 2nd Edition, Galvin Science.
2. L.M.Presscott, D.A.Klein and J.P Harley Microbiology 5th edition Mc Grew-Hill New York.
3. W.Becker, L.Kleinsmith and J.Hardin World of the cell 6th Edition Pearson.
4. D.L.Nelsonand M.M.Cox, Lehringer, Principles of Biochemistry 4th edition
5. Molecular Biology of the cell, Garland Press, 5th Edition, B.Alberts, D.Bray, K.Hopkin, A.Johnson, J.Lewis, M.Raff, K. Roberts and P.Walter.

CHY 121: Kinetics and Mechanisms [2103]

Kinetics and Rate processes
Basic kinetic concepts, analysis of kinetic results- theoretical and experimental methods, energy of activation, theories of reaction rates, thermodynamic and kinetic stability, reactions in solutions and surfaces, enzyme catalysis, parallel, consecutive and oscillatory reactions, Electron transport in biomolecules.

Coordination Chemistry
Bonding, Crystal Field Theory and Jahn-Teller Theorem, Spectrochemical Series, Molecular Orbital Theory of complexes, Spectra and Magnetism, Orgel diagrams, Charge-Transfer spectra, Curie-Wiess Law, Neel temperature, anti-ferromagnetic interactions in complexes, super-exchange and double-exchange.

Organometallic Chemistry
18-electron rules, Counting of electrons in complexes, heptacity, Metal-Carbonyl complexes, Polynuclear Carbonyls, Isolobal analogy, Heteroboranes, Wade's n+1 Rule, Jemmis mno rules, Nitrosyl Complexes, Carbene, Carbyne and Carbide Complexes, Ziese's salt, Metallocenes, Alkene and Alkyne complexes, Cyclobutadiene and cyclo-octatetraene complexes, Organometallic Compounds of main group elements.

Reaction mechanisms
Substitutions, additions and eliminations in organic and inorganic chemistry, Electrophilic aromatic substitutions and related name reactions

Textbooks:

1. Inorganic Chemistry: Principles of Structure and Reactivity (4th Edition) by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter, Prentice-Hall (Indian Edition).
2. Inorganic Chemistry (Fourth Edition), Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller, and Fraser Armstrong, Oxford University Press.
3. The Organometallic Chemistry of the Transition Metals. R. H. Crabtree, Wiley, New York, 1988.
4. Principles and Applications of Organotransition-Metal Chemistry, Collman, Hegedus, Norton, and Finke, 1987.
5. Chemical Kinetics (3rd Edition), Keith J. Laidler, Prentice-Hall.
6. F. Basalo, R. G. Pearson, Mechanisms of Inorganic Reactions- A Study of Metal Complexes in Solutions, NY, J. Wiley.

MAT 121: Multi Variate Calculus and Group Theory [2103]

1. Differential Equations
First order differential equations – examples, the brachistochrone problem, Homogeneous equations and exact solutions, Integrating factors, Linear first-Order equations with examples, Second order linear homogeneous differential equations; the Wronskian and the linear independence of solutions; Equations with constant coefficients; General solution of linear second order inhomogeneous equations, Picard's theorem and applications.

2. Calculus of Functions of Several Variables
Partial derivatives, Chain rule, Implicit dfferentiation, Directional derivatives, gradient vectors and the tangent plane, Maxima, minima and saddle points, Constrained optimization and the method of Lagrange multipliers'

3.Group Theory
Definition and examples of groups, Abelian and cyclic groups, Subgroups, Cosets, Laplace's theorem , Normal subgroups and quotient grups, Homomrphisms and isomorphisms, Automorphisms, Permutation group.

Textbooks:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson Education, New Delhi, 2005.
2. S. Lang, Calculus of Several Variables, Springer, 3rd Edition, 1999.
3. E. Kreyszig, Advanced Engineering Mathematics, 8th Edition, Wiley & Sons, 2006.
4. W.E. Boyce and R.C. Diprima, Elementary Differential Equations and Boundary Value Problems, 8th Edition, Wiley & Sons, 2004.
5. I. N. Herstein, Topics in Algebra, 2nd Edition, Wiley and Sons, 1996

References:

1. G.F. Simmons and S.G. Krantz, Differential Equations: Theory, Technique and Practice, Tata McGraw Hill, New Delhi, 2006.
2. A.E. Taylor and W.R. Mann, Advanced Calculus, 3rd Edition, Wiley & Sons, 1983.

PHY 121: Electromagnetism and Optics [2103]

Electrostatics
Coulomb's law and Gauss's law Simple applications.Differential form of the Gauss's law.Electrostatic potential,electrostatic energy Calculation for some simple cases.Conductors.Surface charges induced on a conductor. Solutions of Poisson's and Laplace's equations.Method of images.Solution by the method of separation of variables in cartesian and spherical polar coordinates.Potential due to an arbitrary charge distributation.Monopole and dipole terms.Electrical field and potential due to a point dipole.Dipole in an electric field.

Magnetostatics.
Biot - Savart and Ampere's laws.Ampere's law in differential form.Magnetic vector potential.Determination of magnetic fields for simple cases. Energy in a magnetic field.

Current electricity.
Electromotive force.Ohm's law. Motional emf. Electromagnetic induction.Faraday's law.Self inductance and mutual inductance.Impedance.LCR circuit.

Electrodynamics
Maxwell's equations. Equation of continuity.Poynting's theorem. Electric and magnetic fields in matter.Fields D and H.Constitutive relations .Linear and nonlinear media.

Electromagnetic Waves
EM waves in vacuum and in a dielectric medium. Boundary conditions on an interface. Reflection and transmission at an interface. Conducting surface.

Optics
Wave nature of light.Interference.Young's double slit , Michelson's interferometer.Concept of coherence.Diffraction. Fraunhofer and Fresnel cases.Fraunhofer diffraction by single and double slits.Fresnel zones. Polarization of light.

Textbooks:

1. D.J.Griffths : Introduction to Electrodynamics.
2. E.M Purcell : Berkeley Physics course. Vol 2. Electricity and Magnetism, McGraw Hill

3. R.P Feynman, R.B.Leighton and M.Sands: Feynman Lectures in Physics Vol 2 Addison-Wesley
4. E. Hecht : Optics Addison - Wesley (2001).
5. F.A. Jenkins and H.E. White: Introduction to Optics. Mc Graw Hill (2001)
6. A.K.Ghatak : Introduction to Modern Optics. Mc Graw Hill.
7. A.K.Ghatak : Optics Tata- Mc Graw Hill.

IDC 121: Thermodynamics [2103]

The scope and methods of thermodynamics
Macroscopic description of the state of a system, Extensive and intensive properties, Thermal equilibrium between systems, Zeroth Law of Thermodynamics, Concept of thermal equilibrium and temperature in classical physics, Adiabatic and diathermal walls, Temperature Scales.

The First Law of Thermodynamics
The concept and definition of work, General compression and expansion, General form of expressions for reversible, irreversible and quasi-static work, Joule's Experiment, Formulation of the 1st law of thermodynamics for a closed system, Concept of internal energy, Conservation of energy in a cycle, Perpetual motion of the 1st kind, Reversible transfer of heat, Definition of specific heat capacity and enthalpy, Adiabatic and isothermal processes. Calculation of pressure, kinetic interpretation of temperature; mean free path; distribution of molecular speeds; equipartition of energy. Microscopic versus macroscopic points of view; temperature; thermodynamic systems and thermodynamic equilibrium; Isothermal and adiabatic changes of ideal and real gases.

Reversible and irreversible processes
The Second Law of thermodynamics. Carnot cycle and the Kelvin temperature scale; Clausius' theorem; entropy and its physical interpretation; entropy change for simple processes; thermodynamic functions: Helmholtz free energy, Gibbs free energy and enthalpy; conditions of equilibrium; Maxwell's relations and their applications. Equilibrium between two phases; general equilibrium conditions; the Clausius- Clapeyron equation; phase transformation of pure substances and mixtures; dilute solutions; chemical equilibrium; the chemical potential.

The Third Law of Thermodynamics
Perfect crystal, The unattainability of absolute zero, Application in magnetic and charge ordering of materials, Adiabatic demagnetization, localization and defects.

Thermodynamics of Chemical and Biological Systems
Non-equilibrium Thermodynamics: Flow of energy in biological systems, molecules of energy in life, storage of energy, the hydrogen economy, Onsager reciprocal relations, Bose-Einstein Condensation, Negative temperature, Thermodynamics of small systems and molecular machines.

Textbooks

1. M. W. Zemanski, Heat and Thermodynamics MacGraw-Hill, New York, 1968.
2. E. Fermi, Thermodynamics, Dover.
3. M. N. Saha, B. N. Srivastava, A Treatise on Heat. (Allahabad, The Indian Press).
4. Chemical Thermodynamics, R. P. Rastogi, R. R. Mishra, Vikas Publishing.
5. Non-Equilibrium Thermodynamics, S. R. De Groot, P. Mazur, Dover.
6. Nonequilibrium Thermodynamics, 2nd Edition: Transport and Rate Processes in Physical, Chemical and Biological Systems, Yasar Demirel, Elsevier.
7. Molecular driving forces: Statistical Thermodynamics in Chemistry and Biology, K.A. Dill and S. Broomberg, Routledge, 2002

HUM 121: INTRODUCTION TO PHILOSOPHY OF SCIENCE [0101]

The aim of this course is to introduce some of the important problems concerning scientific knowledge. This course includes discussion on demarcation principle (science and pseudoscience distinction) and analyses central notions of science such as Explanation and Scientific Law. This course also focuses on competing positions about scientific method and scientific realism. This course aims at introducing philosophical issues about scientific knowledge and prepares students for advanced level courses in philosophy of science.

Science and Pseudo-Science
Inductivism and the Problem of Induction
Scientific Explanation
Inference to the Best Explanation
Laws of Nature
Method of Science
Realism and Instrumentalism
Scientific Experiment

Textbooks

1. Bird, A. (1998) Philosophy of Science, London & New York: Routledge.(Indian edition is available)
2. Chalmers, A. (1982) What is this thing called Science? Second edition. Hackett Publishing Company. Inc. Indianapolis.
3. Okasha, Samir. (2002) Philosophy of Science: A Very Short Introduction. Oxford: Oxford University Press.
4. Rosenberg, Alexander (2000) Philosophy of Science: A Contemporary Introduction, London; New York: Routledge
5. Ladyman, James. (2002) Understanding Philosophy of Science, London: Routledge.

Notes

13. Laboratory Courses

BIO 112: Experiments in Cellular Biology

Cellular Components of Blood.
Study of Osmosis in Red Blood Cells.
Study in membrane permeability using various alcohols.
Mitosis, Meiosis: a microscopic view.
Observations of flora and fauna in a fresh water pond sample.
Protein estimation using spectrophotometer.

BIO 122: Biology Laboratory

Agarose gel electrophoresis of DNA
Amino acid paper chromatography
Enzyme assay and Kinetics
Estimation of DNA
Estimation of iodine number of lipids
Estimation of proteins
Estimation of reducing sugars by DNSA method
Genomic DNA isolation
Plasmid isolation
Preparation of buffers
Protein expression and SDS poly acrylamide gel electrophoresis (PAGE) of proteins
Restriction digestion of DNA
Transformation of bacteria

CHY 112:

1. Titrimetric Analysis
ii. Experiment No 1: Titration of Antacids
ii.Experiment No 2: Estimation of Calcium in milk powder

2. Inorganic Preparations
I. Experiment No.3: Preparation of potash alum from scrap aluminium
ii. Experiment No.4: Preparation of tetrammine Cu (II) sulphate monohydrate
iii. Experiment No.5: Preparation of hexamine nickel (II) chloride

3. Spectrophotometry
i. Experiment No. 6: Determination of the concentration of Fe (II) and Fe (III) in Iron Tablets
ii. Experiment No. 7: Estimation of phosphoric acid in a cola-drink by mo-blue method
iii. Experiment No. 8: Estimation of nickel in hexamine nickel (II) chloride

4. Organic Preparations
i. Experiment No.9: Preparation of Aspirin
ii. Experiment No.10: Preparation of Paracetamol

5. Chromatography
i. Experiment No.11: Paper chromatography and separation of metallic ions
ii. Experiment No.12: Identification of Analgesic drugs
iii. Experiment No..13: Chromatography and spectroscopy of plant pigments

6.Polymer Analysis
i. Experiment No.14: Preparation of polystyrene and determination of its molecular weight by viscosity average method

CHY 122

Oxidation reduction titration
i. Determination of calcium and magnesium in the given solution
ii. Ferrous and ferric iron in iron ore
iii. Determination of ascorbic acid
iv. Determination of dissolved oxygen in water

Determination of partial molar properties

Chemical Kinetics
vi. Bromination of acetone
vi. Rate constant of hydrolysis of ester catalyzed by acid
vii. Velocity constant of hydrolysis of ethyl acetate by sodium hydroxide

ix. Determination of order of reaction
x. Kinetics of the reaction between potassium persulphate and Potassiumiodide
xi. The clock reaction

Organic Preparation
xii.The Grignard Reaction: Preparation of Triphenylmethanol

PHY 112 Experiments in Mechanics

1. Common Balance.
2. Simple Pendulum.
3. Melde's Experiment.
4. Balancing Torques and centre of gravity.
5. Compound Pendulum.
6. Torsional Pendulum.
7. Non-uniform compound pendulum.
8. Sonometer.
9. Projectile Motion.

PHY 122 Experiments in Optics

1. Convex Lens
   (a) 1/f = (1/u) + (1/v)
   (b) u-v graph
   (c) 1/u -1/v graph
   (d) f = (D2-d2)/4D
2. Concave Mirror
   (a) 1/f = (1/u) + (1/v)
   (b) Normal Incidence
   (c) u-v graph
   (d) (1/u)-(1/v) graph
3. Spectrometer – prism
   (a) Angle of prism.
   (b) Angle of minimum deviation: Find n.
4. Spectrometer – Grating
   (a) Normal Incidence.
5. Centripetal Force
6. Ballistic Pendulum
7. Conservation of momentum
8. Conservation of Energy
9. Potentiometer
10. Uniform Bending

Appendices

Appendix 1

Calender for Vasanth Semester 2009

Days	Jan '09	Feb '09	Mar '09	Apr '09	May '09
Sat					
Sun		1	1		
Mon		2	2		
Tue		3	3		
Wed		4	4	1 IInd Mid Sem Exam IDC 121	
Thu	1	5	5	2 IInd Mid Sem Exam PHY 121	
Fri	2	6	6	3 IInd Mid Sem Exam MAT 121	1 May Day
Sat	3	7	7 Mid Sem Recess	4	2
Sun	4	8	8	5	3
Mon	5	9	9	6	4
Tue	6	10	10 Holi	7	5 BIO 121 Final Exam
Wed	7 Muharam	11 Ist Mid Sem Exam HUM 121	11	8	6 CHY 121 Final Exam
Thu	8	12	12	9	7 MAT 121 Final Exam
Fri	9	13	13	10 Good Friday	8 IDC 122 Final Exam
Sat	10	14	14	11	9 Summer Vacation
Sun	11	15	15	12	10
Mon	12	16 Ist Mid Sem Exam BIO 121	16	13	11
Tue	13	17 Ist Mid Sem Exam CHY 121	17	14	12
Wed	14	18 Ist Mid Sem Exam IDC 121	18	15	13
Thu	15	19 Ist Mid Sem Exam MAT 121	19	16	14
Fri	16	20 Ist Mid Sem Exam PHY 121	20	17	15
Sat	17	21	21	18	16
Sun	18	22	22	19	17
Mon	19	23	23	20 Course Evolution Week	18
Tue	20	24	24	21	19
Wed	21	25	25 IInd Mid Sem Exam HUM 121	22	20
Thu	22	26	26	23	21
Fri	23	27	27	24	22
Sat	24	28	28	25	23
Sun	25		29	26	24
Mon	26 Republic Day		30 IInd Mid Sem Exam BIO 121	27	25
Tue	27		31 IInd Mid Sem Exam CHY 121	28 BIO 122 Final Exam	26
Wed	28			29 BIO 121 Final Exam	27
Thu	29			30 PHY 122 Final Exam	28
Fri	30				29
Sat	31				30
	Working Days 18	Working Days 20	Working Days 17	Working Days 19	Working Days 05
	Cumulative Work Days 18	Cumulative Work Days 38	Cumulative Work Days 55	Cumulative Work Days 74	Cumulative Work Days 79

IISER THIRUVANANTHAPURAM GUIDE BOOK 2009

Appendix 2

Time Table for Vasanth Semester 2009

Time / Day	8:45 am to 9:45 am	9:50 am to 10:50 am	10:50 am to 11:00 am	11:00 am to 12:00 pm	12:00 pm to 01:30 pm	01:30 pm to 02:30 pm	02:30 pm to 03:30 pm	03:30 pm to 04:30 pm
MON	BIO 121	IDC 121	SHORT BREAK	CHY 121	LONG BREAK	Physics Lab PHY 122		
TUE	CHY 121	MAT 121		PHY 121		Biology Lab BIO 122		
WED	IDC 121	PHY 121		BIO 121		HUM 121	HUM 121	
THRS	MAT 121	MAT 121		BIO 121		Chemistry Lab CHY 122		
FRI	PHY 121	PHY 121		IDC 121		Seminar / Colloquium		

Appendix 3

COURSES AND FACULTY FOR VASANTH SEMESTER

COURSES	FACULTY
BIO 121 Biochemistry	K.P. Mohanakumar
CHY 121 Kinetcs and Mechanisms	Ayan Datta K. George Thomas
PHY 121 Electromagnetism and Optics	V.M. Nandakumaran
MAT 121 Multivariate Calculus and Group Theory	V. Sunderapandian
IDC 121 Thermodynamics	T.K. Shahjahan M.S. Gopinathan Ayan Datta
HUM 121 Introduction to Philosophy of Science	Anil Nukala
BIO 122	K.P. Mohanakumar
CHY 122	O. Thomas
PHY 122	V.M. Nandakumaran Unnikrishnan Nayar

Appendix 4

Faculty

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Appendix 5

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Notes