

BSc. Life Sciences II Year (Semester -III)

SEC OPTIONS (2021-2022)

S. No.	Department	Paper Name
1	Chemistry	Fuel Chemistry
2	Botany	Biofertilizers
3	Zoology	Medical Diagnostics

Course Descriptions

Chemistry SEC : Fuel Chemistry

FUEL CHEMISTRY (Credits: 02) (Hands on Exercises: 60 Lectures)

A fuel is any compound that has stored energy. This energy is captured in chemical bonds through processes such as photosynthesis and respiration. Energy is released during oxidation. The most common form of oxidation is the direct reaction of a fuel with oxygen through combustion. Wood, gasoline, coal, and any number of other fuels have energy rich chemical bonds created using the energy from the Sun, which is released when the fuel is burned (i.e., the release of chemical energy). Chemical fuels or the fossil fuels are useful reserve of fuels and are therefore used extensively to satisfy the demands of an energy-dependent civilization.

Unit :1 Review of energy sources (renewable and nonrenewable).

Classification of fuels and their calorific value.

Unit:2 Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—

composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

[Fossil fuels](#) can be separated into three categories. The first most prominent and naturally most abundant fossil fuel is coal. [Coal](#) also originates from decayed vegetative material buried years ago, but the process is slightly different, being less oxidizing. The resulting material still has some of the original lignin-like structure exhibiting many fused rings and a large fraction of aromatic compounds. Consequently, coal is more of a polymeric substance than petroleum and is found as a solid not a liquid. The carbon to hydrogen ratio in coal is close to 1:1 (depending upon the type of coal), whereas the carbon to hydrogen ratio in petroleum is closer to the 1:2 value expected for a hydrocarbon chain.

Unit:3 Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

The second is petroleum or oil. This is a mixture of light, simple hydrocarbons dominated by the fractions with 6 to 12 carbons but also

containing some light hydrocarbons (e.g., methane and ethane). Fully half of the energy consumed in the States are from petroleum used to produce fuels for automobiles, recreational vehicles, home heating, or industrial production.

The principal use of petroleum is the production of gasoline. Over 40% all of all production ends up consumed in automobiles and such. Smaller fractions are turned into fuel oil (27%), jet fuel (7.4%), and other miscellaneous fuels, while the small fraction (about 10%) is used for the synthesis of the thousands of petrochemicals used in our daily lives. Indeed, many food compounds and pharmaceuticals owe their synthesis to a petrochemical precursor.

The third major fossil fuel is [natural gas](#) . This is a generic term for the light hydrocarbon fractions found associated with most oil deposits. Natural gas is mostly methane with small quantities of ethane and other gases mixed in. It is hydrogen rich, since methane has a carbon to hydrogen ratio of 1:4. It is also an excellent fuel, burning with a high heat output and little in the way of unwanted pollution. It does produce [carbon dioxide](#) , which is a greenhouse gas, but all organic compounds also generate [carbon dioxide](#) on combustion. Natural gas is also easy to transport through pressurized pipelines

Unit:4 Lubricants: Classification of lubricants, lubricating oils (conducting and non-conducting)Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

Scope Of Fuel Chemistry

Application of Fuel chemistry to enable humanity experience in the area such as Green Environment, sustainable development, Biofuels, petroleum products etc

Botany SEC : Biofertilizers

Biofertilizers include preparations of efficient strains of microorganisms which when applied to plants help in acquisition of nutrients from the rhizosphere. Bio-fertilizers add nutrients through the natural processes of nitrogen fixation, solubilizing phosphorus, and stimulating plant growth through the synthesis of growth promoting substances. They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants. Biofertilizers are ecofriendly, organic agro-inputs and more cost effective than chemical fertilizers. Today, biofertilizers have emerged as a highly potent alternative to chemical fertilizers due to their eco-friendly, easy to apply, non-toxic and cost effective nature. Also, they make nutrients that are naturally abundant in soil or atmosphere, usable for plants and act as supplements to agrochemicals.

The paper will provide a comparative account of various microorganisms used as biofertilizers and their role in agriculture and soil fertility. Students will also acquire knowledge about the practical aspects of various composting methods included under organic farming. The paper will facilitate increasing basic aptitude in the field of agricultural biotechnology to pursue higher studies and research in applied disciplines of life sciences.

Zoology SEC : Medical Diagnostics

“Medical Diagnostics” offered by the Department of Zoology aims at equipping the students with an understanding of the process of diagnosis of various types of infectious and noninfectious diseases. In this paper, the students will learn about the causes, symptoms and types of commonly occurring diseases like hepatitis, tuberculosis, diabetes, hypertension and tumours and how the symptoms are linked to the diseases through case history and various diagnostic tests. Through the various practical exercises, students will gain a first hand knowledge of a few diagnostic techniques used for analysis of blood and urine. The students will learn to make blood smears, identify and do differential counting of various leukocytes, measure haemoglobin and blood glucose and also determine their blood groups. They will learn to measure blood pressure using mercury sphygmomanometer and learn about the symptoms, susceptibility factors and lifestyles associated with hypertension. Students will perform urine analysis by determining the abnormal constituents of urine and learn about the diseases and symptoms associated with each of these components. Through various videos and presentations students will be introduced to various advanced diagnostic techniques like X-ray, PET, MRI, CT scan, etc along with an understanding of their principle of functioning and applications. With the emergence of diagnostic tests as a principal factor in medical practice, this paper will empower the students with information which have practical implications in their day to day life.

BSc. Life Sciences III Year (Semester- V)

SEC Options (2020-2021)

S. No.	Department	Paper Name
1	Zoology	Aquarium Fish Keeping
2	Botany	Ethnobotany

3	Chemistry	Pharmaceutical Chemistry
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Course Descriptions

Zoology SEC : Aquarium Fish Keeping

Aquarium fish keeping is an important skill enhancement course and very useful for academics as well as career point of view. This course requires little prior knowledge about biology and is suitable for anyone involved with or interested in aquarium either on a professional basis or as a hobby. This self-paced course will be helpful for student in multiple ways. Students can start their own fish aquarium business as well as there are equal opportunities for starting up a fish feed industry. Students will gain knowledge and skills in managing both fresh and saltwater aquarium systems, understanding about breeding fish in captivity, design and layout of various aquarium systems, maintenance, water quality management and more.

Botany SEC : Ethnobotany

Ethnobotany is an interdisciplinary field, combining the aspects of botany and ethnology. It is a branch of science that aims to document, describe and explain complex relationships between cultures and plants, focusing primarily on how plants are used, managed and perceived across human societies. Traditionally, indigenous communities worldwide are extremely knowledgeable about local plants and other natural resources, on which they are immediately and intimately dependent for food, clothing, medicines, timber, dyes, construction etc. Ethnobotany, therefore is an important area

of research for documentation and preservation of traditional knowledge. Unfortunately, much of this wealth of knowledge is currently becoming lost as traditional cultures become eroded. Ethnobotanists can play very important roles in rescuing disappearing knowledge and returning it to local communities, by making them understand their medicinal and other practical applicability, helping to maintain a sense of pride in local cultural knowledge and practices, and reinforcing links between various ethnic communities, researchers and pharmaceutical companies.

The paper aims to provide the students a comprehensive account of the methodology of Ethnobotanical studies including field work, role of herbarium, sacred places and archaeological findings. The students will learn the role of ethnobotany in modern medicine and also the legal aspects of ethnobotany including Biopiracy and Intellectual Property Rights (IPR) to protect the interests and knowledge of ethnic groups. The course will certainly provide skills to the students for higher studies, particularly in the area of exploration of medicinal plants for pharmacological and clinical research.

[Chemistry SEC : Pharmaceutical Chemistry](#)

This course combines the knowledge of biological, medical, and physical sciences in the study of the scientific aspect of drug therapy. The development of new pharmaceuticals is critically dependent on molecular level understanding of biological processes and mechanisms of drug action. Progress in the field now depends on the design and synthesis of new molecules using tools such as structure activity relationships,

combinatorial chemistry, and computer-aided drug design. This skill enhancement course will provide students with an in-depth understanding of the processes involved and ethical issues surrounding the design and development of modern pharmaceuticals. The emphasis will be on the chemical nature of the reactions and interactions involved in drug therapy. The students will receive a solid background in the aspects of chemistry, most relevant to drugs: physical, organic, and analytical chemistry. They will also learn the fundamental aspects of the synthesis, manufacture, use, and mode of action of drugs. Thus, the students will be expected to appreciate the relevance of chemistry to pharmacy practice. Over the years, pharmaceutical scientists have been instrumental in discovering and developing innovative drugs that save thousands of people's lives and improve the quality of life for many others. The demand for pharmaceutical chemists is high and is anticipated to grow as modern chemistry and biological sciences provide us with increasingly accurate tools and understanding to develop unique therapies. Pharmaceutical scientists can pursue a variety of jobs. They are employed by pharmaceutical companies, they work as pharmacists and as researchers and professors at universities, as regulatory scientists for agencies like the Food and Drug Administration (FDA), World Health Organization (WHO), and as researchers at national laboratories.

BSc. Life Sciences III Year (Semester- V)

DSE Options

S. No.	Department	DSE Code	Paper Name
1	Zoology	DSE	Animal Biotechnology

2	Botany	DSE 1 (*)	Cell and Molecular Biology
3	Botany	DSE 2 (*)	Bioinformatics
4	Chemistry	DSE	Chemistry of d-Block elements, Quantum Chemistry & Spectroscopy

(*) Students must opt for any one of the two papers offered

Zoology DSE : Animal Biotechnology

Biotechnology is the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of goods and services.” Although we do not realize, biotechnology is part of our everyday lives. The paper on Animal Biotechnology aims to make students familiar with the latest developments in this area. In this paper students will learn about the Molecular Techniques used in Gene manipulation, about Genetically Modified or transgenic animals- how they are created and their benefits, and also the application of biotechnology in medicine. Apart from this students will also get hands on training during the practical classes where they will learn some of the useful techniques used routinely in biotechnology.

Botany DSE 1 : Bioinformatics

Bioinformatics is an interdisciplinary research area with an interface between the computer science and the biological science. It involves the technology that uses computers for storage, retrieval, manipulation, and distribution of information related to biological macromolecules such as DNA, RNA, and proteins. Bioinformatics consists of two subfields that complement each

other: 1) the development of computational tools and databases and 2) the application of these tools and databases in generating biological knowledge to better understand living systems. The tool development includes writing software for sequence, structural, and functional analysis, as well as constructing and curating biological databases. These tools are used in three areas of genomic and molecular biological research: molecular sequence analysis, molecular structural analysis, and molecular functional analysis.

Bioinformatics has not only become essential for basic genomic and molecular biology research, but is having a major impact on many areas of biotechnology and biomedical sciences. It has applications in various fields such as knowledge-based drug design, forensic DNA analysis, and agricultural biotechnology.

Computational studies of protein–ligand interactions provide a rational basis for the rapid identification of novel leads for synthetic drugs. Protein 3D structure knowledge allows molecules to be designed that are capable of binding to the receptor site of a target protein with great affinity and specificity. In forensics, results from molecular phylogenetic analysis have been accepted as evidence in criminal courts. High speed genomic sequencing coupled with informatics technology allows to quickly sequence a patient's genome and easily detect potential harmful mutations and to engage in early diagnosis and effective treatment of diseases. Bioinformatics tools are also being used in agriculture.. Plant genome databases and gene expression profile analyses play an important role in the development of new crop varieties that have higher productivity and are more resistant to disease.

The students will learn sequence retrieval from databases, sequence alignment, sequence homology, Gene annotation, protein and nucleic acid structure analysis, and phylogenetic analysis. The ultimate goal of bioinformatics is to transform biology from a qualitative science to a quantitative and predictive science. It is a promising, potent and indispensable discipline in the field of sciences.

Botany DSE 2. : Cell and Molecular Biology

Cell and Molecular Biology is an important branch of science that deals with the “entire cell” in a three dimensional way viz. the structural details, the functional details and their regulatory mechanisms. The paper is aimed at imparting an in-depth knowledge of the cell structure by various types of microscopy and imaging techniques, structure and functions of various cell organelles, cell membrane, cell wall structure and transport across membrane. Cell division, a vital property of any living cell, forms an important component of the paper and includes the study of mitosis, meiosis and cell cycle regulation. Storage of genetic information and its ideal transmission to the daughter cells after division is an inherent property of the genetic material. The structure of genetic material DNA and RNA, DNA Replication,

Transcription and Translation are important aspects of the discipline. The mechanism of gene regulation and all levels where regulation can be operated is also one of the component covered in the syllabus. The contents of this paper are designed in such a way that a comprehensive and consolidated information about cell structure and functioning can be imparted to the

students that may equip them to prepare for various competitive examinations at the end of the semester.

Chemistry DSE : Chemistry of d-Block elements, Quantum Chemistry & Spectroscopy

This paper on Chemistry of d-Block elements, Quantum Chemistry & Spectroscopy covers the most important realms of inorganic and physical chemistry. The aim of this paper is to kindle the curiosity and interest of the students in the field of inorganic chemistry and spectroscopic studies and help them to understand the intricacies of the subject. The study of Transition metals and their complexes with variety of ligand systems have played an important role in the field of inorganic chemistry due to their extensive and attractive physicochemical properties. The inorganic part of this paper deals with the study of transition elements, lanthanides and actinides. The various properties of coordination compounds will be explained using the valence bond theory and crystal field theory. The physical part of the paper deals with quantum chemistry, spectroscopy and photochemistry and their importance in chemistry. The student will understand the link between spectroscopy and quantum chemistry. Theoretical treatment of rotational, vibrational and electronic spectroscopy will be covered in this paper.