

**MAHATMA GANDHI UNIVERSITY
KOTTAYAM**

**RESTRUCTURED CURRICULUM
FOR
B Sc CHEMISTRY (ENVIRONMENT & WATER MANAGEMENT)**

JUNE 2009

**Mahatma Gandhi University, Kottayam
BSc Programmes in Chemistry (Environments & Water Management)
Curriculum**

Preface

Science is pivotal to the development of any modern society. However, the creation of a scientific temper in society necessitates proper education and guidance. An effective science education can be imparted at the undergraduate level only by revamping the present curriculum. To achieve this goal, the curriculum should be restructured, giving emphasis to various aspects such as the creativity of students, knowledge of current developments in the discipline, awareness of environmental impacts due to the development of science and technology, and the skills essential for handling equipment and instruments in laboratories and industries.

The Higher Education Council has taken the initiative to reformulate the undergraduate syllabi by introducing choice based credit and semester system. This is to cope with the internationally followed curricula and mode of evaluation. This approach has necessitated the revision of the present curriculum.

This curriculum is prepared to give sound knowledge and understanding of chemistry to undergraduate students. The goal of the syllabus is to make the study of chemistry stimulating, relevant and interesting. The syllabus is prepared with a view to equipping the students with the potential to contribute to academic and industrial environments. This curriculum will expose students to various fields in chemistry and develop interest in related disciplines. Chemistry, being a border science to biology, physics and engineering, has a key role to play in learning these disciplines. The new and updated syllabus is based on an interdisciplinary approach with vigour and depth. Care has been given to ensure that the syllabus is not very heavy while remaining compatible to the syllabi of other universities at the same level. Chemistry being an experimental science, sufficient emphasis is given in the syllabus for training in laboratory skills and instrumentation.

The syllabus has been prepared in a participatory manner, after discussions with a number of faculty members in the subject and also after evaluating the existing syllabi of B.Sc. Part- III, the new syllabi of XIth & XIIth standards and U.G.C. model curriculum and the syllabi of other Universities. The units of the syllabus are well defined and the scope of each is given in detail. The number of contact hours required for each unit is also given. A list of reference books is provided at the end of each course.

Broad objectives

To enable the students

- To understand basic facts and concepts in Chemistry while retaining the exciting aspects of Chemistry so as to develop interest in the study of chemistry as a discipline.
- To acquire the knowledge of terms, facts, concepts, processes techniques and principles of the subject.
- To develop the ability to apply the of principles of Chemistry.
- To be inquisitive towards advanced chemistry and developments therein.
- To appreciate the achievements in Chemistry and to know the role of Chemistry in nature and in society.
- To develop problem solving skills.

- To be familiarised with the emerging areas of Chemistry and their applications in various spheres of Chemical sciences and to apprise the students of its relevance in future studies.
- To develop skills in the proper handling of apparatus and chemicals.
- To be exposed to the different processes used in industries and their applications.
- To give a general environmental awareness among students.
- To develop an eco friendly attitude in students which helps in creating a better environment.
- Aim of environmental studies is to have a sustainable development.

At present there are three undergraduate programmes in Chemistry, viz. B.Sc Chemistry, B.Sc Chemistry (Vocational) and B.Sc. Petrochemicals. These programmes are restructured in such a manner that for each of these programmes there are 4 types of courses, viz. **A. Common** courses, **B. Core** courses, **C. Complementary** courses, and **D. Open** courses. The *core courses* are in the discipline of chemistry. These core courses and the pattern of examinations are the same for all the three programmes. In addition to the courses in chemistry there are courses in industrial chemistry for the vocational programme and courses in petrochemicals for B.Sc petrochemicals. *Open course*, is offered by a department to students of other disciplines.

The structure of the B.Sc Environment & Water Management is as follows:

Type of course	Number of courses	Credits
A. Common courses (English)	2	8
B. Core courses		
Core-1 Chemistry	15	49
Core-2 Chemistry (Environment and water Management)	9	31
C. Complementary courses		
i. Mathematics	4	14
ii. Physics	4	14
D. Open courses	1	4
Total	35	120

B.Sc Chemistry (ENVIRONMENT & WATER MANAGEMENT)-Detailed Scheme

Sl. No.	Study components	No. Of Courses	Credit per Course	Total Credits	Total Instructional hours/ week/ For the program	Contact hours/ week SEMESTER					
						1	2	3	4	5	6
A	LANGUAGES AND COMMON COURSES	2	4	8	10	5	5				
	<i>Language: English</i>										
	Total			8							
B	Core Courses -1 (Chemistry)										
	1. Theory and Practical	2	3	6	2 ♦ 4 = 8	4	4				
	2. Theory	2	3	6	2 ♦ 3 = 6					3	3
	3. Theory and Practical	5	4	20	5 ♦ 5 = 25			5	5	10	5
	4. Theory and Practical	3	4	12	3 ♦ 6 = 18					6	12
	5. Practical	2	1	2	2 ♦ 2 = 4					2	2
	6. Choice Based Course	1	3	3	3						3
	Total			49							
	Core Course-2										

	Environment and Water Management				18		5	5	4	4	
	Theory	4		16	8		5	3	4	4	
	Theory	2	4	8	10		3	3	4	4	
	Practical	2	4	4			3		2	2	
	Project	1	2	3							
			3								
	Total			31							
C	1. Mathematics	2	3	6	8		4	4			
		2	4	8	10				5	5	
	2. Physics	2	3	6	8		4	4			
		2	4	8	10				5	5	
	Total			28							
D	Open Course	1	4	4	4					4	
	TOTAL	35		120	150	25	25	25	25	25	25

Detailed Scheme of Instruction of the Core Courses

Core-1 (B)

Sl No.	Course Code	Title of the course	Exam. Duration Hrs	Credit per Course	Total Contact Hours for the course	Contact Hours/ week
1.	CH1B01	First Semester Theory: Methodology of Chemistry As a discipline of Science Practical: Volumetric Analysis	3 3	2 1	36 36	2 2
2.	CH2B01	Second Semester Theory: Theoretical and Inorganic Chemistry Practical: Volumetric analysis	3 3	2 1	36 36	2 2
3.	CH3B01	Third Semester Theory: Fundamentals of Organic Chemistry Practical: Qualitative organic analysis	3 3	3 1	54 36	3 2
4.	CH4B01	Fourth Semester Theory: Basic Organic Chemistry I Practical: Qualitative organic analysis	3 3	3 1	54 36	3 2
5.	CH5B01	Fifth Semester Theory: Chemistry of d and f block Elements Practical: Qualitative Inorganic Analysis	3 3	3 1	54 36	3 2
7.	CH5B03	Theory: Basic Organic Chemistry II Practical: Preparation and basic Lab Skills	3 3	2 2	36 54	2 3
8.	CH5B04	Theory: States of matter Practical: Physical chemistry Practical	3	3	54	3
9.	CH5B05	Theory: Quantum mechanics and Spectroscopy Practical: Gravimetric Analysis	3	1	36	2
10.	CH5P01	Open course	3	4	72	4

Sl. No	Course Code	Title of the course	Exam. Duration Hrs	Credit per Course	Total Contact hours for the course	Contact Hours/ week
Sixth Semester						
11.	CH6B01	Theory: Applied Inorganic Chemistry	3	3	54	3
		Practical: Qualitative Inorganic Analysis	3	1	54	3
12.	CH6B02	Theory: Chemistry of Natural Products and Biomolecules	3	3	54	3
		Practical: Preparation and basic Lab	3	1	36	2
13.	CH6B03	Theory: Equilibrium and kinetics	3	3	54	3
		Practical: Physical Chemistry Practicals	3	1	54	3
14.	CH6B04	Theory: Solution chemistry	3	1	36	2
15.	CH6B05	Practical: Gravimetric Analysis	3	3	54	3
16.	CH6B06	Theory: Choice Based Course				

Detailed Scheme of Instruction of the Environment and Water Management course

Core-2(B)

Sl. No	Course Code	Title of the course	Exam. Duration Hrs	Credit per Course	Total Contact Hours For the course	Contact Hours/ week
First Semester						
1.	EC1B01	Fundamentals Of Environmental Science	3	4	90	5
2.	-	Practical- 1	No Exam.	-	54	3
Second Semester						
3.	EC2B01	Environment and its pollution		4	90	5
4.	EC2B02	Practical ♦ 1	3	2	54	3
Third Semester						
5.	EC3B01	Water resource management		4		4
6.	EC3B02	Water quality management	3	4	72	4
7.	-	Practical-2	3	-	72	2
Fourth Semester						
8.	EC4B01	Environmental management-I	No Exam		36	
9.	EC4B02	Environmental management-II		4		4
10.	EC4B03	Practical-2		4	72	4
Fifth and sixth semester						
11.	EC6B01	Project	3	2	72	2
			3		36	
			3	3		

Evaluation

There shall be two parts for evaluation:

- Internal or In- Semester Examination or Continuous Assessment
- External or End- Semester Examination

For the core courses end-semester practical examinations shall be conducted in all semesters. One of the examiners can be appointed from the college and the other one should be external. For the petrochemical courses end-semester practical examinations shall be conducted at the end of semester-2 and semester-4 only.

The weightages for the Internal and External examinations shall be in the ratio 1:3. Both evaluations shall be done using Direct Grading system based on 5- point scale as given below

Letter Grade	Performance	Grade point (G)	Grade Range
A	Excellent	4	3.5 to 4.00
B	Very Good	3	2.5 to 3.49
C	Good	2	1.5 to 2.49
D	Average	1	0.5 to 1.49
E	Poor	0	0.00 to 0.49

The overall grade for a programme for certification shall be based on Cumulative Grade Point Average (CGPA) with a 7-point scale given below.

CGPA	Grade
3.80 to 4.00	A+
3.50 to 3.79	A
3.00 to 3.49	B+
2.50 to 2.99	B
2.00 to 2.49	C+
1.50 to 1.99	C
1.00 to 1.49	D

A separate minimum of D grade for internal and external evaluations is required for a pass for a course.

For the successful completion of a programme and award of the degree, a student must pass all courses satisfying the minimum credit requirements and must score a minimum CGPA of 2.00 or an overall grade of C+ or above.

Components of the internal evaluation and their weights are as below.

1. Theory

Component	Weight
Attendance	1
Assignment	1
Seminar/Viva voce	1
Best two test papers	2 x1

Assignment: 1 assignment per course

Seminar during Odd Semesters and **Viva voce** during even semester

2. Practical

Component	Weight
Attendance	1
Punctuality	1
Record	1
Best one test paper	1
Viva-voce	1

3. Project

Component	Weight
Project Report	2
Presentation	2
Viva-voce	1

Grades for attendance will be awarded as shown below

% Of Attendance	Grade
> 90%	A
Between 85 and 90	B
Between 80 and 85	C
Between 75 and 80	D
< 75	E

Project: All students have to undertake a project in **Environmental science**. The report of the project should be submitted in duplicate to the department at the end of the sixth semester and should be produced before the examiners appointed by the University.

Pattern of questions

The pattern of questions for theory is given below

	Type of questions	Weight	Number of questions to be answered
1	A bunch of 4 objective type	1	4 bunches (no choice)
2	Short answer type	1	6 out of 9
3	Short essay/problem solving type	2	4 out of 6
4	Essay type	4	2 out of 3

End- semester theory examinations should be conducted using test- booklets where each question is followed by the space for writing the answer.

**B Sc CHEMISTRY
(ENVIRONMENT & WATER MANAGEMENT)**

SYLLABUS

FIRST SEMESTER

Code-EC1B01

Paper ♦ 1: BASIC CONCEPTS IN ENVIRONMENTAL SCIENCES - 90 Hrs.

Module-1 An Introduction To Environment & Ecology (35 hrs)

1(a) Introduction to Environment -13 hrs

Definition, factors affecting environment, types of environment, segments of environment- atmosphere, hydrosphere, lithosphere, biosphere- their composition & structure.

Importance of Environmental Education

1 (b) Introduction to Ecology: -22 hrs

Ecosystem concept. Ecosystem structure, ecological balance, development and evaluation of ecosystem, element and components of ecosystem, population, ecological community, processes within the ecosystem, standing state of abiotic components.

Ecosystem functions, energy exchange between plant communities and their environment, trophic levels and energy flow.

Forest ecosystem, grassland ecosystem, fresh water ecosystem, agro ecosystem, vegetation mapping.

Module II -Environmental Microbiology & Environmental Chemistry.(25 hrs.)

II (a)- Environmental microbiology - 10 hrs.

Characteristics of growth and death of microbes in natural environment

Significance of bacteria, fungi, algae, protozoa and other higher animals in environmental management

Role of microbes in water degradation.

II- (b) - Environmental Chemistry: -15 hrs

Fundamentals of environmental chemistry, stoichiometry, Gibbs energy, chemical equilibrium, acid- base reactions, solubility products, air chemistry, water chemistry, soil chemistry, chemistry of ozone depletion, acid rain, consequences of acid rain, Chemistry of photosynthesis, Principles of analytical methods.

Module- III ♦ Natural Resources & Biodiversity (30 hrs.)

III ♦(a) - Natural resources: -22 hrs

Definition Forest resources ♦ importance of forests, deforestation, effects of deforestation., type of earth resources. Water resources ♦ importance of water, over utilization of water resources, benefits of problems of dams. Mineral resources ♦ distribution of mineral resources, uses and exploitation of minerals, environmental effects of extracting and using mineral resources. Food resources ♦ sources of food, changes caused by agriculture, effects of modern agriculture. Energy resources ♦ renewable and non-renewable sources, hydel, solar, wind, bio energy, geothermal, ocean and nuclear energy.

Land resources- soil as natural resources, land degradation and its causes.

III- (b)- Biodiversity: - 8 hrs

Definition, different types of diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity, conservation of biodiversity, India as a mega diversity nation

References

1. Chemistry of the Environment, -Thomas G Spiro
2. Chemistry of the Environment,, - Bailey
3. Chemistry for Agriculture and Ecology.- Y.Mido, M, Satake
4. Environmental Inorganic Chemistry- Itamar Bodek
5. Environmental Chemistry.- B.K Sharma
6. A Basic Course in Environmental Studies.- S. Deswal and A. Deswal .
7. Essentials of Environmental Science- N. Vasudevan.
8. Fundamental Principles of Bacteriology,.-A.J. Salle

Model question paper**First semester****Paper- EC1B01 ♦ Basic Concepts in Environmental Science****Time 3 hrs****Objective type questions (answer all questions, / any four may be given) weightages for each question is 1**

- A.**
- Ozone is widely seen in
 - Troposphere
 - Stratosphere
 - Ionosphere
 - Mesosphere
 - Which of the following composition is wrong?
 - Oxygen ♦ 21%
 - Nitrogen ♦ 82%
 - Carbon dioxide ♦ 0.3%
 - Water vapour ♦ 0.1%
 - Jhum Cultivation is the other name of
 - Terrace cultivation
 - slope cultivation
 - shifting cultivation
 - jute cultivation
 - What is the degradation product of DDT
 - DDA
 - DDC
 - DDE
 - DDD
- B.**
- What all are the by products of photosynthesis
 - Carbohydrates, oxygen
 - carbohydrates, oxygen, water
 - Carbohydrates, oxygen, hydrogen
 - carbohydrates, hydrogen, water
 - Identify a detritus food chain
 - Algae♦insects♦fish♦ man
 - grass♦ rabbit♦ fox♦ tiger
 - Dead plants♦ soil mites♦ insects♦ fish
 - seeds♦ mouse♦ owl
 - When a solid melts there is
 - No change in enthalpy
 - No change in entropy
 - Decrease in enthalpy
 - increase in enthalpy
 - Which of the following sets has the Lewis acid character for all the components
 - BF₃
 - BF₃, SiF₄, PF₅
 - SiF₄, PF₅
 - BF₃, PF₅
- C.**
- Trace metals are determined by
 - HPLC
 - Atomic Absorption Spectrophotometry
 - Flame photometry
 - none of the above
 - Which of the following is not a function of ecosystem
 - Biological energy flow
 - material or nutrient flow
 - Both the above
 - none of the above
 - The vermiculture technology involves the use of
 - Rhizobium
 - earthworm
 - Azotobacter
 - none of the above
 - Which of the forest is known to be a ♦forest that never burn♦
 - Coniferous forest
 - tropical rain forest
 - Deciduous forest
 - tundra forest
- D.**
- Kanha National Park is in
 - Karnataka
 - Assam
 - Bihar
 - Madhya Pradesh
 - All the population in a given physical area are termed as
 - Population
 - community
 - Biotic community
 - none of the above
 - Which of the following power resources is likely to get exhausted first

- a. Coal
 - b. Oil
 - c. Natural gas
 - d. Hydroelectric power
16. Which of the following is a biogas
- a. Producer gas
 - b. Natural gas
 - c. Water gas
 - d. Coal gas

Very short answer type questions (write any 6) weightages for each question is 1

1. Define biodiversity
2. Define ecosystem
3. What are natural resources
4. Define food web
5. Define environment
6. What is the law of chemical equilibrium
7. What are bio fertilizers
8. Name two factors responsible for the growth of micro organisms
9. What is pyramid of biomass

Short essays (write any 4) weightages for each question is 2

1. What are the effects of deforestation?
2. Describe the structure of atmosphere
3. Describe the structure and function of a grassland ecosystem
4. What are the effects of modern agriculture
5. What are the applications of solubility product
6. Briefly describe the techniques of chromatography

Essay question (write any 2) weightages for each question is 4

1. Describe the structure and function of an ecosystem
2. What are the major threats to biodiversity
3. Describe major energy resources