Research Interests - Faculty of Science for the Years 2022/2024

Research interests – Academic Departments for the Years 2022/2024

Chemistry Department:

1. Complexes chemistry and its applications
2. Electrochemistry
3. Metal corrosion
4. Catalysts and surface chemistry
5. Environmental Chemistry
6. Analytical chemistry, including chromatography, atomic absorption, micro-titration and polarographic analysis
7. The chemistry and technology of polymers, which includes rubber and plastics, the synthesis of new polymers and their properties, as well as the modification and employment of polymers and their applications in materials science and nanotechnology research.
8. Chemistry of hormones as a tool for diagnosing some diseases
9. The chemistry of natural products and carbohydrates
10. Petroleum Chemistry
11. Photochemistry
12. Preparation of dyes and their applications
13. Preparation of heterocyclic compounds and their use in pharmaceutical chemicals, pesticides and dyeing.

14. Preparing new compounds of transition elements and studying their biological applications.
15. Developing new analytical methods and their applications in the fields of water, industry and environmental pollutants.
16. New solid acid catalysts for the preparation of some compounds of biological and environmental importance.
17. Preparation of nano compounds as catalysts and their uses in environmental and industrial fields.
18. Using some elements in nano form to prepare some compounds and study their biological effect.
19. Corrosion study in cement and fertilizer factories, water stations and petroleum companies
20. A study of some silicon reagents in the preparation of organic compounds and their use in pharmaceutical chemistry.
21. Preparation of organometallic compounds using some elements in nano form and their applications in industry.
22. Some selenium compounds are praised and used to treat some tumors.
23. Some dyes and their applications in dyeing nano-sized fibers are constructed.
24. Synthesis of some phthalocyanine compounds and their applications in the field of photodynamic therapy.
25. Preparation of heterocyclic compounds using modern environmentally friendly methods.
26. Preparation of graphene and graphene oxide in nanometer form as catalysts and their use to remove organic and inorganic environmental pollutants.

Matematics Department

- The Biomathematics and Complex Sys.
  1. Modeling some infectious diseases relevant to Egypt e. g. Vian flu.
  2. Studying some topics in evolutionary game theory using integer and fractional order system.
  3. Studying some topics in optimization motivated by biology.
- Classical Mechanics:
  1. Studying classical integrable systems.
  2. Constructing integrable systems in rigid body dynamics.
  3. Studying guidance problems and application in space and satellite mechanics.
- Complex Analysis:
  1. Studying univalent and multivalent functions.
  2. Studying differential subordination and their applications.
- The Probability and Statistics:
  1. Obtaining new forms for the bivariate and multivariate distributions.
  2. Studying some topics in aging notions.
  3. Studying some topics in Stirling numbers and its applications in statistic.
  4. Studying survival analysis.
  5. Studying some combinatorial problems.
- Nonlinear dynamical systems:
  1. Chaos control
  2. Mathematical Modeling
  3. Oscillations
- Topology and Geometry:
  1. Studying some topics in L-fuzzy topological and bitopological spaces.

2. Studying convergence theory in both bitopological and L-fuzzy bitopological spaces.
3. Studying some topics in (bi) topological ordered spaces.
4. Studying some functions of dimensional type in (bi) topological and L-fuzzy (bi) topological spaces.
5. Studying the geometry of manifolds which analysis topics as fifferentible and smooth manifolds, vector fields and forms.
6. Deal with the fundamentals of the theory of Lie groups with emphasis on its connections with differential geometry.
7. Use computer software to plot interesting curves and surfaces and computing things such ac the curvature and torsion of a curve in space.
8. By using this technique described in plotting curves and surfaces, student can understand concepts geometrically.

❖ Quantum Groups and Hopf algebra:

1. Studing the algebraic structure of Quantum Groups from Hopf group G-algebra.
2. Representations of deformed Hopf algebra and Fractal order.
3. Complex Hopf group G-algebra and its induction.

❖ Mechanics & Deformable bodies:

1. Studing the new strucral material.
2. Studing the viscoeluslic corresponding models.
3. Applied bouding & Torsion model to reinforced materials.
4. Mechanical problem of functionly graded elastic and visco elastic material.
5. Different theories of thermal chesses and application to the new materials.

First: Magnetic and Electrical Measurements Group

1. Preparation and characterization of nano-filled polymer
2. Study of Preparation and physical properties of biopolymers and polymers filled with inorganic materials.
3. Preparation, electric, optical and magnetic properties of different polymeric materials.
4. Preparation and studies of thin film of superconductor.
5. Structural and physical properties of some composite materials.
6. Preparation and enhancement of physical properties of filled bio-polymers.
7. Preparation and physical properties of filled biopolymers.
8. Structural studies of organic polymers filed with metal halides.
9. Using density Function Theory For experimental Studies of inorganic materials Filled Some polymers ,
10. Biophysical studies on multiwall carban nanotubes/ polyaprolactione bio composites

Second: Theoretical Physics Group

1. Time dependent radiative transfer through thin films.
2. Determination columnar aerosol size distribution by inversion of spectral aerosol optical depth measurements over Egypt.
3. Comparative study on different models for estimation of direct normal irradiance.
4. Polarized radiation transfer in random media.
5. Nonlinear fluid flows in pipe-like domain.
6. Nonlinear Boltzmann equation in physics.

7. A study of possible improvements to nonlinear equations used to describe dusty plasma.
8. Optical and scattering properties of cigarette smoke particles.
9. Solution and application of some nonlinear evolution equations.
10. Solution of some non-linear physical problems.
11. Band structure calculations for semiconductor nanostructure materials.

Third: Polymer Physics Group

1. Optical and electrical properties of dye- doped polymers
2. Parameters Affecting the TSDC of naylons
3. Irradiation induced Changes in the Electrical Properties of Dosimetric Materials

Fourth: Light Physics Group

1. Spectral dispersion curves of polymeric birefringent textile fibers.
2. Opto-Thermo-Mechanical Devices Designed for Fibers Characterization Interferometrically; I-Opto-Thermal Behavior of PE Fibers.
3. Determining the intrinsic birefringence of polymer fibers.
4. Determination of the radial structural properties and spectral dispersion curves of PEEK fibers.
5. Interferometric study of creep Deformation and some structure parameter properties for PP Fibers for various temperatures.
6. Studies on Optical Properties of Fibres by Automatic Fringe Analysis of their Microinterferograms.

Fifth: Nuclear Physics and Radiation Group

1. The research work in the laboratory includes:
    - Nuclear and Natural Radioactivity Measurements:

- Determination of the natural radioactivity concentrations in the surrounding environment and the establishment of a baseline map of the background radioactivity.
- Determination of uranium (238U), thorium (232Th) and Radon concentrations in Environmental Samples (rocks, sands, air & water).
- Contribute to the Research concerned with making Database & Atlas of the natural Radioactivity in the Region of interest.
- Determination of the rare elements precisely by Neutron Activation Analysis employing research reactors NAA.
- Utilizing nuclear and radiation techniques in the paleontological and archeological investigation research and age dating achieved.
- Study and measuring of the effect of gamma & ultraviolet radiations on some plants and living cells.
- Theoretical evaluation of radiotherapy plans for tumor patients and minimizing & optimizing the radiation doses used in CT or NMR picturing.

2. High Energy Physics:
    - Analysis of the events due to p-p interactions at very high energy (13 TeV) produced from the LHC & measured by the CMS at CERN in Geneva.
3. Joint project:
    - Studying and monitoring environmental radioactivity and naturally occurring radioactivity materials (NORM) and achieving the strategic regions such as mines for prospecting for nuclear materials, gold and mineral mines, phosphate mines, economic lakes.

- Starting to establish atlas of environmental radioactivity for the most important regions in Egypt, through an international-project cooperation with the joint institute for nuclear research (JINR), Russia -Federation and institute of nuclear research, RATEN-ICN, Romania, which contributes to solutions to energy problems and the peaceful uses of nuclear materials.
- Also, we are interested in the field of radiation protection by measuring radiation dosimetry, which helps to create radiation protection protocols to protect the public, workers, and professionals from radiological hazards.
- The group is also interested in the detection of rare elements and the identification and estimation of elements with high accuracy within the samples by non-destructive methods for samples through reactor epithermal neutron activation analysis.

4. The following techniques are present & used in the laboratory:
   - Active Technique, using a low level counting gamma ray spectrometers, NaI(Tl) [3" x 3" and 2" x 2"] and also well type scintillation, 4048 & 8096 MCA, data acquisition systems.
   - Passive Technique, including cup & alpha-auto radioactivity using solid state nuclear track detectors SSNTD (CR-39 & LR-115).
   - Secondary Ion Mass Spectrometer (SIMS). Atomic Force Microscope.

Sixth: Metal Physics Group

1. Study the structure and physical properties of
   a. Shielding blocks alloys
   b. Fusible alloys
   c. Dental Materials

2. Study the structure and physical properties of
    a. Fracture Mechanics
    b. Fractography

Seventh: Glass Physics Group

1. Preparation of different types of semiconductor glass, physical properties and how to use it
2. Study of the physical properties of fast ion conduction glass
3. Effect of denaturation factors on the composition and properties of some types of bioactive glass

Eighth: Bio-Advanced Materials Physics Group

1. Research plan in the Bio-Advanced Materials Physics Laboratory:
2. Preparation and study of some physical properties of biomaterials made of natural polymers that do not affect human health.
3. Preparation of Rome bio-materials and studying their physical properties.
4.
5. Preparation and study of acrylic chitosan and its physical properties

Ninth: Computer Physics Group

1. Study the composition and distribution of clusters during the nomination with the preparation of physics simulation programs for postgraduate studies

Tenth: Frequency measurements grou:

1. Applied research in the field of new and renewable energy
2. Applied research in the field of oncology with ferromagnetic nanoparticles
3. Development of biomaterials for biomedical applications
4. Locally produced cheap solar cells

Zoology Department

The use of some extracted natural products for the prevention and treatment of the effects of environmental pollution in the various vital systems and is characterized by the following-:

- ❖ Estimation of the impact of environmental pollution on the incidence of various modern diseases, as well as its impact on the immune system.
- ❖ Diagnosis and treatment of some diseases resulting from pollution.
- ❖ The use of medicinal plant extracts in the prevention or treatment of some diseases caused by pollution
- ❖ Using natural or extracted antioxidants in different ways to reduce diseases caused by biological contamination (viruses, bacteria, parasites) and prevent through abnormal division and the possibility of treatment.
- ❖ This is in addition to researching the role of stem cells to solve some health problems that serve public health.
- ▪ Researching the role of NATO particles in reducing the most common diseases such as cancer, as a modern technology in the field of treatment, hoping to reach results that serve the medical field for some diseases.

Geology Depertment

1. Geological and geophysical studies on the areas of the Red Sea coast.

2. Studies in the Eastern Desert, the Gulf of Suez, the Western Desert and the North Coast.

3. Studies in South and North Sinai, the Nile Valley and the Delta.

4. Studies on some geoarchaeological explorations in different regions of Egypt and a geological study of the Arab and African world.

First Axis: Energy, Water and Land

1. Rationing fresh water use in agriculture.
2. Use of saline & polluted water in irrigation.
3. Cultivation in dry, saline & polluted lands
4. Potentialities of microalgae in the blue economy applications
5. Biodiesel and biogas production by algal bioremediation of sewage & wastes
6. Using plants in biological treatment of wastewater.
7. Biomonitoring of wastewater quality.

Second axis: Medicine and Health

1. Studies on the effect of zinc oxide nanoparticles on multi drug- resistant bacteria
2. Development of algal biopolymer composites in preparing microspheres for controlled drug delivery processes.
3. Studying green synthesis of some metal nanoparticles using algae extracts and their antimicrobial and anticancer potentiality.
4. Effect of stress on medicinal efficacy of plants
5. Biological control of pathogenic fungi
6. Pathogenic bacteria and its control
7. Biological activities of endophytic fungi isolated from some medicinal plants.
8. Physiological effects of higher elements and nano particles on medicinal-oil containing plants
9. Medicinal uses of some medicinal plants.
10. Uses of pollen grains in the field of medicine.
11. Cytogenetical and Molecular Studies on some medicinal Plants in Egypt.

12. Mechanisms of antibiotic resistance in Multidrug Resistant Bacteria like MERSA
13. Bacterial anticancer compounds
14. Evaluation of medicinal values of wild plants.

Third axis: Agriculture and Food

1. Screening national crop cultivars for stress tolerance
2. Food insurance with strategic crops
3. Maximizing plant medicinal efficacy
4. Genetics characterization of some cultivated taxa and their wild relatives
5. Effect of biofertilizers on plant growth and metabolism
6. Preparation of algal biopolymeric formulations used in water retention and multi-responsive controlled release of agrochemicals.
7. Usage of wastewater for producing microalgal biomass to be used in biofertilizers, soil amendments, biofuels, extraction of antioxidants, natural colorants and food supplements.
8. Microalgae biomass for commercial production of biofertilizers
9. Molecular and physiological traits for increase tolerance in stressed crop plants
10. Actinobacteria as biofertilizers
11. Response of stressed rice (*Oryza sativa*) plants to cobalt treatment.
12. Evaluation of the biocontrol potential of endophytic fungi against fusarium wilt diseases
13. Biological control of plant pathogenic fungi
14. Production of single-cell protein from cyanobacteria by recycling of beet sugar industry wastes.
15. Biological control of plant pathogens.
16. Molecular and genetic enhancements of bacterial biopesticides.
17. Evaluation of food and fodder values of wild plants.

18. Plant growth, metabolism and adaptation in relation to biotic and abiotic stresses.

Fourth Axis: Environmental Protection and Human Resources

1. Sustainable development of the mangrove ecosystem on the Red Sea coast
2. Vegetation Analysis of Coastal and Inland Areas in Egypt
3. Taxonomical and ecological studies on some wild plants in Egypt
4. Spatial distribution and conservation of endemic and rare plant species.
5. Phycoremediation of environmental pollutants.
6. Population and cytogenetics on some wild desert plants in Egypt.
7. Molecular and ultra- structural aspects of some wild plants used for phytoremediation in polluted areas in Egypt.
8. Microbial sand dunes fixation.
9. Bacterial biodegradability of hydrocarbon pollutants.
10. Bacterial production of Biodegradable plastics.
11. Bioremediation of pollutants (eg. heavy metals).
12. Using plants in biological treatment of wastewater.
13. Biomonitoring of wastewater quality.

Fifth Axis: community and Human Resource Developments

Sixth Axis: Economics and Law

Seventh Axis: Life Sciences and Biotechnology

1. Plant microbes interaction
2. Algal biopolymers biotechnology.
3. Isolation and Characterization of Mycoviruses
4. Ecological studies on some wild plants.

5. Taxonomical studies on wild and cultivated plants using different taxonomic tools: macromorphological characters: (stem, leaves, inflorescences, flowers, and fruits).
6. Stem and leaf anatomy, trichomes, Lamina epidermal characteristics by using LM and SEM, leaf architecture, stomatography, Palynological criteria, Molecular characterization, Delimitation of the studied taxa by using numerical analysis.
7. Biological activities of fungal endophytes.
8. Radiation influences on algae cell structure, growth and metabolism.
9. Biotechnological applications of bacteria.
10. Viral identification and applications.
11. Biotechnological applications of some plant enzymes.
12. Biotechnological application of fungi.
13. Biotechnological applications of endophytic fungi
14. Physiological Responses of Salinity-stressed rice plants to Humic acid.
15. Heavy metal: Biological Importance and Detoxification Strategies.
16. Bacterial biodegradable plastics.
17. Application of microbial biotechnology
18. Biotechnological studies on plants, algae, bacteria and fungi.
19. Cytogenetical and molecular studies on some wild plants from different accessions in Egypt.
20. Genetic diversity assessment of some wild plant species in Egypt.
21. Genomics, proteomics, transcriptomics and metabolomics of some bacterial species.
22. Cytogenetical and molecular studies on some wild plants.
23. Genetic characterization and relationships among wild and cultivated plants.
24. Physiological studies of plants (growth and metabolism)
25. Ecological studies on plants at different sites

26. Studies on natural products of plants, bacteria, and algae
27. Biotechnology and material science in cells, tissues, organs and whole bodies

Eighth Axis: technological applications and future sciences

1. Material sciences and technological applications with respect to future perspectives.

Ninth Axis: industry

Tenth Axis: Science and Engineering of Materials and their Nanotechnology Applications

1. Biologically- synthesized nanoparticles & their impact on plant growth & development
2. Biosynthesis of nano-fertilizers using algal extracts.
3. Effects of application of nanofertilizers on plant growth and productivity
4. Application of nanotechnology to uses of seaweeds.
5. Comparative effects of chemically and biologically synthesized silver nanoparticles on growth of Jatropha (*Jatropha curcas*) plant.
6. Assessment of cyto-genotoxicity of some nanoparticles application on plants using chromosome aberrations assays.
7. Bio-production; characterisation and applications of nanoparticles.
8. Assessment of cytotoxicity and genotoxicity of nanoparticles on a model test plants.
9. Impact of nanoparticles on mitigation of heavy metal stress.
10. Ecofriendly Synthesis of nanoparticles using and evaluation of their application in different fields.
11. Agriculture Nanobiotechnology : Nanofertilizers , nano pesticides and nanoherbicides

12. Nano drug delivery systems for control of diseases in medicine, and agriculture