Pt. Ravishankar Shukla University, Raipur
Center for Basic Sciences

Five Year Integrated M.Sc. (Semester II)

Subject code: B 201
Biology –II (Introduction to Macro Molecules)

Unit-I
Cell – Overview: Cellular organization, Bio membranes, Nucleus, Cytoplasmic organelles, Bacteriophages. Nucleic Acids, Genomes and Proteomics: Building blocks- nucleotides, DNA structure, RNA structure and function, chromatin structure, genome code, genes, repetitive DNA sequences.

Unit-II
Gene Transcription: Overview of gene expression, overview of transcription, gene's regulatory elements, transcription mechanisms in prokaryotes and eukaryotes (a comparison).

Unit-III
Protein Structure and Function: Building blocks- amino acids, peptides, secondary structure, three dimensional structure, membrane proteins, miscellaneous proteins, enzymes.

Unit-IV
Cell Signalling: Overview, signalling via hydrophobic molecules, signalling via ion channels, Signalling via G-protein coupled receptors, signalling via cell surface enzymes, intracellular signalling.

Unit-V
Biotechnology: DNA cloning, Uses of recombinant DNA technology, Polymerase chain reaction (PCR), Production of recombinant proteins and SDS-PAGE.

Books Recommended:

S.No.	Author	Book
1	B Alberts, A Johnson, J Lewis, and M Raff	Molecular Biology of the Cell
2	J D. Watson, T A. Baker, S P. Bell, & A Gann	Molecular Biology of the Gene (6th Edition)
3	John Wilson and Tim Hunt (2007)	Molecular Biology of the Cell: The Problems
4	Benjamin Lewin (2007)	Genes IX (Lewin, Genes XI)

Pt. Ravishankar Shukla University, Raipur
Center for Basic Sciences

Five Year Integrated M.Sc. (Semester II)

Subject code: C 201
Chemistry II

UNIT-I

Thermochemistry: Enthalpy, heat of fusion and heat of vaporisation, enthalpy of a chemical reaction (heat of combustion, heat of solution, heat of neutralization), enthalpy of formation, standard reaction enthalpy, Hess's law, Kirchhoff's law, bond energy, dissociation energy. Entropy formulation of Second law, entropy change in a phase transition, Trouton's
Rule, calculation of absolute (Third law) entropy, entropy change in a chemical reaction.

UNIT-II

Free energy functions, criteria for spontaneity and equilibrium of closed systems, variation of Gibbs free energy with pressure and temperature, Gibbs Helmholtz equation, the concept of chemical potential, partial molar quantity, Gibbs Duhem relation.

UNIT-III

Phase equilibrium in simple systems: Solid – liquid, liquid – vapour, vapour – solid, phase diagrams – water, carbon dioxide, sulphur, phase equilibrium condition, Gibbs phase rule, Clapeyron equations, Clausius – Clapeyron equation.

UNIT -IV

Ideal Solutions, chemical potential of a solute in a binary ideal solution, Raoult's Law, entropy and Gibbs energy of mixing, Colligative properties – freezing point depression, boiling point elevation, osmotic pressure, van't Hoff equation.

UNIT-V

Chemical equilibrium: Gibbs energy change of a reaction, standard reaction Gibbs energy, the condition for chemical equilibrium, equilibrium constant, reactions involving gases and pure substances, the Principle of Le Chatelier and applications.
Chemical potential of a charged species, electrochemical cell (galvanic and electrolytic), examples of electrochemical cells, half cell potential (electrode potential), Nernst equation.

Suggested texts and References:

(1) P.W.Atkins, Physical Chemistry, Oxford University Press, 7th Edition, 2006.
(2) G.W. Castellan, Physical Chemistry, 3rd Ed.Wesley/Narosa Publishing House, 1993.
(3) G.N.Lewis and Randall, Thermodynamics, (Revised by K.S.Pitzer and L.Brewer), International Students Edition, McGraw Hill, 1961.
(4) K. Denbigh, The principles of Chemical Equilibrium.
(5) B. G. Kyle , Chemical & Process Thermodynamics.

Pt. Ravishankar Shukla University, Raipur
Center for Basic Sciences

Five Year Integrated M.Sc. (Semester II)

Subject code: MB201
Mathematics – II (For Biology Stream)

Unit I Functions of several variables, partial derivatives, geometric interpretation, properties of partial derivatives, chain rule, applications. Elementary discussion on scalars and vectors, norm of a vector, dot product, projections. Linear equations and matrices, matrix operations. Concept of a determinant, its properties, evaluation of a determinant, cross product as a determinant, lines and planes. Elementary ideas of tensors.

Unit II Vector functions. Gradient of a function, geometric interpretation, properties and applications; divergence and curl of a vector function, geometric interpretation, properties and applications; higher derivatives, Laplacian. Line integrals. Double and triple integrals, their properties and applications to areas, volumes, etc.

Unit III Gradient theorem, Green's theorem, Stokes' theorem, divergence theorem, applications. Proofs of Stokes' and divergence theorems through physical examples (such as circulation in a 2 dimensional plane and accumulation of fluid in a given volume).

Unit IV Curvilinear coordinate systems, spherical and cylindrical coordinates, area and volume elements, illustrations. Gradient, divergence and curl in curvilinear coordinate systems.

Unit V Introduction to linear algebra. Vector spaces, linear dependence and independence, notion of basis, and dimension, subspaces. Examples. More on matrices: special kinds of matrices, their properties. Eignevalues and eigenvectors, secular determinant, characteristic polynomial. Eigenvalues and eigenvectors of a real symmetric matrix. Illustrative examples. Applications of linear algebra.

Suggested Texts and References

(1) Calculus: Gilbert Strang (MIT Courseware)
(2) Calculus: Thomas
(3) Elementary Linear Algebra: Howard Anton and Chris Rorres
(4) Introduction to Linear Algebra: Gilbert Strang (MIT Courseware)
(5) Mathematical Methods for Scientists and Engineers: George B. Arfken and Hans J. Weber (for curvilinear coordinates, beta and gamma functions only)

Pt. Ravishankar Shukla University, Raipur
Center for Basic Sciences

Five Year Integrated M.Sc. (Semester II)

Subject code: M201
Mathematics – II (For Physics & Chemistry Stream)

Unit I Differential equations: separable equations, first order differential equations. Second order differential equations and Wronskian; equations with constant coefficients, homogeneous and inhomogeneous equations.

Unit II Scalar functions of several variables, partial derivatives, geometric interpretation (maxima, minima, saddle points), properties of partial derivatives, chain rule, applications. Gradient of a function, geometric interpretation, properties and applications.

Unit III Vector functions. Derivatives of a vector function, divergence and curl, geometric interpretation, properties and applications; higher derivatives, Laplacian.

Unit IV Spherical and cylindrical coordinates, area and volume elements, illustrations. Gradient and divergence in spherical and cylindrical coordinates.

Unit V Line integrals. Double and triple integrals, their properties and applications to areas, volumes, etc. Gradient theorem, divergence theorem, Stokes' theorem, applications. Illustrations from fluid flow and electromagnetism.

Suggested Texts and References

(1)Calculus, Gilbert Strang (MIT Courseware) http://ocw.mit.edu/resources/res-18-001-calculus-online-textbook-spring-2005/textbook/

(2)Thomas' Calculus, 11th Edition, M. Weir, J. Hass and F. R. Giordano, Pearson Education.

(3)Mathematical Methods in the Physical Sciences, 3rd Ed., Mary L. Boas, Wiley Student Ed., Wiley India (Reprint) 2009 (for complex numbers and differential equations)

(4)Elementary Linear Algebra, 10th Edition, Howard Anton and Chris Rorres, Wiley Student Ed., Wiley 2011.

(5)Introduction to Linear Algebra, 4th Edition, Gilbert Strang, Wellesley Cambridge Press, 2009

Pt. Ravishankar Shukla University, Raipur
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Five Year Integrated M.Sc. (Semester II)

Subject code: M201
Mathematics – II (Calculus and Linear Algebra) (For Mathematics Stream only)

Unit I Recollection and rigorous treatment of continuity and differentiability of a function of one variable. Riemann integration, proof of the Fundamental Theorem of Calculus. Functions of two and three variables, double and triple integrals.

Unit II Line integrals. Parametrized surfaces, oriented surfaces. Stokes Theorem, Gauss Divergence Theorem (both without proof).

Unit III Recollection of the algebra of matrices (mainly over the field of real numbers, but mention other fields also), linear equations, row-echelon form, Gauss-Jordan elimination. Determinants, rank of a matrix, rank and invertibility.

Unit IV Vector spaces (mainly over the field of real numbers, but mention other fields also), span, linear independence, basis, dimension and its uniqueness (without proof).

Unit V Linear transformations, kernel and image, the rank-nullity formula. Eigen values and eigenvectors of a square matrix or a linear operator.

References

[1] D.J.S. Robinson, A Course in Linear Algebra with Applications, World Scientific.
[2] G. B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th ed., Addison-Wesley/Narosa,1998.
[3] J. Marsden, A. Tromba and A. Weinstein, Basic Multivariable Calculus, Springer
[4] Inder K. Rana, Calculus@iitb, Concepts and Examples, Version 1.2, math4all 2009.

Pt. Ravishankar Shukla University, Raipur
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Five Year Integrated M.Sc. (Semester II)

Subject code: G202
Subject: Glimpses of Contemporary Science

Unit-I
Physics in life systems: size and scale, diffusion, cell locomotion, force generated by actin growth and flagellum rotatory motion, ion channels, resting potential across the membrane, nerve conduction velocity, action potential, macromoleculaes of life, random walk model of polymer, single molecular experiments, optical tweezers, magnetic tweezers.

Unit-II
Complex systems: dynamical chaos, logistic map, bifurcation, Universality, Feigenbaum constants, Mechanical demonstrations of chaos, Nanomechanical oscillators, Patterns, Reaction-diffusion systems, Nodal patterns, thermodynamics and human population, Falling leaves, Smoke ring physics.

Unit-III
At the turn of 1900: Silver threads, Discovery of the electron, Rutherford's nuclear atom Wien's law, Blackbody radiation and Max Planck's action.

Unit-IV
Astrophysics, Astrochemistry and Astrobiology

Unit-V
Quantum mechanics, atoms : Entanglement Light-atom interaction, Bringing atoms to rest, Laser tweezers, How bright is laser, Quantum computing.

Books Recommended:

S.No.	Author	Book
1	Darcy Wentworth Thompson	Growth and Forms
2	Rob Phillips	Physical biology of the cell
3	Harward Berg	Random walks in biology
4	L. Cooper	Physics: Structure and Meaning
5	R. P. Feynman, R. B. Leighton, and M. Sands	The Feynman Lectures on Physics vol. 3
6	S. Chandrasekhar	Introduction to the study of stellar structure

Pt. Ravishankar Shukla University, Raipur
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Five Year Integrated M.Sc. (Semester II)

Subject code: P201
Physics – II

UNIT- I

Electricity and Magnetism: Electrostatics: Coulomb's law and Gauss' law; Electrostatic potential, uniqueness theorem, method of images; Electrostatic fields in matter; Conductors and insulators; Capacitors and capacitance; Electric current.

UNIT- II

Magnetostatics: Biot – Savart law, Ampere's law; Electromagnetic induction; Mutual inductance and self inductance; Magnetic fields in matter. Displacement current; Maxwell's equations; Alternating current circuits; Electric and magnetic properties of matter.

UNIT- III

Plane electromagnetic waves in vacuum; Polarisation; Energy and momentum in electromagnetic waves; electromagnetic radiation (qualitative); Dipole radiation formula; Larmor's formula for radiation due to accelerated charge (without proof); Synchrotron radiation (descriptive).

UNIT- IV

Optics: Interference of two beams and involving multiple reflections; Young's experiment, Fresnel's biprism, Lloyd's mirror.

UNIT- V

Optical instruments; Telescope and microscopes; Magnifying power and resolving power. Sources of light and spectra; Dispersion, polarisation, double refraction; Optical activity.

Suggested texts and References:

1. Electricity and Magnetism, Berkeley Physics Course Vol. 2, 2nd Edition, Edward M. Purcell, Tata McGraw Hill, 2011.
2. The Feynman Lectures on Physics Vol. 2, R. P. Feynman, R. B. Leighton and M. Sands, Narosa Publications, 2010.
3. The Feynman Lectures on Physics Vol. 3, R. P. Feynman, R. B. Leighton and M. Sands Narosa 2010.
4. Waves, Berkeley Physics Course Vol. 3, Frank S. Crawford, Tata McGraw – Hill, 2011.
5. Fundamentals of Optics, 4th Edition, F. A. Jenkins and H. E. White, Tata McGraw Hill, 2011.
6. University Physics, 7th Edition, Francis W. Sears, Mark Zemansky and Hugh D. Young, Massachusetts: Addison Wesley, 1987.
7. Optics , 4th Edition Eugene Hecht Massachusetts: Addison Wesley
8. "Foundations of Electromagnetic Theory 4th edition, "John R. Reitz, Fredrick Milford & RobertChrist" Massachusetts: Addison Wesley, 1993

Pt. Ravishankar Shukla University, Raipur
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Five Year Integrated M.Sc. (Semester II)

Subject code: G201
Electronics & Instrumentation

Unit-1

Analog electronics: Introduction to passive electronic components -resistance, capacitance, inductance; Circuit theorems: Thevenin's theorem, Norton's theorem and Maximum power transfer theorem; basic concepts of semiconductor diode and transistor; application of Bipolar Junction Transistor (BJT) – biasing circuits: The CE configuration, fixed base bias, emitter bias, and potential-divider or voltage divider bias; CE amplifier, amplifier as a switch, concept of negative feedback.

Unit-2

Principle of DC power supply; half and full wave bridge rectifier, capacitor filter – ripple factor, concept of load and line regulation, concept of constant voltage source and constant current source; concept of short circuit protection and current limit protection; Zener regulator; concept of Switch Mode Power Supply (SMPS), power supply ICs, charge pump ICs for stepping up voltage and for bipolar supply.

Unit-3

Differential amplifier; Operational Amplifier (OPAMP): principle, basic characteristics and parameters relevant for general use; non-inverting and inverting amplifier, voltage follower, difference amplifier, summing amplifier, voltage controlled current source; OPAMP comparator, Schmidt trigger; Digital to Analog Converter (DAC) with weighted resistance and R-2R ladder network; Anlog to Digital Converter (ADC); filters: low pass, high pass; band pass; Butterworth filter.

Unit-4

Digital electronics: Review of basic logic gates; DeMorgan's theorem, Use of NAND / NOR as universal building blocks; arithmetic circuits; binary addition, half adder, full adder, binary subtraction - 1s and 2s complement, controlled inverter, adder / subtracter, parity checker; Flip-Flops (FF): RS-FF, D-FF, JK-FF; counters and shift registers: binary counter, ripple counter.

Unit-5

Basic concepts of instrumentation, generalized instrumentation systems block diagram representation; Sensing elements: electrodes and transducers. Electrode-electrolyte interface, stability of electrode potentials, circuit models, external and internal electrodes, pH, pO2 and pCO2 electrodes. Transducer, definition, types, displacement, velocity, acceleration, pressure, temperature vibration, ultrasound etc., calibration, sensitivity and resolution.

Books Recommended:

S.No.	Author	Book
1	R. L. Boylestad, L. Nashelsky, K. L. Kishore, Pearson	Electronic Devices and Circuit Theory
2	Malvino and Bates	Electronic Principles
3	Donald A. Neamen, Tata McGraw Hill	Electronic Circuit Analysis and Design
4	David A. Bell	Electronic Devices and Circuits
5	Leach, Malvino and Saha	Digital Principles and Applications
6	R.P. Jain	Modern Digital Electronics, Tata McGraw-Hill (2003)
7	M. Morris Mano, Michael D. Ciletti	Digital Design, Pearson Education Asia, (2007)
8	Thomas L. Floyd	Digital Fundamentals, Pearson Education Asia (1994)
9	DVS Murthy	Measurement & Instrumentation
10	A.K. Sawhney	Electrical Measurements & Electronic Measurements

Pt. Ravishankar Shukla University, Raipur
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Five Year Integrated M.Sc. (Semester II)

Subject code: ES 201
Environmental Studies

Unit-I: Biodiversity and its Conservation: Introduction – Definition : genetics, species and ecosystem diversity. Bio geographical classification of India. Value of biodiversity : consumptive use productive use, social, ethical, aesthetical and option value. Biodiversity at global, National and local levels. India as mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity : habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity : In situ and ex-situ conservation of biodiversity.

Unit-II: Environmental pollution. Definition Causes, effects and control measures of – a. Air pollution b.Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Nuclear hazards.

Unit-III: Solid waste management : Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies Disaster management : floods, earthquake, cyclone and landslides.

Unit-IV: Human population and the Environment: Population growth, variation among nation. Population explosion – Family welfare programme. Environment and human health. Human Rights.

Unit-V: Social Issues and the Environment: From unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people, its problems and concerns. Case studies. Environment ethies : Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products.

Reference books:

Books	Authors
Envirnoments Chemistry	B.K.Sharma
Waste Water tratment	M.N.Rao
Environment science	G.Tyher miller
Environmental studies & undergraduate course	Erach Bharacha
Fundamentals of Ecology	Euogane P. Oaum
The Biodiversity of India	Erach Bharcha
Marine Pollution	R.B.Clark
Ecology	Michael Begon, Colin R. Townsend
Global Biodiversity Assesment, Summary For policy Marker	R.T. Watson, V.H. Heywood