BSMS Sem II – Course Details- Jan 2025

1	Course code	BIO121
2	Course Title	Introductory Biology II: Genetics and Molecular Biology
3	Credits	3
4	Course Coordinator & participating faculty (if any)	Dr. Viji Subramanian* & Dr. Hussain Bhukya
5	Nature of Course	LT -Lectures & Tutorials
6	Pre requisites(if any)	No
7	Objectives & Outcomes	Objectives: This course would enable students to develop their understanding of basic concepts of molecular biology and genetics. Students would learn basics of genetics and classical genetics. On covering all classical concepts of Mendelian genetics, students will be exposed to concepts of population genetics, quantitative genetics encompassing complex traits, clinical genetics and genetics of evolution. Open in semesters/programs - Open to Semester II BSMS Outcomes: Students would learn about the molecular basis of transmission of genetic information and its role in determining the function of cells. They will gain knowledge about the aspects of gene expression and the molecular complexity that regulates differential gene expression.
8	Course contents	Module 1. Biological information: Nature of biological information. Mechanisms of transmission of information: genetic, epigenetic, cultural and other mechanisms of inheritance. Central dogma of molecular biology. How the genetic information is processed into cellular functionality. Mutations. (10L) Module 2: Mendelian genetics (segregation and independent assortment); Bacteriophage genetics and Drosophila crosses; Introduction to polytene and lampbrush chromosomes; sex determination and sex linkage in diploids; cytoplasmic inheritance; pedigrees, markers, mapping and genetic disorders; gene frequencies and Hardy-Weinberg principle. (10L) Module 3: Basic aspects of gene expression and regulation. Transcriptional, translational and post-transcriptional control of gene regulation. (10L)
9	Evaluation /assessment	1. End-sem examination- 40% 2. Mid-sem examination- 30% 3. Quiz/ Assignments- 30% 4. Projects - Not Applicable
10	Suggested readings	1. Lewin's GENES XI- Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpstrick. Jones and Bartlett Publishers, LLC. 2. Molecular Biology of the Cell by Alberts, Johnson, Raff, Lewis et al. (2007) 5th Ed. Garland Science. 3. Molecular Biology of the Gene by James Watson et al., (2007) 6th Ed. Benjamin Cummings. 4. Principles of Biochemistry (Sixth Edition)- David L. Nelson and Michael M. Cox. W.H. Freeman and Company, New York. 5. Biochemistry (Fourth Edition)- Donald Voet and Judith G. Voet. John Wiley & Sons, INC.

Course code	**BIO122**
Course Title	**Biology Lab II - Biochemistry and Molecular Biology Lab**
Credits	**3 (3 hours of lab on 3 different days in a week for 3 different batches of students)** **L&P- Lectures& Lab sessions:** **There will be a half an hour to 1 hour lecture to brief the principle and concept of the experiment to be done prior to the lab session.**
Type of Course/Open in/to	**Lab Course – BS-MS Semester -II**
Name of Course Coordinator & participating faculty (if any)	**Dr. Sivakumar Vallabhapurapu* (Co-ordinator);** **Dr. Santanu Paul (Participating Faculty)**
Course Objective & Outcome	**Objective: To make the students familiar about basic Molecular Biology and Biochemical Experimental methods.** **Outcome: The Students are expected to gain basic training** **in conducting Molecular Biology and Biochemical experiments**
Pre-requisite	**N/A**
Course Content	**· Preparation of solutions, dilutions etc** **· Protein Estimation and Enzyme assay (acid phosphatase enzyme assay)** **· Genomic DNA isolation- estimation using Nano drop method** **· RNA isolation and estimation using Nano drop method** **· Agarose Gel Analysis of DNA and RNA** **· SDS-PAGE analysis of Proteins** **· PCR experiment** **· PCR product purification (Gel extraction), Gel analysis and Restriction Digestion** **· Analysis and Purification of Digested DNA** **· Gel analysis of the Purified DNA and Ligation** **· Transformation** **· Plasmid isolation (rDNA)** **· Confirmation of Recombinant Plasmid DNA by Restriction digestion** **· Animal Cell culture Demo** **Topics 1-6 will be taken by Dr. Eswarayya Ramireddy and** **Topics 7 – 14 will be taken by Dr. Sivakumar Vallabhapurapu** **Each topic will need one lecture and one lab session.**

Grading Scheme	1. **End-sem examination- 35%** 2. **Mid-sem examination- 35%** 3. **Continuous Assessment – 30%** **(Quiz/Record Maintenance & Performance in the lab)** 4. **Quiz- (Part of continuous assessment)** **Seminar/Presentations- Not Applicable**
Suggested Reading	**1. Introduction to Practical Biochemistry by Plummer Mu, David T. Plummer** **Tata Mc Graw-Hill Education** **2. Laboratory Manual in Biochemistry by J. Jayaraman** **New Age International Publishers** **3. Molecular Cloning: A laboratory manual Volume 1, 2, 3 by J. Sambrool, D. W. Russel** **Cold spring Harbour Laboratory Press.** **4. Biochemical Calculations by Irwin H Segel** **John Wiley and Sons**

1	**Course Code**	**CHM121**
2	**Course Title**	**Elementary Inorganic Chemistry**
3	Credits	3 Credits
4	Type of Course/Open in/to	Theory (2L+1T per week)
5	Name of Course Coordinator & participating faculty	Dr. Arun Kumar Bar* and Dr. Pankaj Kumar Koli
6	Objective and Outcome	This course will introduce the students to the rudimentary principles behind the chemistry of inorganic compounds. In this course an overview introduction to the common elements of the periodic table from alkali metals to the noble gases through transition-metal and main group elements will be given and their properties such as periodicity, structure and bonding, acidity and basicity, coordination chemistry *etc.* will be discussed. At the end of the course, the students should be able to derive the structure of various covalent compounds, apply the concept of acid-base chemistry to various reactions and as a whole understand the importance of the elements of the periodic table in the matters.
7	Pre-requisite	CHM111
8	Course Content	● **Introduction to the periodic table and periodic properties of elements, Atomic Structure, electronic configuration, periodicity (sizes of atoms and ions, ionization energy, electron affinity), basic concept of relativistic effects (10-11 h).** ● **Concepts of acids and bases (Brønsted and Lewis theory, hard and soft acids and bases), Understanding acid-base buffers (5h-6h).** ● **chemical bonding (ionic bonding, valance bond, covalent bond and molecular orbital theories) (5-6h).** ● **Coordination complexes and fundamental bonding theories in transition metal compounds, nomenclature of coordination complexes, fundamental concept of isomerism of coordination complexes (10-11 h).**
9	Grading Scheme (tentative)	a. 30% quizzes - 2 quizzes 15% each (one before mid-sem, one after mid-sem) b. 35% mid-sem exam c. 35% end-sem exam
10	Suggested Readings	1. *Inorganic Chemistry: Principle of Structure and Reactivity*, 4th edition, James E. Huheey, Ellen A. Keiter, Richard L. Keiter. (Pearson Education Asia), Third Indian Reprint, 2001. Published by Addison Wesley Longman (Singapore) Pte. Ltd., Indian Branch, 482 F. I. E. Patparganj, Delhi 110092, India. Printed in India by Thomson Press (1) Ltd. 2. *Inorganic Chemistry*, Shriver and Atkins (2006) International Student Edition, 4th edition, Oxford University Press

1	Course code	CHM122
2	Course Title	CHEMISTRY LAB - I
3	Credits	3
4	Type of Course/ Open in/to	Labs only / BS-MS II-Semester
5	Name of Course Coordinator & Participating faculty	Dr. Janardan Kundu*, Dr. Ashwani Sharma & Dr. Sudipta Roy
6	Course Objective & Outcome	Objectives: This is the first chemistry laboratory course at IISER Tirupati. In this course, students will be introduced to good lab practices with a profound emphasis on safety. They will work on a myriad of exciting experiments carefully chosen from organic, inorganic, and physical chemistry, such that they can practically relate with the theory they are learning in college/have learned earlier from school. The lab will also expose them to how chemistry can be applied in everyday life. Outcomes: As a whole, this chemistry lab course will set the platform for the students who wish to pursue research in experimental chemistry.
7	Pre-requisite	NIL
8	Course Content	• An introduction to Organic qualitative analysis – To determine the nature of a given organic compound (Acid/Base/Neutral). • Qualitative Analysis of the given organic compound – 1 • Qualitative Analysis of the given organic compound – 2 • Determination of weight percent of the active ingredient in a commercial calcium carbonate tablet. • Preparation of Hexaamminenickel (II)chloride [Ni(NH3)6]Cl2 • Synthesis of Copper Pigments, Malachite and Verdigris: Making Paint. • Determination of strength of base by volumetric titration (Volumetry). • Determination of phosphoric acid concentration in soft drinks by pH-metric titration (pHmetry). • Determination of Cetirizine concentration from Inclusion Complexes of β-Cyclodextrin: A Spectrophotometric Method (UV-Vis Spectroscopy).
9	Grading Scheme	• Mid-sem examination – 40 Marks (Experiment + Viva) • Continuous Assessment – 20 Marks (10 before mid-sem and 10 after mid-sem) • End-sem examination – 40 Marks (Experiment + Viva)
10	Suggested Reading	• Journal of Chemical Education (ACS Publications) • A.I. Vogel, Text Book of Practical Organic Chemistry IV Edition 1978. • Laboratory Manual of Organic Chemistry – Raj K. Bansal II Edition 1990. • A.J. Elias, A Collection of Interesting General Chemistry Experiments, Revised Edition 2012.

1	**Course code**	**HSS121**
2	**Course Title**	**Critical Reading, Writing and Communication**
3	Credits	2
4	Course Coordinator	Dr. Baburam Upadhyaya
5	Nature of Course	Lectures
6	Pre requisites(if any)	No
7	Objectives & Outcomes	This course aims to develop skill sets applicable to a wide variety of academic settings. The skills include: • writing, • reading, • speaking, and • listening. • Style aspects such as: • Organization, • Clarity, • Cohesion, • Coherence and Concision are emphasized. Upon completion of the course, students will be able to: **Category A**: Academic knowledge and skills • understand and analyse linguistic and discourse features of scientific texts; • develop and produce scientific texts with appropriate linguistic and discourse features; • create scientific documents such as summaries and abstracts,popular scientific articles, procedural texts and technical reports. The students will be able to examine and develop: • text organisation, • point of view, • register and style, • editing skills, • paraphrasing, • summarising, descriptive composition and argumentative composition **Category B:** Attributes for all-roundedness: • extend and enhance strategies for learning independently and • collaboratively (in teams and groups)); • increase their outlook and an awareness of cultural diversity constructed through English for science texts. • Taking responsibility for one's own learning with some monitoring on the part of the teacher. The development of the capacity for individual work, independent learning, organizational skills and time management.

8	Course contents	• Reading comprehension • Critical reading • Structure of a paragraph • Clarity: Nominalisations • Clarity • Concision • Coherence and cohesion • Rhetorical elements • Listening • Speaking
9	Evaluation /assessment	• Continuous assessment (40% weighting) • Mid-semester assessment (30% weighting) • End-semester assessment (30% weighting)
10	Suggested readings	• Kirkman, J. 1992. Good style: Writing for science and technology. London: E & FN Son. • Alley, Michael. 2018. The Craft of Scientific Writing. Springer. Note: These are references for the teacher. The students will be provided with the learning materials by the teacher.

Course Details for MTH121 : January Session 2025

1	Course Code	MTH121
2	Course Title	Linear Algebra and Applications
3	Credits	3
4	Course Coordinator	Dr. Subhash B subhash@labsiisertirupati.ac.in Dr. Girja Shanker Tripathi (Participating faculty) girja@labs.iisertirupati.ac.in
5	Nature of Course	L+T
6	Pre-requisites	None
7	Objectives & Outcomes	**Objectives:** This course is a foundational course in linear algebra starting with system of linear equations and culminating in the diagonalization of real symmetric matrices. The students shall learn about solutions of systems of linear equations and move on to learning the fundamental concepts in linear algebra namely linear transformations, matrices and determinants. The concepts of eigen values, eigenvectors and diagonalization will also be discussed. **Open in semesters/programs - 2/BSMS** **Outcomes:** Upon successful completion of this course, students will be able to use computational techniques and algebraic skills essential for the study of solutions of systems of linear equations, matrix algebra, eigenvalues and eigenvectors, orthogonality and diagonalization.

8	Course Contents	Matrices, Systems of linear equations, Gauss-Jordan elimination. $\mathbb{R}^n$ as a vector space, Subspaces of $\mathbb{R}^n$, linear combinations, linear independence, span, basis, dimensions of subspaces of $\mathbb{R}^n$, coordinates with respect to a basis. Linear transformations and their inverses, relationship between linear transformations and matrices, examples of linear transformations in geometry, properties of the inverse matrix, image and kernel of a linear transformation, Rank-Nullity theorem. $\mathbb{R}^n$ as an inner product space, Cauchy-Schwarz inequality, orthogonality, Gram-Schmidt orthonormalization. Definition of determinants, basic properties of determinants (2 and 3 dimensions). Eigenvalues and Eigenvectors, characteristic polynomial, Diagonalization of real symmetric matrices (2 and 3 dimensions). Generalization of concepts to $\mathbb{C}^n$ (time permitting).
9	Evaluation/Asessment	2 Quizzes of equal weightage 30%, Midsem 30% and Endsem 40%
10	Suggested Readings	[1] S. Lang, *Introduction to Linear Algebra*, Spriger UTM, 2010. [2] S. Kumaresan, *Linear Algebra: A Geometric Appoach*, PHI Learning, 2006. [3] G. Strang, *Linear Algebra and its Applications*, Delhi Cengage Learning, 2006. [4] O. Bretscher, *Linear Algebra with Applications*, Pearson, 5^{th} edn., 2012.

1	Course Code	**PHY121**
2	Course Title	**Foundations of Physics II: Electricity, Magnetism & Optics**
3	Credits	3
4	Course Coordinator & Participating Faculty	Dr. Jessy Jose * Dr. Eswaraiah Chakali
5	Nature of Course	L + T
6	Prerequisites	None
7	Course Objective & Outcome	**Objectives:** ● Introduce the fundamental concepts in electricity, magnetism and elementary circuit theory ● Learn about optical phenomena such as reflection, refraction, interference, diffraction, and polarization and their applications ● Establish the foundation for higher-level courses in Electrodynamics and Optics **Outcomes:** ● Describe various concepts in electromagnetism and understand electric circuits ● Analyse different problems in electromagnetism using mathematical methods ● Understand optical phenomena such as reflection, refraction, interference, diffraction, and polarization. ● Apply the theory of optics to understand and analyze optical devices
8	Course contents	● Review: Electric charge and field, point charge, dipole, Gauss's law, planar, cylindrical, and spherical symmetry, electric potential, equipotential surfaces, conductors [2] ● Electric fields in matter, capacitors and dielectrics, direct currents in materials, resistance, Ohm's law [3] ● Magnetic force and field, force on point charge, torque on currents, working principles of electric motors and generators [2] ● Ampere's law, Faraday's law, solenoids, Inductance, induced electric field, alternating currents and circuits, working principles of transformers, loudspeakers, magnetic recording and data storage equipment [6] ● Maxwell equations, Electromagnetic waves [1] ● Huygen's Principle, reflection and refraction of plane wave [1] ● Interference of light by division of wavefront, Young's double slit experiment, Interference of light by division of amplitude, Newton's ring [2] ● Diffraction of light: Fresnel & Frauhnofer diffraction, diffraction due to a single slit and a double slit, diffraction grating [2] ● Polarization of light: Polarization by reflection, scattering and double refraction, superposition of two plane polarized waves, elliptically and circularly polarized light [2] ● Optical path length, Fermat's principle and its applications [1] ● Optical Instruments: microscopes, telescopes; Aberrations [2]
9	Evaluation /assessment	a. Quizzes (1+1) - 30% b. Mid-Sem examination- 35% c. End- Sem examination- 35%

10	Suggested readings	**Text Books:** 1. Introduction to Electrodynamics, David J. Griffiths, Pearson, 4th Edition (2012). 2. Electricity and Magnetism, E. M. Purcell and D.J. Morin, Cambridge University Press, 3rd Edition (2013). 3. Optics, Ajoy Ghatak, Tata McGraw-Hil, 3rd Edition (2005) 4. Optics, Eugene Hecht, Addison-Wesley, 4th Edition (2001). **5.** University Physics, Young and Freedman, 12th Edition (2007).

1	Course Code	**PHY122**
2	Course Title	**Basic Physics Lab I**
3	Credits	3
4	Course Coordinator & Participating Faculty	Dr. Eswaraiah Chakali* Dr. Kanagasekaran T Dr. Sudipta Dutta Dr. Sambuddha Sanyal Dr. Aradhana Singh Dr. Jessy Jose Dr. Rakesh S Singh
5	Nature of Course	P
6	Prerequisites	PHY111 (Foundations of Physics I: Mechanics & Waves)
7	Course Objectives & Outcomes	To demonstrate the physical concepts in mechanics and properties of matter. To introduce elementary laboratory techniques such as data recording, data analysis and error estimation.
8	Course Contents	0. Least count, significant figures, error analysis, histogram and graph plotting, curve fitting, etc. 1. Kater's pendulum: Determine the value of "g" 2. Pohl's pendulum: Damped and Forced Oscillation 3. Coupled Pendula: Determine the pendulum's characteristic frequency 4. Moment of Inertia: Definition, different body shape, parallel axis theorem 5. Gyroscope: Laws of gyroscopes, Precession, Nutation 6. Torsional vibrations and shear modulus 7. Kundt's Tube: Speed of sound in air 8. Acoustic Doppler Effect 9. Surface Tension of Liquids 10. Falling-ball viscosimeter
9	Evaluation/Assessment	Daily lab evaluation (record + viva) – 60% End semester Exam (Practical) – 40%
10	Suggested Readings	1. The Art of Experimental Physics, Daryl W. Preston, John Wiley & Sons. 2. Fundamentals of Physics, Halliday, Resnick, and Walker, John Wiley & Sons. 3. Introduction to Physics, Cutnell and Johnson, Wiley. 4. The General Properties of Matter, F.H. Newman and V.H.L. Searle, Edward Arnold. 5. Elements of Properties of Matter, D.S. Mathur, S Chand & Company. 6. Statistics: A Guide to the Use of Statistical Methods in the Physical Sciences, R. J. Barlow, Wiley.