Program Name : Diploma in Medical Laboratory Technology

Program Code : ML

Semester : First

Couse Title : Elementary Chemistry

Couse Code : 24115

1. RATIONALE

Chemistry is a fundamental science, the correct understanding and recording of observation is possible by learning chemistry. Biological and Microbiological laboratories work on the application of chemical change. Chemistry is mainly required to Biochemistry which is one of major course in medicinal science course.

2. COMPETENCY

Select and Identify relevant equipments and chemicals for analysis of specimens.

3. COURSE OUTCOMES (COs)

The theory, practical experiences, and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following laboratory oriented COs associated with the above-mentioned competency:

a. Calculate emperical formula and molecular formula and use knowledge of organic compounds and IUPAC rules.
b. Use radiolabelled compounds used in medical fields.
c. Apply safety practices in laboratory.
d. Relate organic compounds and biomolecules in various biochemical reactions.
e. Illustrate role of biomolecules in functioning of human body.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	--	4	7	3	70	28	30*	00	100	40	50@	20	50	20	100	40

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

***Legends:** **L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **ESE** - End Semester Examination; **PA** - Progressive Assessment.*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map

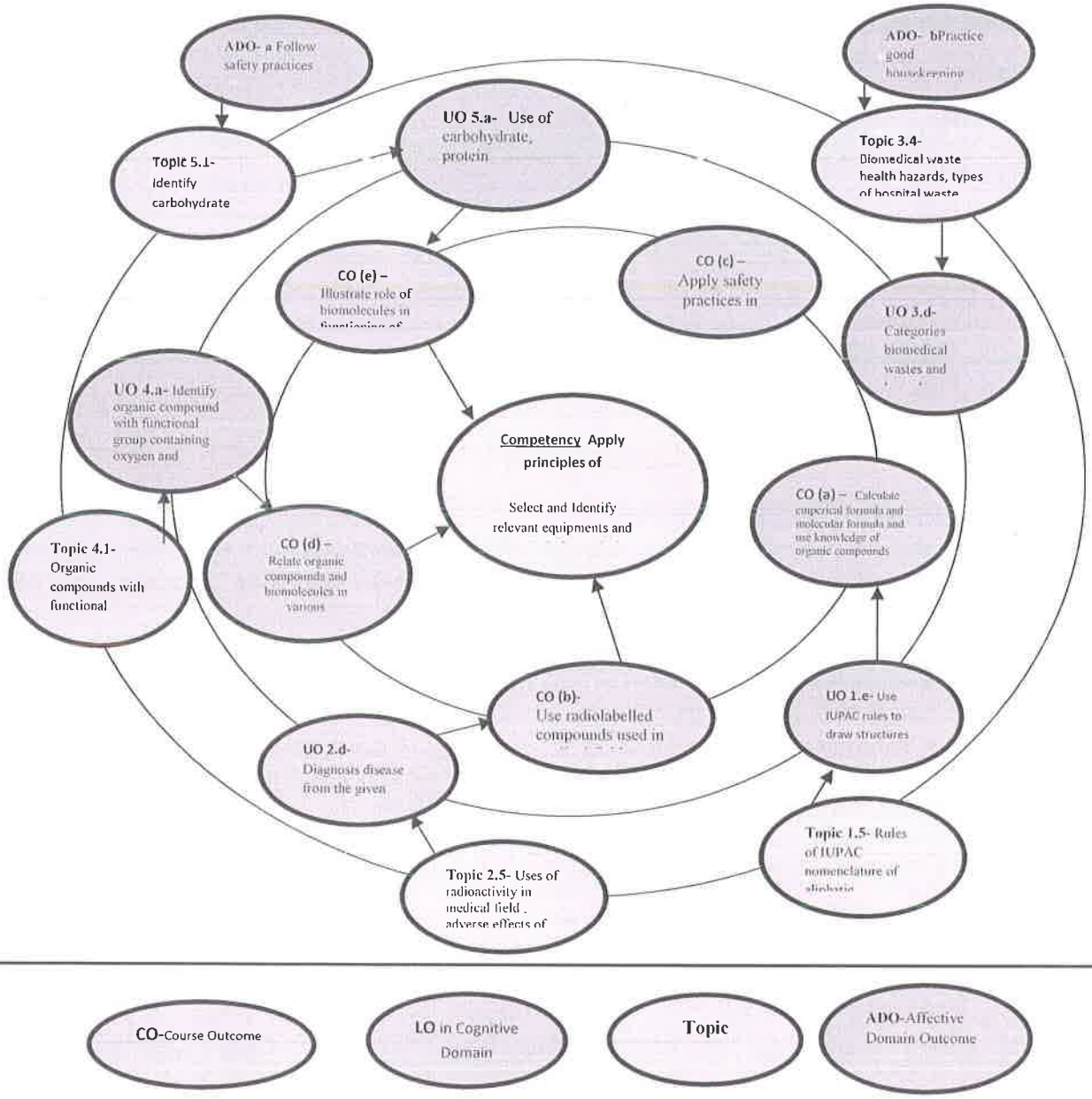

Figure 1 – Course Map

6. SUGGESTED PRACTICALS / EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the structure of aliphatic compound from given structural formula using IUPAC rules.	I	04*
2	Identify the structural formula of aliphatic compound from given structure using IUPAC rules.	I	04*
3	Perform weighing of chemicals on an analytical balance.	II	04*
4	Identify corrosive and toxic and to draw their symbol, storage procedure.	II	04*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
5	Identify flammable and explosive chemical and to draw their symbol, storage procedure.	II	04*
6	Prepare charts of IUPAC rules.	III	04*
7	Prepare models of ten aliphatic saturated and unsaturated compound.	I	04*
8	Perform qualitative test of carbohydrate.	IV & V	04*
9	Perform qualitative test of proteins.	IV & V	04
10	Identify the given sample of pipette and diagram.	II	04*
11	Identify the given sample of tubes and diagram.	II	04
12	Identify the given sample of measuring cylinder and diagram.	II	04
13	Identify the given sample of flask and diagram.	II	04*
14	Select carbon of correct hybridization using orchem teaching aid model.	I	04*
15	Identify given chemical in hazardous and non hazardous class.	III	04*
16	Identify the given acids , bases and salts.	I & IV	04
	Total		**64**

Note

*i.A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii.Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Observations and Recording	30
c.	Answer to sample questions	30
d.	Submission of report in time	20
	Total	**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a.Follow safety practices.

b.Practice good housekeeping.

c.Demonstrate working as a leader/a team member.

d.Maintain tools and equipment.
e.Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No	Equipment Name with Broad Specifications	PrO. S. No.
1	Test tubes , Pipettes , Flasks , Beakers , Reagent bottles	5.8,9, 10,11, 12,13,16
2	Analytical balance	3
3	Orchem model	14

8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Chemistry of Carbon Compounds	1.a Differentiate between organic and inorganic compound. 1.b Identify given functional groups. 1.c Calculate empirical and molecular formula of organic compound from the percentage composition data. 1.d Describe types and characteristics of hybridization. 1.e Use International Union of Pure and Applied Chemistry (IUPAC) rules to draw structures from given names and vice-versa.	1.1 Introduction, Importance and General characteristics. 1.2 Classification, Functional group, Covalent bond, Homologous series. 1.3 Empirical, Molecular and Structural formula, Numerical based on empirical and molecular formula. 1.4 Hybridisation, Sigma and pi bond. 1.5 Rules of IUPAC nomenclature of aliphatic compounds.

Unit – II Nuclear Chemistry	2.a Describe properties and characteristics of various radio waves. 2.b Compares between nuclear isomers on given basis. 2.c Use giger muller counters For measurements of radioactive. 2.d Diagnosis disease from the given radiolabelled compounds.	2.1 Definition of radioactivity, natural and artificial, half life 2.2 Properties of alpha, beta and gamma rays 2.3 Definition of Isotope, Isobar and isotone, nuclear fusion and fission reaction. 2.4 Measurement of radioactivity, radiation units. 2.5 Uses of radioactivity in medical field (window in to living organisms), adverse effects of radiations.
Unit– III Glassware and Laboratory First-Aid	3.a Use given apparatus for volume measuring. 3.b Compare simple and fractional distillation on given basis. 3.c Identify chemicals symbols. 3.d Categories biomedical wastes and hazardous effects.	3.1Composition of Borosilicate glass, name and specific use of various types of glass wares used in medical laboratory. *Distillation – Simple and fractional, Analytical balance. 3.2 Safe use, storage of chemicals, lab. first aid procedure. 3.3 Definition and symbol of corrosive, toxic, flammable, biohazardous, explosive, poisonous and carcinogenic chemicals. 3.4 Biomedical waste – Definition, sources, health hazards, types of hospital waste and its management,rules and regulation regarding biomedical wastes.
Unit– IV Important Organic Molecules	4.a Identify organic compound with functional group containing oxygen and nitrogen. 4.b Use and characteristics of amino acids. 4.c Identify dextro/leavo rotator optically active compound.	4.1 * Organic compounds with functional groups containing oxygen-alcohol, carboxylic acid, ether, aldehyde (method of preparation from alkyl halide) classification, medicinal usage. * Organic compounds with functional groups containing nitrogen-amines (method of preparation from alkyl halide, classification, chemical properties, basic nature) 4.2* Amino acids – definition, classification, characteristics and uses. Nucleic acid – definition, characterstic feature . 4.3 Isomerism – introduction , definition , types of isomerism , chiral compounds
Unit– V Chemistry of Biomolecules	5.a Use of carbohydrate, protein. 5.b Significance of acid, saponification, iodine and Riechert missel values of	5.1 * Carbohydrate – Introduction, definition, classification, uses. * Proteins – Introduction, definition, classification (based on function), uses and definition of peptide bond.

	oils and facts. 5.c Compare between fats and oils.	5.2 * Lipids – Introduction, definition, classification (based on function), difference between fats and oil and significance of acid, saponification, iodine and Richert Missel values. * Enzymes – Introduction, definition & uses of enzyme, Metabolism.

***Note**: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.*

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Chemistry of Carbon Compounds	9	2	4	8	14
II	Nuclear Chemistry	9	2	4	6	12
III	Glassware and Laboratory First-Aid	10	2	8	4	14
IV	Important Organic Molecules	11	2	4	8	14
V	Chemistry of Biomolecules	9	4	4	8	16
Total		**48**	**12**	**24**	**34**	**70**

***Legends:** R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
***Note**: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Identify hazardous and non-hazardous chemicals
b. Prepare a list of apparatus used in Medical Laboratory
c. Prepare a list of various biomolecules analysis in the laboratory.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Procure various materials required for practical exercises.
g. Use video/animation films to explain various processes like Manufacturing of construction materials, concrete mixing, and base preparation for painting, mortar laying, carpentry work, false ceiling.
h. Use different instructional strategies in classroom teaching.
i. For better understanding of International Union of Pure and applied Chemistry (IUPAC) rules each rule should be explained by taking suitable examples and concept should be build stepwise.
j. The chapter no 3 should be taught in such a way that students realize the Importance of safe use of chemical, storage of chemicals and bio waste management and their safe disposal.
k. Method of preparation and chemical properties of organic molecule should be taught strictly as per curriculum.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare cards for creating safety awareness in the laboratory.
b. Prepare a chart of symbol of various chemicals use in the laboratory.
c. Prepare a chart of biomedical waste management.
d. Collect the relevant information regarding radio labeled substances use in diagnoses of diseases.
e. Prepare a model on given aliphatic compounds.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication	Year
1.	Introduction to General, Organic and Biochemistry	Morristtein Leo R., Best Seott Pattison, Susaro Arena	International Thomson Publishing Co. ISBN-10 : 0470598808 ISBN-13 :978-0470598801	1995
2.	A text Book of Organic Chemistry	Arun Bahl, B.S. Bahl	S Chand & Co. ISBN-10:9788121935159 ISBN-13:978-8121935159	2003
3.	Chemistry A Text	K.N. Ganesh, V,	NCERT	1997

S. No.	Title of Book	Author	Publication	Year
	Book of Class XII	Krishna, B. Prakash, N, R. Rao, K.V. Sane	ISBN-10:	1989
4.	Modern abc of Chemistry for Class XII	Dr. S.P. Jauhar	NCERT ISBN-10:9383907231 ISBN 13:9789383907236	2014
5.	Comprehensive Practical Chemistry for Class XII	Dr. N.K. Verma, K.K. Rehani, B.K. Vermani	Laxmi Publication Pvt. Ltd. ISBN 13:9788131803703	2008

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

a. http://en.wikwpedia.org/wiki/matter
b. http://en.wikwpedia.org/wiki/Electron_configuration
c. http://www.footprints-science.co.uk/chemistry.htm.