



## DEPARTMENT OF APPLIED SCIENCES

HIGHER COLLEGE OF TECHNOLOGY

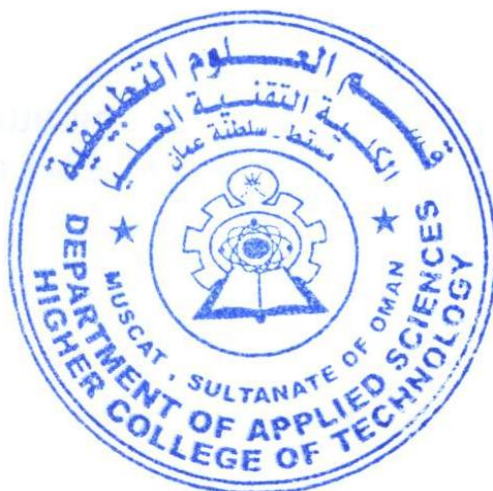
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# ENVIRONMENTAL SCIENCES SECTION

## Course Booklet



# Academic Year 2015-2016

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# Environmental Sciences Program Objectives and Outcomes

## Diploma Year I

**Duration:** 1 year full time

**Credit Hours :** 34

**Goals:** This program is designed to:

- Produce semi-skilled trainee with the basic scientific knowledge and skills and who are practically trained in one aspect of the applied sciences taking into account their own skills and tendencies and the market demand.

**Program Objectives:** The certificate program is committed to the following objectives:

- introduces the students to general foundation in scientific knowledge and practical skills
- provides the students with a practical training taking into account his / her own skills and tendencies and the market demand
- introduces to the students the basic knowledge in supporting skills such as English and Computing and keeping a work log book
- develops in the student the ability to work as an individual and in a team and the personal qualities and attitudes essential to his / her career
- helps the students understand the job search technique
- develops in the student the desire for long life learning
- promote the spirit of entrepreneurship among students

**Program Outcomes:** Graduates of the certificate level will be able to:

- apply his / her basic scientific knowledge and skills to solve minor and general problems
- undertake a work-based assignment in the aspect of his / her training
- keep a work log book to record the details of the job conducted as regards to method, instrument observation and dates of communicating and finishing the job
- observe the professional responsibility
- communicate through the English medium orally and in writing
- use available information sources
- evaluate resources and strategies which may be used in a job search
- continue long life learning
- Identify strategies and challenges involved in running a business and demonstrate entrepreneurship skills.

## Diploma Year 2

**Duration:** 2 years full time

**Credit Hours :** 70

**Goals :** This program is designed to achieve the following educational goals:

- Provides nationally - recognized qualifications in environmental science.
- Provide broad-based education that is geared towards the application of Science concepts and principles in the understanding of environmental issues.
- Produce technicians that match the requirements of a wide range of employers.

**Program Objectives:** The Diploma in Environmental Science is committed to:

- provide studies / courses in science, which are relevant to the changing need of employees and employers in science employment
- focus on the development and practical application of knowledge and skills needed by environmental science technicians in their place of work
- provide the opportunity to specialize in environmental science
- provide studies in laboratory safety, organization and management
- develop a range of skills and techniques, personal qualities and attitudes essential for career development in science-oriented employment
- develop the ability to function as an individual and as a member of a team
- develop the skill needed for the use of IT and for effective communication and cooperation with employers, colleagues and the community
- provide a strong base or core of study which is directed towards employment, professional or academic advancement in graduate and postgraduate studies
- promote the spirit of entrepreneurship among students

**Program Outcomes:** Graduates of Diploma in Environmental Science will be able to:

- apply scientific knowledge and technical skills that are needed in environmental science laboratories and field studies
- assist in the performance of experiments and scientific laboratory tests
- conduct experiments and scientific laboratory tests
- identify the sources of hazards and their environmental impact
- follow and maintain safety rules and standard operating procedures in the laboratory
- organize and manage environmental laboratory in terms of finance, storekeeping, administration and maintenance
- communicate and relate with people from a range of background

- write quality reports
- appraise professional and ethical responsibilities related to his / her profession
- Identify strategies and challenges involved in running a business and demonstrate entrepreneurship skills.

## **Advanced Diploma**

**Duration: 3 years full time**

**Credit Hours: 106**

**Goals:** This program is designed to achieve the following educational goals:

- Provides nationally - recognized qualifications in environmental science.
- Provide integrated education that focuses on the application of science to the understanding of environmental issues.
- Produce competent, professional and practicing environmental technologists who are capable of giving practical, economically viable, socially acceptable and scientific solutions to environmental problems and issues.
- Produce graduates that match the requirements of a wide range of employers.

**Program Objectives:** The Higher diploma in Environmental Science is designed to:

- provide the students with understandings and practical competencies in the major areas of environmental science
- provide the opportunity to gain expertise in one or more branches of environmental science and develop inter-disciplinary knowledge and skills
- provide studies or courses that deals with the human impact on the environment
- develop the knowledge and skills needed in environmental impact assessment, waste management, environmental data gathering and in conducting scientific researches
- develop the skill needed for the use of IT and for effective communication and cooperation with employers, colleagues and community
- provide the scientific, social, ethical, economical and legal dimensions of the practice of environmental science
- provide a strong base or core of study which is directed towards employment, professional or academic advancement in graduate and post-graduate studies
- promote the spirit of entrepreneurship among students

**Program Outcomes:** Graduates with Higher Diploma in Environmental Science will be able to:

- apply the relevant and current knowledge and skills gained with flexibility and innovation to the practice of the profession in the workplace

- work as environmental and rehabilitation officer in rural, mining or petroleum industries
- contribute to the monitoring and management of processes and activities that affect the environment
- identify the sources of pollutants and their environmental impacts and suggest control mechanisms for them
- communicate, relate and cooperate with people from a range of background and expertise
- communicate through writing and presentation
- apply the scientific, social and ethical dimensions of the practice of environmental science
- Identify strategies and challenges involved in running a business and demonstrate entrepreneurship skills.

## **B. Tech.**

**Duration: 4 years full time**

**Credit Hours : 142**

**Goals:** This program is designed to achieve the following educational goals:

- Provides nationally and internationally-recognized qualifications in environmental science
- Provide integrated education that focuses on the application of science to the understanding of environmental issues
- Produce competent, professional and practicing environmental technologists who are capable of giving practical, economically viable, socially acceptable and scientific solutions to environmental problems and issues
- Produce graduates that match the requirements of a wide range of local and international employers

**Program Objectives:** The Bachelor Degree in Environmental Science is designed to:

- provide students with understandings and practical competencies in the major areas of environmental science
- provide the student with the opportunity to gain expertise in one or more branches of environmental science and develop inter-disciplinary knowledge and skills
- provide studies or courses that deals with human impact on the environment

- develop in the student the ability to monitor and manage processes and activities that affect the environment
- develop the skills needed for the use of IT and for effective communication and cooperation with employers, colleagues and the community
- provide the student with scientific, social, ethical, economical and legal dimensions of the practice of environmental science
- provide a strong base or core of study which is directed towards employment, professional or academic advancement in graduate and post-graduate studies
- promote the spirit of entrepreneurship among students

**Program Outcomes:** Graduates with Bachelor Degree in Environmental Science will be able to:

- apply the relevant and current knowledge and skills gained with flexibility and innovation to the practice of the profession in the workplace
- do quality and effective researches, suggest solutions to environmental problems and issues, and make decisions that are anchored on critical thinking and analysis
- work as environmental and rehabilitation officer in rural and mining or petroleum industries
- work as environmental consultant in private and government enterprises
- contribute to monitoring and management of processes and activities that affect the environment
- identify the sources of pollutants and their environmental impacts and suggest control mechanisms for them
- have the initiatives and ability to communicate and cooperate with people from a range of background and expertise
- communicate through writing and presentation
- appraise the ethical responsibilities of the practice of environmental science
- Identify strategies and challenges involved in running a business and demonstrate entrepreneurship skills.



## Degree Audit (Environmental Sciences)

### Diploma Year I

Course Code	Course Title	Pre-Requisites	Co-Requisites	Passing Grade	Credit Hours	Theory Hours	Practical Hours	Contact Hours	Semester
MATH 1102	PURE MATH	FP MT0101	–	Pass/fail	0	3	0	3	<b>O N E</b>
ENTW 1100	TECHNICAL WRITING – I	FP Level 4	–	D	3	2	2	4	
ITAD 1100	Advanced IT Skills	FPIT0001	–	D	3	0	6	6	
BIOL 1100	FUNDAMENTALS OF BIOLOGY	–	–	C-	4	3	2	5	
CHEM 1102	FUNDAMENTALS OF CHEMISTRY	–	–	C-	3	2	2	4	
<b>Total</b>					13	10	12	22	

ENTW 1200	TECHNICAL WRITING II	ENTW1100	–	D	3	2	2	4	<b>T W O</b>
ENVS 1200	FUNDAMENTALS OF ENVIRONMENTAL SCIENCES	–	–	C-	3	2	2	4	
PHYS 1201	PHYSICS	MATH1102	–	C-	3	2	2	4	
LABT 1201	LABORATORY TECHNIQUES	–	BIOL 1100 & CHEM 1102	C-	3	0	6	6	
CHEM 1202	CHEMISTRY I	CHEM1102	–	C-	3	2	2	4	
<b>Total</b>					15	8	14	22	
BAMG 2111	ENTREPRENEURSHIP	ENTW 1200	–	D	3	2	2	4	<b>S U M M E R</b>
SLOM 1301	SLOM		–	C-	3	2	2	4	
<b>Total</b>					6	4	4	8	

Credits	Theory	Practical	Total	Ratio
34	22	30	52	42% : 58%

## Diploma Year II

Course Code	Course Title	Pre- Requisites	Co- Requisites	Passing Grade	Credit Hours	Theory Hours	Practical Hours	Contact Hours	Semester
ENGL 2100	TECHNICAL COMMUNICATION	ENTW1200	–	D	3	3	0	3	<b>O N E</b>
CHEM 2104	GENERAL ORGANIC CHEMISTRY	CHEM1102	–	C-	3	2	2	4	
ENVS2101	PRINCIPLES OF ENVIRONMENTAL SCIENCES	ENVS 1200	–	C	3	2	2	4	
BIOL2203	MICROBIOLOGY	BIOL 1100	–	C	3	2	2	4	
ENVS 2102	FIELD STUDY AND LABORATORY TECHNIQUES IN ENVIRONMENTAL SCIENCES	LABT 1201	–	C	3	0	6	6	
<b>Total</b>					15	9	12	21	

CHEM 2201	ANALYTICAL CHEMISTRY I	CHEM1202	–	C-	3	0	6	6	<b>T W O</b>
ENVS 2201	INTRODUCTION TO ENVIRONMENTAL POLICY AND IMPLEMENTATION	ENVS 2101		C	3	2	2	4	
ENVS2202	POLLUTION SOURCES AND CONTROL 1	ENVS 2101		C	3	2	2	4	
IRSE2105	INTRO TO RENEWABLE ENERGY	PHYS1201	–	C-	3	2	2	4	
ENVS2204	PROJECT I A	LABT 1201, ENVS 2101	ENVS 2102	C	3	0	6	6	
<b>Total</b>					15	6	18	24	
PHIL 3108	BUSINESS ETHICS	–	–	D	3	3	0	3	<b>S U M M E R</b>
ENVS2301	PROJECT I B	ENVS 2204	–	C	3	0	6	6	
<b>Total</b>					6	3	6	9	

Credits	Theory	Practical	Total	Ratio
36	18	36	54	33% : 67%

## Advanced Diploma

Course Code	Course Title	Pre-Requisites	Co-Requisites	Passing Grade	Credit Hours	Theory Hours	Practical Hours	Contact Hours	Semester
STAT 3120	STATISTICS & IT	ITAD 1100	-	C-	3	2	2	4	<b>O N E</b>
ENVS3101	BIODIVERSITY AND NATURE CONSERVATION	ENVS 2101	-	C	3	2	2	4	
ENVS3102	ENVIRONMENTAL TOXICOLOGY	ENVS 2101	-	C	3	2	2	4	
ENVS 3103	HAZARDOUS WASTE MANAGEMENT	ENVS 2202	-	C	3	2	2	4	
ENVS3104	CHEMISTRY OF THE ENVIRONMENT	CHEM 2104 CHEM 2201	-	C	3	2	2	4	
<b>Total</b>					15	10	10	20	

ENGL 3100	PUBLIC SPEAKING	ENTW1200	-	D	3	2	2	4	<b>T W O</b>
PHIL 3201	FORMAL ARABIC COMMUNICATION	-	-	D	3	3	0	3	
ENVS3201	ENVIRONMENTAL IMPACT ASSESSMENT AND COMPLIANCE INSPECTION	ENVS 3103	-	C	3	2	2	4	
XXXX	SPECIALIZATION ELECTIVE *	-	-	C	3	2	2	4	
ENVS3203	FRESHWATER ECOLOGY	ENVS 2101	-	C	3	2	2	4	
<b>Total</b>					15	11	8	19	
ENVS3301	EARTH SCIENCE	-	-	C	3	2	2	4	<b>S U M M E R</b>
QAQC3200	QUALITY ASSURANCE AND QUALITY CONTROL	-	-	C-	3	2	2	4	
<b>Total</b>					6	4	4	8	

\*ENVS3202 ECOTOURISM MANAGEMENT

Credits	Theory	Practical	Total	Ratio
36	25	22	47	53% : 47%

## B. Tech

Course Code	Course Title	Pre-Requisites	Co-Requisites	Passing Grade	Credit Hours	Theory Hours	Practical Hours	Contact Hours	Semester
PHIL 4101	OMAN CIVILIZATION	-	-	D	2	2	0	2	<b>O N E</b>
XXX	SPECIALIZATION ELECTIVE*	-	-	C	3	2	2	4	
ENVS4101	MARINE ECOLOGY AND COASTAL RESTORATION	ENVS 2101	-	C	3	2	2	4	
ENVS4103	WASTE WATER MANAGEMENT	ENVS 3104	-	C	3	2	2	4	
ENVS 4104	POLLUTION SOURCES AND CONTROL II	ENVS 2202	-	C	3	2	2	4	
<b>Total</b>					14	10	8	18	

ENVS 4201	ENVIRONMENTAL MONITORING SYSTEMS AND DATA ANALYSIS	ENVS 3102	-	C	3	3	0	3	<b>T W O</b>
ENVS 4202	GIS AND REMOTE SENSING	-	-	C	3	2	2	4	
ENVS 4203	DISASTER MANAGEMENT	-	-	C	3	2	2	4	
ENVS 4204	ENVIRONMENTAL ADVOCACY AND AWARENESS	ENVS 2201	-	C	3	3	0	3	
ENVS 4205	PROJECT IIA	ENVS 2301	-	C	3	0	6	6	
<b>Total</b>					15	10	10	20	
ENVS 4301	PROJECT II B	ENVS 4205	-	C	3	0	6	6	<b>S U M M E R</b>
XXX	DEPARTMENTAL ELECTIVE**		-	C-	3	2	2	4	
<b>Total</b>					6	2	8	10	

\*ENVS4102 BIOSAFETY

\*\*CHEMISTRY FOR LIFE, PHYSICS FOR LIFE, NUTRITION

Credits	Theory	Practical	Total	Ratio
35	22	26	48	46% : 54%

# DIPLOMA YEAR I COURSES

MATH1102	PURE MATH
Course Description	<p>This course is a first year mathematics course for the students in Engineering Technology, Information Technology and Applied Science programs. The Foundation Mathematics remains as a pre-requisite course for this. It provides the students with a background of mathematical skills essential for progression to the study of Calculus and further Engineering Mathematics.</p>
Course Objectives and Outcomes	<p><b>Course Objectives:</b> The course bridges the gap in mathematical skills between secondary school and Higher Education. Prepares students who are going for engineering, science, and technology oriented specializations to learn and solve mathematical problems in English. Enables students to meet the prescribed learning outcomes. Prepares students to acquire necessary knowledge and skills for further studies in their specializations.</p> <p><b>Learning Outcomes:</b> The students should be able to: Demonstrate understanding of the definition of a function and its graph. Describe polynomial functions. Define and manipulate exponential and logarithmic functions and solve. Problems arising from real life applications. Understand the inverse relationship between exponents and logarithms functions and use this relationship to solve related problems. Describe analytically the trigonometric functions and their inverses. Demonstrate an understanding of trigonometric identities. Use the law of sines and cosines to solve a triangle and real life problems. Use appropriate software to interpret equations and graphs. Identify special notation and formulas for representing and generating sequences and series. Know the conic sections and understand in particular the parabola, ellipse and hyperbola and construct their standard equations.</p>
Course Technical Skills	<p>Graphing utility is used to refer to any of the various graphing calculators or computer software packages that might be available for students using this course. The graphing utility, graphs different functions directly which is the bypass of the creation of table values using calculator to draw the graphs. The use of graphing utility is optional within this course.</p>
Course Content	<p>This course is the extension of basic mathematics of the foundation program. This course includes functions and their graphs with different operations on them, introduction of trigonometry, sequences and series and some topics of analytic geometry also. This course covers functions and its properties, combining functions, composite functions and their properties, inverse functions, polynomial functions, exponential and logarithmic functions. In Trigonometry, graphs of basics of trigonometry functions, law of sines and law of cosines are covered. The topics of analytic geometry are Parabolas, Ellipse and Hyperbolas with their standard geometrical and analytical definitions.</p>

ENTW1100	TECHNICAL WRITING - I
Course Description	<p>The course equips the students to analyze an essay and break it down into its structural parts. Plan and draft a paragraph. Evaluate purpose and audience. Develop organizational skills in writing. Monitor, check and revise one's own work or that of other course participants, giving feedback. Support controlling idea in the thesis statement with explanation, facts and examples. Convey a specific attitude about a topic. Write well-organized essays and paragraphs of exposition and comparison and contrast showing evidence of significant planning.</p>
Course Objectives and Outcomes /	<p>Course Objectives:  This course will teach basic academic writing skills to enable students to communicate effectively and clearly. Students will learn to analyze required readings and discover ideas that they can use for writing essays. Students will also learn research skills for writing assignments and projects by practicing the methods of literature review, data collection and analysis, and results reporting. Emphasis will be placed on critical thinking skills. Students will learn skills of presentation using technology such as computers, LCD and Smart board.</p> <p>Learning Outcomes:  The students should be able to:  Analyze an essay and break it down into its structural parts.; Plan and draft a paragraph; Evaluate purpose and audience; Develop organizational skills in writing; Monitor, check and revise one's own work or that of other course participants, giving feedback; Support controlling idea in the thesis statement with explanation, facts and examples; Convey a specific attitude about a topic; Write well-organized essays and paragraphs of exposition and comparison and contrast showing evidence of significant planning; Use clear purpose to compare/contrast and express a specific attitude about the items being analyzed;</p> <p>Express ideas using significant and insightful points which support the thesis; Describe place and object; Write one research question for a given topic; Read at least two printed and electronic resources critically as part of literature review to use others' information and ideas in one's own report; Document precisely the information and ideas; Design a questionnaire and collect data and information from secondary sources such as printed materials and electronic devices for assignment; Analyze the data collected by questionnaire using charts and tables; Interpret the analyzed data in order to provide explanation for the phenomenon investigated in the research; Deliver a presentation on the assignment topic using LCD.</p>

Course Technical Skills	This course will enable students to develop technical skills in writing be able to come up with a writing output that is well organized and idea conveyed are expressed and written clearly.
Course Content	<ul style="list-style-type: none"><li>• Introduction to the Course: issuing Course Book, explaining Course Outline</li><li>• Incorporating Information Taken from Sources</li><li>• Referencing</li><li>• Basic Mathematics Vocabulary</li><li>• Compare and Contrast Essays</li><li>• Using Charts and Tables</li><li>• Basic Computer Vocabulary</li><li>• Descriptive Essays</li></ul>

ITAD1100	ADVANCED IT SKILLS
Course Description	<p>This course introduces the fundamentals of applications programs, using the Microsoft Office suite as a typical example. Differentiate the categories of software: operating system (including communications software and user interface) and Applications software (pre-packaged, or Custom-built). Make use of "keystroke" and "mouse" movements to perform fundamental exercises in all two applications within the suite. Demonstrate the ability to navigate and utilize the hypertext "help" system as a troubleshooting tool. Demonstrate the common commands and functions of Word and Excel in a variety of applications. Demonstrate the common commands and functions of Access and PowerPoint in a variety of applications.</p>
Course Objectives and Outcomes	<p>Course Objectives:  The course builds on the skills acquired in the IT foundation course to train students on important computer tools and software applications such as desktop publishing, web applications, advanced spread sheets, and databases. Throughout the semester, students have been actively utilizing the e-learning infrastructure of the college.</p> <p>Learning Outcomes:  The students should be able to:  Demonstrate their ability to use the e-learning portal; Design publications using a publishing software and design tools; Develop web applications using a web development software; Use advanced functions in spread sheet; and Develop databases.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Prepare Newsletters &amp; Brochures</li> <li>• Develop websites through Web Expression</li> <li>• Perform advanced functions using Spread sheets</li> <li>• Design Queries, Forms and Reports using MS-Access</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• E-Learning</li> <li>• Desktop Publishing</li> <li>• Web Applications</li> <li>• Advanced Spreadsheets</li> <li>• Databases</li> </ul>



BIOL1100	FUNDAMENTALS OF BIOLOGY
Course Description	<p>It introduces the students to a general understanding of basic principles of biology particularly the organization of life at cellular level. It contains: The general characteristics of living things; diversity of life; Structure and functions of cells; Tissues; movement of substances in and out of cells; Nutrition and digestion; Respiration; Excretion and osmoregulation; Communication and coordination; Cellular reproduction; mitosis and meiosis; Reproduction and outline of genetics.</p>
Course Objectives and Outcomes	<p>Course Objectives:  The course should enable the students to:  Recognize the characteristics of living things. Understand the diversity of life. Identify the major classification levels for living organisms. Identify the organelles of the cell. Determine the structure, location and function of plant and animal tissues. Identify the five main processes by which substances get in and out of cells. Recognize the transport tissues in plants and animals. Identify the six classes of nutrients required in a human's diet. Understand the physical and chemical digestion. Understand the process of respiration in living organisms. Identify the components of the mammal's excretory system. Recognize the nervous system in mammals and identify the divisions of the brain. Identify the endocrine system in mammals. Understand mitosis and meiosis cell divisions. Identify the mammalian reproductive systems. Understand the basics of genetics.</p> <p>Learning Outcomes:  The students should be able to:  Differentiate between living and non-living things. Classify organisms to kingdoms of life. Differentiate between an animal cell and a plant cell. Recognize the different tissues in plants and animals and differentiate between them. Relate the structures of plant and animal tissues to their ultimate functions. Explain the processes of diffusion, osmosis, active transport, phagocytosis and pinocytosis and give examples. Construct conclusions based on the results of diffusion and osmosis experiments. Explain how food and water is transported in plants. Show a complete understanding of the blood flow in mammals. Explain in details how food is digested in the digestive system. Compare between aerobic and anaerobic respiration. Explain the mechanism of excretion in the kidneys. Explain how the different parts of organism's body are communicating and coordinating with each other. Understand the endocrine and nervous systems. Apply how fast the reflex response to a stimulus in relation to time is and explain the importance of reflex actions in our daily life. Explain the importance of cell division and it's relation to growth. Differentiate between sexual and asexual reproduction. Explain in details the male and female reproductive systems. Show an understanding of Mendelian genetics. Construct genetics crossings between organisms to show their effects on traits.</p>

<p>Course Technical Skills</p>	<ul style="list-style-type: none"> <li>• Safety in the lab in general</li> <li>• Identification of different parts of the microscope setting up a microscope for its proper use.</li> <li>• Follow biological rules in drawing any cell or structure.</li> <li>• Draw and list characteristic features of the five kingdoms.</li> <li>• Identifying different parts of animal and plant cells using the microscope.</li> <li>• Study the plant stems and differentiates between dicot and monocot stems.</li> <li>• Study different types of animal tissues.</li> <li>• Understand the process of osmosis in plants cells.</li> </ul>
<p>Course Content</p>	<ul style="list-style-type: none"> <li>• Characteristics of Living things</li> <li>• Diversity of life</li> <li>• Cell structure and function</li> <li>• Transport</li> <li>• Nutrition and digestion</li> <li>• Respiration</li> <li>• Excretion and osmoregulation</li> </ul>

CHEM1100	FUNDAMENTALS OF CHEMISTRY
Course Description	<p>It is the first course in chemistry that introduces the basic concepts of chemistry and explains the basic scientific principles concerning the states of matter, separation techniques, the atom, the mole as well as the atomic theory and redox reactions. It also states and applies the laws of electrolysis. Practical work forms an integral part of this course.</p>
Course Objectives and Outcomes	<p><b>Course Objectives:</b>  The course should enable the student to:  Understand the basic scientific principles concerning the states of matter and separation techniques. Describe the structure of an atom and understand the concept of the mole. Gain familiarity with concepts of measurements and significant figures. Convert names of compounds into formulae and represent chemical reaction using formulae and balanced equations. Learn methods of expressing concentration. Name organic compounds with different functional groups and describe the properties of saturated and unsaturated hydrocarbons and identify the type of isomerism in organic compounds. Study the sources and extraction of organic compounds and the fractional distillation of petroleum. Compare the properties and reactions of acids and bases and describe methods of preparing soluble and insoluble salts. Understand about the redox reactions of acids and bases and describe methods of preparing soluble and insoluble salts. State and apply the laws of electrolysis. Gain hands-on exposure to some of the above by practical work.</p> <p><b>Learning Outcomes:</b>  At the end of this course, the students should be able to:  Distinguish between gases, liquids and solids at the molecular level. Apply the idea of particles to explain the changes in the states of matter. Describe the particles in an atom. Describe early experimental evidence for the existence of the electron and the nucleus. Describe the simple structure of the atom using the s, p, d and f notations. Use the concept of significant figures. Translate names of compounds into formulae. Represent chemical reaction using formulae and balanced equations. Determine and distinguish between empirical formulae and molecular formulae. Use chemical equations to calculate amount of reactant consumed or product formed in a chemical reaction. Explain the mole concept and apply it in chemical calculations. Express concentrations of solutions by different methods. Explain the differences between organic and inorganic compounds. Explain fractional distillation of petroleum. Name organic compounds with different functional groups. Write some reactions of hydrocarbons. Explain the properties and reactions of acids and bases. Express the strength of acids and bases with respect to pH. Review the methods of the preparation of soluble and insoluble salts. Define redox in terms of electron transfer and identify common oxidizing and reducing agents. Represent a redox reaction with two half ionic equations and use two half ionic equations to write a full ionic redox reaction. Apply Faraday's first and second law to calculate the amount of a metal deposited during electrolysis. Predict the products of electrolysis of fused salts and solutions. Design an electrolytic cell to isolate a pure metal from its core.</p>

<p>Course Technical Skills</p>	<ul style="list-style-type: none"> <li>• Classroom lecture;</li> <li>• PowerPoint presentations;</li> <li>• Experiments and Practicals</li> <li>• Basic skills like use and names of glassware, weighing, use of Bunsen burner;</li> <li>• Group discussions; e-learning</li> </ul>
<p>Course Content</p>	<ul style="list-style-type: none"> <li>• States of Matter (Particle Theory and Changing States of Matter)</li> <li>• Homogenous Mixture, Solubility and saturated Solutions</li> <li>• Atomic Structure</li> <li>• Electronic configuration and formation of ions</li> <li>• Chemical formulae and equations; writing balanced equations</li> <li>• Empirical and molecular formula</li> <li>• Introduction to organic chemistry; saturated and unsaturated hydrocarbons</li> <li>• Functional groups in organic chemistry</li> <li>• Principles of nomenclature of organic compounds</li> <li>• Oxidation-reduction reactions</li> <li>• Electrolysis</li> </ul>

ENTW1200	TECHNICAL WRITING - II
Course Description	This course is a continuation of ENTW 1100. It teaches basic academic and technical writing skills to enable students to communicate effectively and clearly. It also develops critical thinking skills. Students will learn to analyze readings and discover ideas that they can use for writing essays and reports relevant to their majors. They will also learn to use basic vocabulary relevant to different technical contexts. In addition, they will learn research skills pertinent to their subject area studies and future work environments.
Course Objectives and Outcomes	<p>Course Objectives:</p> <ul style="list-style-type: none"> <li>Develop organizational skills in writing.</li> <li>Reinforce the research skills of paraphrasing, quoting, and referencing.</li> <li>Write well-organized, well-developed summaries.</li> <li>Write well-organized, well-developed syntheses.</li> <li>Write well-organized, well-developed process essays of at least four paragraphs.</li> <li>Write well-organized, well-developed business and scientific reports, incorporating tables.</li> </ul> <p>Learning Outcomes:</p> <ul style="list-style-type: none"> <li>Effectively use basic vocabulary relevant to different technical contexts.</li> <li>Develop critical thinking skills.</li> <li>Monitor, check and revise one's own work or that of other course participants, giving feedback.</li> </ul>
Course Technical Skills	Research skills, study skills, technical writing skills, speaking skills, critical thinking skills, teamwork skills, entrepreneurial skills.
Course Content	Summarizing, synthesizing, process essays, business reports, scientific reports, technical vocabulary

ENVS1200	FUNDAMENTALS OF ENVIRONMENTAL SCIENCES
Course Description	This course will give the student general introduction to fundamentals of environmental sciences and addresses relationships among ecological resources in the ecosystems. The course also discusses human impact on the natural resources and the way to approach our ecosystems sustainably.
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the students to:: Know the physical, chemical, climatic and biological determinants in the environment; understand the characteristics of communities and the concepts of population ecology and human populations; provide a critical point of view to approach environmental problems through ecological concepts and understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain the makeup of an ecosystem and discuss the structure and function of various components of natural ecosystems. Distinguish between biotic and abiotic subsystems and describe the interaction of the biosphere with its physical environment and the different biogeochemical cycles. Describe major biomes, ecosystem types, and habitat types of the biosphere. Define the role of energy in the ecosystem and discuss the process of obtaining and using energy in living organisms. Explain how a food chain is organized and distinguish among food chains, food webs, and food pyramids. Define the meaning population ecology, and understand the growth of human population. Know some environmental issues and concerns. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Identification of biotic and abiotic subsystems and describe the interaction of the biosphere with its physical environment and the different biogeochemical cycles.</li> <li>• Classify major biomes, ecosystem types, and habitat types of the biosphere</li> <li>• Simple laboratory and field study techniques</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• The Biosphere</li> <li>• The Ecosystems</li> <li>• Production and Decomposition</li> <li>• Population and Communities</li> <li>• Environmental Issues and Concerns</li> <li>• Sustainability</li> </ul>

PHYS1201	PHYSICS
Course Description	<p>This is a first course in physics, which is practical and also theoretical. This course will review and extend the competency of the students entering in HCT in the areas of the fundamentals of physics. It will also improve the students' knowledge in the basic scientific principles and their applications.</p> <p>This course covers the topics in fundamental Physics viz., units, vectors, speed, velocity, acceleration, force, energy, momentum, circular motion, oscillation, elastic properties, temperature, heat, sound, charge, electric field, current, D.C. circuits, magnetism and wave optics.</p>
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the student to Explain the behavior of the physical world around him/her by constructing a logical structure of it. Apply the concepts of physics in his/her field of study and everyday life. Understand and relate the different phenomena in the world. Control the physical aspects of the world beneficially. Approach problems, predict their results in advance, and solve them in quantitative and qualitative manners. Gain a broader understanding of other sciences.</p> <p>Learning Outcomes: The students should be able to: Use the S.I. system of measurement. Recognize and manipulate the mathematical relationship between quantities. Plot technical graphs. Define, analyze, and experimentally demonstrate the concepts of force, energy, and collisions. Apply and verify experimentally the laws of elementary mechanics. Define, analyze, and experimentally demonstrate the concepts of rotational motion. Define, apply, and experimentally demonstrate the concepts of linear and angular momentum. Analyze systems/objects using the law of conservation. Define, apply, and experimentally demonstrate the concepts of oscillation. Define, apply, and experimentally demonstrate the thermal properties of materials. Define, apply, and experimentally demonstrate the concepts of gas laws and ideal gas equation. Define, apply, and experimentally demonstrate the concepts of electric fields, electric properties of matter and forces. Define and apply the concepts of electric currents. Construct circuits and analyze their electrical currents. Define, apply, and experimentally demonstrate the concepts of magnetic fields and forces. Define, apply, and experimentally demonstrate the concepts of wave optics and wave motion.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Developed the skill of using electrical and mechanical instruments, etc.</li> <li>• Developed the skill of finding relation of two physical quantities, plotting the graph, and interpreting results</li> <li>• Finding out error in the measurements and writing reports</li> <li>• Making electrical circuit and finding faults in it</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Units, Dimension &amp; Vectors</li> <li>• Motion in One and Two Dimensions</li> <li>• Laws of Motion</li> <li>• Work &amp; Energy</li> <li>• Momentum and Collisions</li> <li>• Electric Forces and Electric</li> <li>• Current and Resistance</li> <li>• Direct Current Circuits</li> </ul>

LABT1201	LABORATORY TECHNIQUES
Course Description	<p><b>Chemistry:</b> This is a full practical course. It introduces the students, whatever their previous chemical background, to the fundamental chemical techniques. It fosters in them a correct approach to lab. work, precision and safety. It introduces the basic concepts of the chemical techniques and supply the students with the basic scientific principles concerning the measuring techniques, separation, purification and titration techniques.</p> <p><b>Biology:</b> This course focuses on developing the technical skills of the students by exposing them to the basic techniques in the fields of microscopy, microbiology and biochemistry. The experiments designed in this course will enable the students to measure the size of different objects using the optical microscope, prepare temporary and permanent mounts, understand centrifugation and perform serial dilutions. They will also learn how to culture microorganisms and detect different food classes using biochemical techniques.</p>
Course Objectives	<p><b>Chemistry:</b> The course should enable the student to:</p> <ol style="list-style-type: none"> <li>1. Understand the theoretical and practical applications of a variety of simple separation techniques of homogeneous and heterogeneous mixtures; Synthesise and establish the purity of an organic solid sample. Use qualitative chromatography techniques (paper &amp; TLC) and determine R<sub>f</sub> values of the components; Carry out titrimetric analysis (acid-base &amp; Redox) and pH titrations.</li> <li>2. Determine the boiling points of liquids and the boiling point composition diagrams for ideal and non-ideal liquid mixtures.</li> <li>3. Work safely in a chemical laboratory.</li> </ol> <p><b>Biology:</b> Understand the basic laboratory and regulations. Learn the parts of a compound optical microscope. Understand the setting of a compound microscope. Determine the size of a microscopic object by comparing it with the size of the circular field of view. Develop skill in preparing temporary and permanent mount. Understand the techniques in preparing squash slides. Understand the serial dilution. Describe the principles of centrifugation. Study the anatomy of the stem using double staining technique. Understand the requirements for cultivation and isolation of microorganisms. Prepare and sterilize nutrient agar and nutrient broth by autoclaving. Develop the skills in preparing agar slope and agar plates aseptically. Practice the steps involved in the inoculation of agar plate and agar slope. Examine the microorganisms collected from different parts of the body. Perform different qualitative test on carbohydrates, protein, and fats. Identify unknown compounds in the given food samples. Determine the amount of Vitamin C in some fruits. To mount and examine tissues cut by microtome.</p>



Course Outcomes	<p>Chemistry:</p> <p>The students should be able to:</p> <ol style="list-style-type: none"> <li>1. Describe simple separation techniques used to isolate a solid or a liquid sample from a homogeneous or heterogeneous mixture using filtration and distillation techniques.</li> <li>2. Design experiments to purify and establish the purity of an isolated solid or a liquid sample.</li> <li>3. Select a suitable technique for the separation of immiscible liquids and a small suspension.</li> <li>4. Distinguish between the two types of chemical analysis, the qualitative and quantitative analysis.</li> <li>5. Define the terms standard solution, primary standard, alkali metric and Acidimetric titrations.</li> <li>6. Select a suitable indicator to be used in an acid-base titration to determine the concentration of the unknown sample.</li> <li>7. Apply acid-base titrimetric analysis to determine the RMM of a substance.</li> <li>8. Operate a pH meter to determine the pH of a solution.</li> <li>9. Interpret the different pH titration curves in terms of the type of the acid-base titration and use it to find the equivalence point.</li> <li>10. Compute Redox ionic half equations to predict the full Redox ionic equation.</li> <li>11. Use Redox titration to determine the water of crystallization in a hydrated Iron(II) salt.</li> <li>12. Design a Redox titration experiment to determine free chlorine in a Super--Market bleach.</li> <li>13. Design an experiment to separate a binary liquid mixture and justify their Purity by recording their b.pts.</li> <li>14. Use qualitative TLC- chromatography technique to separate &amp; identify the components of a mixture.</li> <li>15. Demonstrate awareness of working safely in chemical labs.</li> </ol>
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<p>Course Outcomes</p>	<p>Biology:</p> <p>The students should be able to:</p> <p>Perform the experiments with all safety measures. Recognize the common symbols used in the laboratory. Able to identify the parts and functions of different parts of a compound optical microscope. Compare the focusing of microscope under different objectives. Calculate the size of the object under different objectives. Practice and differentiate between temporary and permanent mounts. Perform and compute for serial dilution. Learn centrifuge parts and their usage. Observe, identify, draw and describe the plant stem. Use staining techniques in order to demonstrate specific structures of plant tissue. List the requirements necessary for the growth of microorganisms. Recognize the safety measures in a microbiology laboratory and different methods of sterilization. Compare the use of nutrient agar with a nutrient broth. Demonstrate the steps involved in preparing an agar slope and agar plate. Inoculate microorganisms in an agar plate and agar slope. Compare the microorganisms from different parts of the body. Perform different tests and get familiarized with the steps in testing carbohydrates including Molisch's test, Moore's test, Benedict's Test, Fehling's Test, Lugol's test. Learn how to perform different tests and get familiarized to perform different techniques on Biuret Test, Millon's Test, Ninhydrin Test. Performs different test and get familiarized with the steps involved in doing Emulsion Test, Translucency Test, Sudan III Test. Perform different tests in order to identify unknown compound in the given food samples. Learn how to determine the amount of vitamin C in some fruits. Recognize which fruit juice contains more vitamins.</p>
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Chemistry:

- Identification and use of suitable separatory techniques (filtration, separatory funnel, distillation & chromatography) to carry out the separation of the pure components of heterogeneous and homogeneous mixtures.
- Confirmation of purity of separated components (m.pt. b.pt. & chromatography)
- Setting up and carrying out acid-base titration experiments and application of these techniques for standardization, determination of molarity of analyte, determination of the RMM of a substance, etc.
- Carrying out redox titrations and their applications (eg. determination of the water of crystallization in a hydrated salt and analysis of a supermarket bleach for the amount of free chlorine content).
- Demonstration of working safely in a chemistry lab.

Biology:

- Recognize the common symbols used in the laboratory.
- Able to identify the parts and functions of different parts of a compound optical microscope.
- Compare the focusing of microscope under different objectives
- Calculate the size of the object under different objectives.
- Practice and differentiate between temporary and permanent mounts.
- Recognize the importance of onion root tip in making a squash slide.
- Perform and compute for serial dilution.
- Learn centrifuge parts and their usage.
- Observe, identify, draw and describe the plant stem.
- Use staining techniques in order to demonstrate specific structures of plant tissue.
- List the requirements necessary for the growth of microorganisms.
- Recognize the safety measures in a microbiology laboratory and different methods of sterilization.
- Compare the use of nutrient agar with a nutrient broth.
- Demonstrate the steps involved in preparing an agar slope and agar plate.
- Inoculate microorganisms in an agar plate and agar slope.
- Compare the microorganisms from different parts of the body.
- Perform different tests and get familiarized with the steps in testing carbohydrates including Molisch's test, Moore's test, Benedict's Test, Fehling's Test, Lugol's test.
- Learn how to perform different tests and get familiarized to perform different techniques on Biuret Test, Millon's Test, Ninhydrin Test.
- Performs different test and get familiarized with the steps involved in doing Emulsion Test, Translucency Test, and Sudan III Test.
- Perform different tests in order to identify unknown compound in the given food samples.
- Learn how to determine the amount of vitamin C in some fruits.
- Recognize which fruit juice contains more vitamins.
- Learn microtomy technique, its usage and applications.

Course  
Content

Chemistry:

- Separation Techniques
- Determination of melting point
- Titrimetric Analysis - acid base
- pH Titration
- Redox titrations
- Determination of Boiling Point
- Thin Layer Chromatography

Biology:

- Laboratory safety
- Care and use of a compound optical microscope
- Measurement with the microscope
- Preparation of temporary and permanent mount of yeast cells
- Preparation of serial dilution
- Centrifugation
- Double staining of plant stem section
- Preparation and sterilization of culture media
- Inoculation of agar plates and agar slopes
- Biological analysis : Quantitative analysis
- Biological analysis : Quantitative Analysis

CHEM1202	CHEMISTRY I
Course Description	It builds on the principles explained in Fundamentals of Chemistry / ASAC1101. The concepts of enthalpy, bonding, chemical equilibrium and kinetics are introduced. In addition, the relationships between electronic, structural and chemical properties of elements, as well as trends across the periodic table are explored. Practical work forms an integral part of this course.
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the student to: State and investigate the factors affecting the rate of chemical reactions. Develop understanding of the importance of energy changes to chemical reactions and in industry. Understand and investigate the principles and characteristics of equilibria. Explain the relationship between structure, bonding and properties. Describe the pattern in properties across the periodic table.</p> <p>Learning Outcomes: The students should be able to: Describe and investigate the factors affecting reaction rates. Account for the importance of catalysts for chemical reactions. Apply the concept of enthalpy to calculate the heat change for a chemical reaction. Apply Hess's law to calculate the standard enthalpy of reactions using related enthalpies of combustion. Predict the heat of formation of compounds and compare their stabilities using Bohn Haber cycle. Devise experiments to determine the enthalpy of neutralization and solutions. Apply dot/cross diagram to represent bonding in molecules. Evaluate the effect of hydrogen bonding on the structure and properties of some biological molecules. Use the law of mass action to derive a mathematical equation for the equilibrium law. Use Le Chatelier's principle to explain the effect of external factors on the composition of an equilibrium mixture. Apply the principles of equilibrium and reaction rate in industrial processes e.g. Contact, Haber &amp; HNO<sub>3</sub>. Relate the periodic properties (physical and chemical) of the elements and their compounds to the electronic structure of the elements. Deduce the relationship between the electronic structure of an atom, its properties and its position in the periodic table (elements in the same group have similar properties). Differentiate between thermal stability of the nitrates and carbonates of the alkali and alkaline earth metals. Compare between the properties and reactivities of the s- and p-block elements. Demonstrate ability to work as an individual and in a team</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Classroom lecture;</li> <li>• Powerpoint presentations;</li> <li>• Experiments and Practicals;</li> <li>• Group discussions; e-learning; practical demonstrations of concepts like enthalpy &amp; Le Chatelier principle.</li> </ul>

Course  
Content

- Kinetics ( Introduction to reaction kinetics, Collision theory of gas molecules, factors affecting reaction rates, increasing reaction rates in industry, measuring reaction rates, rate laws and types of rate laws)
- Chemical equilibrium (Equilibrium constant, Lechatlier Principle)
- Acids and Bases (Arrhenius theory, Bronstead theory, ionic equilibrium in aqueous solutions of acids and bases, strong acids and bases, dissociation constant, buffer solutions)
- 4. Colligative Properties (Raoultz law and vapor pressure lowering, freezing point depression, boiling point elevation, osmotic pressure)

BAMG2111	ENTREPRENEURSHIP
Course Description	<p>This course introduces the students the concept of entrepreneurship and the vital role played by entrepreneurs in the global economy. It covers the area of financial management and planning and allows the students to use tools in developing new ventures for small business. In addition, it enables them to be able to identify the types of businesses and the challenges associated with government regulations as well as the management processes involved in running small firms. The students will be able to recognize the development of working models for entrepreneurship.</p>
Course Objectives and Outcomes	<p>Course Objective: The student will be exposed to the theory as well the experience associated with entrepreneurship. The course will cover such area as financial management and planning, legal regulation, concepts and tools in developing new venture, communication tools in small business.</p> <p>Learning Outcome: The students should be able to: Explain the vital role played by entrepreneurs and small business in the global economy. Define entrepreneurship and describe how entrepreneurs are different from other business-people. Define small business and identify the industries in which most small firms are established. Compares the advantages and disadvantages of small business. Analyze the small business opportunities for women and the special challenges faced by this entrepreneur. Describes how the small business administration functions. Recognize the important contemporary topic such as family business, small business risks, and government regulations. Recognize management process and operation management for the small firm. Develop a working model of entrepreneurship by creating a small business plan.</p>
Course Technical Skills	
Course Content	

SLOM1103	SAFETY AND LABORATORY MANAGEMENT (SLOM)
Course Description	<p>It fosters in the student the correct approach to safe laboratory work and laboratory behavior and be trained to administer a laboratory to ensure that a laboratory is well organized, smoothly, efficiently and safely run. It involves the general rules/codes of safety; Fire hazards; Hazards in physical, chemical, biological/medical laboratories; First aid, boxes and contents, artificial respiration, control of bleeding, treatment of poisons, burns, electrical shocks and fractions and accident reporting; Laboratory design; Laboratory finance; Stores management; Laboratory administration and Laboratory maintenance. The practical part and visits to related laboratories constitute not less than 20% of the course.</p>
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Explain the necessity of maintaining personal codes of safety in a laboratory. Provide the basic precautions to prevent fire and the actions to be taken in the event of fire. Recognize the potential hazards, which may be encountered in a chemical, a physical, a biological or a medical lab. Be able to care for the items of equipment common to all labs. Have a clear idea of the lab design. Compare the systems of purchasing and financial control for a lab. Understand the organization and management of labs stores. Describe the basic principles of laboratory administration and maintenance.</p> <p>Learning Outcomes: The students should be able to: Demonstrate awareness of the personal code of safety in the labs. Operate the suitable firefighting equipment for the right type of fire. Demonstrate awareness of the precautions to prevent and escape or help people to escape fire. Work safely in a chemical, physical, biological or medical labs. Demonstrate awareness of the international warning signs and the safe storage and the dispensing of flammable, poisonous and carcinogenic materials. Select the appropriate rate flex for a specified piece of equipment and use multiple adapters and distribution boards. Design and sketch a lab for a definite function and a specified number of people. Make up a purchase and record the necessary details about expenditure for a lab. Use a computer for stock records. Demonstrate awareness of the lab administration and maintenance.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Student acquired the knowledge of safety rules in laboratories.</li> <li>• They learnt about First AID and First AID techniques in case of Wounds, burn bounds and Chocking etc.,</li> <li>• Students gain the knowledge and causes of fire, fire extinguishers technique, different types of fire extinguishers and their use.</li> <li>• Also they are well worth with electrical and radiation hazard.</li> <li>• They learn about how to deal with different types of chemical and glassware.</li> <li>• Now they know about MSDS sheets and importance of that.</li> <li>• Students know how to deal with biohazard waste and disease causing agents.</li> <li>• Now students are in a position to draw the outline of a laboratory and conditions pertaining to laboratory construction.</li> </ul>



Course Content

- Lab safety Rules
- First Aid
- Fire hazards
- Electrical and radiation hazards
- Chemical and glassware hazards
- Biological hazards
- Lab Design
- Lab Finance

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# DIPLOMA YEAR II COURSES

ENGL2100	TECHNICAL COMMUNICATION
Course Description	During the course the students will learn how to write on technical subjects for the practical needs of a specified audience. They will also learn how to process factual information objectively and persuasively, making use of information and communication technology.
Course Objectives and Outcomes	<p><b>Course Objectives:</b>            Analyze, synthesize, evaluate and interpret information and ideas.            Write in a style appropriate to the technical purpose and audience.            Identify and write various kinds of technical documents.            Plan and manage short and long-term writing projects in terms of drafting, designing, revising and editing documents, work with various writing technologies and electronic equipment.            Write collaboratively, providing peers with constructive feedback on your work.            Develop effective style and tone, following technical and business writing practices.            Analyze charts, graphs, specifications, diagrams, etc., and respond orally and in writing.</p> <p><b>Learning Outcomes:</b>            Design visually effective documents paying attention to layout and format, and incorporating graphics and visuals into documents.            Prepare and deliver clear and effective presentations.            Locate source materials in the library and on the Internet, evaluate their usefulness, relevance and credibility and then incorporate them into an assigned task with in-text citation and full reference list.            Read critically print and electronic source material as part of literature review to use others' information and ideas in one's own report.</p>
Course Technical Skills	Research skills, technical writing skills, speaking skills, critical thinking skills, teamwork skills, entrepreneurial skills, presentation skills, PowerPoint skills.
Course Content	Elements of technical communication, technical reports, memos, letters, definitions, technical description, technical process, technical comparison and recommendation, presentations.

CHEM2104	GENERAL ORGANIC CHEMISTRY
Course Description	It is the first course in organic chemistry which introduces the basic concepts of organic chemistry and explains the basic scientific principles concerning nomenclature and reactions of aliphatic, alicyclic and aromatic hydrocarbons, and simple monofunctional organic compounds. It also introduces the student to a few selected mechanistic approaches of some important organic reactions. Practical work forms an integral part of this course.
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the student to: Name, write molecular formula and identify the type of isomerism in organic compounds. Describe the properties of saturated and unsaturated hydrocarbons; Understand the relationship between the reactions of some a-cyclic and cyclic organic compounds and their structures; Describe and apply further range of functional group reactions and understand some aspects of organic reaction mechanisms. ; Appreciate some aspects of organic stereochemistry.; Understand the influence of structure and bonding on the physical properties and isomerism of organic compounds.; Be aware of roles of nomenclature to specify the configuration of isomers.; Develop understanding of the organic reaction mechanisms of hydrocarbons and simple mono-functional group compounds.; Explain the reactions of hydrocarbons in relation to their structure and mechanisms of reactions.; Develop understanding of the reactions of simple mono-functional group compounds in relation to their structure and mechanisms of reaction.</p> <p>Learning Outcomes: At the end of this course, the student should be able to: Differentiate organic and inorganic compounds.; Define a homologous series, isomerism and a functional group.; Predict the type of isomerism (structural or geometrical) in an organic molecule.; Apply acquired knowledge to name monofunctional organic compound.; Differentiate between saturated and unsaturated hydrocarbons.; Apply acquired knowledge to name, prepare and describe the reactions of a-cyclic hydrocarbons, alkyl halides, alcohols, carbonyl compounds, carboxylic acids and primary amines) and cyclic compounds (cyclohexane, cyclohexene and benzene); Apply knowledge to distinguish experimentally between the different organic compounds studied.; Present the substitution reactions of the benzenoid ring by chemical equations.; Distinguish experimentally between the three types of amines. ; Compare reactions of different functional groups in organic compounds. ; Identify the type of stereoisomerism in organic molecules; Predict the mechanisms of some simple organic reactions; Demonstrate ability to work as an individual and in a group.</p>
Course Technical Skills	Design and conduction of experiments to differentiate between alkanes & alkenes, aldehydes and ketones and the 3 types of amines.
Course Content	<ul style="list-style-type: none"> <li>• Introduction to Organic and Inorganic compounds</li> <li>• Nomenclature</li> <li>• Saturated and Unsaturated Hydrocarbons</li> </ul>

ENVS2101	PRINCIPLES OF ENVIRONMENTAL SCIENCES
Course Description	<p>This course introduces the concepts and principles of environmental sciences and provides basic background in some important environmental issues to enable a proper understanding of how people can live sustainably on their environment. This prepares the students to the higher courses in applied environmental science.</p>
Course Objectives and Outcomes / Program Objectives and Outcomes	<p><b>Course Objectives:</b>  The course should enable the student to:  Understand the concepts and principles of environmental science. Describe some major ecological dilemmas and issues that shape our current environmental agenda. Define the term sustainable development and describe some of its requirements, and appreciate the importance of sustainable development. Understand and apply the concepts and principles in laboratory and field works</p> <p><b>Learning Outcomes:</b>  The students should be able to:  Define the term environment and identify some important environmental concerns that we face today. Understand the meaning of greenhouse effect and the harmful consequences of human alteration of the composition of the atmosphere. Define pollution and describe different types of pollutants, the pathways of pollutants, the biological and environmental effects of common pollutants, and the usual approaches to pollution control, with special examples from Omani environment. Compare the advantages and disadvantages of renewable and non-renewable energy resources and understand the future energy demands and the need for energy conservation measures and environmental protection. Explain how huge increases in agriculture productivity have been achieved, illustrate how this has caused environmental damage and describe the feature of a more sustainable agriculture and reforestation. Explain the importance of nature and wildlife conservation. Define the term waste and recognize the problem associated with waste and recognize the importance of waste management and examine different types of waste disposal. Understand the impact of human population on the environment and describe different approaches towards more sustainable development. Apply ingenuity to environmental problems and prepare for a more sustainable living. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>

Course Technical Skills	<ul style="list-style-type: none"> <li>• Determination of greenhouse effect and the harmful consequences of human alteration of the composition of the atmosphere.</li> <li>• Identification of the different types of pollutants, the pathways of pollutants, the biological and environmental effects of common pollutants, and the usual approaches to pollution control, with special examples from Omani environment.</li> <li>• Propose mechanisms of nature and wildlife conservation.</li> <li>• Waste management</li> <li>• Measure the impact of human population on the environment and describe different approaches towards more sustainable development.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Principles and Concepts Related to Environmental Science</li> <li>• Air, Weather and Climate</li> <li>• Water</li> <li>• Soil</li> <li>• Energy</li> <li>• Forests and Agriculture</li> <li>• Nature Conservation</li> <li>• Sustainable Development</li> </ul>

BIOL2203	MICROBIOLOGY
Course Description	This course introduces the students, to the study of microorganisms and offer basic laboratory skills required to perform microbiological investigations. Introduce students to basic staining techniques in microbiology as well as basic techniques of water microbiology.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Learn practical culturing of microorganisms. Observe microorganisms and carry out biochemical tests. Estimate microbial population. Investigate the effect of antibiotics and UV on growth of bacteria. Identify the harmful microorganisms. Detect Coliform bacteria in water samples. Investigate the effect of pasteurization on food substances. Apply microbiological examination of food. Perform practical of culturing and identification of molds.</p> <p>Learning Outcomes: The student should be able to: Define microorganisms. Identify the types of microorganisms, their characteristics and size. Recognize the basic features of bacteria, classification and nomenclature. Identify bacterial growth, growth requirements and factors affecting growth. Apply safety rules when doing microbiological experiments, sterilization and disinfection. Prepare agar plates, slopes and broth media. Inoculate agar plates, slopes and broth with microbial culture. Separate a mixed culture into its separate bacterial components, sub-culture bacteria and culture anaerobic bacteria. Observe the shape of bacterial colonies and motility of microorganisms. Perform staining techniques, detection of spores and biochemical tests. Estimate microbial population by applying direct counts; pour plate counts and turbidity method. Recognize the effect of antibiotics and UV on growth of bacteria. Identify the harmful microorganism. Examine water sample for most probable Coliform numbers and other microorganisms using Millipore filters. Apply practical culturing and identification of molds. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Sterilization techniques: autoclaving, Aseptic technique.</li> <li>• Staining of Fungi</li> <li>• Preparation and sterilization of agar and broth, inoculation of media.</li> <li>• Hanging drop technique</li> <li>• Staining technique of bacteria : Simple and Gram</li> <li>• Estimation of viable counts of bacteria using Spread plate, drop and pour plate counts techniques.</li> <li>• Presumptive coliform test</li> </ul>

Course Content

- Brief History of Microbiology
- Culturing Microorganisms
- Observing Microorganisms
- Estimating Microbial Population
- Effect of Antibiotics and UV on Growth of Bacteria
- Harmful Microorganisms
- Examination of Water
- Culturing and Identification of Molds

ENVS2102	FIELD STUDY AND LABORATORY TECHNIQUES IN ENVIRONMENTAL SCIENCES
Course Description	Collection of samples and other data gathering techniques done in the field and in the laboratory for ecological researches.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Know the different techniques in data gathering in the field. Understand the different laboratory techniques essential for ecological researches. Use laboratory and field equipment that are essential for ecological / environmental studies. Understand the concepts and principles behind each technique. Apply the concepts in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain the procedures / techniques in the collection and preservation of samples for terrestrial and aquatic ecosystem. Discuss the procedures / techniques in determining physical parameters. Discuss the procedures / techniques in determining chemical parameters. Explain the procedures / techniques in the laboratory analysis of biological factors. Perform ecological investigation in the field for terrestrial, freshwater and marine ecosystems. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Techniques in the collection and preservation of samples for terrestrial and aquatic ecosystem</li> <li>• Techniques in determining physical parameters</li> <li>• Techniques in determining chemical parameters</li> <li>• Techniques in the laboratory analysis of biological factors</li> <li>• Ecological investigation in the field for terrestrial, freshwater and marine ecosystems</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Field Collection and Sample Preservation Techniques</li> <li>• Determination of Physical Parameters</li> <li>• Determination of Chemical Parameters</li> <li>• Laboratory Analysis of Biological Factors</li> <li>• Field Studies</li> </ul>



CHEM2201	ANALYTICAL CHEMISTRY I
Course Description	<p>It shows the scientific principles, concepts and skills to help the student understand and perform some of the processes involved in Analytical Chemistry. The principles governing standard analytical techniques like chromatography, polarimetry, colorimetry, atomic and molecular spectroscopy are discussed. The opportunity to obtain hands-on experience with some of these techniques is also provided with selected experiments.</p> <p>Statistical approach to quantitative analytical techniques regarding aspects like accuracy and reliability of results forms an important aspect of this course in addition to the presentation, reporting and evaluation of data. The course is primarily concerned with the acquisition of skills and 70% of it devoted to practical work</p>
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the student to: Describe the essential stages of the analytical process; Understand the theoretical principles and practical applications of a variety of separation techniques; Understand the theoretical principles and practical applications of a variety of classical and spectrophotometric techniques; Analyze experimental data and draw honest and meaningful conclusions.; Be aware of sources of errors and standard of accuracy.; Present results lucidly and concisely through writing or orally</p> <p>Learning Outcomes: The students should be able to: Select and justify the analytical method to be used for an analytical sample.; Evaluate and validate the selected method; Assess the results and define the criteria for accuracy and precision.; Select and justify a separation technique(TLC, Paper, Ion exchange) of an analytical sample.; Select and set up the appropriate chromatographic column for separation of a given mixture.; Assess the validity of the analytical separation technique.; Select and justify the appropriate analytical spectroscopic technique (IR, UV, AA) to analyze a sample .; Identify the principles of the selected technique to show appropriateness to the analysis performed.; Select and set up the appropriate conditions for spectrophotometric equipment to be used.; Apply Beer-Lambert law for quantitative colorimetry.; Use polarimetry for determination of the specific rotation of an optically active sample and to determine the concentration of a suitable solution.; Compile experimental data to required accuracy and evaluate the results.; Apply appropriate mathematical and statistical methods to process results of analysis.; Set up an ion-exchange column and use it for the quantitative separation of an ionic mixture.; Appraise the use of gel-permeation technique for the separation of commercially important oligosaccharides.; Describe the preparation of deionized water.; Present the findings in an appropriate format.</p>

<p>Course Technical Skills</p>	<ul style="list-style-type: none"> <li>• Classroom lecture;</li> <li>• Experiments and Practicals;</li> <li>• Group discussions;</li> <li>• Quantitative &amp; qualitative instrumental analysis;</li> <li>• Hands-on experience with instruments like uv-vis spectrophotometer, flame photometer &amp; polarimeter;</li> <li>• Practical applications in commercial products ;</li> <li>• Submission of written reports,</li> <li>• Plotting of graphs manually &amp; using excel,</li> <li>• Interpretation of IR spectra.</li> </ul>
<p>Course Content</p>	<ul style="list-style-type: none"> <li>• Introduction and Overview of Analytical chemistry</li> <li>• Statistical methods</li> <li>• Principles of partition and adsorption</li> <li>• General principles of molecular spectroscopy</li> <li>• Atomic absorption and Atomic emission spectroscopy</li> <li>• Flame Photometry</li> <li>• UV-Vis Spectroscopy</li> <li>• IR spectroscopy</li> <li>• Polarimetry</li> </ul>

ENVS2201	INTRODUCTION TO ENVIRONMENTAL POLICY AND IMPLEMENTATION
Course Description	Policy system and implementation on the management of human activities that reduce or mitigate harmful effects on nature and natural resources.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Understand environmental governance and agreements, EIA, EIS and pollution regulation system. Know the basis of environmental law in Oman. Comprehend principles of sustainable development, sectoral policy cooperation and integration. Gain knowledge of the various environmental policy instruments. Know how policy measures are applied in the different sectors. Understand and apply the concepts and principles in field works</p> <p>Learning Outcomes: The students should be able to: Explain the key terms, rationale or importance of environmental policy, environment and biodiversity protection in Oman, environmental laws, government organizational structure of Oman, International Environmental Law and the Government Policies on Pollution Abatement. Discuss the principles behind sustainable development, public participation, the Rio Declaration and lobbying. Discuss both global and regional environmental policy instruments, importance of international environmental cooperation. Discuss some sectoral policy measures. Explain how policies are implemented and the problems and their causes in the implementation of policies. Demonstrate ability to participate, share and develop skills and competencies during field excursions and self-paced field work. Perform field/industrial visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Draft policies on environment and biodiversity protection in Oman, environmental laws, government organizational structure of Oman, International Environmental Law and the Government Policies on Pollution Abatement</li> <li>• Proposal preparation on the implementation of both local and international environmental policies</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Principles</li> <li>• Environmental Policy Instruments</li> <li>• Sectoral Policy Measures</li> <li>• Implementation Issues and Case studies</li> </ul>

ENVS2202	POLLUTION SOURCES AND CONTROL 1
Course Description	This course intends to provide general understanding of pollution and the role of man in damaging the environment. The course will emphasize on sources of air, water, soil, noise and electromagnetic field pollutions, and methods of controlling or minimizing these types of pollution.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Understand pollution and the role of man in damaging the environment. Familiarize with the sources and types of pollution understand methods of controlling or minimizing pollution in our environments. Understand the ecological terms: Reduction, Reuse and Recycle. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The student should be able to: Define pollution and pollutants and describe pathways and general effects of pollutants. Classify air pollutants in terms of their physical state and origin. Describe the cause and the effects of the ozone depletion layer, acid rain and the greenhouse effect. Identify the nature and effects of particulates pollutants and their remedial measures. Identify the appropriate air pollution control method/s to minimize the extent of pollution of a specified pollutant. Describe types, sources and effects of water pollution. Describe water pollution control methods. Apply the artificial sewage treatment process to render sewage inoffensive and to reduce danger to public health and aquatic life. Define soil pollution, list its sources and methods of checking and control. Understand the sources and hazards of radioactive pollution, and compare different methods of disposal of radioactive and hazardous wastes. Understand pollution reduction, reuse and recycle of materials. Define noise pollution and electromagnetic pollution, and explain their biological effects and methods of controlling them. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Identification of environmental pollutants through bio-physico and chemical analysis</li> <li>• Classify air pollutants in terms of their physical state and origin.</li> <li>• Identification of particulates pollutants and their remedial measures.</li> <li>• Propose pollution control method/s to minimize the extent of pollution of a specified pollutant.</li> <li>• Laboratory analysis of the quality of water</li> <li>• Application of artificial sewage treatment process to render sewage inoffensive and to reduce danger to public health and aquatic life.</li> <li>• Detection of soil pollution, list its sources and methods of checking and control.</li> <li>• Measurement of radioactive pollution, and compare different methods of disposal of radioactive and hazardous wastes.</li> <li>• Measurement of noise pollution and electromagnetic pollution, and explain their biological effects and methods of controlling them.</li> </ul>

Course Content

- Introduction
- Air pollution
- Water Pollution
- Pests and Pesticides
- Soil Pollution and Land Contamination
- Nuclear Pollution and Radioactive Wastes
- Noise and Electromagnetic Field Pollutions
- Environmental Health and Toxicology

IRSE 2105	INTRODUCTION TO RENEWABLE SOURCES OF ENERGY
Course Description	<p>This is an introductory course on the renewable sources of energy practical part. The current flow of energy into the growing global economy is not sustainable. Renewable energies have become increasingly popular and more common with policy drivers being put in place to increase consumer use and production of renewable energy. This course will investigate the principle types of renewable energy, as well as historical and technological challenges, and their place in the current global market. The place of renewable energy in society as a whole will be examined through individual, political, corporate and industry perspectives. Modern society had relied upon largely non-renewable energy production processes which have large scale detrimental environmental impacts. While there has been historical use of renewable energy, low production with often intermittent availability, and the inability to capture and store this form of energy have limited its usage. Today, renewable energies are becoming more widely utilized and promoted at various scales and with variable success. As the general population becomes more aware of the impact on the natural environment by fossil fuels and nuclear energy, renewable energy is becoming more common place. The study of renewable energy requires an understanding from a multitude of perspectives, drawing upon skills from numerous areas. Policy drivers for renewable energy can be critical for both developed and developing nations, often requiring different approaches and decision-making processes. This course is designed to engage the student, to bring understanding to the need for an interdisciplinary approach to the incorporation of renewable energy, and bring to the student a set of skills that they can utilize in the decision-making process for renewable energy.[1]This course improves the student knowledge in the basic scientific principles and their applications to materials.[1] School of the Environment, University of Toronto : <a href="http://www.uoftbookstore.com/">http://www.uoftbookstore.com/</a></p>
	<p>Course Objectives:</p> <p>This course should enable the students to:</p> <p>To recognize and differentiate the renewable and non renewable sources of energy. To appreciate how historically, renewable energy powered growth of early human societies. To outline division aspects and utilization of renewable energy sources for both domestics and industrial applications. To acquire knowledge about the principle, construction and working of working of box type solar, cooker, solar concentrators', solar water heater, solar thermal power plant and their limitations / advantages and disadvantages. To acquire knowledge about the principle, working, different types of solar photovoltaic cells/panels their applications like solar water pumps, solar powered phones, domestic and street lighting. Solar power generation scheme and their limitations / advantages and disadvantages. To understand the efficiencies of both new</p>

<p>Course Objectives and Outcomes</p>	<p>and established energy generation and conversion methods; To distinguish between physical, chemical and biological aspect of renewable energies. To appreciate the importance of renewable energy as this is related with the economic problems. Explain the principles for detecting various types of renewable energies and to be aware of the career opportunities. Understand types of renewable energy and its application related with greenhouse effect, global warming in modern life. Broad overview of fundamental and applied concepts of energy in the overall context of the modern and built environment. Relate the concepts of physics to the advancement of technology. Approach problems, predict their result and solve them in quantitative and qualitative manners. To analyse the environmental and cost economics of using renewable energy sources compared to fossil fuels.</p> <p>Learning Outcomes:</p> <p>A student who satisfactorily completes the course should be able to:</p> <p>Learn about the various types of renewable sources of energy and also to differentiate the renewable and non-renewable sources of energy. Appreciate how early human societies used solar energy, wind energy etc. Understand the principle, construction and working of box type solar cooker, solar concentrators', solar water heater, solar thermal power plant and their limitations. To understand the concept of principle, working, different types of solar photovoltaic cells/panels their applications like solar water pumps, solar powered phones, domestic and street lighting. Solar power generation scheme and their limitations / advantages and disadvantages. Learn the principle, construction and working wind mill, wind energy generator, hydro electric generators and their limitations. Understands the basic concept of renewable energy, as it is importance in the present day world. Learn about the geothermal energy, hydrogen and alcohol as a fuel, also selected renewable emerging energy technologies. Understand the construction and working of biogas plant and also to differentiate between the biomass and bio fuel as renewable sources of energy. Students will understand advantage and disadvantage of different types of renewable energy. Students will learn the concepts and technologies of using renewable energy which is related with the economic problems. Demonstrate awareness on different types of renewable energy and also to understand its working and principles which is related with the career opportunity. Apply knowledge to recognize classification of renewable energies. Appreciate the applications of renewable energies in science and technology. Demonstrate applied competence in applying basic physics knowledge to analyze problems of renewable energy. Be able to choose the appropriate renewable energy as an alternate for conventional power in any application.</p>
<p>Course</p>	<ul style="list-style-type: none"> <li>• Students collect and record basic experimental data and present result in the form of report.</li> </ul>

<p>Technical Skills</p>	<ul style="list-style-type: none"> <li>• Students learn how solar module (solar cell) works and what are the factors affecting the generation of electric power by the solar module. <ul style="list-style-type: none"> <li>a) Effect of surface area of a PV module exposed to the light radiations.</li> <li>b) Effect of the angle of incidence of the light radiations to the PV module</li> </ul> </li> <li>• Students learn how wind turbine works and what are the factors affecting the generation of electric power by the wind turbine. <ul style="list-style-type: none"> <li>a) Effect of wind speed on the power output of the wind turbine.</li> <li>b) Effect of wind direction on the power out put of the wind turbine.</li> </ul> </li> <li>• Students learn about power generation by the different types of wind turbines <ul style="list-style-type: none"> <li>a) Horizontal axis wind turbine and</li> <li>b) vertical axis wind turbine</li> </ul> </li> <li>• Students investigate efficiency of the various types batteries.</li> <li>• Students verify principles /laws related to the power radiated by hot objects (i.e., Stefan's Law) and heat losses from the hot objects (i.e., Newton's law of cooling).</li> </ul>
<p>Course Content</p>	<ul style="list-style-type: none"> <li>• Introduction of renewable sources of energy:</li> <li>• Solar Energy: Part-A</li> <li>• Solar Energy: Part-B</li> <li>• Wind Energy :</li> <li>• Hydro electric power and tidal energy :</li> <li>• <u>Geothermal Energy:</u></li> <li>• Bio-Energy and other forms of the sources of renewable energy:</li> </ul>



ENVS2204	PROJECT IA
Course Description	An introductory course in environmental science research. Basic concepts of research in applied science will be discussed giving emphasis on the parts of a research proposal and a research paper
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives:  The course should enable the students to:  Understand the basic concepts of scientific research  Know the parts of a scientific paper  Write a research proposal of a topic of his / her choice  Conduct the research based on the research proposal  Analyze the data.</p> <p>Learning Outcomes:  The student should be able to:  Discuss the basic concepts of scientific research  Explain the parts of a scientific paper  Discuss his /her experimental design  Write a research proposal  Conduct his/her research based on the research proposals.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Field Sampling Techniques</li> <li>• Laboratory techniques in soil, water and air analysis</li> <li>• Statistical analysis of data</li> <li>• Writing and oral presentation of technical paper</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Parts of Scientific Paper</li> <li>• General and Specific Objectives</li> <li>• Significance of the Study</li> <li>• Scope and Limitation</li> <li>• Review of Related Studies and Citations of References</li> <li>• Experimental Design</li> <li>• Results and Discussion</li> <li>• Conclusion and Recommendation</li> </ul>

PHIL2108	BUSINESS ETHICS
Course Description	To equip the student with the highest ethical standards that will guide him/her through real life dilemmas. Define the concept of values. Define how values develop. Understand the effects of religion and society on values. Understand the effects of Islamic and Omani values on work ethics. Define the concept of ethnic and cultural diversity. Understand the importance of ethnic and cultural diversity for society and the world. Work with people from different ethnicities/cultures. Function in a moral and ethical manner in his/her life.
Course Objectives and Outcomes	<p>Course Objectives:            To enable the student to:            Understand the concept of value            Understand Islamic and Omani values            Understand, appreciate and respect ethnic and cultural diversity            Gain the highest work ethics</p> <p>Learning Outcomes:            The students should be able to: Define the concept of values; Define how values develop; Understand the effects of religion and society on values; Understand the effects of Islamic and Omani values on work ethics; Define the concept of ethnic and cultural diversity; Understand the importance of ethnic and cultural diversity for society and the world; Work with people from different ethnicities/cultures; and Function in a moral and ethical manner in his/her life</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Developed skills and techniques to implement an business organization's code of ethics and train employees in its use and application.</li> <li>• Developed skills to effectively implement ethical principles and practices as defined business organization's code of ethics.</li> </ul>
Course Content	

ENVS2301	PROJECT IB
Course Description	An introductory course in environmental science research. Basic concepts of research in applied science will be discussed giving emphasis on the parts of a research proposal and a research paper.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives:  The course should enable the students to:  Analyze the data  Write a technical paper of the research that he /she conducted  Present and defend the research proposal</p> <p>Learning Outcomes:  The student should be able to:  Analyze the data for concrete recommendations  Submit his / her research paper / report  Present and defend his / her research proposal</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Field Sampling Techniques</li> <li>• Laboratory techniques in soil, water and air analysis</li> <li>• Statistical analysis of data</li> <li>• Writing and oral presentation of technical paper</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Writing of the Technical Paper / Report</li> <li>• Documentation and PowerPoint Presentation of the Technical Paper / Report</li> </ul>

## ADVANCED DIPLOMA COURSES

STAT3120	STATISTICS & IT
Course Description	This course will provide the students with the working knowledge of the statistical techniques and methodologies for a data driven decision making which they may use in their field of computational applied sciences.
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Develop the skills and knowledge to classify record, display and summarize scientific data. Understand the basic statistical concepts and techniques. Have understanding of estimation from parametric measures.</p> <p>Learning Outcomes: The students should be able to: Define the concept of values: Demonstrate knowledge of statistical terms and differentiate between the two branches of statistics. Identify types of data and the measurement level for each variable together with the four basic sampling techniques. Organize data using a frequency distribution and represent data in frequency distributions graphically using histograms, frequency polygons, ogives and pie graphs. Summarize data, using measures of central tendency, such as the mean, median, mode, midrange, weighted mean; Describe data, using measures of variation, such as the range, variance, and standard deviation. Identify the position of a data value in a data set, using various measures of position, such relative position and quartiles and explore the outlier detection. Determine sample spaces and find the probability of an event, using classical probability or empirical probability. Find the probability of compound events, using the addition rules, multiplication rules and conditional rule. Find the number of ways that <math>r</math> objects can be selected from <math>n</math> objects, using the permutation rule and combination. Construct a probability distribution for a random variable and find the mean, variance, standard deviation, and expected value for a discrete random variable. Find the exact probability for <math>X</math> successes in <math>n</math> trials of a binomial experiment and find its mean, variance, and standard deviation. Find probabilities for outcomes of variables, using the Poisson distributions. Identify the properties of a normal distribution. Find the area under the standard normal distribution, given various <math>z</math> values. Find probabilities for a normally distributed variable by transforming it into a standard normal variable. Find specific data values for given percentages, using the standard normal distribution. Find the confidence interval for the mean when <math>s</math> is known. Determine the minimum sample size for finding a confidence interval for the mean. Find the confidence interval for the mean when <math>s</math> is unknown. State the five steps used in hypothesis testing. Draw a scatter plot for a set of ordered pairs, compute for the correlation and the equation of the regression line together with the coefficient of determination.</p>
Course Technical Skills	Automating statistical techniques and methodology via statistical software add ins of MS Excel - Data Analysis Toolpak

Course Content

This statistics course contains the fundamentals of Statistics. Emphasis is on the development of statistical thinking and applications that are directed towards applied sciences. Topics include data summaries and descriptive statistics, introduction to a statistical computer package giving emphasis on MS Excel Data Analysis toolpak add-ins; Probability - distributions, expectation, variance, statistical inference of univariate data and regression analysis.

ENVS3101	BIODIVERSITY AND NATURE CONSERVATION
Course Description	This course introduces the importance of nature and biological resources biological and describes different approaches to conserve natural ecosystems and appreciate some of the conflicts associated with conservation measures.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course will enable the students to Know the country's important natural resources and summarize the benefits we derive from natural ecosystem and biodiversity. Examine various approaches to conserve natural resources and come up with a plan for a specific problem in biodiversity conservation. Familiarize with protected areas in Oman and understand the goal of conserving these areas. Evaluate the tension between nature conservation and economic development and how conservation projects address this tension. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Define niche, species richness, and habitats and explain the values of biodiversity and natural products. Think critically the importance of biological diversity and their interaction in the ecosystem. Familiarize with flora and fauna diversity of Omani ecosystems and recognize the urgent need for conservation of various plant and animal species. Outline the strategic plan for environmental protection and nature conservation in Oman. Describe different approaches to conservation of natural ecosystems and appreciate some of the conflicts associated with conservation measures. Identify some natural products, island and protected areas in Oman. Relate the role of conservation areas with economic development. Discuss legal and international issues such as loss of biodiversity, deforestation, poaching, exotics, socio-economic of biodiversity, population growth and its impact. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>

Course Technical Skills	<ul style="list-style-type: none"> <li>• Taxonomic identification of organisms</li> <li>• Techniques in natural conservation of plants, animals and habitat</li> <li>• Determination of species richness, habitats and explain the values of biodiversity and natural products.</li> <li>• Identification of the flora and fauna diversity of Omani ecosystems and recognize the urgent need for conservation of various plant and animal species.</li> <li>• Outlining the strategic plan for environmental protection and nature conservation in Oman.</li> <li>• Approaches to conservation of natural ecosystems and appreciate some of the conflicts associated with conservation measures.</li> <li>• Identification of some natural products, island and protected areas in Oman.</li> <li>• Relating the role of conservation areas with economic development.</li> <li>• Outlining legal and international issues such as loss of biodiversity, deforestation, poaching exotics, socio-economic of biodiversity, population growth and its impact.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Taxonomic identification of organisms</li> <li>• Characteristics of Oman Ecosystems and Habitats</li> <li>• Diversity and Ecological Stability</li> <li>• Nature Protection Management</li> <li>• Approaches to Nature Conservation</li> <li>• Nature Conservation in Oman</li> </ul>

ENVS3102	ENVIRONMENTAL TOXICOLOGY
Course Description	Introduction to eco-toxicological principles, methods and its management.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Know the basic concepts of environmental toxicology. Understand the methods in toxicity testing. Gain information on different types of toxicants Understand the procedures in monitoring and assessing ecological risk of toxicants. Understand and apply the concepts and principles in laboratory and field works</p> <p>Learning Outcomes: The students should be able to: Define critical terms and concepts in eco-toxicology Explain the biological, ecological and chemical factors affecting toxicity testing, Discuss the effects of toxicants on the ecosystem. Explain the principle behind bio-remediation, bio-magnification, bio-concentration and bio-transformation of toxicants in the environment. Discuss the effects of different toxicants (e.g. metals, lipids, herbicides, oil spills, PCB's and insecticides). Discuss the use of microorganisms and other factors as biological indicators and bio-markers for pollution. Explain some approaches in ecological risk assessment. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Determination of lethal dosage</li> <li>• Toxicological analysis of environmental pollutants</li> <li>• Techniques in determining the effects of toxicants on the ecosystem</li> <li>• Methodology in bio-remediation and determination of bio-magnification, bio-concentration and bio-transformation of toxicants in the environment</li> <li>• Determination of the effects of different toxicants (e.g. metals, lipids, herbicides, oil spills, PCB's and insecticides)</li> <li>• Using microorganisms and other factors as biological indicators and bio-markers for pollution</li> <li>• Ecological risk assessment</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction to eco-toxicology</li> <li>• Toxicity testing</li> <li>• Chemical distribution</li> <li>• Specific toxicant effects</li> <li>• Biological monitoring</li> <li>• Ecological Risk Assessment</li> </ul>



ENVS3103	HAZARDOUS WASTE MANAGEMENT
Course Description	The course introduces some management practices in handling, treating and disposing hazardous wastes.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Know what are hazardous wastes and their characteristics. Understand the history of the different regulatory provisions on handling hazardous wastes and evaluate the opinion for hazardous waste management. Give examples of hazardous wastes produced in developed countries and understand the practices in the proper disposal of hazardous wastes. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Identify what is meant by the term 'hazardous waste' and problem associated with hazardous waste. Identify the different components of hazardous waste and explain the growth in the amount of waste produced. Describe how hazardous wastes have been, and are being, disposed and treated. Overview of industrial practices in different manufacturing sectors such as food processing industry; chemical process industry; oil, mining and mineral industries. Understand pollution prevention and waste minimization programs. Explain ways of handling of hazardous wastes in Oman and future prospective. Explain the different environmental laws of import and export of environmental hazardous wastes. Discuss some management practices in handling and disposal of the hazardous wastes. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Techniques in handling and transport of hazardous waste</li> <li>• Identification of the different components of hazardous waste</li> <li>• Techniques in proper treatment and disposal of hazardous wastes</li> <li>• Techniques in pollution prevention and waste minimization.</li> <li>• Handling of hazardous wastes</li> <li>• Management practices in handling and disposal of the hazardous wastes.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Basic concepts of Waste Management</li> <li>• Planning Waste Management Programs</li> <li>• Components of Hazardous Waste</li> <li>• Hazardous waste Management</li> <li>• Industrial Practices</li> <li>• Establishing Pollution and Waste Minimization Programs</li> </ul>

ENVS3104	CHEMISTRY OF THE ENVIRONMENT
Course Description	<p>The course introduces the students to the principles of Chemistry which are very useful and linked to the study of Environmental Sciences. It develops in the students the appreciation of the application of general chemical principles to improve and preserve the quality of the environment, understand the methods of transport and accumulation of metals and organic compounds in the environment, describe analytical techniques for the assessment of chemical substances in the environment.</p>
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to:</p> <ol style="list-style-type: none"> <li>1. Understand the principles of atmospheric, soil and water Chemistry and pollution</li> <li>2. Understand the methods of transport and accumulation of metals and organic compounds in the environment</li> <li>3. Know the different analytical techniques for the assessment of chemical substances in the environment</li> <li>4. Explain the need for reliable and appropriate quantization in environmental Chemistry</li> <li>5. Understand and evaluate the usefulness of environmental modeling to complement analytical data</li> <li>6. Understand and apply the concepts and principles in laboratory and field works</li> </ol> <p>Learning Outcomes:</p> <p>The students should be able to:</p> <ol style="list-style-type: none"> <li>1. Explain the basic principles of Atmospheric Chemistry</li> <li>2. Identify the effects of air pollutants, acid rain, greenhouse gases</li> <li>3. Explain the principles of Water Chemistry</li> <li>4. Identify the factors controlling the fate and transport of chemical substances in water, air and soil</li> <li>5. Differentiate between the materials by which inorganic and organic materials are distributed in the environment</li> <li>6. Explain the importance of identifying a suitable sample location and correct sampling methods and storage</li> <li>7. Describe soil contamination by heavy metals, their bioaccumulation, metal speciation and toxicity</li> <li>8. Identify the importance of well characterized environmental reference standards and detection sensitivity</li> <li>9. Recognize and list environmental factors capable of affecting the speciation of elements in natural systems</li> <li>10. Demonstrate how chemical speciation modeling is a viable alternative to an experimental study of environmental systems</li> <li>11. Select appropriate analytical technique for analyzing ions and molecules in environmental samples</li> <li>12. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work.</li> <li>13. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</li> </ol>

<p>Course Technical Skills</p>	<ul style="list-style-type: none"> <li>• Determining the effects of air pollutants, acid rain, greenhouse gases</li> <li>• Identification of the factors controlling the fate and transport of chemical substances in water, air and soil</li> <li>• Identification of a suitable sample location and correct sampling methods and storage</li> <li>• Determination of soil contamination by heavy metals, their bioaccumulation, metal speciation and toxicity</li> <li>• Identification of the importance of well characterized environmental reference standards and detection sensitivity</li> <li>• Determination of environmental factors capable of affecting the speciation of elements in natural systems</li> <li>• Chemical speciation modeling of experimental studies on environmental systems</li> <li>• Analytical technique for ions and molecules in environmental samples</li> </ul>
<p>Course Content</p>	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Atmospheric Chemistry</li> <li>• Air pollution</li> <li>• Water</li> <li>• Soil</li> <li>• Transport of Pollutant in the Environment and Approaches to their Analysis</li> <li>• Laboratory practical sessions / Field visits</li> </ul>

ENGL3100	PUBLIC SPEAKING
Course Description	This is a non-major graduate credit course, which is designed to improve student performance in public speaking and oral communication. The course covers speech research, preparation, outlining, delivery and evaluation.
Course Objectives and Outcomes	<p>Develop skills in speech development strategies and delivery techniques.</p> <p>Develop skills in rhetorical sensitivity and critical thinking.</p> <p>Observe, analyze and provide feedback on the effectiveness of a speech/presentation.</p> <p>Demonstrate the ability to collect, analyze and use information to develop and adapt messages for particular audiences, purposes and settings.</p> <p>Organize ideas and create an outline for presentation.</p> <p>Prepare visual aids proper to the purpose of the speech/presentation.</p> <p>Organize ideas and supporting materials in a coherent message.</p> <p>Identify and refine personal speaking styles to business, government and industry functions.</p>
Course Technical Skills	Research skills, speaking skills, critical thinking skills, teamwork skills, entrepreneurial skills, presentation skills, PowerPoint skills.
Course Content	Public speaking ethics, preparing speeches, using PowerPoint and visual aids, informative speeches, persuasive speeches

PHIL3201	FORMAL ARABIC COMMUNICATION
Course Description	<p>This course deals with basic skills in communicating and writing in modern Arabic language; introduction of ideas in clear and critical meanings; modern methods of writing in a scientific way so as to avoid linguistic mistakes; developing skills in communication and correspondence.</p> <p>This also introduces the students to express the linguistic functions and be able to control his native Arabic language.</p>
Course Objectives and Outcomes	<p>Course Objectives:  A student who satisfactorily complete the course should be able to:  Student should gain the appropriate communication skills that allow him develop his career and his life after graduation. Student should identify the communication term and its associates, (Sender, Receiver, Message, and the Communication Channel). Student should apply verbal communication skills (using: words, different presentation methods, emphasizing on the meaning). Student should gain written communication skills (Punctuation, Spelling, Writing an official letter and meeting minutes).</p> <p>Learning Outcomes:  A student who satisfactorily complete the course should be able to:  To identify the communication term and the elements of communication process. To specify each element of the communication process and be able to analyze a communication letter. To analyze a communication letter and re-format that letter with a clear language. To determine the aesthetic, scientific and social level of the communication channel, and to apply the linguistic guidelines of the communication process. To gain verbal communication skills. To employ written communication skills in his writings To write a formal letter or minutes of a meeting or CV</p>
Course Technical Skills	
Course Content	

ENVS3201	ENVIRONMENTAL IMPACT ASSESSMENT AND COMPLIANCE INSPECTION
Course Description	This course introduces some important procedures and processes of environmental impact assessment and monitoring of compliance.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives:  The course should enable the students to  Know EIA, EIS and environmental compliance.  Understand the principles that pertain to environmental impact studies.  Know national policies that apply to projects having impact on the environment and understand the standard procedures in carrying out an EIA and compliance inspection.  Write an EIA report based on a selected environmental project understand and apply the concepts and principles in laboratory and field works</p> <p>Learning Outcomes:  The student should be able to:  Differentiate between EIA and EIS. Explain the principles, nature and purpose of EIS. Present other options for project appraisal in relation to environmental concern. Explain the current issues on EIA and national policies pertaining to environmental impact. Outline the standard procedures in conducting EIA and compliance inspection. Explain what are an EIS and the principles pertaining to EIS. Write and present an EIA report.  Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Processes in environmental impact assessment</li> <li>• Writing of environmental impact assessment reports</li> <li>• Project appraisal in relation to environmental concern.</li> <li>• Outline the standard procedures in conducting EIA and compliance inspection.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• What is an EIA? Project Preparation</li> <li>• EIA Process</li> <li>• Environmental Statement</li> <li>• Post decision Practices and Compliance Inspection</li> </ul>

ENVS3202	ECOTOURISM MANAGEMENT
Course Description	Concept, theory, history, terminology and practices in ecotourism planning and management.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Know what ecotourism, its types and origin is. Understand the principles of eco-tourism as they apply to natural, cultural, social and economic sustainability. Know the challenges related to ecotourism, planning &amp; management. Understand the processes in ecotourism planning. Identify the positive and negative impacts of ecotourism. Know the management practices involved in ecotourism. Demonstrate an awareness of international guidelines for eco- tourism planning &amp; management. Demonstrate an understanding of monitoring and risk management related to sustainability. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain the principles of sustainable development, its goals and practical approaches. Describe the factors and components of the environment and their significance to ecotourism. Describe the features of a potential ecotourism site. Explain the process of development, design and implementation of ecotourism programs. List the potential customers who may be attracted to ecotourism programs. Outline ecotourism activities including related interpretation. Prepare an ecotourism management plan. List the different impacts of ecotourism. Explain the definitions, terminologies and concepts of ecotourism. Describe the history and development of natural/cultural resource attractions and demand for recreation and tourism opportunities at such attractions. Discuss the basic ecological principles and ecosystem functions that have bearings on ecotourism. Explain the socio-cultural sensitivities of ecotourism development. Explain the demand-supply, carrying capacity, economic benefits and sustainability issues inherent in sustainable ecotourism developments. Discuss the different dimensions of ecotourism in relation to Oman. Explain the basic planning and management guidelines for ecotourism development. Explain the international guidelines for eco- tourism planning &amp; management. Explain monitoring and risk management related to sustainability. List the potential benefit gained by the community from eco- tourism projects. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>

Course Technical Skills	<ul style="list-style-type: none"> <li>• Ecotourism tour guiding</li> <li>• Explain the principles of sustainable development, its goals and practical approaches</li> <li>• Design a process of development and implementation of ecotourism programs.</li> <li>• Outlining ecotourism activities including related interpretation.</li> <li>• Preparing ecotourism management plan</li> <li>• Basic planning and management ecotourism development</li> <li>• Monitoring and risk management related to sustainability.</li> <li>• Conduct of eco- tourism projects.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Brief Review of Ecological Principles</li> <li>• Environmental Impacts</li> <li>• Global Eco-tourism</li> <li>• Eco-tourism Planning</li> <li>• Business of Eco-tourism</li> <li>• Issues with Eco-tourism</li> <li>• Ecotourism Management: Environmental Implementation</li> </ul>



ENVS3203	FRESHWATER ECOLOGY
Course Description	Discovering the richness and diversity of the freshwater ecosystem as a unique and important part and parcel of the earth. How to protect the freshwater ecosystem and its biodiversity are included in the discussion.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the student to:</p> <ol style="list-style-type: none"> <li>1. understand the different concepts pertaining to freshwater ecosystem</li> <li>2. know the processes that take place in the freshwater ecosystem</li> <li>3. learn the interactions among the freshwater organisms</li> <li>4. gain knowledge on how the freshwater ecosystem could be protected and sustain its good environmental condition</li> <li>5. understand and apply the concepts and principles in laboratory and field works</li> </ol> <p>Learning Outcomes: The students should be able to:</p> <ol style="list-style-type: none"> <li>1. differentiate between lotic and lentic ecosystems</li> <li>2. discuss what is limiting factors and the physical factors in a freshwater ecosystem</li> <li>3. discuss the classifications of freshwater organisms</li> <li>4. describe the different flora and fauna in a freshwater ecosystem</li> <li>5. explain the different communities and zonations in the lentic ecosystem</li> <li>6. explain the different communities and zonations in the lotic ecosystem</li> <li>7. discuss the different resources, uses and management of freshwater ecosystem</li> <li>8. describe how pollution sets-in in the freshwater ecosystem and the possible solution to this problem</li> <li>9. demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work.</li> <li>10. perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</li> </ol>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Bio-physics chemical analysis of freshwater ecosystem</li> <li>• Community analysis of freshwater ecosystem</li> <li>• Identification of the different flora and fauna in a freshwater ecosystem</li> <li>• Management of freshwater ecosystem</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• The Freshwater Environment- Types of Limiting Factors</li> <li>• Ecological Classifications of Freshwater Organisms</li> <li>• The Freshwater Biota (Flora and Fauna)</li> <li>• Lentic Communities</li> <li>• Lotic Communities</li> <li>• Freshwater Resources</li> <li>• Freshwater Pollution</li> </ul>

ENVS3301	EARTH SCIENCE
Course Description	This course will give the student basic concepts of earth science with emphasis on global geological processes and their impact on humans.
Course Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Explore the origin of the earth within the developing solar system. Understand the evolution of the earth biosphere, hydrosphere and atmosphere through geological times. Understand landscape development, fluvial, arid, ocean, coastal zone, wadis and lakes. Be aware of the forces that shape the surface of the earth: volcanic activities, earthquakes and other geological hazards, mountains, plains and plateaus and those that sculpture the earth surface: weathering and erosion, running water. Explore the earth envelope of water: running, oceans and the earth atmosphere and climate. Participate in field excursions and other self-paced fieldwork to examine rocks and minerals and read maps. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Describe the origin of the earth and its materials. Explain the structure and the evolution of the crust, continents, oceans and the atmosphere. Identify and tell the rock sequences and the time sequencing of major events, which shaped the planet and the development of life forms and geological controls on these. Describe the development of fluvial, arid and coastal zones and forces that shape and sculptured the earth's surface. Assess the influence of volcanic activity, earthquake and other geological hazards on human occupation of the planet. Apply knowledge to examine sediments, minerals and rock and give geological interpretation of Oman land mass. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Reading of maps and elevation contour</li> <li>• Analysis of rocks and soil</li> <li>• Simple procedure in dating of geological rocks and events</li> <li>• Identification and analysis of minerals</li> <li>• Identification of rocks in hand specimens and fossils</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Geological history</li> <li>• Introduction to landscape development</li> <li>• Earth atmosphere and climate</li> </ul>

QAQC3200	QUALITY ASSURANCE & QUALITY CONTROL
Course Description	It provides the student with the concepts of quality assurance systems and encourages their applications to familiar situations while considering related statistical methods. It involves quality systems and their applications; quality control in industry; specification and non-conformance; statistical process control and sampling and inspection plans. It also introduces the student to the application of the quality techniques in a range of industries and their implementation. Industrial visits are integral part of this course.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the student to: Understand the principles and practices of quality systems. Apply the tools of quality assurance and management procedures which can lead to an effective quality organization or a process improvement. Understand the: a) statistical methods used in quality control, b) process capability, c) discrete and continuous data for specific examples. Understand the concepts of control charts and sampling plans and their application in the quality assurance of industries. Understand some quality approaches and their application. Apply the concepts and principles of quality assurance and quality control in the management of science laboratories.</p> <p>Learning Outcomes: The students should be able to: Use process flow charts, Pareto analysis to investigate a familiar industrial process from local industry. Identify the critical control points in a selected industrial process and investigate the management structures which can lead to the process improvement. Outline the principles underlying a quality system and design structures for familiar operations. Illustrate the economic benefits of quality assurance and quality control in selected example from the local industry. Examine and use statistical methods in quality control. Define the terms, specification, tolerance, process variation, assignable variation, process capability, in-control and out-of-control. Explain how statistical techniques can be used in the control of a selected process and identify the consumer's and producer's risk. Choose simple quality procedures for a selected process from the local industry. Explain the process capability for specific examples. Explain PDCA and ISO as an approach to quality assurance and quality control. Explain the use and importance of quality assurance and quality control in an analytical chemistry laboratory. Describe how to validate analytical method.</p>
Course Technical Skills	Quality Assurance and Control, Statistical Analysis, Preparation of Product Specification
Course Content	<ul style="list-style-type: none"> <li>• Introduction to Quality</li> <li>• Quality Tools</li> <li>• Process capability</li> <li>• Quality Continual improvement/Some Quality approaches</li> <li>• Main Activities and Responsibilities of Quality Control and Quality Assurance in analytical laboratories</li> </ul>

## B.TECH COURSES

PHIL4101	OMAN CIVILIZATION
Course Description	<p>The course will acquaint the student with Omani and Islamic civilization, their development and significance during different pre- and post-Islam eras, and with the Islamic judicial system. Explain the effects of geography on Omani civilization. Investigate and describe the significance of Omani civilization during the pre-Islam era. Investigate and describe Oman's embracing of Islam. Investigate and describe the significance of Omani civilization during the caliphates, ummait, and abbasi eras. Describe the characteristics of Islamic civilization. Describe the development, and external and internal supporting factors for Islamic civilization. Describe the Islamic judicial system during the post-Islam eras.</p>
Course Objectives and Outcomes	<p><b>Course Objectives:</b> To enable the student to: Understand the geography of Oman. Be familiar with the significance of Omani civilization during pre- and post-Islam eras. Understand Islamic civilization, its development, and its supporting factors. Understand the Islamic judicial system during different post-Islam eras.</p> <p><b>Learning Outcomes:</b> The students should be able to: Describe Oman's geography. Explain the effects of geography on Omani civilization. Investigate and describe the significance of Omani civilization during the pre-Islam era. Investigate and describe Oman's embracing of Islam. Investigate and describe the significance of Omani civilization during the caliphates, ummait, and abbasi eras. Describe the characteristics of Islamic civilization. Describe the development, and external and internal supporting factors for Islamic civilization. Describe the Islamic judicial system during the post-Islam eras</p>
Course Technical Skills	
Course Content	

ENVS4102	BIO-SAFETY
Course Description	Research, collection, and ethics on the utilization of biological and genetic resources; observance in the elimination of potential risks from biotechnology and its products.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Learn the concepts and principles of bio-prospecting and bio-safety and their impact on biodiversity. Understand the laws and agreement pertaining to bio-prospecting and bio-safety. Realize the importance of bio-safety in various fields of study. Know Oman's regulations on bio-prospecting and bio-safety. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain what is bio-prospecting and bio-safety and their roles in pharmaceutical research. Discuss some well-known cases of bio-prospecting. Explain the salient features of the patent law and the Convention on Biological Diversity. Discuss ownership rights and arguments about biological entities. Explain the principles that apply to bio-safety. Discuss the application of bio-safety in ecology, agriculture, chemistry, and biological warfare. Explain the country's policies and regulations on bio-prospecting and bio-safety. Discuss general principles and practices in laboratory bio-safety. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Handling of genetically modified organisms</li> <li>• Bio-prospecting and bio-safety</li> <li>• Patenting of biological entities</li> <li>• Application of bio-safety in ecology, agriculture, chemistry, and biological warfare</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction and Definition of Terms</li> <li>• Famous Cases</li> <li>• Legal and Political Aspects</li> <li>• Ownership</li> <li>• Bio-safety Principles</li> <li>• Biosafety in various Fields</li> <li>• Frameworks for Oman</li> <li>• Laboratory Biosafety</li> </ul>

ENVS4101	MARINE ECOLOGY AND COASTAL RESTORATION
Course Description	Discovering the richness and diversity of the marine environment as a unique and important part of life on earth. Coastal restoration will also be included
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Understand oceanography, oceanic exploration, plate tectonics, tsunamis, Coriolis effect. Learn the ocean's physical characteristics and the important marine organisms and their interactions. Know various marine and coastal resources and the legal issues pertaining to marine and coastal resources. Gain information on how marine pollution affect the marine environment particularly the coastal communities. Know the concepts and principles in the restoration of coastal areas. Learn the impact of various activities affecting the coastal areas. Learn management practices that address the needs for controlling coastal pollution, coastal development, restoration of salt marshes, mangrove and reefs. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain the definition of oceanography and oceanic exploration. Describe the topography of the ocean floor. Explain the formation of sediments and their classification and characteristics. Discuss the different physical and chemical factors in a marine ecosystem. Explain wave formation and their effects including El Nino phenomenon, upwelling and out-welling. Explain tidal formation and some phenomena related to it such as tsunami, occurrence of high tide and low tide, Explain coastal formation, destruction and pollution. Discuss energy flow in the marine ecosystem. Characterize the different marine organisms and their existence in the marine ecosystem. Discuss the different marine communities. Discuss the different marine resources, their uses and legal issues pertaining to the resources. Describe the different types of marine and coastal pollution and the management strategies that must be implemented. Explain the impact of some activities done in the coastal areas such as construction, reclamation, human settlement, urbanization, industry, tourism, coastal and seabed mining, upland mining, offshore oil and gas. Explain tidal marsh restoration. Discuss reef restoration. Describe mangrove restoration. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>

Course Technical Skills	<ul style="list-style-type: none"> <li>• Bio-physics chemical analysis of marine ecosystem</li> <li>• Community analysis of marine ecosystem</li> <li>• Characterize the different marine organisms and their existence in the marine ecosystem</li> <li>• Impact analysis of some activities done in the coastal areas such as construction, reclamation, human settlement, urbanization, industry, tourism, coastal and seabed mining, upland mining, offshore oil and gas</li> <li>• Tidal marsh restoration</li> <li>• Reef restoration</li> <li>• Mangrove restoration</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• The Ocean World</li> <li>• Over the Edge</li> <li>• An Ocean's Memory</li> <li>• Ocean Water</li> <li>• Ocean Waves</li> <li>• Ocean Currents</li> <li>• On the Coast</li> <li>• Energy Flow and Marine Organisms</li> <li>• Marine Resources</li> <li>• Managing Coastal and Marine Pollution at the Local Level</li> <li>• Impact of Selected Coastal Activities</li> <li>• Salt Marsh Restoration</li> <li>• Reef Restoration</li> <li>• Mangrove Restoration</li> </ul>

ENVS4103	WASTEWATER MANAGEMENT
Course Description	Principles and practices in managing domestic and industrial wastewater.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Know the relationship between the natural water cycle and human water use. Gain knowledge of the basic chemical, physical and biological principles of the water treatment process. Understand the chemistry of ground water contamination. Learn various methods in waste water treatment system. Understand the management practices in Wastewater treatment. Expound on wastewater treatment regulations and programs. Learn the guidelines on water conservation plan. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Present an overview of water and wastewater management. Explain the chemical, physical and biological principles that revolve around wastewater treatment. List the physical/chemical properties of ground water contamination. Discuss background of wastewater treatment system. Explain the procedures in managing the wastewater. Discuss the economic and design considerations in wastewater treatment. Explain the different policies/regulations and programs on wastewater treatment. Discuss the guidelines on water conservation plan suitable for the country. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Water quality analysis and waste water management</li> <li>• Water and wastewater management</li> <li>• Chemical, physical and biological analysis of wastewater</li> <li>• Detection of physical/chemical properties of ground water contamination</li> <li>• Establishing wastewater treatment system</li> <li>• Managing the wastewater</li> <li>• Preparation of water conservation plan suitable for the country</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Principles of Wastewater Treatment</li> <li>• Ground Water Contamination</li> <li>• Wastewater Treatment Systems</li> <li>• Overview of Wastewater Management</li> <li>• Wastewater Treatment Consideration</li> <li>• Water Treatment Consideration</li> <li>• Water Conservation Plan Guidelines</li> </ul>



ENVS4104	POLLUTION SOURCES AND CONTROL II
Course Description	This course intends to provide advance topics in environmental pollution and the methods of minimizing and controlling major classes of environmental pollutants.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Understand environmental pollution and their adverse effects to human and environment. Explain ways of controlling environmental pollution and disposal mechanisms of toxic and hazardous pollutants. Understand industrial ecology and sustainable industrial production. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes:</p> <p>Learning Outcomes: The student should be able to: Describe the major categories and sources of air pollution and road emissions. Analyze the origin and dangers of some indoor air pollutions. Compare different approaches to air pollution. Understand what solid and hazardous wastes are and how we dispose of them. Explain the advantages and disadvantages of different waste treatments and waste disposal methods. Understand what persistent organic pollutants and adverse effects of these pollutants. Explain sources and effects of marine pollution. Explain the meaning of industrial ecology and how industrial ecology views ecological processes and natural resources. Explain the role of modern industries in achieving future sustainability. Explain the simulation / computer modeling of pollution control. Demonstrate the ability to develop simulation / computer modeling techniques of pollution control. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Sampling techniques</li> <li>• Chemical analysis of pollutants</li> <li>• Determination of the major categories and sources of air pollution and road emissions.</li> <li>• Analysis of the origin and dangers of some indoor air pollutions.</li> <li>• Proper disposal of solid and hazardous wastes</li> <li>• Waste treatments and waste disposal methods.</li> <li>• Detection of persistent organic pollutants and adverse effects of these pollutants.</li> <li>• Simulation / computer modeling of pollution control.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Air Pollution</li> <li>• Solid Waste</li> <li>• Toxic and Hazardous Wastes</li> <li>• Radiation in the Environment</li> <li>• Persistent Organic Pollution (POP)</li> <li>• Marine Pollution</li> <li>• Industrial Ecology</li> </ul>

ENVS4201	ENVIRONMENTAL MONITORING SYSTEMS AND DATA ANALYSIS
Course Description	Monitoring systems for environmental contaminants; assessing consequences on natural resource management and pollution risks; and application of bioremediation technologies. The course is also designed to enable the students how to conceptualize a problem, acquire, process, analyze and properly interpret environmental data generated.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Understand the complexities of environmental problems. Learn how to organize, present, analyze and communicate environmental data. Know the applications of statistical methods in analyzing environmental data. Understand environmental problem conceptualization, methods of data collection, presentation and discussion of results. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain the scientific method in the context of environmental science. Identify an environmental problem. Explain the methods of data collection. Discuss vital statistical methods in data analysis. Discuss the methods in result presentation. Explain how to interpret and discuss results of research. Explain how to write conclusion, recommendation and abstract. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Data Collection</li> <li>• Statistical data analysis</li> <li>• Monitoring ecosystem health</li> <li>• Identification of components of environmental contaminants and their pathways</li> <li>• Sampling and monitoring methods employed in air, water, sediments and biological entities</li> <li>• Identification of common biological indicators on the state of the environment</li> <li>• Determination of risks and their impact on natural resource management</li> <li>• Bioremediation practices and monitoring efforts</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction and Background</li> <li>• Environmental Contaminants</li> <li>• Ecosystem Health Monitoring</li> <li>• Sampling/monitoring Methods</li> <li>• Assessment of Consequences</li> <li>• Bioremediation</li> <li>• Legal Framework</li> </ul>

ENVS4202	GIS AND REMOTE SENSING
Course Description	Introduction to remote sensing and geographical information system as they are applied for explaining events, predicting outcomes, and planning strategies in managing the environment.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Understand the concept of remote sensing; principles: the photon and radiometric parameters; quantum physics underlying remote sensing; use of spectroscopy; electromagnetic spectrum; distribution of radiant energies; sensor technologies, processing and classification of data; pattern recognition; data/image interpretation. Learn the applications of Remote Sensing. Understand the importance of Remote Sensing in the 21st Century. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain the concept of remote sensing; principles: the photon and radiometric parameters; quantum physics underlying remote sensing; use of spectroscopy; electromagnetic spectrum; distribution of radiant energies; sensor technologies, processing and classification of data; pattern recognition; data/image interpretation. Explain the salient points in the applications of Remote Sensing. Discuss the mechanism of landsat tours. Explain the principle and mechanisms of photography and spectroscopy in remote sensing. Explain the principles and importance of Remote Sensing in the 21st Century disaster management. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Techniques in remote sensing</li> <li>• Use of spectroscopy; electromagnetic spectrum; distribution of radiant energies; sensor technologies, processing and classification of data; pattern recognition; data/image interpretation</li> <li>• Mechanism of landsat tours</li> <li>• Mechanisms of photography and spectroscopy in remote sensing</li> </ul> <p>Disaster management through Remote Sensing</p>
Course Content	<ul style="list-style-type: none"> <li>• Introduction, Perspectives of Remote Sensing, Special Applications</li> <li>• Applications of Remote Sensing</li> <li>• Landsat Tours the World</li> <li>• Photography and Spectroscopy</li> <li>• Remote sensing into the 21<sup>st</sup> century</li> </ul>

ENVS4203	DISASTER MANAGEMENT
Course Description	Understanding how natural and man-made disasters happen, their consequences and approaches in managing them.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: At the end of the course, the student should be able to: Discuss operation and characteristics of natural disasters. Recite how to assess risk from natural and man-made disasters and its prevention measures. List emergency response actions in time of disasters. Discuss preparedness measures in anticipation of disasters. Expound on accepting aids and donations for disaster help. Discuss global agenda in dealing with disasters. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Recite the anatomy of natural and human-made disasters. List management practices in times of disasters. Explain how to estimate risk on humans, properties and the environment if ever a disaster operates on certain locality. Suggest prevention and preparedness measures to cope with future disasters. Recite emergency responses after a disaster. Discuss recovery and rehabilitation measures. Explain steps to prepare for disasters. Discuss actions in recovery and rehabilitation. Recite protocols in accepting aids and donations. Discuss world's agenda to cope up with natural disasters. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Assessment and evaluation of disaster effects</li> <li>• Management practices in times of disasters</li> <li>• Estimation of risk on humans, properties and the environment if ever a disaster operates on certain locality</li> <li>• Prevention and preparedness measures to cope with future disasters</li> <li>• Emergency responses after a disaster</li> <li>• Recovery and rehabilitation measures</li> <li>• Actions in recovery and rehabilitation</li> <li>• Protocols in accepting aids and donations</li> <li>• Coping up with natural disasters</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction</li> <li>• Chaos Theory</li> <li>• Emergency Planning</li> <li>• Emergency Response and Disaster Management</li> <li>• Disaster Preparedness</li> <li>• Rebuilding after a disaster</li> <li>• International responses and the global agenda</li> </ul>

ENVS4204	ENVIRONMENTAL ADVOCACY AND AWARENESS
Course Description	Approaches in creating public awareness on the importance of environmental conservation; planning and implementing environmental advocacy programs.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the students to: Clarify the distinction between the role of ecological science and the role of social and political values for the environment within environmental education. Examine the changing perspectives of ecology in education and the changing perspectives of education in environmental education. Assess the science and education perspectives within environmental education, along with suggested frameworks for development of programs and resources that integrate current science, education and action. Understand and apply the concepts and principles in laboratory and field works.</p> <p>Learning Outcomes: The students should be able to: Explain what is environmental advocacy and awareness. Explain the contextual history of environmental justice, culture, the social structure of accumulation and resource mobilization. Discuss the features, examples and principles of social and environmental change, advocacy, mediation and justice research. Explain dependency theory, global warming and other issues. Explain what environmental advocacy research is. Discuss public awareness. Demonstrate ability to participate, share and develop skills and competencies during practical sessions, field excursions and self-paced field work. Perform at least 10 to 12 practical activities / field visits for better understanding of the theoretical concepts and to develop related skills and competencies.</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Environmental protection campaign techniques</li> <li>• Community engagement</li> <li>• Techniques in environmental advocacy and awareness</li> <li>• Conduct of public awareness</li> </ul>

Course Content

- Introduction
- Contextual History of Environmental Justice Culture
- The Social Structure of Accumulation
- Resource Mobilization
- A Creative Response to Violence and Hate
- Building Ideology and Organization for Social and Environmental Change
- Environmental Advocacy and Environmental Mediation; Differences and Similarities
- Key Environmental Justice Research Issues in the Positivist Tradition
- Political Practices, Pollution Prevention, and Participatory Research as Methodology for Environmental Justice
- Dependency Theory
- Global Warming
- Environmental Crisis or Crisis of Epistemology
- Environmental Advocates as Futurists
- Environmental Advocacy Research
- Public Awareness

ENVS4205	PROJECT IIA
Course Description	Addressing urgent global environmental problems such as global warming, ozone depletion, cyclones and desertification by conducting and presenting experimental research and current issues in environmental science
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the student to: Understand natural phenomena having impact on the human environment to include global warming, ozone depletion, occurrence of cyclones and desertification. Propose solutions to address these environment problems by conducting experimental research. Present to class in a seminar style their proposal and the results of their research</p> <p>Learning Outcomes: The students are expected to: Discuss current and urgent problems confronting the environment having pronounced impact on the human species. Explain factors and events that brought these environmental problems. Defend well-thought measures in solving environmental problems. Submit a research paper / report</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Research techniques</li> <li>• Laboratory analysis</li> <li>• Data analysis</li> <li>• Techniques in technical writing of reports</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Importance of Scientific Research</li> <li>• Differences between Experimental and Descriptive Research</li> <li>• Parts of Scientific Paper</li> <li>• General and Specific Objectives</li> <li>• Significance of the Study</li> <li>• Scope and Limitation</li> <li>• Review of Related Studies and Citations of References</li> <li>• Experimental Design</li> <li>• Results and Discussion</li> <li>• Conclusion and Recommendation</li> </ul>

ENVS4301	PROJECT II B
Course Description	Addressing urgent global environmental problems such as global warming, ozone depletion, cyclones and desertification by conducting and presenting experimental research and current issues in environmental science.
Course Objectives and Outcomes / Program Objectives and Outcomes	<p>Course Objectives: The course should enable the student to:</p> <ol style="list-style-type: none"> <li>1. understand natural phenomena having impact on the human environment to include global warming, ozone depletion, occurrence of cyclones and desertification</li> <li>2. propose solutions to address these environment problems by conducting experimental research</li> <li>3. present to class in a seminar style their proposal and the results of their research</li> </ol> <p>Learning Outcomes: The students are expected to:</p> <ol style="list-style-type: none"> <li>1. discuss current and urgent problems confronting the environment having pronounced impact on the human species</li> <li>2. explain factors and events that brought these environmental problems</li> <li>3. defend well-thought measures in solving environmental problems</li> </ol> <p>submit a research paper / report</p>
Course Technical Skills	<ul style="list-style-type: none"> <li>• Research techniques</li> <li>• Laboratory analysis</li> <li>• Data analysis</li> <li>• Techniques in technical writing of reports</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Writing of the Technical Paper/Report</li> <li>• Documentation and PowerPoint Presentation of the Technical Paper / Report</li> </ul>



NUTR4200	NUTRITION
Course Description	<p>This course provides an integrated overview of the physiological requirements and functions of protein, energy, and the major vitamins and minerals that are determinants of health and disease. Topics include dietary sources, intake levels, biological determinants of nutrient requirements, and the role of diet on the development of chronic diseases, such as cardiovascular disease, cancer, diabetes, etc.</p>
Course Objectives and Outcomes	<p><b>Course Objectives:</b>  The course should enable the students to:  Explain the terms nutrition, carbohydrate, protein, lipid (fat), vitamin, mineral, water, kilocalorie, epidemiological studies; the use of caloric values of energy yielding nutrients. Identify the basic structures and food sources of carbohydrates, lipids, proteins, vitamins and minerals; list and describe the functions, and the role of each in nutritional health. Describe the uses of energy by the body and what constitutes energy balance, and list and explain the factors that might cause eating disorders. Outline the overall processes of digestion and absorption in the mouth, stomach, small intestine and large intestine, as well as the roles played by the liver, gall bladder and pancreas. Identify the major nutrition-related health problems and approaches to treatment; outline the causes of, effects of, typical persons affected by, and treatment for coronary heart disease, hypertension, cancer, diverticulosis, diabetes mellitus and osteoporosis.</p> <p><b>Learning Outcomes:</b>  The students should be able to:  Understands the meaning of the terms nutrition, carbohydrate, protein, lipid (fat), vitamin, mineral, water, kilocalorie, and fiber. Determine the total calories (kcal) of a food or diet. Learn the epidemiological studies. Differentiate among hunger, satiation and satiety and how these influence our eating behavior. Recognize the different in structure between carbohydrates - monosaccharides, disaccharides, polysaccharides (e.g. starches) and fiber. Understands the functions of carbohydrate in the body and the problems that result from not eating enough carbohydrate. Recognize the beneficial effects of fiber on the body. Determine the food sources of carbohydrate and list some alternative sweeteners. List four classes of lipids and the role of each in nutritional health. Compare between saturated, monounsaturated, and polyunsaturated fatty acids in term of structure and food sources. Recognize the implications of various fats, including omega-3, omega-6, and omega-9. Describe how amino acids make up proteins. List the primary functions of protein in the body. Understand the term vitamin and classify the vitamins according to whether there are fat soluble or water soluble. Understand the functions of water in the body. Classify the minerals as major or trace minerals. Describe the uses of energy by the body and what constitutes energy balance. Recognize the benefits and hazards of various weight-loss methods for severe obesity. Understands how protein-calorie malnutrition eventually can lead to disease in the body. Understand the causes of, effects of, typical persons affected by, and treatment for vitamin A, vitamin C, calcium deficiency</p>

	Understand the causes of, effects of, typical persons affected by, and treatment for anorexia nervosa, bulimia nervosa. Understand the term body mass index and list the factors that might cause obesity. Recognize obesity as a causative factor in a number of different conditions. Understand the overall processes of digestion in the mouth, stomach, small intestine and large intestine, as well as the role played by the liver, gall bladder and pancreas. Recognize the histology of the wall of the different parts of the digestive system. Identify the major nutrition-related health problems and approaches to treatment. Understand the causes of, effects of, typical persons affected by, and treatment for coronary heart diseases, hypertension, cancer, diverticulosis, diabetes mellitus and osteoporosis
Course Technical Skills	Quantitative estimation and identification of carbohydrate (variety of sugar and starch), protein, lipids (visible and invisible) and vitamins in a variety of food such as fruits, vegetables, milk and other prepared food. -Quantitative estimation and identification of cholesterol in variety of cooking oil such as sunflower oil, corn oil, olive oil, canola oil, sesame oil and other kind of food.
Course Content	<ul style="list-style-type: none"> <li>• Introduction to Nutrition</li> <li>• Carbohydrate</li> <li>• Lipid</li> <li>• Protein</li> <li>• Minerals, ions, vitamin and water</li> <li>• Energy Requirements</li> <li>• Unbalanced Diet</li> <li>• Over nutrition</li> <li>• Digestion and Absorption</li> </ul> Disease linked to Diet

## COURSE MAPPING

### New Programme vs OND/Lab School up to Diploma Level

Course contents matched approximately

NEW Programme Environmental Science			OND Programme /Lab School		
Matched Courses			Matched Courses		
Course Code	Description	CR	Course Code	Subjects	CR
CHEM1102	Fundamentals of Chemistry	3	SCIG 120	Chemistry 1A	3
			SCIG 220	Chemistry 1B	3
BIOL1100	Fundamentals of Biology	4	SCIG 110	Biology 1A	3
			SCIG 210	Biology 1B	3
LABT1201	Laboratory Techniques	3	SCIG 141	Lab. Tech 1	2
			SCIG 241	Lab. Tech 2	2
CHEM1202	Chemistry I	3	SCIC 310	Chemistry II	4
CHEM2104	General Organic Chemistry	3		75% covered in all chemistry courses	
SLOM1103	Safety & Lab. Management	3	SCIG 410	Safety & Lab. Management	2
PHYS1201	Physics	3	SCIG 130	Physics 1A	3
			SCIG 230	Physics 1B	3
ITAD1100	Advanced IT Skills	3	COMS 110	I.T. I	1
			COMS 210	I.T. II	1

MATH 1102	Pure Math	3	MATS 110	Math I	3
CHEM2201	Analytical Chemistry I	3	SCIB 341	Analytical Tech.(only OND)	3
Additional Extra Courses to be taken			Extra Courses to be matched		
ENTW 1100	Technical Writing I	3	ENLS 110	English I	3
ENTW 1200	Technical Writing II	3	ENLS 210	English II	3
BACO 1212	Job Search Techniques	3	ENLS 310	English III	3
PHIL 2108	Business Ethics	3	ENLS 410	English IV	3
ENGL 2100	Technical Communication	3	SCIC 441	Lab. Tech IV	2
ENVS 1200	Fundamentals Of Environmental Sciences	3			
PHIL 2200	Formal Logic	3			
ENVS 2101	Principles Of Environmental Sciences	3			
ASAB 2103	Microbiology	3			
ENVS 2201	Introduction To Environmental Policy And Implementation	3			
ENVS 2202	Pollution Sources And Control 1	3			
ENVS 2203	Field Study And Laboratory Techniques In Environmental Sciences	3			
ENVS 2204	Project I A/Project Ib	6			
	On Job Training				

## Student Centered Approaches - Environmental Science

Level	Course code	Course title	Total No. of outcomes	No. of outcomes covered	No. of outcomes covered by SCA	% of outcomes covered by SCA	Method used to cover SCA
Diploma 1	ENVS1200	FUNDAMENTALS OF ENVIRONMENTAL SCIENCES	9	7	5	71.5%	-Practical, lab work -Group Discussions -Reports -Field trips -Video
Diploma 1	SLOM1103	SLOM	13	8	3	38%	-Practical, lab work
Diploma 2	ENVS2101	PRINCIPLES OF ENVIRONMENTAL SCIENCES	11	8	7	89%	-Practical, lab work -Field activity
Other Courses Offered by Environmental Sciences Section							
Advanced Diploma	QAQC3200	QUALITY ASSURANCE AND QUALITY CONTROL	12	9	3	33%	-Class works
Advanced Diploma	ASES2104	PRINCIPLES OF ENVIRONMENTAL CHEMISTRY	9	6	2	33%	- Practical Lab work - Reports -Assignment
Advanced Diploma	ASES3209	ENVIRONMENTAL CHEMISTRY	8	6	2	33%	-Practical Lab work - Reports - Assignment
B. Tech	ASES3100	ENVIRONMENTAL POLLUTION AND ITS IMPACT	12	10	3	30%	Practical and Field Activities

## MAPPING OF GRADUATE ATTRIBUTES

Course code	Course	Level (Diploma, A. Diploma, B. Tech)	Graduate Attribute No. (Tick the graduate attribute no. that is covered in the course)										
			1	2	3	4	5	6	7	8	9	10	
ENVS1200	FUNDAMENTALS OF ENVIRONMENTAL SCIENCES	Diploma	√	√	√	√	√	√	√	√	√	√	
SLOM1103	SLOM	Diploma	√	√	√	√	√	√	√	√			√
CHEM2102	PRINCIPLES OF ENVIRONMENTAL SCIENCES	Diploma	√	√	√	√	√	√	√	√	√	√	
ASAB2103	MICROBIOLOGY	Diploma											
ENVS2102	INTRODUCTION TO ENVIRONMENTAL POLICY AND IMPLEMENTATION	Diploma	√	√	√	√	√	√	√	√	√	√	
ENVS2201	POLLUTION SOURCES AND CONTROL 1	Diploma	√	√	√	√	√	√	√	√	√	√	
ENVS2202	FIELD STUDY AND LABORATORY TECHNIQUES IN ENVIRONMENTAL SCIENCES	Diploma	√	√	√	√	√	√	√	√	√	√	√
ENVS2203	PROJECT I A	Diploma	√	√	√	√	√	√	√	√	√		
ENVS2301	PROJECT I B	Diploma	√	√	√	√	√	√	√	√	√		
ENVS3101	BIODIVERSITY AND NATURE CONSERVATION	A. Diploma	√	√	√			√	√	√		√	
ENVS3102	ENVIRONMENTAL TOXICOLOGY	A. Diploma	√	√	√	√	√	√	√	√			
ENVS3103	HAZARDOUS WASTE MANAGEMENT	A. Diploma	√	√	√			√	√	√		√	
ENVS3104	PRINCIPLES OF ENVIRONMENTAL CHEMISTRY	A. Diploma	√	√	√	√	√	√	√	√			
QAQC3200	QUALITY ASSURANCE AND QUALITY CONTROL	A. Diploma	√	√	√	√	√	√	√	√			
ENVS3201	ENVIRONMENTAL IMPACT ASSESSMENT AND COMPLIANCE INSPECTION	A. Diploma	√	√	√	√	√	√	√	√	√	√	
XXXX	INTRODUCTION TO RADIATION PHYSICS/ EARTH SCIENCE	A. Diploma	√	√	√	√	√	√	√	√			
ENVS3203	FRESHWATER ECOLOGY	A. Diploma	√	√	√			√	√	√			
ENVS3301	ECOTOURISM MANAGEMENT	A. Diploma	√	√	√	√	√	√	√	√	√	√	√
ASES2104	Principles of Environmental Chemistry*	A. Diploma	√	√	√			√	√	√	√		

ASES3209	Environmental Chemistry*	A. Diploma	√	√	√		√	√	√	√		
ENVS4101	MARINE ECOLOGY AND COASTAL RESTORATION	B. Tech	√	√	√		√		√		√	
ENVS4102	BIO- SAFETY	B. Tech	√	√	√		√	√	√		√	
ENVS4103	WASTE WATER MANAGEMENT	B. Tech	√	√	√		√	√	√		√	
ENVS4104	POLLUTION SOURCES AND CONTROL II	B. Tech	√	√	√		√		√	√	√	
ENVS4201	ENVIRONMENTAL MONITORING SYSTEMS AND DATA ANALYSIS	B. Tech	√	√	√	√	√	√	√		√	
ENVS4202	REMOTE SENSING	B. Tech	√	√	√	√	√	√		√	√	
ENVS4203	DISASTER MANAGEMENT	B. Tech	√	√	√	√	√	√	√	√	√	
ENVS4204	ENVIRONMENTAL ADVOCACY AND AWARENESS	B. Tech	√	√	√		√		√		√	
ENVS4205	PROJECT IIA	B. Tech	√		√							
ENVS4301	PROJECT II B	B. Tech	√	√	√	√	√	√	√		√	
ASES3111	Environmental Pollution and Its Impact*	B. Tech	√	√	√		√		√	√	√	√

\*Other Courses Offered by ESS

<b>College Graduate Attribute</b>
1. Are well disciplined and committed to hard work and a high standard of productivity.
2. Are able to apply the knowledge and skills to a diverse and competitive work environment.
3. Are able to think critically, analyze and solve problems.
4. Have a high degree of competence in using information and communication technology.
5. Are professionally competent and up-to-date in their field of specialization in a changing global environment.
6. Can gather and process knowledge from a variety of sources, and communicate effectively in written and spoken English.
7. Can effectively demonstrate and apply good interpersonal skills in team work and leadership roles.
8. Are committed to self development through lifelong learning.
9. Are socially responsible citizens aware of contemporary issues in contributing to national development
10. Are able to demonstrate and apply their entrepreneurial skills.