Department of Accountancy

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

COURSE OUTCOMES (Non CBCS)

Course Outcomes	**102: Financial Accounting I**
CO1	Students will know about the concept and applications of Generally Accepted Accounting Principles (GAAP) in the preparation and presentation of financial statements and Accounting Standard setting procedure in India
CO2	Students will know of how to prepare maintain accounts under Sectional and self balancing ledger system
CO3	It familiarizes the students with the concept of Hire Purchase and Installment Purchase System and their accounting treatments
CO4	Students will know the accounting for royalty transactions
Course Outcomes	**105: Cost Accounting**
CO1	It familiarizes the students with the fundamentals of cost accounting including the various classification of costing methods and techniques with the practical on cost ascertainment.
CO2	It introduces the one of the elements of cost, i.e. materials and its purchasing procedure, pricing of materials issues and inventory control techniques.
CO3	It provides the practical aspect of labour cost element for the determination of cost of a final product.
C04	It gives the idea of allocation and apportionment of overheads, and the methods of overhead absorption. It also helps the students to reconsolidate the transactions under cost and financial accounts.
CO5	It introduces the process costing and contract costing procedures.
Course Outcomes	**202: Financial Accounting – II**
CO1	Students will know the Indian Accounting Standards and International Accounting Standards Board, International Financial Reporting

	Interpretations Committee (IFRIC) and International Financial Reporting Standards (IFRS).
CO2	It aims to help the students to know the recording of transactions between branches and head office of a concern under different methods.
CO3	Students will gain knowledge on how to prepare departmental trading and profit and loss accounts, allocate common expenses, and transfer funds between departments. Additionally, it will acquaint students with the procedures for valuing goodwill.
C04	It aims at helping the students to know the settlement of accounts of partnership firms under different circumstances, for example, when one or more partners are insolvent, selling to a company and conversion into a company.
Course Outcomes	**205: Management Accounting**
CO1	It provides the basic knowledge on management accounting and its tools and techniques.
CO2	Students will know the importance of marginal costing in managerial decision making.
CO3	It gives insight into the practical aspect of preparing different types of budgets and importance of budgetary control as one of the cost controlling techniques.
CO4	It acquaints the students with the concept of standard costing and use of standard cost in variance analysis for materials, labour and overheads.
Course Outcomes	**303: Corporate Accounting**
CO1	It gives the idea of preparing final accounts of a joint stock company.
CO2	It helps students understand the theoretical and practical aspects of right and bonus shares, Employee Stock Option Plans (ESOP), and share buybacks.
CO3	Students will know about the fundamentals of issue and redemption of debentures.
CO4	It gives understanding of the concept and provisions of amalgamation as per the Accounting Standard 14.
Course Outcomes	**304: Direct Taxes**
CO1	It provides introductory information on the fundamentals of income and other basic terms used under the Income Tax Act,1961.
CO2	Students will know how to calculate taxable income under the heads of

	salary, Income from House Property, profits and gains from Business and Profession, Capital Gains, and Income from other sources following the provisions of Income Tax Act, 1961.
CO3	Students will become familiar with the assessment process within the guidelines of the Income Tax Act of 1961 as well as the concepts of returns, advance tax payment, and tax deduction.
CO4	Students will be familiar with the 1957 Wealth Tax Act's provisions.
Course Outcomes	**306: Advanced Corporate Accounting**
CO1	It imparts fundamental information on various theoretical and practical attributes of share valuation.
CO2	Students will learn about the accounting treatment of internal reconstruction of a company.
CO3	It introduces the students to the concept of winding up and its procedures including the practical understanding
CO4	Students will have basic understanding of consolidated financial statement and its preparation in the books of a holding company.
Course Outcomes	**402: Auditing & Assurance**
CO1	Students will gain knowledge of the concept, objectives and principles of auditing
CO2	It introduces the conceptual understanding of internal control and internal check for quality audit.
CO3	It acquaints the students with the basic idea of audit sampling
CO4	It imparts the knowledge of audit procedure.
CO5	Students will learn how to prepare audit report and other legal procedures to be followed for preparing the report.
Course Outcomes	**403:Indirect Taxes**
CO1	It provides the basic understanding of the Central Sales Tax Act, 1956 and the registration process under the Act.
CO2	It imparts the history and basic understanding of the Central Excise Act 1944.
CO3	It provides the history and features of the Customs Act 1962 including the procedural aspect of levying or clearing custom duties.
CO4	It acquaints the learners with the understanding of Value Added Tax and the Assam Value Added Tax Act.
Course Outcomes	**405: Advanced Financial Accounting**
CO1	It provides the students with the understanding of the bank accounting

	system.
CO2	It acquaints the students with the accounts prepared by the Life insurance company and General Insurance Company.
CO3	It imparts the practical understanding of preparing investment account.
CO4	It provides the practical knowledge of ascertaining insurance claims
CO5	Students will learn about conceptual understanding of Government Accounting.
Course Outcomes	**505 : Financial Statement Analysis**
C01	It provides a basic understanding of the financial statements of a company.
C02	It imparts the knowledge about the provisions of the Companies Act of 1956 for the preparation of a company's final accounts and corporate financial reporting.
C03	It acquaints the students with the different techniques of Financial Statement analysis.
CO4	Students will gain the knowledge of conceptual framework and preparation of fund flow statement and cash flow statement.

DEPARTMENT OF ACCOUNTANCY

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

COURSE OUTCOMES (CBCS)

Couse Code	Outcomes
COM-HC-1016/ COM-RC-1016: Financial Accounting	Students will acquire conceptual knowledge of the Financial Accounting and skills for recording various kinds of business transactions.
COM-HC-2016/ COM-RC-4016: CORPORATE ACCOUNTING	Students will gain conceptual understanding of the corporate accounting and learn the techniques of preparing financial statements.
COM-HC-3026/ COM-RC-3026: INCOME TAX LAW AND PRACTICE	Students will be equipped with the idea of the application of principles and provisions of Income-tax Act, 1961 and the relevant Rules.
COM-HC-4016/ COM-RC-4026: COST ACCOUNTING	Students will be imparted with the basic concepts used in cost accounting, various methods involved in cost ascertainment and cost accounting book keeping systems.
COM-SEC-4024: E-Filing of Returns	Students will learn about the theoretical underpinnings and practical knowledge about electronic filling of returns.
COM-HC-5026/ COM-RE-5056: FUNDAMENTALS OF FINANCIAL MANAGEMENT	It will familiarize the students with the principles and practices of financial management.
COM-HE-5016/ COM-RE-6036: MANAGEMENT ACCOUNTING	Students will have understanding about the use of financial, cost and other data for the purpose of managerial planning, control and decision making.
COM-HC-5026: ADVANCED FINANCIAL ACCOUNTING	Students will gain advanced knowledge on financial accounting applicable in the business of special nature and on Government accounting system

COM-HC-6016/ COM-RE-5036: AUDITING AND CORPORATE GOVERNANCE	Students will acquaint with the knowledge of auditing principles, procedures and techniques in accordance with current legal requirements and professional standards and to give an overview of the principles of Corporate Governance and Corporate Social Responsibility.
COM-HC-6026/ COM-RE-5056: INDIRECT TAX LAWS	Students will be familiar with application of principles and provisions of Service Tax, VAT, Central Excise, and Customs Laws
COM-HC-6036(C): ADVANCED CORPORATE ACCOUNTING	Students will acquire advanced knowledge of corporate accounting and to learn the techniques of preparing accounts and statements under various corporate situations.

****

DEPARTMENT OF ASSAMESE

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

B.COM PROGRAMME (CBCS)

COURSE OUTCOME

COURSE CODE	COURSE TITLE	COURSE OUTCOME
BC-AE-1014	**BUSINESS COMMUNICATION** **(This course will enable students to develop communication skills and presentation skills.)**	This Course is divided into following five units: **Unit 1: Introduction** [Communication, Nature of communication, Methods of communication, Types of communication (Verbal/Non-verbal), Requirement of communication skill, Various kinds of communication, Barriers of communication (Language/ Psychological/Inter-personal/Cultural/ Physical/organizational)] **Unit 2: Business Correspondence** (Letter writing, Presentation, inviting quotations, sending quotations, placing orders, inviting tenders, sales letter, claim and adjustment letter and social correspondence, memorandum, inter office memo, notices, agenda, minutes, job application letter, preparing the resume) **Unit 3: Report writing** (Business reports, Types, Characteristics, Importance, Elements of structure, Process of writing, order of writing, The final draft, Checklist for reports) **Unit 4: Vocabulary** (Words often confused, words often misspelled, common errors in English) **Unit 5: Oral Presentation** (Importance, Characteristics, Presentation plan, Powerpoint presentation, Visual aids)
ASM-CC-3016	**Ancient Assamese Literature**	This course consists of four

	(This course will enable students to learn about Song-poetry, Drama, Prose literature of Ancient Assamese literature)	(04) units: **Unit 1: Song-Poetry** • **Sankardev's Borgeet : *Jaya Jaya Jadava*** • **SukabiNarayan Dev's Panchali song: *Ou ki Befula Jaag o*** **Unit 2: Poetry** • **Hari Bar Bipra's " *Babrubahanor Juddho"*** • **Ananta Kandali's "*Kumara Haran"*** **Unit 3: Drama** • **Madhavdeva's "*Arjuna Bhanjan"*** **Unit 4: Prose-Literature** • **Baikunthanath Bhattacharya's " *Arjuna's Shankhya Jug" (Srimad Bhagavat Geeta's 2nd Chapter; Assamese translation)*** • **Raghunath Mahanta's "*Raamor Bon gomon*"**

DEPARTMENT OF COMMERCE

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia
P.O.-North Salmara::Dist.-Bongaigaon::Pin-783383

COURSE OUTCOME (CBCS)

Course Outcome	**COM-GE-1046(B): Investing in Stock Markets**
CO1	This paper intends to provide basic skills to operate in stock markets and the ways of investing in it. It will enable the student to take up investment in stock markets independently.
Course Outcome	**COM-GE-2046(B): Insurance & Risk Management**
CO1	To develop on understanding among students about identifying analyzing and managing various types of risk. Besides, the students will be in a position to understand principles of insurance and its usefulness in business along with its regulatory framework
Course Outcome	**COM-GE-4046 (B): Micro Finance**
CO1	The course aims to make the students understand the basic concepts of micro-finance and its importance, institution structure, management of micro-finance institutions and microfinance in Indian context.
Course Outcome	**COM-DSE- HC-5036 (D): Banking**
CO1	To provide students the basic knowledge of Indian Banking System and its components, institutions and their functions
Course Outcome	**COM-DSE- HC-5036 (F): Indian Financial System**
CO1	To provide students the basic knowledge of Indian Financial System and its components, institutions and their functions.
Course Outcome	**COM- DSE- HC-6036 (A): Fundamentals of Investment**
CO1	To familiarize the students with different investment alternatives, introduce them to the framework of their analysis and valuation and highlight the role of investor protection.
Course Outcome	**COM- DSE- RC-6016 (B): Banking**
CO1	To provide students the basic knowledge of Indian Banking System and its components, institutions and their functions
Course Outcome	**COM- GE- RC-6046 (B): Micro Finance**
CO1	The course aims to make the students understand the basic concepts of micro-finance and its importance, institution structure, management of micro-finance institutions and microfinance in Indian context

DEPARTMENT OF COMMERCE

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia
P.O.-North Salmara::Dist.-Bongaigaon::Pin-783383

COURSE OUTCOME (NON-CBCS)

Course Outcome	**105: Rural & Micro Finance [Specialised]**
CO1	The course aims to make the students understand the basic concepts of Rural & Micro Finance and its importance, institution structure, management of micro-finance institutions and microfinance in Indian context.
Course Outcome	**104: Indian Financial System [Core]**
CO1	To provide students the basic knowledge of Indian Financial System and its components, institutions and their functions.
Course Outcome	**101: Fundamentals of Insurance [General]**
CO1	To develop on understanding among students about identifying analyzing and managing various types of risk. Besides, the students will be in a position to understand principles of insurance and its usefulness in business along with its regulatory framework
Course Outcome	**205: Micro Credit Institutions [Specialised]**
CO1	To provide students the basic knowledge of Micro Credit Institutions and its components, institutions and their functions.
Course Outcome	**306: Financial Institutions & Markets [Specialised]**
CO1	To provide students the basic knowledge of Indian Financial Institutions & Markets and its components, institutions and their functions.
Course Outcome	**405: International Banking Markets [Specialised]**
CO1	To develop on understanding among students about the working of International Banking Markets. Besides, the students will be in a position to understand usefulness of its in business along with its regulatory framework
Course Outcome	**404: Financial Services [Core]**
CO1	To provide students the basic knowledge of Financial Services and its components, institutions and their functions
Course Outcome	**505: International Trade [Specialised]**
CO1	To develop on understanding among students about the working of International Trade. Besides, the students will be in a position to understand usefulness of its in business and economic development along with its regulatory framework
Course Outcome	**603: Modern Banking Practices [Core]**
CO1	To provide students the basic knowledge of Modern Banking System and its components, institutions and their functions
Course Outcome	**605: Project Report [Specialised]**
CO1	This paper aims to provide the practical research knowledge to the students.

Department of Economics
Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia
P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

COURSE OUTCOME

Programme Name: Bachelor of Commerce

COURSE CODE	COURSE TITLE	COURSE OUTCOME
COM-GE-1046(A)	Microeconomics	This course is designed to give an idea of basic microeconomic theories and principles among the students. This course focuses scope of microeconomics including production, cost, market structures etc.
COM-GE-2046(A)	Macroeconomics	This course aims to introduce the students to the basic concepts of Macroeconomics. This course discusses the preliminary concepts associated with the determination and measurement of aggregate Macroeconomic variables like savings, investment, GDP, money, inflation and the balance of payments. It discusses various alternative theories of output and employment determination in a closed economy in the short run as well as medium run, and the role of policy in this context. It also introduces the students to various theoretical issues related to an open economy.
COM-GE-4046(A)	Indian Economy	Using appropriate analytical frameworks, this

		course reviews major trends in economic indicators in India in the post-independence period, with particular emphasis on paradigm shifts and turning points. This course examines sector-specific polices and their impact in shaping trends in key economic indicators in India. Emphasis needs to be given in capturing the emerging issues.
COM-GE-RC-5036 (A)	Principles of Micro Economics	The course is designed to provide a sound training in microeconomic theory to formally analyze the behaviour of individual agents. This course looks at the behaviour of the consumer and the producer and also covers the behaviour of a competitive firm.
COM-GE-RC-5036 (B)	Business Economics	The course designed to give an idea about how economics and economic theories are related with current business environment. Every economic theory have a close relationship with business and commercial aspects so these course is prepared to study different microeconomic theories and its importance in business.
COM- GE-RC-6046(A)	Indian Economy	Using appropriate analytical frameworks, this course reviews major trends in economic indicators in India in the post-independence period, with particular emphasis on paradigm shifts and turning points. This course examines sector-specific polices and their impact in shaping trends in key economic indicators in India. Emphasis needs to be given in capturing the emerging issues.

DEPARTMENT OF ENGLISH
Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia
P.O. North Salmara :: Dist .- Bongaigaon:: Pin – 783383

COURSE OUTCOME (CBCS)

B.COM PROGRAMME

Course Code	*Course Title*	*Course Outcome*
BCME-AE-1014	Business Communication	CO1 development of skills in reading, writing, comprehension and communication. CO2 enabling the capacity use of electronic media for business communication.
ENG-AE-1014	English Communication	CO1 enhance the English language skills . CO2 develop organizing thinking and learning by use of language.
ENG-CC-1016	English I	CO1 obtain knowledge about basic English Literature(Prose)and Grammar. CO2 understanding value of humanities in life.
ENG-CC-2016	English II	CO1 obtain knowledge about basic English Literature(Poetry) and Grammar . CO2 understanding value of humanities in life.
ALT –CC-3016	Alternative English	CO1 obtain knowledge about Advanced English Literature- Poetry, Drama, Fiction . CO2 analyzing and appreciating literature . CO3 enhance the literary understanding of texts.
COM-CC-4016	Soft SkillS for Business	CO1 enhance confidence in using English in academic, professional and social purpose. CO2 enhance in speech delivery. CO3 development in writing formal texts. CO4 Growth in oral communication .

DEPARTMENT OF ENVIRONMENTAL SCIENCE

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia
P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

COURSE OUTCOMES (Non CBCS)

Course Outcome	301: Environmental Studies
CO 1	Students will acquire knowledge about various natural resources, gain a realistic understanding of environmental issues, and promote environmental awareness.
CO 2	Students will grasp the concept of ecosystems, including forest, grassland, desert, and more.
CO 3	It will impart knowledge on biodiversity, including its value, biodiversity hotspots, and conservation methods to students.
CO 4	It will introduce students to the causes, effects, and control measures of various environmental pollution types. Additionally, it will highlight individuals' roles in pollution prevention.
CO 5	It will give the idea of water conservation, rain water harvesting, watershed management etc.

COURSE OUTCOMES (CBCS)

Course Outcome	ENV -AE -2014: Environmental Studies
CO 1	It will introduce the multidisciplinary nature of environmental studies, its scope and importance and the concept of sustainable development.
CO 2	Students will gain the concept of ecosystem and structure & function of different ecosystems.
CO 3	It will familiarise the students with different kind of natural resources. It will explain the problems associated with the environment.
CO 4	The students will get the knowledge about different levels of biological diversity and threats to biodiversity.
CO 5	It will provide the concept of environmental pollution, its types, causes, effects and control measures.
CO 6	Students will be imparted the basic knowledge of different environmental acts.
CO 7	Students will have understanding about the disaster management, different environmental movements, and environmental ethics.

DEPARTMENT OF INFORMATION TECHNOLOGY

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

COURSE OUTCOMES (Non CBCS)

Course Outcome	**601: Information Technology in Business**
CO 1	It will introduce the fundamentals of computer hardware and applications of computers in business.
CO 2	It will familiarizes the students with the concept of operating system, I/O management and memory management.
CO 3	It gives the idea of computer network and its type.
CO 4	It will provide the practical knowledge of application software, mainly MS Word.
CO 5	It will impart the theoretical as well as the practical knowledge of MS Excel, MS power point and MS Access.
CO 6	It will give a brief knowledge about the application of information technology in different sectors like railways, banking, video games, hotel management etc.

COURSE OUTCOMES (CBCS)

Course Outcome	**COM-SEC-RC-3044(A) /COM-HC-RC-3016: Computer Application in Business**
CO 1	Students will gather the knowledge of word processing. It will help them in creating business documents using different facilities available in word processing software.
CO 2	The basics of power point presentation will be taught and the student will be able to create business presentations.
CO 3	The students will familiarises with the theoretical concept as well as the practical knowledge of spreadsheet and its use in business.
CO 4	It gives the idea of creating business spreadsheets like loan and lease statement, payroll statements, capital budgeting etc.
CO 5	It provides the knowledge of database designs for accounting and business applications.
Course Outcome	**COM-SEC-RC-4044(A)/ COM-SEC-HC-4054(A): E-Commerce**
CO 1	It introduces the basic concept of e-commerce, e-commerce models and technology used in e-commerce.
CO 2	Students will get to know the need and concepts of e-commerce security environment. They will know the scope of e-security and security threats in the E-commerce environment.
CO 3	It will impart a fundamental understanding of cybercrime and introduce students to the IT Act of 2000.
CO 4	The student will familiarise with different models and methods of e-payments (debit card, credit card, smart cards etc.). It will help to know about online banking systems and the risk involved in e-payments.
CO 5	It helps students to understand the advantages and disadvantages of online transactions. It will also provide the knowledge about e-commerce applications in different industries like banking, insurance, online marketing etc.
CO 6	Students will gain insight into the fundamentals of website design through HTML.

Department of Statistics

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

P.O.-North Salmara::Dist.-Bongaigaon:: Pin-783383

COURSE OUTCOME (CBCS)
B.COM PROGRAMME

COURSE CODE	COURSE TITLE	COURSE OUTCOME
COM-GE-3046 (A)	Business Statistics	The learners will apprehend the basics of data science and data analysis like Averages and forecasting techniques. The learners will be able to understand the business implications and probabilities of every decision being made. The course is designed to give an idea about the correlation between two variables. The learners will calculate the simple linear regression equation for a set of data. They will understand the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient.and the association between the attributes. They will also understand use of Time series and Index numbers in management decisions. After completing this course, students have a clear understanding of the basic concept of sample survey and its different sampling techniques like Simple random sampling, Stratified random sampling, Systematic sampling etc.
COM-RC-2036	Business Mathematics and Statistics Part B: Business Statistics	This course is designed to provide students with an understanding of the data and its relevance in business and develop an understanding of the quantitative techniques from statistics. The course aims to give an idea about

		the correlation between two variables. The learners will calculate the simple linear regression equation for a set of data. They will also understand use of Time series and Index numbers in management decisions.
COM-DSE-HC-6036(F)	Business Research Methods and Research Work	This paper focuses in imparting on field practical knowledge to the students in conducting researches. Attention is given to give different training in the various research methodologies so that students can gain practical lessons in conducting a research successfully. Students learn to collect their primary data using questionnaires and also to collect secondary data from various offices and authorities. They also learn how design their sample and practically learn to interpret the collected data. They also learn to represent the data using both traditional and digital techniques. Thus through this paper, students get hands on expertise in conducting field research enquiring various research questions. After successful completion of the course students will be able to summarize and analyze statistical data to solve practical business related problems.

(NON CBCS) COURSE OUTCOME

COURSE CODE	COURSE TITLE	COURSE OUTCOME
101	Business Mathematics	This course provides complete skill to understand basic function of Mathematics and their use in Business and Finance. After completing the course, student will be able to solve business and finance problems. A particular emphasis is placed on developing the ability to interpret the numerical information that forms the basis of decision-making in business. Most of the examples are drawn from a variety of business applications. It examines aspects of business and marketing with regards to basic statistical analysis. Students will be provided with the theoretical concepts, tools and methods of mathematics as well as the opportunity to work through example problems. After completion of this course students will be able to apply the knowledge of Mathematics (Algebra, Matrices, Calculus and Optimization) in solving business problems. Demonstrate mathematical skills required in mathematically intensive areas in Commerce such as Finance and Economics. They will understand the important role Mathematics plays in all facets of the business world and the use of equations, formulae, and mathematical expressions and relationships in a variety of contexts. They will demonstrate critical thinking, modeling, and problem-solving skills in a variety of contexts.
204	Business Statistics	This course examines the use of descriptive statistics, probability, confidence intervals, hypothesis testing, regression and correlation analysis, t-tests, and applications of technology for statistical analysis, including the interpretation of the relevance of statistical findings for business problem solving. The learners will apprehend the basics of data science and data analysis like Averages and forecasting techniques. Most of the examples are drawn from a variety of business applications. This course introduces business statistics and fundamental aspects of decision-making. It examines aspects of business and

		marketing with regards to basic statistical analysis. Students will be provided with the theoretical concepts, tools and methods of statistics as well as the opportunity to work through example problems. The learners will be able to understand the business implications and probabilities of every decision being made. The course is designed to give an idea about the correlation between two variables. The learners will calculate the simple linear regression equation for a set of data. They will understand the principles of linear regression and correlation, including least square method, predicting a particular value of Y for a given value of X and significance of the correlation coefficient.and the association between the attributes. They will also understand use of Time series and Index numbers in management decisions. After completing this course, students have a clear understanding of the basic concept of sample survey and its different sampling techniques like Simple random sampling, Stratified random sampling, Systematic sampling etc.

DEPARTMENT OF BOTANY
PANDIT DEENDAYAL UPADHYAYA ADARSHA MAHAVIDYALAYA
(AGovt.ModelCollegeandAffiliatedtoUGCu/s2(f)**)**
P.O:-NorthSalmara,Dist:-Bongaigaon,Assam-783383

COURSE OUTCOME

B.Sc. Botany Honours

Core Papers

BOT-HC-1016: Phycology and Microbiology

CO1. Detailed knowledge on microbes, viruses and bacteria, and their importance in agriculture and medicine
CO2. Knowledge on Algal classification, Economic and ecological importance of Algae
CO3. Practical knowledge on structure of T-Phage and TMV, lytic and lysogenic life cycle
CO4. Practical knowledge on microscopy of bacteria and algae

BOT-HC-1026: Biomolecules and Cell Biology

CO1. Knowledge on structure, classification and physicochemical properties of biomolecules and enzymes
CO2. Detailed knowledge on structure, properties and functions of cell and its components
CO3. Practical knowledge on properties of cell and cell membrane, DNA staining techniques and microscopy of plant cell
CO4. Knowledge on qualitative tests of biomolecules

BOT-HC-2016: Mycology and Phytopathology

CO1. Detailed knowledge on different classes of fungi, their structure, classification, life cycle and reproduction
CO2. Knowledge on diseases in plants caused by viruses, bacteria and fungi and biotechnological applications of fungi
CO3. Structural analysis of different classes of fungi and their reproductive stages
CO4. Knowledge on structures of symbiotic associations (Lichens, Mycorrhiza)

BOT-HC-2026: Archegoniate

CO1. Detailed knowledge on morphology, anatomy, classification and properties of bryophytes, pteridophytes and gymnosperms
CO2. Knowledge on reproduction and economic importance and ecological significance of bryophytes, pteridophytes and gymnosperms
CO3. Practical knowledge on morphology and reproductive structures of archegoniates
CO4. Spore morphology analysis and detailed knowledge on male and female reproductive structures in gymnosperms

BOT-HC-3016: Morphology and Anatomy of Angiosperms

CO1. Knowledge on morphology of angiosperms and developmental biology of plant bodyCO2. Knowledge on structural and anatomical organization of tissue system in plants and their classification
CO3. Practical knowledge on inflorescences and fruits of angiosperms
CO4. Practical knowledge on anatomical features of plant body parts

BOT-HC-3026: Economic Botany

CO1. Knowledge on morphology, uses and economic importance of crop plants
CO2. Knowledge on uses of industrially important plants
CO3. Practical knowledge on economically important plant parts and their products

BOT-HC-3036: Genetics

CO1. Knowledge on Mendelian concepts in genetics; structure, functions and properties of chromosome; chromosomal aberration
CO2. Knowledge on gene structures and gene mutations, population genetics
CO3. Practical knowledge on chromosomal mapping and gene interaction studies
CO4. Practical visualization of chromosomal anomalies

BOT-HC-4016: Molecular Biology

CO1. Detailed knowledge on architecture of nucleic acids, organization of DNA in organisms, models of replication and the factors associated with it
CO2. Detailed knowledge on transcriptional and post transcriptional events in a cell, translation of proteins
CO3. Practical acquaintance of isolation and quantification of DNA from plants
CO4. Knowledge on photographic study of RNA polymerases and RNA modification machinery

BOT-HC-4026: Plant Ecology and Phytogeography

CO1. Knowledge on origin, formation and properties of abiotic components of the ecosystem, interactions and adaptation of plants with biotic and abiotic factors
CO2. Knowledge on properties of communities in a population and trophical and habitat organization in an ecosystem
CO3. Practical knowledge on property analysis of abiotic components of the ecosystem
CO4. Practical knowledge on vegetation study and different ecological sites

BOT-HC-4036: Plant Systematics

CO1. Knowledge on plant identification and classification systems, plant nomenclature
CO2. Knowledge on phylogenetic and evolutionary relationships of angiosperms
CO3. Practical knowledge on foliar morphology and taxonomical study of angiosperms

BOT-HC-5016: Reproductive Biology of Angiosperms

CO1. Knowledge on detailed morphological and anatomical study of reproductive structures of angiospermic plants
CO2. Knowledge on embryology and embryological abnormalities in angiosperms
CO3. Structural documentation of reproductive structures of angiosperms
CO4. Practical knowledge on developmental biology of embryo and endosperms

BOT-HC-5026: Plant Physiology

CO1. Knowledge on mechanisms of water, minerals and nutrient absorption of plants
CO2. Knowledge on roles of plant hormones and mechanism of flowering in plants
CO3. Practical knowledge on effects of growth regulators on plant parts
CO4. Practical knowledge on determination of osmotic and water potential

BOT-HC-6016: Plant Metabolism

CO1. Detailed knowledge of metabolic events of photosynthesis and nutrient metabolism
CO2. Knowledge of signalling molecules and pathways in the plant cell
CO3. Practical knowledge on different types of chromatographic techniques
CO4. Estimation of TAN, sugar and protein contents in plant sample

BOT-HC-6026: Plant Biotechnology

CO1. Knowledge on applications of tissue culture techniques, construction of recombinant DNA and transformation into hosts, construction of DNA libraries
CO2. Knowledge on development of transgenic plants for agricultural or industrial use
CO3. Practical utility on isolation of plasmid DNA, its digestion and separation of fragments through gel electrophoresis
CO4. Preparation of media for tissue culture techniques and photographic study of plant tissue culture
CO5. Photographic study of generating transgenic plants for agriculture

Discipline Specific Elective (DSE) Papers

BOT-HE-5016: Natural Resource Management

CO1. Comprehensive knowledge on different types of natural resources and their ecological, economical and socio-cultural values
CO2. Basic understandings of land, water and forest resources
CO3. Overall knowledge on resource degradation, their judicious use and management for sustainability
CO4. Knowledge on biodiversity - its importance, management and Bioprospecting
CO5. Knowledge on IPR, and global arena on resource management, conservation and benefit sharing
CO6. Hands on experience on the domestic solid waste estimation and determining its impact on land degradation
CO7. Hands on experience on forest study using tools like GPS/GIS, and understanding of ecological importance of forest resources

BOT-HE-5026: Horticultural Practices and Post-Harvest Technology

CO1. Basic understandings on Horticultural science and its importance in employment generation and socio-economic development CO2. Classification of horticultural crops, identification of potential horticultural crops – their cultivation, production, management and commercialization
CO3. Knowledge on horticultural techniques, landscaping and gardening
CO4. Overall knowledge on post-harvest technology, disease management, and germplasm management for horticulture
CO5. Field knowledge of gardening, nurseries, standing crops of horticultural importance

BOT-HE-6016: Industrial and Environmental Microbiology

CO1. Understanding the roles of microbes in industries and environment
CO2. Basic knowledge of different kinds of bioreactors and fermentation processes
CO3. Knowledge on production processes of some microbial products in industries through site visits
CO4. Knowledge on application of enzymes in industries
CO5. Diversity and distribution of microbes in air, water and soil
CO6. Basic understandings on water microbiology and water analysis methods
CO7. Usefulness of microbes in agriculture and bioremediation of contaminated soils
CO8. Practical experiences on basic microbiological techniques and handlings

BOT-HE-6026: Analytical Techniques in Plant Sciences

CO1. Knowledge on microscopy and imaging in plant science
CO2. Principles and application of centrifuge, spectroscopy and chromatography in biology
CO3. Basic knowledge on biostatistics including measures of central tendency and dispersions, statistical data analysis and representations
CO4. Practical knowledge on microscopy, chromatography, centrifugation and spectroscopy

BOT-HE-6036: Project Work/Dissertation

CO1. Practical knowledge on addressing relevant scientific questions through experimentation

Generic Elective Courses

BOT-HG-1016: Biodiversity (Microbes, Algae, Fungi and Archegoniate)

CO1. Knowledge on structure and reproduction of viruses and bacteria, and their economic importance

CO2. Describe general characteristics, morphological diversity, thallus organization, life cycles, ecological and economic importance of algae
CO3. Describe general characteristics, morphological diversity, thallus organization, life cycles, ecological and economic importance of fungi
CO4. General characteristics, classification, morphological diversity and evolutionary significance of bryophytes
CO5. General characteristics and classification of pteridophytes; evolution of stele, heterospory and seed habit in pteridophytes
CO6. Classify gymnosperms, and describe their general characteristics and economic importance
CO7. Practical knowledge on staining and slide preparation to study bacteria, algae and fungi under the microscope
CO8. Practical knowledge on vegetative and reproductive structures of some representative bryophytes, pteridophytes and gymnosperms

BOT-HG-2016: Plant Ecology and Taxonomy

CO1. Understanding soil, water, light and temperature as ecological factors

CO2. Knowledge on adaptive characters of hydrophytes and xerophytes
CO3. Knowledge on plant community types and their succession
CO4. Knowledge on ecosystem, trophic levels and energy flow in ecosystems
CO5. Knowledge on biogeochemical cycling with an emphasis on carbon, nitrogen and phosphorus cycles
CO6. General idea on phytogeography and endemism
CO7. Knowledge on plant taxonomy, principles, ICN rules, ranks and hierarchy
CO8. Knowledge on different systems of plant classification and cluster analysis
CO9. Practical knowledge on soil temperature measurement, humidity measurement, rainfall estimation and light intensity measurement
CO10. Adaptive morphological characterization of hydrophytes and xerophytes
CO11. Quadrate size determination for herbaceous plant studies in ecology
CO12. Estimation of frequency distribution of herbaceous plants using quadrate method
CO13. Practical knowledge on plant identification upto the family level that belongs to Brassicaceae, Solanaceae and Lamiaceae; Preparation of herbarium specimens

BOT-HG-3016: Plant Physiology and Metabolism

CO1. Understanding the roles of water in plant physiology, transpiration, and guttation
CO2. Knowing of macro- and micro-nutrients and mineral uptakes in plants
CO3. Understanding the transportations of minerals and foods in plants
CO4. Knowledge on photosynthetic pigments, photosynthetic reactions and photorespiration
CO5. Understanding of respiration processes – glycolysis, TCA and PPP pathways
CO6. Knowledge on enzyme properties, actions and inhibitions
CO7. Knowledge on biological nitrogen fixation
CO8. Knowledge on plant hormones, and plant responses to light and temperature
CO9. Determine osmotic potentials of plant cells and effect of light on transpiration
CO10. Calculate stomatal index and frequency
CO11. Demonstrate the effect of pH and concentrations in catalase activity
CO12. Demonstrate the effect of bicarbonate concentration on O2 evolution in photosynthesis

BOT-HG-3026: Environmental Biotechnology

CO1. Knowledge on environment and the cause of environmental pollutions
CO2. Knowledge on the methods of pollution measurement and bioremediation
CO3. Knowledge on waste water treatment processes
CO4. Knowledge on xenobiotics – their types and bioremediation
CO5. Knowledge on application of immobilized cells/enzymes in industries
CO6. Knowledge on national legislations and international treaties for environmental protection and pollution management
CO7. Practical knowledge on determining basic properties of soil and water like DO, salinity, pH, total hardness, etc
CO8. Practical knowledge on gravimetric analysis of effluents
CO9. Practical knowledge on the assessment of microorganisms in air and water samples

BOT-HG-4016: Plant Anatomy and Embryology

CO1. Knowledge on different types of tissues and their organizations in plants
CO2. Knowledge on secondary growth and anomalous structures in plants
CO3. Knowledge on adaptive and protective characters of plants
CO4. Understanding the reproductive units of a flower; ovule types, ovary types, pollination and fertilization mechanisms; embryo and endosperm developments and functions
CO5. Hands on experiences on slide preparation for anatomical studies of leaf, stem and root
CO6. Flower dissection and study of flower reproductive parts and events

BOT-HG-4026: Economic Botany and Plant Biotechnology

CO1. Understanding the concept of ‘centre of origin of crop plants’ and their distribution with a special emphasis on wheat
CO2. Overall knowledge on economically important crops with their botanical characters and parts used
CO3. Knowledge on plant tissue culture and the basic molecular techniques used in biotechnology
CO4. Basic concept of bioinformatics and its application

Skill Enhancement

Paper BOT-SE-3014: Biofertilizers

CO1. Basic knowledge on the microbes used as biofertilizer and understand the process of their isolation, identification, mass multiplication, carrier based inoculants and knowledge on Actinorrhizal symbiosis
CO2. Concept on the general characteristics, isolation, mass multiplication carrier based inoculants of *Azospirillum* and *Azotobacter* also the knowledge on the crop response to *Azotobacter*
CO3. Basic knowledge on Cyanobacteria including factors affecting growth of Cyanobacteria, concept on the nitrogen fixation and use of blue green algae in rice cultivation
CO4. Brief knowledge on the Mycorrhizal association and understand the details of various types, taxonomy, occurrence, distribution and growth parameters of Mycorrhiza
CO5. Details about the organic farming, maintenance and recycling of biodegradable waste material and understand the methods of making biocompost and vermicompost with application

BOT-SE-3024: Herbal Technology

CO1. Concept on the plants used as traditional medicine, and understanding the process of cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants CO2. Brief knowledge on medicinal drugs obtained from plants and comprehensive idea about systematic position, medicinal uses of Tulsi, Ginger, Fenu greek, Indian goose berry and Ashoka
CO3. Concept on the phytochemistry of medicinal herbs and identification, utilization of medicinal plants
CO4. Basic knowledge on quality control, owing the medicinal properties of herbal drugs including the secondary metabolites and concept of drug adulteration, types, methods of drug evaluation CO5. Understand the process of micro propagation of important medicinal plant species

BOT-SE-4014: Nursery and Gardening

CO1. Brief idea about objectives, scope, infrastructure and maintenance of Nursery
CO2. Concept on structure, types and dormancy of seeds and brief idea about seed storage including types and process and knowledge on seed production technology
CO3. Knowledge on various modes of vegetative propagation and maintenance of plants in green house
CO4. Brief idea about development and maintenance of gardening including scope and types and understand the various gardening operations including management of pests and diseases
CO5. Detail knowledge on managements of seeds and seedlings and concept about cultivation, storage and marketing of important vegetables

BOT-SE- 4024: Floriculture

CO1. Basic knowledge including history, importance and scope of floriculture
CO2. Brief idea about Nursery management and garden operations and knowledge on the terms related to gardening and concept about role of plant growth regulators
CO3. Covers the knowledge of various ornamental plants and concept of cultivations of plants in pots and knowledge about Bonsai
CO4. Idea about various garden designs and features of such gardens and knowledge about some famous gardens of India
CO5. Knowledge about the process of making garden more attractive by altering the existing design in places of public importance, highways and educational institute

BOT-SE-4034: Intellectual Property Rights

CO1. Knowledge on IPR, their types and infringement CO2. Understanding about traditional knowledge and their protection, bio-prospecting and bio-piracy.
CO3. Knowledge on protection of plant varieties, farmer rights
CO4. Knowledge on Information technology related IPR; data, database, chips and domain name protection
CO5. Knowledge on novelty, bio-based patenting, and moral issues associated with biotechnological inventions

CO2. Brief knowledge on medicinal drugs obtained from plants and comprehensive idea about systematic position, medicinal uses of Tulsi, Ginger, Fenu greek, Indian goose berry and Ashoka
CO3. Concept on the phytochemistry of medicinal herbs and identification, utilization of medicinal plants
CO4. Basic knowledge on quality control, owing the medicinal properties of herbal drugs including the secondary metabolites and concept of drug adulteration, types, methods of drug evaluation

DEPARTMENT OF CHEMISTRY
PANDIT DEENDAYAL UPADHYAYA ADARSHA MAHAVIDYALAYA, TULUNGIA
(A Govt. Model College and Affiliated to UGC u/s 2(f))
P.O:- North Salmara, Dist:-Bongaigaon, Assam-783383

Date: 09/08/2022

Teachers and students are aware of the stated programme and course outcomes of the Programmes offered by the institution

The Department follows the guidelines and rules issued by Gauhati University which describes the stated programme and course outcomes of the Programmes in each semester in details.

CORE COURSE (HONOURS IN CHEMISTRY)

Semester I

CHE-HC-1016: INORGANIC CHEMISTRY-I

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

***Course Objectives**: This course aims at giving students theoretical understanding about the basic constituents of matter – atoms, ions and molecules in terms of their electronic structure and reactivity. Structure and bonding in/of these are to be dealt with basic quantum chemistry treatment. Reactivity of chemical species based on their electron transfer affinity is introduced. Further, periodic classification of elements in the periodic table and changes in properties along the periods and groups to be studied in detail. Accompanying laboratory course is designed for students to have hands-on experience of basic quantitative analytical techniques related to volumetric titrations.*

***Learning Outcome:** On successful completion, students would have clear understanding of the concepts related to atomic and molecular structure, chemical bonding, periodic properties and redox behaviour of chemical species. Students will also have hands on experience of standard solution preparation in different concentration units and learn volumetric estimation through acid-base and redox reactions.*

CHE-HC-1026: PHYSICAL CHEMISTRY I

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course objective: *This course contains states of matter- gaseous, liquid and solid sates along with ionic equilibria. A small unit of molecular and crystal symmetry is also there in the course.*

Learning outcome: *In gaseous state unit the students will learn the kinetic theory of gases, ideal gas and real gases. In liquid state unit, the students are expected to learn the qualitative treatment of the structure of liquid along with the physical properties of liquid, viz, vapour pressure, surface tension and viscosity. In the molecular and crystal symmetry unit they will be introduced to the elementary idea of symmetry which will be useful to understand solid state chemistry and group theory in some higher courses. In solid state unit the students will learn the basic solid state chemistry application of x-ray crystallography for the determination of some very simple crystal structures. The students will also learn another important topic "ionic equilibria" in this course.*

Semester II

CHE-HC-2016: ORGANIC CHEMISTRY I

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objectives*: This course is inducted to apprise students with introduction to organic compounds, electron displacement, type of reagents and reaction intermediates. The chemistry of aliphatic and aromatic hydrocarbon, conformational analysis of cycloalkanes and basic stereochemical phenomena are included.*

Students are expected to learn different classes learn, explain, describe and analyze different classes of organic compounds, their reactivities and mechanisms along with stereo chemical considerations.

Learning Outcome: *Students will be able to identify different classes of organic compounds, describe their reactivity and explain/analyze their chemical and stereo chemical aspects.*

CHE-HC-2026: PHYSICAL CHEMISTRY II

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *In this course the chemical thermodynamics, chemical equilibrium, solutions and colligative properties will be taught to the students. Another unit of this course is systems of variable compositions.*

Learning Outcome: *In this course the students are expected to learn laws of thermodynamics, thermochemistry, thermodynamic functions, relations between thermodynamic properties, Gibbs Helmholtz equation, Maxwell relations etc. Moreover the students are expected to learn partial molar quantities, chemical equilibrium, solutions and colligative properties. After completion of this course, the students will be able to understand the chemical systems from thermodynamic point of view.*

Semester III

CHE-HC-3016: INORGANIC CHEMISTRY-II

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *This course starts with the basic principles of metallurgy so as to acquaint the students with the application of the redox chemistry they have learnt in the earlier course on inorganic chemistry. Concepts of protonic and non-protonic acids and bases are introduced for students to appreciate different types of chemical reactions. Periodic behavior of s and p block elements related to their electronic structure and their reactivity is included to acquaint students with the principles governing their reactivity. This course further intend to apprise students about the variety of compounds of the main group elements including oxides, hydrides, nitrides, interhalogens, noble gases and inorganic polymers. As part of the accompanying lab course, experiments involving iodo- and iodi-metric titrations are included for the students to explore other varieties of redox titration. Preparation of simple inorganic compounds is introduced to give hands-on experience of inorganic synthesis.*
Learning Outcome: *On successful completion of this course students would be able to apply theoretical principles of redox chemistry in the understanding of metallurgical processes.*

Students will be able to identify the variety of s and p block compounds and comprehend their preparation, structure, bonding, properties and uses. Experiments in this course will boost their quantitative estimation skills and introduce the students to preparative methods in inorganic chemistry.

CHE-HC-3026: ORGANIC CHEMISTRY-II

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Course Objectives: *This course is intended to apprise students about different classes of organic compounds, including halogenated hydrocarbons, alcohols, phenols, epoxides, carbonyl compounds and carboxylic and sulfonic acids.*

Students are expected to learn and differentiate between various organic functional groups; explain, analyze and design transformations between different functional groups.

Learning Outcome: *Students will be able to describe and classify organic compounds in terms of their functional groups and reactivity.*

CHE-HC-3036: PHYSICAL CHEMISTRY-III

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *The aim of this course is to teach students four important topics of physical chemistry- phase equilibria, chemical kinetics, surface chemistry and catalysis. Phase equilibria and chemical kinetics will be discussed in detail but surface chemistry and catalysis will be introduced to the students.*

Learning Outcome:*The students are expected to learn phase rule and its application in some specific systems. They will also learn rate laws of chemical transformation, experimental methods of rate law determination, steady state approximation etc. in chemical kinetics unit. After attending this course the students will be able to understand different types of surface adsorption processes and basics of catalysis including enzyme catalysis, acid base catalysis and particle size effect on catalysis.*

Semester IV

CHE-HC-4016: INORGANIC CHEMISTRY-III

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *This course introduces students to coordination chemistry. Various aspects like nomenclature, structure, bonding, variety and reactivity of the coordination compounds are included for the students to appreciate.*
Bioinorganic chemistry is included in this course to acquaint students on the useful and harmful aspects of metals in biological systems.
Through the accompanying lab course, experiments related to gravimetric analysis, synthesis of coordination compounds and separation of metal ions using chromatography is included. This will broaden the experimental skills of the students where students will learn about various aspects of experiment design depending upon the requirements like synthesis, estimation or separation.
Learning Outcome: *On successful completion, students will be able name coordination compounds according to IUPAC, explain bonding in this class of compounds, understand their various properties in terms of CFSE and predict reactivity. Students will be able to appreciate the general trends in the properties of transition elements in the periodic table and identify differences among the rows.*
Through the experiments students not only will be able to prepare, estimate or separate metal complexes/compounds but also will be able to design experiments independently which they should be able to apply if and when required.

CHE-HC-4026: ORGANIC CHEMISTRY-III

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objectives*: The course intrudes students to different classes of N-based compounds, including alkaloids and terpenoids and their potential application.*

Students are expected to learn about different classes of N-based compounds; their structures, synthesis and reactivity.

Learning Outcome: *Students shall demonstrate the ability to identify and classify different types of N-based derivatives, alkaloids and hetrocyclic compounds/explain their structure mechanism and reactivity/critically examine their synthesis and reactions mechanism.*

CHE-HC-4036: PHYSICAL CHEMISTRY-IV

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *The aim of this course is to introduce students with primarily two areas of physical chemistry- electrochemistry and electrical and magnetic properties of atoms and molecules. It contains three units- conductance, electrochemistry and electrical & magnetic properties of atoms and molecules.*

Learning Outcome: *In this course the students will learn theories of conductance and electrochemistry. Students will also understand some very important topics such as solubility and solubility products, ionic products of water, conductometric titrations etc. The students are also expected to understand the various parts of electrochemical cells along with Faraday's Laws of electrolysis. The students will also gain basic theoretical idea of electrical & magnetic properties of atoms and molecules.*

Semester V

CHE-HC-5016: ORGANIC CHEMISTRY-IV

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

***Course Objectives**: This course introduces students to nucleic acids, amino acids and pharmaceutical compounds.*

Students will be familiarized with the importance of nucleic acids, amino acids and develop basic understanding of enzymes, bioenergetics and pharmaceutical compounds.

***Learning Outcome**: Students will be able to explain/describe the important features of nucleic acids, amino acids and enzymes and develop their ability to examine their properties and applications.*

CHE-HC-5026: PHYSICAL CHEMISTRY V

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

***Course Objective:** The aim of this course is to introduce the students with three important areas- quantum chemistry, molecular spectroscopy and photochemistry. In quantum chemistry unit the students will be taught the postulates of quantum mechanics and the application of quantum mechanical ideas in some simple systems such as particle in a box, rigid rotor, simple harmonic oscillator etc. In spectroscopy unit, rotational, vibrational, Raman, electronic, spin resonance, and electronic spectroscopy will be introduced.*

***Learning Outcome:** After completion of this course the students are expected to understand the application of quantum mechanics in some simple chemical systems such as hydrogen atom or hydrogen like ions. The students will also learn chemical bonding in some simple molecular systems. They will able to understand the basics of various kinds of spectroscopic techniques and photochemistry.*

Semester VI

CHE-HC-6016: INORGANIC CHEMISTRY-IV

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *The unit on reaction mechanism is included for the students to get acquainted with the kinetic and thermodynamic factors governing the reaction path and stability of inorganic compounds.*
Organometallic compounds are introduced so as to apprise students about the importance of metal carbon bond to form complexes and their application as catalysts. Students are expected to learn factors leading to stability of organometallic compounds, their synthesis, reactivity and uses.
Qualitative inorganic analysis is included to give students an idea and hands on experience of application of inorganic chemistry. Students should learn how differential reactivity under different conditions of pH can be used to identify variety of ions in a complex mixture.
Experiments related to synthesis and characterization of coordination compounds are included to supplement their theoretical knowledge.

Learning Outcome: *By studying this course the students will be expected to learn about how ligand substitution and redox reactions take place in coordination complexes.*
Students will also learn about organometallic compounds, comprehend their bonding, stability, reactivity and uses. They will be familiar with the variety of catalysts based on transition metals and their application in industry.
On successful completion, students in general will be able to appreciate the use of concepts like solubility product, common ion effect, pH etc. in analysis of ions and how a clever design of reactions, it is possible to identify the components in a mixture.
With the experiments related to coordination compound synthesis, calculation of 10Dq, controlling factors etc. will make the students appreciate the concepts of theory in experiments.

CHE-HC-6026: ORGANIC CHEMISTRY-V

(Credits: Theory-04, Lab -02)
Theory: 60 Lectures
(24 Lectures)

***Course Objectives**: This is a basic course in organic spectroscopy and provides introduction to carbohydrate chemistry, dyes and polymers.*

Students are expected to learn about the different spectroscopic techniques and their applications in organic chemistry. Students shall be apprised with carbohydrate chemistry, dyes and polymers and their structure, reactivity and chemical properties.

***Learning Outcome**: Students will be able to explain/describe basic principles of different spectroscopic techniques and their importance in chemical/organic analysis. Students shall be able to classify/identify/critically examine carbohydrates, polymers and dye materials.*

CHEMISTRY-Discipline Specific Electives (DSE)

CHE-HE-5016: APPLICATIONS OF COMPUTERS IN CHEMISTRY

(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

***Course Objective:** This course intends to make learners familiar with basics of computer language, computer programming, handling of experimental data, curve fitting etc to analyze experimental results. This basic knowledge will help the students to perform and interpret results of various chemistry practicals.*

***Learning Outcome:** After the completion of this course it will help the student to interpret laboratory data, curve fitting of experimental work, also perform quantum mechanical calculations for various molecular models.*

CHE-HE-5026: ANALYTICAL METHODS IN CHEMISTRY

(Credits: Theory-04, Lab -02)

Theory: 60 Lectures

Course Objective: *This is an elective course designed to complement the needs of students who wish to learn more about the qualitative/quantitative characterization and separation techniques. The content of this course aims to cover some of the widely used instrumental techniques for characterization of samples. Experiments included aim at giving students hands on experience using different instrumental techniques and chemical analysis.*

Learning outcome: *On successful completion students will be have theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples. At the same time through the experiments students will gain hands on experience of the discussed techniques. This will enable students to take judicious decisions while analyzing different samples.*

CHE-HE-5036: MOLECULAR MODELLING & DRUG DESIGN

(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objective: *The course introduces students to the basic principles of computer assisted drug design, modelling and the important theoretical concepts and programming.*

Learning Outcome: *Students will be able to identify basic components of computer and programming as applied to computer assisted design and modelling of molecules.*

CHE-HE-5046: NOVEL INORGANIC SOLIDS

(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objective: *This introductory course intends to make learners familiar with a wide variety of technologically important and emerging materials. It will prepare the learners for studying materials further at the master's level. Prior completion of one introductory UG level course on inorganic and physical chemistry will be essential.*

Learning outcome: *After the completion of this course it will also be possible for the students to opt for studying an interdisciplinary master's programme with an emphasis on the synthesis and applications of various materials or take up a job in the materials production and/or processing industry.*

CHE-HE-5056: POLYMER CHEMISTRY

(Credits: Theory-06, Lab -02)
Theory: 60 Lectures

Course objective: *This is an introductory level course in polymer chemistry. The aim of the course is to introduce the theory and applications of polymer chemistry to the students. Some industrially important polymers and conducting polymers, a promising class of polymeric materials for next generation devices will also be introduced in this course.*

Learning outcome: *After completion of this course the students will learn the definition and classifications of polymers, kinetics of polymerization, molecular weight of polymers, glass transition temperature, and polymer solutions etc. They also learn the brief introduction of preparation, structure and properties of some industrially important and technologically promising polymers.*

CHE-HE-5066: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *Students shall be introduced to the fundamental concepts/theory and application of different analytical techniques, as applied to chemistry.*
Learning Outcome: *Students shall be able to explain the theoretical basis of different analytical techniques, identify the experimental requirements and compare/analyze the data/results thereof.*

CHE-HE-6016 : GREEN CHEMISTRY

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *The learners will be taught about the emerging discipline of green chemistry particularly to differentiate as to how the principles of green chemistry may be applied to organic synthesis.*
Learning Outcome: *Apart from introducing learners to the principles of green chemistry, this course will make them conversant with applications of green chemistry to organic synthesis. Students will be prepared for taking up entry level jobs in the chemical industry. They also will have the option of studying further in the area.*

CHE-HE-6026: INDUSTRIAL CHEMICALS AND ENVIRONMENT

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objectives: *This course provides an introduction to the various industrial gases and inorganic chemicals, their manufacturing processes, applications, storage and the hazards of handling them. Contribution of these industrial chemicals towards air and water pollution and their effects on living organisms and the environment has also been covered. Students are also expected to learn about metallurgy, energy generation industry and the pollution threat they pose. This course also discusses about management of the different kinds of wastes, their safe disposal and the importance of practicing green chemistry in chemical industry.*

Learning Outcomes: *After successful completion of the course, students would have learnt about the manufacture, applications and safe ways of storage and handling gaseous and inorganic industrial chemicals. Students will get to know about industrial metallurgy and the energy generation industry. Students will also learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings. Finally, the students will learn about industrial waste management, their safe disposal and the importance of environment friendly "green chemistry" in chemical industry.*

CHE-HE-6036: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objectives: *To learn the synthetic process, properties and the utility of the industrially important inorganic materials (such as silicates, ceramics, cements, fertilizers, paints, batteries, alloys and explosives).*
To provide opportunity to learn some of the industrial process such as surface coating and catalysis in relevant to industry where heterogeneous catalysis dominates.
Experiments are aimed at helping learners acquire hands on experience in qualitative and quantitative analysis of the inorganic materials which are basically manufactured in chemical industries.
To learn some industrial techniques such as surface coating etc..

Learning Outcome: *This course will establish the basic foundation of industrial inorganic chemistry among the students. This will be helpful for pursuing further studies of industrial chemistry in future. Experiments will help the Students to gather the experience of qualitative and quantitative chemical analysis. Students will be capable of doing analysis of the inorganic materials which are used in our daily life. They will have insight of the industrial processes.*

CHE-HE-6046: RESEARCH METHODOLOGY FOR CHEMISTRY

(Credits: Theory-05, Tutorials-01)
Theory: 75 Lectures

Course Objectives:
This course is introduced to impart knowledge about the basic concepts of research and to provide a road map for conducting research
Students are expected to identify, explain and apply basic concepts of research; acquire information, recognize various issues related to research and to learn instrumental methods required for research in chemistry.
Learning Outcome:
After completing this course, students should be able to construct a rational research proposal to generate fruitful output in terms of publications and patents in the field of chemical sciences.

CHE-HE-6056: DISSERTATION

Student will complete a project work and then prepare a report on that.

Skill Enhancement Courses

CHE-SE-3024: IT SKILLS FOR CHEMISTS

(Credits: 04)
60 Lectures

Course Objective: *The objectives of the proposed course are:*

1) *To provide the basic knowledge of mathematics which are needed to pursue chemistry as major subject.*
2) *To provide the necessary training for the basic programming knowledge.*
3) *The course provides information technology literacy and basic skills training for learners with limited experience.*
4) *To familiarize with the Introductory writing activities and Handling numeric data.*

Learning Outcome: *Course learning outcomes focus on skill development related to basic computer operations and information technology. After completing the course the incumbent is able to use the computer for basic purposes of preparing his personnel/business letters, viewing information on Internet (the web), sending mails, using internet banking services etc. After opting this course the students are expected to accumulate the skills in writing activities and Handling numeric data.*

CHE-SE-3034: BASIC ANALYTICAL CHEMISTRY

(Credits: 04)
60 Lectures

Course Objective: *To familiarize students with different micro and semimicro analytical techniques and help develop the ability to use modern instrumental methods for chemical analysis of food, soil, air and water.*

Learning Outcome: *Upon completion of this course, students shall be able to explain the basic principles of chemical analysis, design/implement microscale and semimicro experiments, record, interpret and analyze data following scientific methodology.*

CHE-SE-3044: CHEMICAL TECHNOLOGY & SOCIETY

(Credits: 04)
Theory: 60 Lectures

Course Objective: *The objective of the course is to enable students to have a firsthand understanding of different types of equipments needed in chemical technology and offer them concepts regarding some important parameters. The syllabus also emphasizes the dynamic nature of the relations between society on one hand and technological achievement from chemical industries on the other hand. In other words, it tries to explore societal and technological issues from a chemical perspective.*
Learning Outcome: *Students shall be familiarized with processes and terminologies in chemical industry, like mass balance, energy balance etc… Learners will be able to use chemical and scientific literacy as a means to better understand the topics related to the society.*

CHE-SE-3054: CHEMOINFORMATICS

(Credits: 04)
Theory: 60 Lectures

Learning Objectives: *The primary objective of this course is to familiarize the students with the use of various computer software and information technology. The students are expected to learn different chemical search engines and utilize them for molecular modelling and structure elucidation with a final goal to compute NMR, IR, mass and other spectra that can be later compared with the experimental data. The course also provides sufficient information and hands on exercises on the use of cheminformatics, with a special emphasis on its application in modern drug discovery.*

Learning Outcomes: *On the successful completion of the course, the students should be able to explain, interpret and critically examine the utility of computers and software tools to solving chemistry related problems. Recognize, apply, compare and predict chemical structures, properties, and reactivity and; solve chemistry related problems.*

Employ critical thinking and scientific reasoning to design and safely implement laboratory experiments and keep the records of the same.

Compile, interpret and analyze the qualitative/quantitative data and communicate the same in a scientific literature

CHE-SE-3064: BUSINESS SKILLS FOR CHEMISTS

(Credits: 04)
Theory: 60 Lectures

Course Objective: *To familiarize students with important concepts of business operations and intellectual rights as applied to chemical industry.*
Learning outcome: *students shall be able to explain and/or analyze the important steps of business operations, finance and intellectual property as applied to chemical industry.*

CHE-SE-3074: INTELLECTUAL PROPERTY RIGHTS (IPR)

(Credits: 04)
Theory: 60 Lectures

Course Objective: *In this era of liberalization and globalization, the perception about science and its practices has undergone dramatic change. The importance of protecting the scientific discoveries, with commercial potential or the intellectual property rights is being discussed at all levels – statutory, administrative, and judicial. With India ratifying the WTO agreement, it has become obligatory on its part to follow a minimum acceptable standard for protection and enforcement of intellectual property rights. The purpose of this course is to apprise the students about the multifaceted dimensions of this issue.*

Learning Outcome: *After completing this course, students will have in-depth understanding about the importance and types of IPR. This course will also provide the clarity on the legal and economic aspects of the IP system.*

CHE-SE-4014: ANALYTICAL CLINICAL BIOCHEMISTRY

(Credits: 04)
THEORY: 60 Lectures

Course objective: *This course is intended to apprise students with various clinically relevant biomolecules, their structures and physiological roles. Students are also expected to learn the basics of analysis of pathological samples (blood and urine).*

Learning outcome: *Students will be able to identify various molecules relevant to a particular pathological condition and their estimation protocols.*

CHE-SE-4024: GREEN METHODS IN CHEMISTRY

(Credits: 04)
Theory: 60 Lectures

Course Objectives: *This course introduces students to the utilization of green chemistry from industrial perspective and provides exposure to methods by which environmental problems are evaluated and designing of sustainable solutions.*

Learning Outcome: *Students shall be able to describe and evaluate chemical products and processes from environmental perspective, define and propose sustainable solutions and critically assess the methods for waste reduction and recycling.*

Tools of Green chemistry, Twelve principles of Green Chemistry, with examples.

CHE-SE-4034: PHARMACEUTICAL CHEMISTRY

(Credits: 04)
Theory: 60 Lectures

Course Objective: *This primary objective of this course is to introduce students to the fundamentals of drug design and development process, drugs for various diseases available in market, their mode of action and side effects. Students are expected to learn the biosynthetic procedures of various bio-relevant small molecules.*

Learning Outcome: *Students will be able to appreciate the drug development process, identify various small molecules used for treatments different ailments and other physiological processes.*

CHE-SE-4044: CHEMISTRY OF COSMETICS & PERFUMES

(Credits: 04)
60 Lectures

Course Objective: *This course intends to apprise students about the chemical knowledge related to some of the commonly used cosmetics. Laboratory experiments for preparation of talcum powder, shampoo etc. are included to give hands on experience.*

Learning Outcome: *Students will learn about the preparation and chemistry involved with the production different cosmetic. This may encourage students to take up entry level jobs at cosmetics industry or venture into commercial production of cosmetics as an entrepreneur.*

CHE-SE-4054: PESTICIDE CHEMISTRY

(Credits: 04)
60 Lectures

***Course Objective**: This is a brief and introductory course on pesticides, through which the students will be introduced to various classes of pesticides, their synthesis, applications and possible hazards of their uses.*

***Learning Outcome**: Students will be able to explain or describe and critically examine different types of pesticides, their activity/toxicity and their applications and the need for the search of an alternative based on natural products.*

CHE-SE-4064: FUEL CHEMISTRY

(Credits: 04)
60 Lectures

***Course Objectives:** This course discusses about the chemistry of various sources of energy. Students are expected to learn about the composition of coal and petroleum products, their extraction, purification methods and usage. A section also covers classification and applications of natural and synthetic lubricants. Students will also learn about the determination and significance of various industrially relevant physical parameters for different fuels and lubricants.*

***Learning Outcomes:** At the end of this course students will learn about the classes of renewable and non-renewable energy sources. Students will learn about the composition of coal and crude petroleum, their classification, isolation of coal and petroleum products and their usage in various industries. They will also learn to determine industrially significant physical parameters for fuels and lubricants.*

Dipankar Baerman Sharanga Nath

(Signature of the Faculty members)

Core courses for B. Sc. with Chemistry /Chemistry as Generic Elective

---

Semester I

CHE-RC/HG-1016: CHEMISTRY1

ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: *This course may be divided into two broad parts-inorganic and organic chemistry. In inorganic chemistry part the students will be taught atomic structure, chemical bonding and molecular structure. The organic chemistry part contains fundamentals of organic chemistry, stereochemistry and aliphatic hydrocarbons.*

Learning Outcome: *After completion of this course the students will learn the atomic structure through the basic concepts of quantum mechanics. They will understand the chemical bonding through VB and MO approaches. In organic part, the students are expected to learn basic ideas used in organic chemistry, stereochemistry, functional groups, alkanes, alkenes, alkynes etc.*

Semester II

CHE-RC/HG-2016: CHEMISTRY2

s- **AND** ***p*****-BLOCK ELEMENTS, TRANSITION ELEMENTS, COORDINATION CHEMISTRY STATES OF MATTER & CHEMICAL KINETICS**

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: *This course may be divided into two broad parts-inorganic and physical chemistry. Three units-main group elements, transition elements and co-ordination chemistry will be taught in the inorganic chemistry part. The physical chemistry part contains states of matter and chemical kinetics.*

Learning Outcome: *After completion of this course the students will learn periodic properties in main group elements, transition metals (3d series). They will also learn the crystal field theory in coordination chemistry unit. In physical chemistry part, the students are expected to learn kinetic theory of gases, ideal gas and real gases, surface tension, viscosity , basic solid state chemistry and chemical kinetics.*

Learning Outcome: *After completion of this course the students will learn periodic properties in main group elements, transition metals (3d series). They will also learn the crystal field theory in coordination chemistry unit. In physical chemistry part, the students are expected to learn kinetic theory of gases, ideal gas and real gases, surface tension, viscosity , basic solid state chemistry and chemical kinetics.*

Semester III

CHE-RC/HG-3016: CHEMISTRY 3

CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL ORGANIC CHEMISTRY-I

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: *This course contains two broad parts- physical and and organic chemistry. In physical chemistry part the students will be taught chemical energetics, chemical equilibrium and ionic equilibrium. In organic chemistry part, the students will be introduced to different classes of organic compounds.*

Learning Outcome: *After completion of this course the students will able to understand the chemical system from thermodynamic points of view. They will also learn two very important topics in chemistry- chemical equilibrium and ionic equilibrium. In organic chemistry part, the students are expected to learn various classes of organic molecules-alkyl halides, aryl halides, alcohols, phenols, ethers, aldehydes and ketones.*

Semester IV

CHE- RC/HG-4016: CHEMISTRY4

SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: *This course may be divided into two broad parts-physical and organic chemistry. In 1st part of this course students will be introduced to solutions, phase equilibrium and electrochemistry. The 2nd part contains carboxylic acid and derivatives, amines and diazonium salt and biochemistry.*

Learning Outcome: *After completion of this course the students learn solutions, phase rule and its application in specific cases, basics of conductance and electrochemistry. Students will also learn some important topics of organic and biochemistry- carboxylic acids, amines, amino acids, peptides, proteins and carbohydrates.*

Discipline Specific Elective (DSE)

CHE-RE-5016: APPLICATIONS OF COMPUTERS IN CHEMISTRY

(Credits: Theory-04, Lab-02)

Theory: 60 Lectures

Course Objective: *This course intends to make learners familiar with basics of computer language, computer programming, handling of experimental data, curve fitting etc to analyze experimental results. This basic knowledge will help the students to perform and interpret results of various chemistry practicals.*

Learning Outcome: *After the completion of this course it will help the student to interpret laboratory data, curve fitting of experimental work, also perform quantum mechanical calculations for various molecular models.*

CHE-RE-5026: ANALYTICAL METHODS IN CHEMISTRY

(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objective: *This is an elective course designed to complement the needs of students who wish to learn more about the qualitative/quantitative characterization and separation techniques. The content of this course aims to cover some of the widely used instrumental techniques for characterization of samples. Experiments included aim at giving students hands on experience using different instrumental techniques and chemical analysis.*
Learning outcome: *On successful completion students will be have theoretical understanding about choice of various analytical techniques used for qualitative and quantitative characterization of samples. At the same time through the experiments students will gain hands on experience of the discussed techniques. This will enable students to take judicious decisions while analyzing different samples.*

CHE-RE-5036: MOLECULAR MODELLING & DRUG DESIGN

(Credits: Theory-04, Lab-02)
Theory: 60 Lectures

Course Objective: *The course introduces students to the basic principles of computer assisted drug design, modelling and the important theoretical concepts and programming.*
Learning Outcome: *Students will be able to identify basic components of computer and programming as applied to computer assisted design and modelling of molecules.*

CHE-RE-5046: NOVEL INORGANIC SOLIDS

(Credits: Theory-04, Practicals-02)
Theory: 60 Lectures

Course Objective: *This introductory course intends to make learners familiar with a wide variety of technologically important and emerging materials. It will prepare the learners for studying materials further at the master's level. Prior completion of one introductory UG level course on inorganic and physical chemistry will be essential.*
Learning outcome: *After the completion of this course it will also be possible for the students to opt for studying an interdisciplinary master's programme with an emphasis on the synthesis and applications of various materials or take up a job in the materials production and/or processing industry.*

CHE-RE-5056: POLYMER CHEMISTRY
(Credits: Theory-06, Lab-02)
Theory: 60 Lectures

Course objective: *This is an introductory level course in polymer chemistry. The aim of the course is to introduce the theory and applications of polymer chemistry to the students. Some industrially important polymers and conducting polymers, a promising class of polymeric materials for next generation devices will also be introduced in this course.*

Learning outcome: *After completion of this course the students will learn the definition and classifications of polymers, kinetics of polymerization, molecular weight of polymers, glass transition temperature, and polymer solutions etc. They also learn the brief introduction of preparation, structure and properties of some industrially important and technologically promising polymers.*

CHE-RE-5066: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS
(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objective: *Students shall be introduced to the fundamental concepts/theory and application of different analytical techniques, as applied to chemistry.*
Learning Outcome: *Students shall be able to explain the theoretical basis of different analytical techniques, identify the experimental requirements and compare/analyze the data/results thereof.*

CHE-RE-6016: GREEN CHEMISTRY
(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objective: *The learners will be taught about the emerging discipline of green chemistry particularly to differentiate as to how the principles of green chemistry may be applied to organic synthesis.*
Learning Outcome: *Apart from introducing learners to the principles of green chemistry, this course will make them conversant with applications of green chemistry to organic synthesis. Students will be prepared for taking up entry level jobs in the chemical industry. They also will have the option of studying further in the area.*

CHE-RE-6026: INDUSTRIAL CHEMICALS AND ENVIRONMENT
(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objectives: *This course provides an introduction to the various industrial gases and inorganic chemicals, their manufacturing processes, applications, storage and the hazards of handling them. Contribution of these industrial chemicals towards air and water pollution and their effects on living organisms and the environment has also been covered. Students are also expected to learn about metallurgy, energy generation industry and the pollution threat they pose. This course also discusses about management of the different kinds of wastes, their safe disposal and the importance of practicing green chemistry in chemical industry.*

Learning Outcomes: *After successful completion of the course, students would have learnt about the manufacture, applications and safe ways of storage and handling gaseous and inorganic industrial chemicals. Students will get to know about industrial metallurgy and the energy generation industry. Students will also learn about environmental pollution by various gaseous, liquid wastes and nuclear wastes and their effects on living beings. Finally, the students will learn about industrial waste management, their safe disposal and the importance of environment friendly "green chemistry" in chemical industry.*

CHE-RE-6036: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE
(Credits: Theory-04, Lab -02)
Theory: 60 Lectures

Course Objectives: *To learn the synthetic process, properties and the utility of the industrially important inorganic materials (such as silicates, ceramics, cements, fertilizers, paints, batteries, alloys and explosives).*
To provide opportunity to learn some of the industrial process such as surface coating and catalysis in relevant to industry where heterogeneous catalysis dominates.
Experiments are aimed at helping learners acquire hands on experience in qualitative and quantitative analysis of the inorganic materials which are basically manufactured in chemical industries.
To learn some industrial techniques such as surface coating etc..

Learning Outcome: *This course will establish the basic foundation of industrial inorganic chemistry among the students. This will be helpful for pursuing further studies of industrial chemistry in future. Experiments will help the Students to gather the experience of qualitative and quantitative chemical analysis. Students will be capable of doing analysis of the inorganic materials which are used in our daily life. They will have insight of the industrial processes.*

CHE-RE-6046: RESEARCH METHODOLOGY FOR CHEMISTRY

(Credits: Theory-05, Tutorials-01)
Theory: 75 Lectures

Course Objectives:
This course is introduced to impart knowledge about the basic concepts of research and to provide a road map for conducting research
Students are expected to identify, explain and apply basic concepts of research; acquire information, recognize various issues related to research and to learn instrumental methods required for research in chemistry.
Learning Outcome:
After completing this course, students should be able to construct a rational research proposal to generate fruitful output in terms of publications and patents in the field of chemical sciences.

CHEM-HE-6056: Dissertation

Student will complete a project work and then prepare a report on that.

Skill Enhancement Course (SEC)

AAA-SE-3014: ENGLISH

(Credits: 04)
60 Lectures

Syllabus will be available at GU website

CHE-SE-3024: IT SKILLS FOR CHEMISTS

(Credits: 04) 60 Lectures

Course Objective: *The objectives of the proposed course are:*

1) *To provide the basic knowledge of mathematics which are needed to pursue chemistry as major subject.*
2) *To provide the necessary training for the basic programming knowledge.*
3) *The course provides information technology literacy and basic skills training for learners with limited experience.*
4) *To familiarize with the Introductory writing activities and Handling numeric data.*

Learning Outcome: *Course learning outcomes focus on skill development related to basic computer operations and information technology. After completing the course the incumbent is able to use the computer for basic purposes of preparing his personnel/business letters, viewing information on Internet (the web), sending mails, using internet banking services etc. After opting this course the students are expected to accumulate the skills in writing activities and Handling numeric data.*

CHE-SE-3034: BASIC ANALYTICAL CHEMISTRY

(Credits: 04) 60 Lectures

Course Objective: *To familiarize students with different micro and semimicro analytical techniques and help develop the ability to use modern instrumental methods for chemical analysis of food, soil, air and water.*

Learning Outcome: *Upon completion of this course, students shall be able to explain the basic principles of chemical analysis, design/implement microscale and semimicro experiments, record, interpret and analyze data following scientific methodology.*

CHE-SE-4014: ANALYTICAL CLINICAL BIOCHEMISTRY
(Credits: 04) 60 Lectures

Course objective: *This course is intended to apprise students with various clinically relevant biomolecules, their structures and physiological roles. Students are also expected to learn the basics of analysis of pathological samples (blood and urine).*

Learning outcome: *Students will be able to identify various molecules relevant to a particular pathological condition and their estimation protocols.*

CHE-SE-4024: GREEN METHODS IN CHEMISTRY
(Credits: 04) 60 Lectures

Course Objectives: *This course introduces students to the utilization of green chemistry from industrial perspective and provides exposure to methods by which environmental problems are evaluated and designing of sustainable solutions.*

Learning Outcome: *Students shall be able to describe and evaluate chemical products and processes from environmental perspective, define and propose sustainable solutions and critically assess the methods for waste reduction and recycling.*

CHE-SE-4034: PHARMACEUTICAL CHEMISTRY
(Credits: 04) 60 Lectures

Course Objective: *This primary objective of this course is to introduce students to the fundamentals of drug design and development process, drugs for various diseases available in market, their mode of action and side effects. Students are expected to learn the biosynthetic procedures of various bio-relevant small molecules.*

Learning Outcome: *Students will be able to appreciate the drug development process, identify various small molecules used for treatments different ailments and other physiological processes.*

CHE-SE-5014: CHEMICAL TECHNOLOGY & SOCIETY
(Credits: 04) 60 Lectures

Course Objective: *The objective of the course is to enable students to have a firsthand understanding of different types of equipments needed in chemical technology and offer them concepts regarding some important parameters. The syllabus also emphasizes the dynamic nature of the relations between society on one hand and technological achievement from chemical industries on the other hand. In other words, it tries to explore societal and technological issues from a chemical perspective.*
Learning Outcome: *Students shall be familiarized with processes and terminologies in chemical industry, like mass balance, energy balance etc… Learners will be able to use chemical and scientific literacy as a means to better understand the topics related to the society.*

CHE-SE-5024: CHEMOINFORMATICS
(Credits: 04) 60 Lectures

Learning Objectives: *The primary objective of this course is to familiarize the students with the use of various computer softwares and information technology. The students are expected to learn different chemical search engines and utilize them for molecular modelling and structure elucidation with a final goal to compute NMR, IR, mass and other spectra that can be later compared with the experimental data. The course also provides sufficient information and hands on exercises on the use of cheminformatics, with a special emphasis on its application in modern drug discovery.*

Learning Outcomes: *On the successful completion of the course, the students should be able to explain, interpret and critically examine the utility of computers and software tools to solving chemistry related problems. Recognize, apply, compare and predict chemical structures, properties, and reactivity and; solve chemistry related problems.*

Employ critical thinking and scientific reasoning to design and safely implement laboratory experiments and keep the records of the same.

Compile, interpret and analyze the qualitative/quantitative data and communicate the same in a scientific literature

CHE-SE-5034: BUSINESS SKILLS FOR CHEMISTS
(Credits: 04) 60 Lectures

Course Objective: *To familiarize students with important concepts of business operations and intellectual rights as applied to chemical industry.*
Learning outcome: *students shall be able to explain and/or analyze the important steps of business operations, finance and intellectual property as applied to chemical industry.*

CHE-SE-5044: INTELLECTUAL PROPERTY RIGHTS
(Credits: 04) 60 Lectures

Course Objective: *In this era of liberalization and globalization, the perception about science and its practices has undergone dramatic change. The importance of protecting the scientific discoveries, with commercial potential or the intellectual property rights is being discussed at all levels – statutory, administrative, and judicial. With India ratifying the WTO agreement, it has become obligatory on its part to follow a minimum acceptable standard for protection and enforcement of intellectual property rights. The purpose of this course is to apprise the students about the multifaceted dimensions of this issue.*

Learning Outcome: *After completing this course, students will have in-depth understanding about the importance and types of IPR. This course will also provide the clarity on the legal and economic aspects of the IP system.*

CHE-SE-6014: CHEMISTRY OF COSMETICS & PERFUMES
(Credits: 04) 60 Lectures

Course Objective: *This course intends to apprise students about the chemical knowledge related to some of the commonly used cosmetics. Laboratory experiments for preparation of talcum powder, shampoo etc. are included to give hands on experience.*

Learning Outcome: *Students will learn about the preparation and chemistry involved with the production different cosmetic. This may encourage students to take up entry level jobs at cosmetics industry or venture into commercial production of cosmetics as an entrepreneur.*

CHE-SE-6024: PESTICIDE CHEMISTRY
(Credits: 04) 60 Lectures

Course Objective*: This is a brief and introductory course on pesticides, through which the students will be introduced to various classes of pesticides, their synthesis, applications and possible hazards of their uses.*

Learning Outcome*: Students will be able to explain or describe and critically examine different types of pesticides, their activity/toxicity and their applications and the need for the search of an alternative based on natural products.*

CHE-SE-6034: FUEL CHEMISTRY
(Credits: 04) 60 Lectures

Course Objectives: *This course discusses about the chemistry of various sources of energy. Students are expected to learn about the composition of coal and petroleum products, their extraction, purification methods and usage. A section also covers classification and applications of natural and synthetic lubricants. Students will also learn about the determination and significance of various industrially relevant physical parameters for different fuels and lubricants.*

Learning Outcomes: *At the end of this course students will learn about the classes of renewable and non-renewable energy sources. Students will learn about the composition of coal and crude petroleum, their classification, isolation of coal and petroleum products and their usage in various industries. They will also learn to determine industrially significant physical parameters for fuels and lubricants.*

Dipankar Baerman Sharanga Nath

(Signature of the Faculty members)

Department of Mathematics

Established: 2017

Pandit Deendayal Upadhyaya

Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon

Assam-783383

Course Outcome

B.Sc. Major Programme in Mathematics

Paper MAT-HC-1016: Calculus (including practical)

This course will enable the students to:

i) Learn first and second derivative tests for relative extremum and apply the knowledge in problems in business, economics and life sciences.
ii) Sketch curves in a plane using its mathematical properties in different coordinate systems.
iii) Compute area of surfaces of revolution and the volume of solids by integrating over cross-sectional areas.
iv) Understand the calculus of vector functions and its use to develop the basic principles of planetary motion.

Paper MAT-HC-1026: Algebra

This course will enable the students to:

i) Employ De Moivre's theorem in a number of applications to solve numerical problems.
ii) Learn about equivalent classes and cardinality of a set.
iii) Use modular arithmetic and basic properties of congruences.
iv) Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
v) Learn about the solution sets of linear systems using matrix method and Cramer's rule

Paper MAT-HC-2016: Real Analysis

This course will enable the students to:

i) Understand many properties of the real line R, including completeness and Archimedean properties.
ii) Learn to define sequences in terms of functions from N to a subset of R.
iii) Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
iv) Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

Paper MAT-HC-2026: Differential Equations (including practical)

The course will enable the students to:

i) Learn basics of differential equations and mathematical modeling.
ii) Formulate differential equations for various mathematical models.
iii) Solve first order non-linear differential equations and linear differential equations of higher order using various techniques.
iv) Apply these techniques to solve and analyze various mathematical models.

Paper MAT-HC-3016: Theory of Real Functions

This course will enable the students to:

i) Have a rigorous understanding of the concept of limit of a function.
ii) Learn about continuity and uniform continuity of functions defined on intervals.

iii) Understand geometrical properties of continuous functions on closed and bounded intervals.
iv) Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
v) Know about applications of mean value theorems and Taylor's theorem

Paper MAT-HC-3026: Group Theory – I

The course will enable the students to:

i) Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
ii) Link the fundamental concepts of groups and symmetrical figures.
iii) Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
iv) Explain the significance of the notion of cosets, normal subgroups and factor groups.
v) Learn about Lagrange's theorem and Fermat's Little theorem.
vi) Know about group homomorphisms and group isomorphisms.

Paper MAT-HC-3036: Analytical Geometry

This course will enable the students to:

i) Learn conic sections and transform co-ordinate systems
ii) Learn polar equation of a conic, tangent, normal and properties
iii) Have a rigorous understanding of the concept of three-dimensional coordinates systems

Paper MAT-SE-3014: Computer Algebra Systems and Related Software

This course will enable the students to:

i) Use of softwares; Mathematica/MATLAB/Maxima/Maple etc. as a calculator, for plotting functions and animations
ii) Use of CAS for various applications of matrices such as solving system of equations and finding eigenvalues and eigenvectors.
iii) Understand the use of the statistical software R as calculator and learn to read and get data into R.
iv) Learn the use of R in summary calculation, pictorial representation of data and exploring relationship between data.
v) Analyze, test, and interpret technical arguments on the basis of geometry.

Paper MAT-SE-3024: Combinatorics and Graph Theory

This course will enable the students to:

i) Learn about the counting principles, permutations and combinations, Pigeonhole principle
ii) Understand the basics of graph theory and learn about social networks, Eulerian and Hamiltonian graphs, diagram tracing puzzles and Knight's tour problem.

Paper MAT-HC-4016: Multivariate Calculus

This course will enable the students to:

i) Learn the conceptual variations when advancing in calculus from one variable to multivariable discussion.
ii) Understand the maximization and minimization of multivariable functions subject to the given constraints
iii) Learn about inter-relationship amongst the line integral, double and triple integral formulations.
iv) Familiarize with Green's, Stokes' and Gauss divergence theorems.

Paper MAT-HC-4026: Numerical Methods (including practical)

The course will enable the students to:

i) Learn some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
ii) Know about methods to solve system of linear equations, such as False position method, Fixed point iteration method, Newton's method, Secant method and LU decomposition.
iii) Interpolation techniques to compute the values for a tabulated function at points not in the table.
iv) Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.

Paper MAT-HC-4036: Ring Theory

On completion of this course, the student will be able to:

i) Appreciate the significance of unique factorization in rings and integral domains.
ii) Learn about the fundamental concept of rings, integral domains and fields.
iii) Know about ring homomorphism and isomorphism theorems of rings.
iv) Learn about the polynomial rings over commutative rings, integral domains, Euclidean domains, and UFD

Paper MAT-SE-4014: R Programming

This course will enable the students to:

i) Become familiar with R syntax and to use R as a calculator.
ii) Understand the concepts of objects, vectors and data types.
iii) Know about summary commands and summary table in R.
iv) Visualize distribution of data in R and learn about normality test.
v) Plot various graphs and charts using R.

Paper MAT-SE-4024: LaTeX and HTML (practical)

After studying this course, the student will be able to:

i) Create and typeset a LaTeX document.
ii) Typeset a mathematical document using LaTex.
iii) Learn about pictures and graphics in LaTex.
iv) Create beamer presentations.
v) Create web page using HTML.

Paper MAT-HC-5016: Riemann Integration and Metric spaces

The course will enable the students to:

i) Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration.
ii) Know about improper integrals including, beta and gamma functions.
iii) Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
iv) Analyse how a theory advances from a particular frame to a general frame.
v) Appreciate the mathematical understanding of various geometrical concepts, viz. Balls or connected sets etc. in an abstract setting.
vi) Know about Banach fixed point theorem, whose far-reaching consequences have resulted into an independent branch of study in analysis, known as fixed point theory.

vii) Learn about the two important topological properties, namely connectedness and compactness of metric spaces.

Paper MAT-HC-5026: Linear Algebra

The course will enable the students to:

i) Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
ii) Basic concepts of linear transformations, dimension theorem, matrix representation of a linear
transformation, and the change of coordinate matrix.
iii) Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
iv) Compute inner products and determine orthogonality on vector spaces, including Gram−Schmidt orthogonalization to obtain orthonormal basis.
v) Find the adjoint, normal, unitary and orthogonal operators.

Paper MAT-HE-5016: Number Theory

This course will enable the students to:

i) Learn about some fascinating discoveries related to the properties of prime numbers, and some of the open problems in number theory, viz., Goldbach conjecture etc.
ii) Know about number theoretic functions and modular arithmetic.
iii) Solve linear, quadratic and system of linear congruence equations.

Paper MAT-HE-5026: Mechanics

The course will enable the students to:

i) Know about the concepts in statics such as moments, couples, equilibrium in both two and three dimensions.
ii) Understand the theory behind friction and center of gravity.
iii) Know about conservation of mechanical energy and work-energy equations.
iv) Learn about translational and rotational motion of rigid bodies.

Paper MAT-HE-5036: Probability and Statistics

This course will enable the students to:

i) Learn about probability density and moment generating functions.
ii) Know about various univariate distributions such as Bernoulli, Binomial, Poisson, gamma and exponential distributions.
iii) Learn about distributions to study the joint behavior of two random variables.
iv) Measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
v) Understand central limit theorem, which helps to understand the remarkable fact that: the empirical frequencies of so many natural populations, exhibit a bell-shaped curve, i.e., a normal distribution

Paper MAT-HE-5046: Linear Programming

This course will enable the students to:

i) Learn about the graphical solution of linear programming problem with two variables.
ii) Learn about the relation between basic feasible solutions and extreme points.
iii) Understand the theory of the simplex method used to solve linear programming problems.

iv) Learn about two-phase and big-M methods to deal with problems involving artificial variables.
v) Learn about the relationships between the primal and dual problems.
vi) Solve transportation and assignment problems.
vii) Apply linear programming method to solve two-person zero-sum game problems.

Paper MAT-HE-5056: Spherical Trigonometry and Astronomy

This course will enable the students to:

i) Learn about the properties of spherical and polar triangles
ii) know about fundamental formulae of spherical triangles
iii) learn about the celestial sphere, circumpolar star, rate of change of zenith distance and azimuth
iv) learn about Keplar's law of planetary motion, Cassini's hypothesis, differential equation for fraction

Paper MAT-HE-5066: Programming in C (including practical)

After completion of this paper, student will be able to:

i) Understand and apply the programming concepts of C which is important to mathematical investigation and problem solving.
ii) Learn about structured data-types in C and learn about applications in factorization of an integer and understanding Cartesian geometry and Pythagorean triples.
iii) Use of containers and templates in various applications in algebra.
iv) Use mathematical libraries for computational objectives.
v) Represent the outputs of programs visually in terms of well formatted text and plots.

Paper MAT-HC-6016: Complex Analysis (including practical)

Completion of the course will enable the students to:

i) Learn the significance of differentiability of complex functions leading to the understanding of
Cauchy−Riemann equations.
ii) Learn some elementary functions and can evaluate the contour integrals.
iii) Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula.
iv) Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

Paper MAT-HC-6026: Partial Differential Equations (including practical)

The course will enable the students to:

i) Formulate, classify and transform first order PDEs into canonical form.
ii) Learn about method of characteristics and separation of variables to solve first order PDE's.
iii) Classify and solve second order linear PDEs.
iv) Learn about Cauchy problem for second order PDE and homogeneous as well as nonhomogeneous wave equations.
v) Apply the method of separation of variables for solving second order PDEs.

Paper MAT-HE-6016: Boolean Algebra and Automata Theory

The course will enable the students to:

i) Learn about the order isomorphism, Hasse diagrams, building new ordered set.
ii) Learn about the algebraic structure lattices, properties of modular and distributive lattices.

iii) Get ideas about the Boolean algebra, switching circuits and applications of switching circuits.
iv) Appreciate the theory of automata and its applications

Paper MAT-HE-6026: Bio-Mathematics

Apropos conclusion of the course will empower the student to:

i) Learn the development, analysis and interpretation of bio mathematical models such as population growth, cell division, and predator-prey models.
ii) Learn about the mathematics behind heartbeat model and nerve impulse transmission model.
iii) Appreciate the theory of bifurcation and chaos.
iv) Learn to apply the basic concepts of probability to molecular evolution and genetics.

Paper MAT-HE-6036: Mathematical Modelling (including practical)

The course will enable the students to:

i) Know about power series solution of a differential equation and learn about Legendre's and Bessel's equations.
ii) Use of Laplace transform and inverse transform for solving initial value problems.
iii) Learn about various models such as Monte Carlo simulation models, queuing models, and linear programming models.

Paper MAT-HE-6046: Hydromechanics

The course will enable the students to:

i) Know about Pressure equation, rotating fluids.
ii) Learn about Fluid pressure on plane surfaces, resultant pressure on curved surfaces, Gas law, mixture of gases
iii) Learn about the Eulerian and Lagrangian method.
iv) Learn about equation of continuity, examples, acceleration of a fluid at a point

Paper MAT-HE-6056: Rigid Dynamics

The course will enable the students to:

i) Know how to find the moments and products of inertia.
ii) Learn about the motion of the centre of inertia
iii) Learn about the D'Alembert's principle and Lagrange's equations
iv) Learn about motion of a body in two dimensions

Paper MAT-HE-6066: Group Theory II

The course shall enable students to:

i) Learn about automorphisms for constructing new groups from the given group.
ii) Learn about the fact that external direct product applies to data security and electric circuits.
iii) Understand fundamental theorem of finite abelian groups.
iv) Be familiar with group actions and conjugacy in Sn.
v) Understand Sylow theorems and their applications in checking non-simplicity.

Paper MAT-HE-6076: Mathematical Finance

On completion of this course, the student will be able to:

i) Know the basics of financial markets and derivatives including options and futures.
ii) Learn about pricing and hedging of options, as well as interest rate swaps.
iii) Learn about no-arbitrage pricing concept and types of options.

iv) Learn stochastic analysis (Ito formula, Ito integration) and the Black−Scholes model.
v) Understand the concepts of trading strategies and valuation of currency swaps.

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

Department of Physics

Course Outcome

Course Code	Title	Course outcome
PHY-HC-1016	Mathematical Physics I	Successful students should be able to understand vector and its applications in various fields, differential equations and its applications, different coordinate systems, concept of probability and error.
PHY-HC-1026	Mechanics	On successful completion of the course students should be able to understand Inertial and non inertial reference frames, Newtonian motion, Galilean transformations, projectile motion, work and energy, Elastic and inelastic collisions, motion under central force, simple harmonic oscillations, special theory of relativity.
PHY-HG/RC-1016	Mechanics	Upon completion of this course, students are expected to understand the role of vectors and coordinate systems in Physics, solve Ordinary Differential Equations, laws of motion and their application to various dynamical situations, Inertial reference frames their transformations, concept of conservation of energy, momentum, angular momentum and apply them to basic problems, phenomenon of simple harmonic motion, motion under central force, concept of time dilation, Length contraction using special theory of relativity. In the laboratory course, after acquiring knowledge of how to handle measuring instruments (like screw gauge, Vernier calipers, travelling microscope) student shall embark on verifying various principles and associated measurable parameters.
PHY-HC-2016	Electricity & Magnetism	After successful completion of this course, students will be able to Understand electric and magnetic fields in matter, Dielectric properties of matter magnetic properties of matter, electromagnetic induction, applications of Kirchhofff's law in different circuits, applications of network theorem in circuits.
PHY-HC-2026	Waves & Optics	After successful completion of this course, students will be able to Understand superposition of harmonic oscillations, different types of wave motions, superposition of harmonic waves, interference an interferometer, diffraction, holography.
PHY-HG/RC-2016	Electricity & Magnetism	Upon completion of this course, students are expected to apply Gauss's law of electrostatics to solve a variety of problems, calculate the

		magnetic forces that act on moving charges and the magnetic fields due to currents, have brief idea of magnetic materials, understand the concepts of induction, and apply them to solve variety of problems. In the Lab course, students will be able to measure resistance (high and low), Voltage, Current, self and mutual inductance, capacitor, strength of magnetic field and its variation, study different circuits RC, LCR etc
PHY-HC-3016	Mathematical Physics II	After successful completion of the course, students will be able to solve differential equation using power series solution method, solve differential equation using separation of variables method, special integrals, different properties of matrix, Fourier series
PHY-HC-3026	Thermal Physics	Upon successful completion, students will have the knowledge and skills to identify and describe the statistical nature of concepts and laws in thermodynamics, in particular: entropy, temperature, Thermodynamics potentials, Free energies, Maxwell's relations in thermodynamics, behaviour of real gases
PHY-HC-3036	Digital Systems & Applications	After successful completion of the course student will be able to understand the working principle of CRO, develop a digital logic and apply it to solve real life problems, Analyze, design and implement combinational logic circuits, Classify different semiconductor memories, Analyze, design and implement sequential logic circuits, Analyze digital system design using PLD, Simulate and implement combinational and sequential circuits
PHY-HG/RC-3016	Thermal Physics & Statistical Mechanics	Upon completion of this course, students are expected to learn the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations, Maxwell's thermodynamic relations, fundamentals of the kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion, black body radiations, Stefan- Boltzmann's law, Rayleigh-Jean's law and Planck's law and their significances, quantum statistical distributions, viz., the Bose- Einstein statistics and the Fermi-Dirac statistics. In the laboratory

		course, the students will be able to Measure the value of Planck's constant using black body radiation, determine Stefan's Constant, coefficient of thermal conductivity of a bad conductor and a good conductor, determine the temperature coefficient of resistance, study variation of thermo emf across two junctions of a thermocouple with temperature etc.
PHY-SE-3014	Physics Workshop Skills	On successful completion of this course the students will familiar and experience with various mechanical and electrical tools through hands-on mode.
PHY-HC-4016	Mathematical Physics III	On successful completion of the course students will able to solve complex integrals using residue theorem, apply Fourier and Laplace transforms in solving differential equations, understand properties of Tensor like Transformation of coordinates, contravariant and co-variant tensors, indices rules for combining tensors.
PHY-HC-4026	Elements of Modern Physics	On completion of the course students will be able to understand modern development in Physics, Starting from Planck's law, it development of the idea of probability interpretation and the formulation of Schrodinger equation. Students will also get preliminary idea of structure of nucleus, radioactivity Fission and Fusion and Laser
PHY-HC-4036	Analog Systems & Applications	On successful completion of the course students will be able to understand about the physics of semiconductor p-n junction and devices such as rectifier diodes, zener diode, photodiode etc. and bipolar junction transistors, transistor biasing and stabilization circuits, the concept of feedback in amplifiers and the oscillator circuits, students will also have an understanding of operational amplifiers and their applications
PHY-HG/RC-4016	Waves & Optics	Upon completion of this course, students are expected to understand Simple harmonic oscillation and superposition principle, importance of classical wave equation in transverse and longitudinal waves and solving a range of physical systems on its basis, concept of normal modes in transverse and longitudinal waves: their frequencies and configurations, interference as superposition of waves from coherent sources derived from same parent source, Demonstrate understanding of Interference and diffraction experiments, Polarization. In the laboratory course, student

		will gain hands-on experience of using various optical instruments and making finer measurements of wavelength of light using Newton Rings experiment, Fresnel Biprism etc. Resolving power of optical equipment, the motion of coupled oscillators, study of Lissajous figures and behaviour of transverse, longitudinal waves.
PHY-SE-4024	Research & Technical Writing	On successful completion of the course students will be able to identify and write different parts of technical reports, write article, thesis, and presentation in latex, create chart in Microsoft excel, use different format of chart based on need, plot data from different sources using Origin plot
PHY-HC-5016	Quantum Mechanics & Applications	On successful completion of the course students will be able to understand the principles in quantum mechanics, such as the Schrödinger equation, the wave function, the uncertainty principle, stationary and non-stationary states, time evolution of solutions, as well as the relation between quantum mechanics and linear algebra. Students will be able to solve the Schrödinger equation for hydrogen atom. Students will have the concepts of angular momentum and spin, as well as the rules for quantization and addition of these, spin-orbit coupling and Zeeman Effect.
PHY-HC-5026	Solid State Physics	On successful completion of the course students should be able to explain the main features of crystal lattices and phonons, understand the elementary lattice dynamics and its influence on the properties of materials, describe the main features of the physics of electrons in solids; explain the dielectric ferroelectric and magnetic properties of solids and understand the basic concept in superconductivity.
PHY-HE-5046	Physics of Devices and Instruments	Upon completion of this course, students will be able to gain knowledge on advanced electronics devices such as UJT, JFET, MOSFET, CMOS etc., detailed process of IC fabrication, Digital Data serial and parallel Communication Standards along with the understanding of communication systems.
PHY-HE-5056	Nuclear and Particle Physics	Upon completion of this course, students will have the understanding of the sub atomic particles and their properties. They will gain knowledge about the different nuclear techniques and their applications in different branches of Physics and societal application. The

		course will develop problem based skills and the acquire knowledge can be applied in the areas of nuclear, medical, archeology, geology and other interdisciplinary fields of Physics and Chemistry
PHY-HC-6016	Electromagnetic Theory	On successful completion of the course students will acquire the concepts of Maxwell's equations, propagation of electromagnetic (EM) waves in different homogeneous-isotropic as well as anisotropic unbounded and bounded media, production and detection of different types of polarized EM waves, general information as waveguides and fibre optics
PHY-HC-6026	Statistical Mechanics	On successful completion of the course students will be learn the techniques of Statistical Mechanics to apply in various fields including Astrophysics, Semiconductors, Plasma Physics, Bio-Physics, Chemistry and in many other directions.
PHY-HE-6046	Astronomy and Astrophysics	Upon completion of this course, students will be able to understanding the origin and evolution of the Universe. The course will give a comprehensive introduction on the measurement of basic astronomical parameters such as astronomical scales, luminosity and astronomical quantities. It will give an overview on key developments in observational astrophysics. Students will have the idea of the instruments implemented for astronomical observation, the formation of planetary system and its evolution with time, the physical properties of Sun and the components of the solar system; and stellar and interstellar components of our Milky Way galaxy. Students will have the understanding of the origin and evolution of galaxies, presence of dark matter and large scale structures of the Universe
PHY-HE-6056	Classical Dynamics	Upon completion of this course, students will have the overview of Newton's Laws of Motion, Special Theory of Relativity by 4-vectoer approach and fluids. Students will also have the understanding of the Lagrangian and Hamiltonian of a system. By the end of this course, students will be able to solve the seen or unseen problems/numericals in classical mechanics.

Department of Zoology

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon, ASSAM-783383

Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

Course outcome

B.Sc. Zoology Honours

Core Papers

ZOO-HC-1016: NON-CHORDATES I: PROTISTS TO PSEUDOCOELOMATES

1. Identify and classify protists, including their structural and functional diversity, and understand their evolutionary significance within the broader context of non-chordate organisms.

2. Analyze the morphological characteristics and physiological adaptations of protists, including their locomotion, reproduction, nutrition, and ecological roles.

3. Explore the evolutionary relationships among various non-chordate groups, such as Porifera, Cnidaria, Platyhelminthes, Nematoda, and Pseudocoelomates, understanding their phylogenetic connections and evolutionary history.

4. Analyze life cycles and developmental stages of representative non-chordate organisms, including reproductive strategies and embryonic development.

ZOO-HC-1026: PRINCIPLES OF ECOLOGY

1. Comprehend the basic principles and concepts of ecology, including population dynamics, community interactions, ecosystems, biogeochemical cycles, and the relationships between organisms and their environments.

2. Describe and analyze various ecological interactions such as competition, predation, mutualism, parasitism, and how these interactions shape the structure and function of ecological communities.

3. Understand the components of ecosystems, including biotic and abiotic factors, and how they function together, emphasizing energy flow, nutrient cycling, and the concept of ecological succession.

4. Recognize the importance of biodiversity and its conservation, exploring the factors influencing biodiversity loss, the significance of conservation strategies, and the role of humans in ecosystem management.

5. Develop skills in collecting, analyzing, and interpreting ecological data, using quantitative methods to study populations, communities, and ecosystems.

ZOO-HC-2016: NON-CHORDATES II: COELOMATES

1. Identify and classify coelomate organisms, including Annelida, Mollusca, Arthropoda, and Echinodermata, emphasizing their structural diversity, evolutionary relationships, and ecological significance.

2. Analyze the anatomical structures and physiological adaptations of coelomate animals, including their organ systems, locomotion, feeding mechanisms, reproduction, and sensory adaptations.

3. Explore the evolutionary history and relationships among coelomate groups, discussing their phylogenetic connections and understanding their significance in the context of animal evolution.

4. Investigate the functional morphology of coelomates, examining adaptations related to their habitats, lifestyles, and ecological roles, highlighting both similarities and differences among different taxa.

5. Study the life cycles and developmental stages of representative coelomate organisms, including embryonic development, metamorphosis, and reproductive strategies.

ZOO-HC-2026: CELL BIOLOGY

1. Demonstrate a thorough understanding of the fundamental concepts of cell biology, including cell structure, organelle function, cellular metabolism, and the molecular mechanisms underlying cellular processes.

2. Describe the structure and function of cellular components, including membranes, cytoskeleton, nucleus, endoplasmic reticulum, Golgi apparatus, mitochondria, and other organelles, and their roles in cellular activities.

3. Explain key cellular processes such as cell signaling, cell cycle regulation, DNA replication, transcription, translation, protein folding, transport mechanisms, and cell differentiation.

ZOO-HC-3013: DIVERSITY OF CHORDATA

1. Identify and classify major groups of chordates based on their morphological and anatomical characteristics, understanding the distinguishing features and evolutionary relationships among them.

2. Analyze the anatomical structures, physiological adaptations, and diversity within each class of chordates, including skeletal systems, nervous systems, circulatory systems, and reproductive strategies.

3. Explore the evolutionary history of chordates, tracing the development of key features such as the notochord, dorsal nerve cord, pharyngeal slits, and post-anal tail across different taxa.

4. Understand the adaptations of chordates to various environments, examining their ecological roles, behaviors, and interactions within ecosystems.

5. Investigate the life histories, developmental stages, and metamorphosis of different chordate groups, including embryonic development and the transition from aquatic to terrestrial habitats.

6. Compare the physiological mechanisms and adaptations among different classes of chordates, emphasizing respiratory, circulatory, nervous, and sensory systems.

7. Discuss paleontological findings and fossil records related to chordates, understanding the evolutionary transitions and diversity of ancient chordate forms.

ZOO-HC-3026: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

1. Develop a comprehensive understanding of the nervous system, endocrine system, and other coordinating systems in animals, including their structure, function, and interactions.

2. Comprehend the fundamentals of neurophysiology, including neuronal structure, action potentials, synaptic transmission, sensory processing, and motor control mechanisms.

3. Analyze the endocrine system, including hormone production, secretion, and regulation, and understand how hormones control various physiological processes such as growth, metabolism, and reproduction.

4. Explore the mechanisms underlying motor control and movement in animals, including muscle physiology, reflexes, coordination, and locomotion.

ZOO-HC-3036: FUNDAMENTALS OF BIOCHEMISTRY

1. Understand the basic molecular structure and function of biomolecules including proteins, carbohydrates, lipids, and nucleic acids, and their roles in cellular processes.

2. Explain enzyme structure, function, and kinetics, and understand how enzymes catalyze biochemical reactions within cells.

3. Comprehend the principles of metabolism, including catabolic and anabolic pathways, energy production, and the regulation of metabolic pathways.

4. Understand the principles of thermodynamics and how they apply to biochemical reactions, including energy transfer and the laws governing energy changes in biological systems.

5. Describe cellular signaling mechanisms including signal transduction pathways, receptors, and second messengers that regulate cellular responses.

Department of Zoology

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon, ASSAM-783383

Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

ZOO-HC-4016: COMPARATIVE ANATOMY OF VERTEBRATES

1. Identify and classify major groups of vertebrates (fishes, amphibians, reptiles, birds, and mammals) based on their anatomical characteristics, emphasizing the diversity within each group.

2. Analyze the skeletal systems of vertebrates, comparing and contrasting the structure and function of bones, cartilage, and other supportive structures among different vertebrate classes.

3. Understand the muscular systems of vertebrates, including muscles, tendons, and their attachment sites, and compare the adaptations for different modes of locomotion.

4. Explore the similarities and differences in the organ systems of vertebrates, including the circulatory, respiratory, digestive, nervous, and reproductive systems.

5. Understand the evolutionary adaptations in vertebrates that relate to their habitats, behaviors, feeding strategies, reproduction, and other ecological aspects.

ZOO-HC-4026: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

1. Understand the mechanisms of gas exchange, respiratory structures, and processes in animals, including ventilation, transport of gases, and adaptations to various environmental conditions.

2. Comprehend the functions of the cardiovascular system, including heart structure, blood vessels, blood composition, hemodynamics, and mechanisms of circulation and blood pressure regulation.

3. Analyze the processes of waste elimination, osmoregulation, and fluid balance in animals, including kidney function, filtration, reabsorption, and secretion.

4. Understand the mechanisms of digestion, absorption, and nutrient processing in animals, including gastrointestinal tract anatomy, enzyme action, and absorption of nutrients.

5. Explore how animals regulate body temperature, including mechanisms for heat production and dissipation, and adaptations to thermal stress.

6. Analyze the maintenance of internal stability and balance in animals through feedback mechanisms, maintaining homeostasis despite changing external and internal conditions.

ZOO-HC-4036: BIOCHEMISTRY OF METABOLIC PROCESSES

Department of Zoology
Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia
North Salmara, Bongaigaon, ASSAM-783383
Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

1. Understand the concept of metabolism, including catabolic and anabolic pathways, energy transformation, and the interconnected nature of metabolic processes.

2. Explain the biochemical reactions and regulation of glycolysis and gluconeogenesis, pathways involved in the breakdown and synthesis of glucose, respectively.

3. Understand the steps and regulation of the citric acid cycle, elucidating the oxidation of acetyl-CoA and the production of reducing equivalents.

4. Comprehend the electron transport chain and ATP synthesis, elucidating the generation of ATP via oxidative phosphorylation.

5. Analyze glycogen metabolism, including glycogen synthesis and breakdown, as well as the regulation of glycogen stores in different tissues.

6. Understand the metabolism of lipids, including fatty acid oxidation, biosynthesis of fatty acids and triglycerides, and regulation of lipid metabolism.

7. Explain the catabolism and anabolism of amino acids, including processes such as transamination, oxidative deamination, and the urea cycle.

8. Understand how different metabolic pathways are interconnected and regulated to maintain homeostasis and respond to cellular needs.

9. Discuss the role of hormones in regulating metabolic processes, including insulin, glucagon, adrenaline, and their effects on metabolism.

ZOO-HC-5016: MOLECULAR BIOLOGY

1. Understand the central dogma of molecular biology, including DNA replication, transcription, RNA processing, translation, and the flow of genetic information.

2. Explain the structure and organization of genomes, including chromatin structure, DNA packaging, and the role of non-coding DNA sequences.

3. Understand mechanisms regulating gene expression, including transcriptional control, post-transcriptional modifications, and epigenetic regulation.

4. Comprehend the process of DNA replication, its fidelity, and the mechanisms involved in DNA repair pathways.

5. Analyze the roles of different types of RNA molecules, including mRNA, rRNA, tRNA, and non-coding RNAs in gene expression and cellular processes.

6. Understand the process of translation, including ribosome structure, tRNA-mediated protein synthesis, and post-translational modifications.

7. Gain practical skills in molecular biology techniques such as PCR (Polymerase Chain Reaction), gel electrophoresis, DNA sequencing, cloning, and recombinant DNA technology.

8. Explore genomic approaches and bioinformatics tools used in molecular biology research, including genome sequencing, analysis, and interpretation.

ZOO-HC-5026: PRINCIPLES OF GENETICS

1. Understand the principles of Mendelian genetics, including the laws of segregation and independent assortment, and their application to inheritance patterns.

2. Comprehend the role of chromosomes in inheritance, including chromosomal theory of inheritance, sex determination, linkage, and gene mapping.

3. Explain the molecular mechanisms underlying inheritance, including DNA structure, replication, transcription, translation, and the central dogma of molecular biology.

4. Analyze the sources of genetic variation, including mutations, genetic recombination, and the role of genetic drift and natural selection in shaping genetic diversity.

5. Understand the genetic principles governing the inheritance and variation in bacteria, viruses, and other microorganisms.

6. Explore population genetics principles, including Hardy-Weinberg equilibrium, genetic drift, gene flow, and factors influencing gene frequencies in populations.

7. Understand the principles of quantitative genetics, including polygenic inheritance, heritability, and the genetic basis of complex traits.

ZOO-HC-6016: DEVELOPMENTAL BIOLOGY

1. Understand the fundamental concepts and principles of developmental biology, including fertilization, embryogenesis, organogenesis, and morphogenesis.

2. Explore the use of model organisms (such as Drosophila, zebrafish, Xenopus, and mice) and experimental techniques (such as genetics, imaging, and molecular biology) in studying developmental processes.

3. Understand the mechanisms of cell differentiation, fate determination, and cell signaling pathways involved in specifying cell types during development.

4. Describe the stages of embryonic development, including cleavage, gastrulation, and neurulation, and the formation of germ layers and embryonic tissues.

5. Analyze the processes of organogenesis, including the development of major organ systems and tissues, such as the nervous system, cardiovascular system, and limbs.

6. Understand the role of genes and genetic regulation in controlling developmental processes, including gene expression, patterning, and the role of homeotic genes.

7. Explore the biology of stem cells, their properties, differentiation potentials, and their role in regeneration and tissue repair.

8. Discuss evolutionary aspects of development, examining the conservation and divergence of developmental processes among different species.

ZOO-HC-6026: EVOLUTIONARY BIOLOGY

1. Understand the basic concepts of evolution, including natural selection, genetic variation, adaptation, and descent with modification as proposed by Charles Darwin.

2. Explore the mechanisms driving evolution, including mutation, genetic drift, gene flow, natural selection, and their roles in shaping populations and species.

3. Understand principles of population genetics, including allele frequencies, Hardy-Weinberg equilibrium, and genetic drift in populations.

4. Differentiate between microevolutionary processes (changes within populations) and macroevolutionary patterns (origination and diversification of species and higher taxa).

5. Explore the process of speciation, including allopatric, sympatric, and parapatric speciation, and the factors contributing to the formation of new species.

6. Understand the role of genetics in evolutionary processes, including molecular evolution, mechanisms of molecular adaptation, and evolutionary genomics.

7. Analyze the interaction between ecology and evolution, including coevolution, adaptation to ecological niches, and the evolutionary arms race.

8. Discuss the role of developmental processes in evolution, exploring the concept of evolutionary developmental biology and its implications.

9. Understand how geographic factors influence evolutionary processes, including biogeography, continental drift, and their impact on species distribution and diversity.

DISCIPLINE CENTRIC ELECTIVE COURSES

ZOO-HE-5016: COMPUTATIONAL BIOLOGY and BIOSTATICS

1. Understand the fundamental concepts of computational biology and biostatistics, including data analysis, algorithms, programming languages, and statistical methods relevant to biological sciences.

2. Gain practical experience in using bioinformatics tools and databases for tasks such as sequence alignment, genome assembly, gene expression analysis, and protein structure prediction.

3. Understand and apply statistical methods commonly used in biological research, including hypothesis testing, regression analysis, ANOVA, survival analysis, and Bayesian statistics.

4. Use graphical and visualization tools to represent biological data effectively, interpreting and communicating results through various visualizations such as graphs, charts, and heatmaps.

5. Analyze genomic data, including DNA sequencing, RNA-seq, and other high-throughput data, using computational approaches to study gene expression, variation, and evolutionary relationships.

6. Apply computational methods to analyze protein structure, function, interactions, and metabolomic data, understanding their relevance in biological processes.

7. Understand the principles of machine learning algorithms and data mining techniques, applying them to solve biological problems and predict biological patterns.

ZOO-HE-5026: ANIMAL BIOTECHNOLOGY

1. Comprehend the principles and techniques used in animal biotechnology, including genetic engineering, cloning, transgenic technology, and reproductive biotechnologies.

2. Understand the principles and applications of recombinant DNA technology in animals, including gene editing techniques like CRISPR/Cas9, TALENs, and ZFNs.

3. Analyze the generation and applications of transgenic animals for scientific research, biopharmaceutical production, and the study of gene function.

4. Understand the methodologies and applications of animal cloning techniques, such as somatic cell nuclear transfer (SCNT) and its significance in agriculture and biomedicine.

5. Explore the various assisted reproductive technologies used in animals, including in vitro fertilization (IVF), embryo transfer, and sex determination techniques.

6. Discuss the potential of genome editing and gene therapy in treating genetic diseases in animals, understanding the ethical and practical considerations.

7. Examine the applications of animal biotechnology in biomedicine, including the production of pharmaceuticals, disease models, and regenerative medicine.

Department of Zoology

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon, ASSAM-783383

Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

ZOO-HE-5036: ENDOCRINOLOGY

1. Understand the organization and functioning of the endocrine system, including major endocrine glands, hormones, and their modes of action.

2. Comprehend the biosynthesis, storage, secretion, and regulation of hormones by endocrine glands, including feedback mechanisms.

3. Analyze the mechanisms of hormone-receptor interactions, signal transduction pathways, and the cellular responses induced by hormones.

4. Understand the pathophysiology, diagnosis, and treatment of endocrine disorders such as diabetes mellitus, thyroid disorders, adrenal disorders, and reproductive hormone imbalances.

5. Explore the roles of the hypothalamus and pituitary gland in controlling hormonal secretion and their interactions with target glands.

6. Differentiate between steroid and non-steroid hormones, understanding their mechanisms of action and physiological effects.

7. Analyze the role of hormones in growth, development, and metabolism, including the growth hormone axis and factors influencing growth.

ZOO-HC-5046: PARASITOLOGY

1. Understand the fundamental concepts of parasitism, including definitions of parasites, hosts, and the interactions between parasites and their hosts.

2. Classify parasites based on their taxonomy, distinguishing between protozoa, helminths (including nematodes, cestodes, trematodes), and ectoparasites.

3. Describe the morphology, life cycles, and stages of parasites, including their adaptations for transmission, infection, and survival in different host environments.

4. Analyze the interactions between parasites and their hosts, including mechanisms of pathogenesis, immune responses, and host adaptations to parasitic infections.

5. Understand the epidemiology, transmission dynamics, geographic distribution, and risk factors associated with parasitic infections.

6. Gain familiarity with laboratory techniques and methods used for the diagnosis of parasitic infections, including microscopy, serology, molecular methods, and imaging techniques.

7. Discuss treatment options, including pharmacological interventions, preventive measures, and control strategies for parasitic infections in humans and animals.

8. Explore parasites that can be transmitted between animals and humans, understanding their impact on public health and the One Health concept.

9. Understand the role of vectors (such as mosquitoes, ticks, and flies) in transmitting parasitic diseases and the control measures to prevent vector-borne infections.

ZOO-HC-6016 : BIOLOGY OF INSECTA

1. Understand the diversity of insects, their classification, and taxonomy, exploring the major insect orders, families, and species.

2. Describe the external and internal structures of insects, including their anatomical features, adaptations, and physiological systems.

3. Explain the physiological processes in insects, including digestion, respiration, circulation, reproduction, and development through various life stages (egg, larva, pupa, and adult).

4. Analyze the behavior and ecology of insects, including mating behavior, communication, social insects (such as bees, ants, and termites), foraging strategies, and defense mechanisms.

ZOO-HE-6026: FISH AND FISHERIES

1. Understand the diversity of fish species, their classification, and taxonomy, exploring the major fish groups and their evolutionary relationships.

2. Describe the external and internal structures of fish, including their anatomical features, adaptations, physiological systems, and sensory organs.

3. Analyze the ecology and behavior of fish species, including feeding habits, migration patterns, reproductive strategies, and interactions within aquatic ecosystems.

4. Understand the principles and practices of fisheries management, including sustainable fishing practices, stock assessment, and the role of regulations in conservation.

5. Explore the principles and methods of aquaculture, including fish farming techniques, species selection, nutrition, disease control, and sustainable aquaculture practices.

6. Discuss the importance of fish conservation, threats to fish populations, habitat degradation, overfishing, and strategies for fish conservation and restoration.

Department of Zoology

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon, ASSAM-783383

Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

ZOO-HC-6036: REPRODUCTIVE BIOLOGY

1. Understand the anatomical structures and physiological mechanisms involved in reproduction across different organisms, including mammals, invertebrates, and plants.

2. Explore the processes of gamete formation (spermatogenesis and oogenesis), understanding the differentiation and maturation of gametes.

3. Understand the hormonal regulation of the reproductive system, including the hypothalamic-pituitary-gonadal axis, hormone interactions, and their roles in reproductive processes.

4. Describe the process of fertilization, including sperm-egg interaction, fusion, and the initiation of embryonic development.

5. Analyze the cyclic nature of reproductive events, including menstrual cycles, estrous cycles, and their hormonal regulation in different species.

6. Explore the behavioral aspects of reproduction, including courtship, mating behaviors, mate selection, and parental care.

7. Learn about assisted reproductive technologies (ART), such as in vitro fertilization (IVF), artificial insemination, and reproductive cloning, and their applications in human and animal reproduction.

8. Understand reproductive health issues, including infertility, sexually transmitted infections (STIs), contraceptive methods, and reproductive system disorders.

ZOO-HC-6046: WILD LIFE CONSERVATION AND MANAGEMENT

1. Understand the ecological principles governing wildlife populations, their habitats, and biodiversity conservation, including ecosystem dynamics and trophic interactions.

2. Identify and classify different wildlife species, understanding their taxonomy, distributions, and ecological roles within ecosystems.

3. Explore the principles and concepts of conservation biology, including genetic diversity, population dynamics, habitat fragmentation, and the extinction crisis.

4. Assess wildlife habitats, understand factors affecting habitat quality, and learn techniques for habitat restoration and enhancement to support wildlife populations.

5. Identify and analyze various threats to wildlife populations, including habitat loss, climate change, invasive species, pollution, poaching, and human-wildlife conflicts.

6. Learn about wildlife management techniques, including population monitoring, conservation planning, captive breeding, and reintroduction programs.

7. Understand the principles and practices of managing protected areas, including national parks, wildlife sanctuaries, and reserves, for conservation purposes.

8. Analyze interactions between humans and wildlife, understanding conflicts, mitigation strategies, and approaches to fostering coexistence.

9. Discuss national and international conservation policies, laws, and treaties related to wildlife conservation and their implications.

ZOO-HE-6056 : DISSERTATION on zoology specific subject

GENERIC ELECTIVE COURSES

ZOO-HG-1016: ANIMAL DIVERSITY

1. Understand the principles of animal taxonomy and classification, including the major groups, evolutionary relationships, and phylogenetic diversity of animals.

2. Describe the diversity in animal morphology and anatomy, including body plans, organ systems, adaptations, and specialized structures in various animal groups.

3. Explore physiological adaptations in animals related to nutrition, respiration, circulation, reproduction, locomotion, and sensory systems.

4. Understand the various reproductive strategies and life cycles exhibited by different animal taxa, including asexual and sexual reproduction, metamorphosis, and developmental stages.

ZOO-HG-2026: COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

1. Comprehend the diversity of vertebrate organisms, their taxonomic relationships, and the anatomical variations among different vertebrate groups.

2. Analyze the anatomical structures, organ systems, and homologous traits among vertebrates, understanding evolutionary modifications and adaptations across species.

3. Understand the developmental processes from fertilization to organogenesis in different vertebrate embryos, comparing developmental stages and patterns.

4. Explore the evolutionary relationships among vertebrate taxa, including phylogenetic relationships, cladistics, and the study of ancestral traits.

5. Discuss the functional significance of anatomical structures in vertebrates, understanding how form relates to function across different species.

6. Examine the skeletal and muscular systems in vertebrates, comparing variations in structure and function among different classes of vertebrates.

7. Analyze the reproductive systems and embryonic development in vertebrates, comparing reproductive strategies and developmental patterns.

8. Understand the structure and function of the nervous system and sensory organs in vertebrates, comparing adaptations for different environmental niches.

9. Discuss the relationship between ontogeny (development of an individual) and phylogeny (evolutionary history), exploring how developmental processes reflect evolutionary changes.

10. Integrate evolutionary concepts with developmental biology, understanding how genetic and developmental mechanisms contribute to evolutionary change.

ZOO-HG-3016: PHYSIOLOGY AND BIOCHEMISTRY

1. Understand the fundamental biochemical processes occurring within cells, including metabolism, enzyme kinetics, cellular respiration, and energy production.

2. Comprehend molecular mechanisms underlying cellular functions, including DNA replication, transcription, translation, and gene regulation.

3. Explore major biochemical pathways, such as glycolysis, the citric acid cycle, electron transport chain, and their regulation and integration within cellular metabolism.

4. Understand the structure-function relationships of proteins, including enzyme structure, catalysis, and regulation of protein function.

5. Describe the structure and function of biological membranes, including membrane transport mechanisms, ion channels, and membrane potential.

6. Understand the role of hormones in physiological processes, their biosynthesis, release, and mechanisms of action in regulating various bodily functions.

7. Explore the physiology of the nervous system, including the action potential, synaptic transmission, neural signaling, and nervous system organization.

8. Understand the function of the cardiovascular system, including heart function, blood circulation, blood pressure regulation, and cardiovascular diseases.

9. Describe the mechanisms of respiration, gas exchange, oxygen transport, and the regulation of breathing.

10. Comprehend kidney function, including filtration, reabsorption, secretion, and regulation of water and electrolyte balance.

11. Understand the physiology of the digestive system, including digestion, absorption, and nutrient metabolism.

ZOO-HG-4016: GENETICS AND EVOLUTIONARY BIOLOGY

1. Understand the principles of Mendelian inheritance, including the laws of segregation, independent assortment, and their application to genetic analysis.

2. Comprehend the structure and function of DNA, RNA, and proteins, including gene expression, regulation, replication, and genetic code.

3. Explore genetic variation within populations, including mutations, polymorphisms, and their effects on phenotype and evolution.

4. Learn about genetic mapping techniques, genome sequencing, and bioinformatics tools used in studying genomes and genetic variation.

5. Understand the principles of population genetics, including Hardy-Weinberg equilibrium, genetic drift, gene flow, and natural selection.

6. Explore mechanisms driving microevolutionary processes (changes within populations) and macroevolutionary patterns (evolutionary changes leading to new species and higher taxa).

7. Discuss evolutionary mechanisms such as natural selection, genetic drift, gene flow, mutation, and their roles in shaping genetic diversity and adaptation.

8. Understand concepts in evolutionary biology, including speciation, adaptation, convergent evolution, coevolution, and evolutionary developmental biology (evo-devo).

9. Analyze the genetic evidence for human evolution, population genetics, migration patterns, and evolutionary relationships among human populations.

10. Discuss the genetic basis of diseases, including inherited disorders, genetic predispositions, and the role of genetics in health and medicine.

SKILL ENHANCEMENT COURSES

ZOO-SE-3014: Ornamental Fish & Fisheries

1. Understand the diversity of ornamental fish species, their taxonomy, habitat preferences, and ecological requirements.

2. Comprehend the principles and techniques of breeding ornamental fish, including selective breeding, mating systems, and artificial reproduction methods.

3. Learn the principles of maintaining aquarium environments, including water quality management, filtration systems, lighting, and temperature control for ornamental fish.

4. Understand the common diseases affecting ornamental fish, preventive measures, treatments, and health management in aquarium settings.

5. Explore the global ornamental fish trade, market demands, regulations, and economic aspects related to the ornamental fish industry.

6. Learn about the practical aspects of ornamental fish farming, including facility setup, management practices, and sustainable aquaculture techniques.

7. Study the specific requirements and management practices for different ornamental fish species, including their feeding habits, behavior, and environmental needs.

ZOO-SE-3024: APICULTURE

1. Understand the biology, life cycle, and behavior of honeybees and other important pollinator species, including their roles within ecosystems.

2. Learn about beekeeping equipment, hive structures, and techniques for managing beehives effectively to maintain healthy colonies.

3. Understand the dynamics of colony growth, reproduction, swarming behavior, and factors influencing the health and productivity of bee colonies.

4. Study the nutritional needs of bees, their foraging behavior, floral preferences, and the impact of environmental factors on bee nutrition.

5. Learn the methods of honey harvesting, extraction, and processing, including techniques to maintain honey quality and hygiene standards.

6. Understand the importance of bees in pollination services for agriculture, ecosystems, and food production, including the role of managed and wild bee populations.

7. Identify common bee diseases, parasites, pests, and pathogens affecting bee colonies, and learn strategies for disease prevention and treatment.

Department of Zoology

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon, ASSAM-783383

Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

ZOO-SE-4014: MULBERRY SERICULTURE

1. Understand the principles and practices of mulberry cultivation, including soil preparation, planting, pruning, fertilization, and pest management.

2. Learn the lifecycle, biology, and management practices of silkworms (like Bombyx mori), including feeding, disease management, cocoon formation, and harvesting silkworm cocoons.

3. Study the techniques involved in sericulture, such as silkworm egg production, rearing methods, silkworm disease identification, and the use of appropriate rearing equipment.

4. Understand the process of silk extraction from silkworm cocoons, including cocoon boiling, silk reeling, spinning, dyeing, weaving, and finishing techniques.

5. Learn methods for quality assessment, grading, and testing of silk fibers, and understand the factors influencing silk quality.

6. Understand the economic aspects of sericulture, including cost analysis, market trends, value addition, and entrepreneurship opportunities in the silk industry.

ZOO-SE-4024: Wildlife Photography and Ecotourism

1. Understand the technical aspects of wildlife photography, including camera settings, composition, lighting, exposure, and equipment selection for capturing wildlife in natural habitats.

2. Gain knowledge about wildlife behavior, habitats, and ecological interactions to effectively anticipate and capture animal movements and interactions in their natural environment.

3. Learn ethical considerations and responsible practices in wildlife photography, including respecting wildlife, minimizing disturbance, and adhering to ethical standards.

4. Develop field skills for wildlife observation and photography, including navigation, fieldcraft, safety measures, and protocols for interacting with wildlife.

5. Understand the principles of ecotourism, sustainable travel practices, and the role of responsible tourism in nature conservation and local community development.

6. Explore the role of photography and ecotourism in conservation education, raising awareness about wildlife conservation, and promoting environmental stewardship.

7. Learn about selecting ecologically significant destinations, understanding ecosystems, biodiversity hotspots, and conservation areas for ecotourism activities.

Department of Zoology

Pandit Deendayal Upadhyaya Adarsha Mahavidyalaya, Tulungia

North Salmara, Bongaigaon, ASSAM-783383

Email: zoology@pduamtulungia.co.in Ph. No. 9401995662

ZOO-SE-4034: RESEARCH METHODOLOGY

1. Understand the fundamental concepts of research, including its purpose, importance, ethics, and the scientific method.

2. Comprehend different research designs, such as experimental, observational, qualitative, quantitative, and mixed-method approaches, and their applicability in various research scenarios.

3. Develop skills to conduct thorough literature reviews, search and evaluate scholarly sources, and synthesize relevant information for research projects.

4. Learn to formulate clear and focused research questions, hypotheses, or objectives that guide the research process.

5. Understand ethical considerations in research involving human subjects, animals, data collection, confidentiality, integrity, plagiarism, and compliance with ethical guidelines.

6. Explore various data collection methods, including surveys, interviews, observations, experiments, archival research, and data mining techniques.

7. Understand sampling methods, sample size determination, sampling bias, and strategies for selecting appropriate samples in research studies.

8. Learn about different statistical or qualitative analysis methods, software tools (e.g., SPSS, R, NVivo), and interpretation of results to address research questions.

9. Gain skills in writing a comprehensive research proposal, including background information, objectives, methodology, timeline, and budget considerations.

10. Develop effective communication skills for presenting research findings through written reports, presentations, and academic papers adhering to academic standards.