

Program Name : Diploma in Medical Laboratory Technology

Program Code : ML

Semester : Second

Course Title : Applied Chemistry

Course Code : 24219

1. RATIONALE

Chemistry will provide the input for learning the applications of basic principles of Chemistry in medical field. It is intended to teach the students, applications of chemistry in related technologies and also to prepare base for learning Biochemistry. Applied Chemistry provides a kaleidoscope to view to complexities and diversities of human life and the gadgets required for civilized life.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

Identify the composition of basic chemicals & use their properties in medical laboratory.

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:-

- Identify the active biocompounds in medicine.
- Use of the steroids & quality control in medical field.
- Analyze the aspects of biochemistry in medical field.
- Create the solutions & use of reagent in medical field.
- Apply the basic laboratory calculations.

4. TEACHING AND EXAMINATION SCHEME

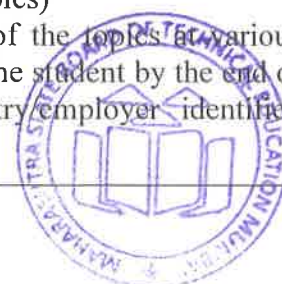
Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
Max	Min	Max	Min		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
4	--	4	8	3	70	28	30*	00	100	40	50#	20	50	20	100	40

(*): 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



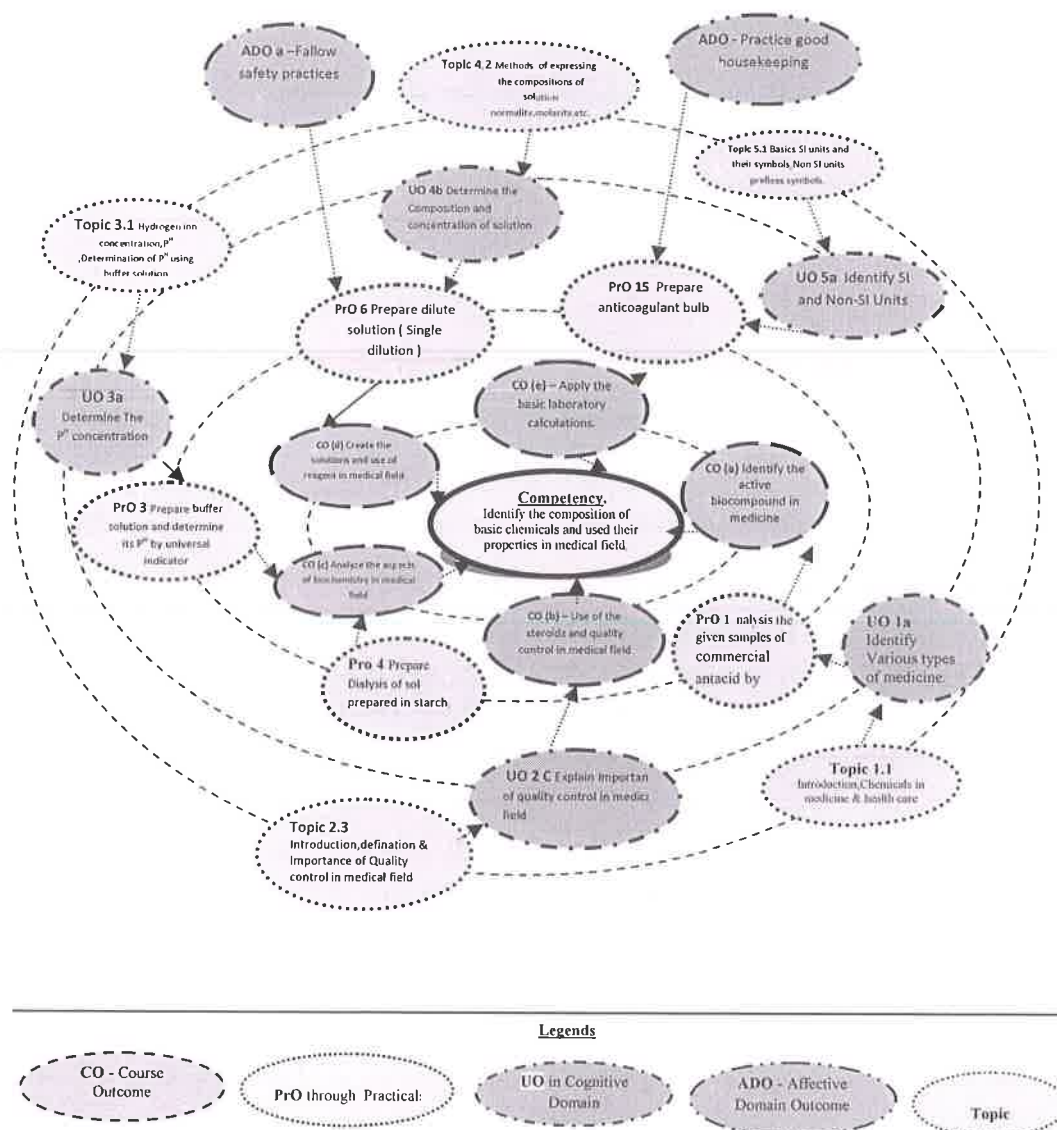


Figure 1 - Course Map

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.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Analyse the given samples of commercial antacid by determining the amount of Hydrochloric acid they can neutralize.	I	04*
2	Determine pH of some solution obtained from known solution & varied concentration of acids, bases, salts using pH paper or universal indicator.	III	04*
3	Prepare buffer solution (single salt buffer) and determine its pH by its universal indicator.	III	04*
4	Perform Dialysis of sol prepared in starch.	III	04
5	Perform Dialysis of sol prepared in Aluminum Hydroxide.	III	04
6	Prepare dilute solution (Single dilution)	IV	04*
7	Prepare 250 ml of 2% solution of acetic acid from 10% acetic	IV	04*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	acid solution.		
8	Prepare 1 N HCl in 1 litre from 1.15 N HCl.	IV	04*
9	Determine molarity of KMnO_4 solution by titrating it against a standard solution of oxalic acid.	IV	04*
10	Prepare the 0.5N H_2SO_4 from the 2N H_2SO_4 Solution.	IV	04
11	Analyze the effect of temperature on the rate of diffusion of solids in liquids.	IV	04*
12	Prepare the standard solution of oxalic acid.	IV	04
13	Prepare percent solution Weight by weight and Volume by volume percent solution.	IV	04*
14	Prepare different grades of alcohol and to understand their significance.	IV	04*
15	Prepare anticoagulant bulb.	V	04*
16	Perform five fold serial dilution of given KMnO_4 solution.	V	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 judicious 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.

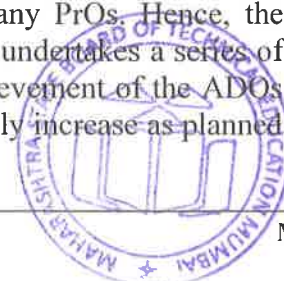
ii. Hence, the 'Process' and 'Product' related skills associated with each **PrO** of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Preparation of experimental set up	20
b.	Observations and Recording	20
c.	Safety measures	10
d.	Answer to sample questions	30
e.	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.

Sr. No	Equipment Name with Broad Specifications	PrO. S. No.
1	Test tubes , Flasks , Beakers , Reagent bottles	1, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 16
2	Pipettes, Burette	11, 15
3	pH paper/meter, Thermometer	2, 3

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 Chemicals in Medicine	1.a Identify various types of Medicine. 1.b Write the use of chemicals in Medicine.	1.1 Introduction, chemicals in medicine & health care. 1.2 Specific action & example of analgesics, Tranquilizers Antiseptic, Disinfectants, Antibiotics, Antacids, Antiemetic, Artificial sweetening agent, Ant inflammatory, Antioxidant, Detoxication.
Unit – II Steroids , Automation and Quality Control	2.a List the steroids and importance of steroids. 2.b Use of autopipette and autoanalyzer. 2.c Explain the importance of quality control in medical field.	2.1 Definition of sterol with examples, Introduction & example Of steroids biological system. Physiological importance of cholesterol, bile acid, vitamin D, sex hormones, Adrenocortical hormones, cardiac glycosides (Excluding structural formula). 2.2 Introduction and current trends in Automation in medical laboratory. 2.3 Introduction, Definition & Importance of quality control in medical field.
Unit– III Physiochemic al Aspects of Biochemistry	3.a Determine the pH concentration. 3.b Explain the colloidal state. 3.c Explain the Donnan membrane equilibrium.	3.1 Hydrogen Ion concentration pH, P ^{OH} Buffer mechanism, determination of pH using buffer solution. 3.2 Colloidal state – Introduction definition & properties-Dialysis, Osmotic pressure & electrical potential. 3.3 Donnan membrane equilibrium physiological importance of blood.

	<p>3.d Determine the role of osmosis in blood.</p> <p>3.e Use of surface tension in medical field.</p> <p>3.f Use of viscosity in medical field.</p>	<p>3.4 Osmosis-Hypertonic, Hypotonic Isotonic solution, role of osmosis in regulation of blood volume, Haemolysis and crenation.</p> <p>3.5 Surface tension-Physiological Importance, Definition.</p> <p>3.6 Viscosity-Definition & application of viscosity in medical field.</p>
Unit– IV Solution and Reagent Preparations	<p>4.a Identify the types of solution.</p> <p>4.b Determine the composition and concentration of solution.</p> <p>4.c Explain the types and rate of diffusion.</p>	<p>4.1 Solution, Types of solution (true, colloidal, Suspension Saturated, Supersaturated solutions), Classification of solution depending upon nature of solute & solvent.</p> <p>4.2 Methods of expressing the composition of solution normality, molarity, molality, mole fraction, percentage by Weight by weight, Weight by volume, grades of alcohol.</p> <p>4.3 Diffusion-Types, diffusion of Electrolyte & water across membrane, affecting rate of diffusion.</p>
Unit– V Basic Laboratory Calculations	<p>5.a Identify SI & Non-SI Units.</p> <p>5.b Describe types & uses of dilution.</p> <p>5.c Explain types and uses of urine preservative.</p>	<p>5.1 Basic SI units and their symbol, Non-SI units Prefixes, Symbols used to designate (Deci, centi, Milli, Micro, Nano, Pico), Units used in conjunction with SI-Gram, Litre, Minute, Mole, Mass concentration, electrolyte concentration, Ionic strength.</p> <p>5.2 Dilution – Types and uses of dilution.</p> <p>5.3 Chemistry of Anticoagulant Types & uses, chemistry of urine preservatives-Types and uses.</p>

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	Chemicals in Medicine	8	2	4	4	10
II	Steroids, Automation and Quality Control	16	2	8	6	16
III	Physiochemical Aspects of Biochemistry	16	2	4	12	18

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Solution and Reagent Preparation	12	2	4	6	12
V	Basic Laboratory Calculations	12	2	8	4	14
Total		64	10	28	32	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:-

- Illustrate use of various chemicals in modern medicines.
- Prepare a various types of reagent.
- Prepare a list of apparatus used in medical 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:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '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.
- 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).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.
- Procure various materials required for practical exercises.
- 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.
- Use different instructional strategies in classroom teaching.
- 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.
- The chapter no 4 should be taught in such a way that students realize the Importance of safe use of chemical, storage of chemicals.
- 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:

- Prepare a chart on different types of medicine use & disposal.
- Prepare a chart on effects of steroids in human body.
- Analysis of P^H from fruit or vegetables.
- Prepare a chart for concentration of solution (Normality, Molarity, etc.).
- Prepare a chart on SI and non-SI Units.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication	Year
1.	Laboratory Technology	Kanai L. Mukharjee	Tata McGraw Hill ISBN-10-93532606825 ISBN-13-978-9352606825	2017
2.	A text Book of Organic Chemistry	Arun Bahl, B. S. Bahl	S Chand & Co. ISBN-10:978-8121935159 ISBN-13:978-8121935159	2003
3.	Human Physiology	Dr. C. C. Chatterjee	Medical Allied Agency ISBN-10-9387964027 ISBN-13-978-9387964020	2018
4.	Comprehensive practical chemistry for class XII	Dr. N. K. Verma, K. K. Rehani and B. K.	Laxmi Publication Pvt. Ltd. ISBN-10-978-8131803714 ISBN 13-978-8131803714	2019
5.	A Textbook Biochemistry	Dr. U Satyanarayana and Dr. U. Chakrapani	Books and Allied (P) Ltd. Calcutta ISBN 10-8187134453, 13-978-8187134459	2012

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

- <http://en.wikipedia.org/wiki/matter>
- http://en.wikipedia.org/wiki/Electron_configuration
- <http://www.footprints-science.co.uk/chemistry.htm>



