Program Name : Diploma in Medical Laboratory Technology

Program Code : ML

Semester : First

Couse Title : Elementary Physics

Couse Code : 24116

1. RATIONALE

The subjects is classified under basic science. It describe physical facts concept principles and techniques used in medical laboratory investigation. It intends to acquaint medical laboratory technologist to have clear concept and grasping before using the core technology.

2. COMPETENCY

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

- Use precision and accuracy in measurement by various instrument and solve broad based Medical Laboratory problem applying principles of Physics.

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 industry/medical laboratory oriented COs associated with the above-mentioned competency:

a. Estimate errors in measurement of physical quantities.
b. Apply rate concept in medical applications.
c. Calculate work, energy and power.
d. Use centrifuge for medical laboratory sample testing.
e. Apply principles of physics in working with Medical Lab. Equipments'.

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

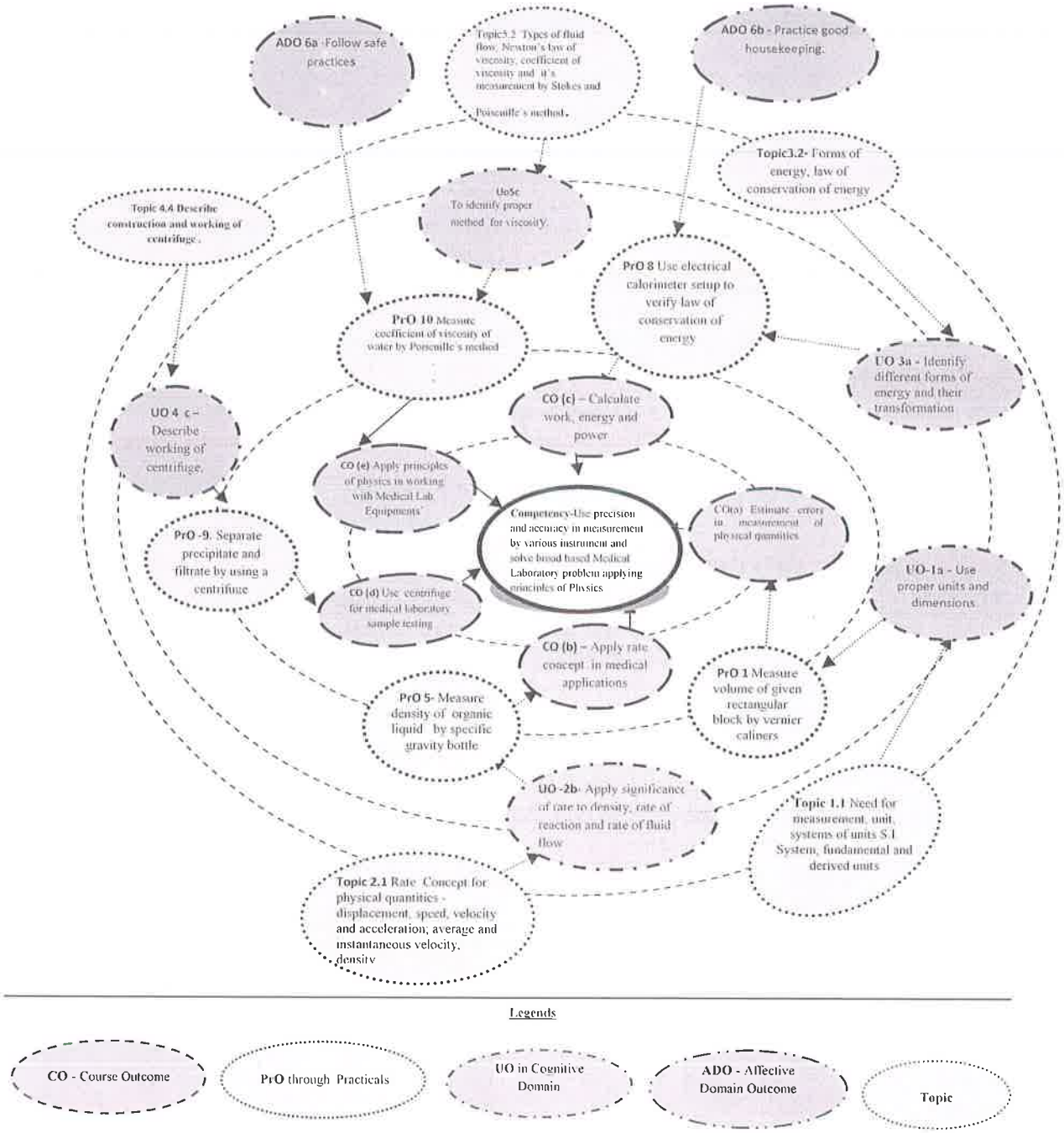

Figure 1 - Course Map

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	Measure volume of given rectangular block by vernier calipers.	I	04*
2	Measurement of diameter by micrometer screw gauge (m.s.g.)and find percentage error.	I	04*
3	Measure of mass of given object by physical balance	I	04*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
4	Measure density of distilled water by specific gravity bottle.	II	04*
5	Measure density of organic liquid by specific gravity bottle.	II	04*
6	Measure density of particulate solid by specific gravity bottle.	II	04*
7	To determine acceleration due to gravity by simple pendulum.	II	04*
8	Use electrical calorimeter setup to verify law of conservation of energy.	III	04*
9	Separate precipitate and filtrate by using a centrifuge.	IV	04*
10	Measure coefficient of viscosity of water by Poiseuille's method.	V	04*
11	Measure coefficient of viscosity by Stokes's method.	V	04*
12	Measure coefficient of viscosity by Ostwald's apparatus.	V	04*
13	To determine surface tension by capillary rise method.	V	04
14	Estimate absolute & percentage error in measurement by m.s.g.	I	04
15	Determine the density of regular shape solid object.	II	04
16	Determine acceleration due to gravity by falling drop method.	II	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.	Setting and operation	20
c.	Safety measures	10
d.	Observations and Recording	10
e.	Interpretation of result and Conclusion	20
f.	Answer to sample questions	10
g.	Submission of report in time	10
	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
- Organizing Level' in 2nd year
- Characterizing Level' in 3rd year

6. 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	Vernier caliper with 0.01 cm. least count	1,7,15
2	Micrometer screw gauge with 0.001 cm. least count.	2,7,11,15,16
3	Physical balance.	3,4,5,6,8,15
4	Weight box & fractional weight box.	3,4,5,6,8,15
5	Specific gravity bottle with 25 cc. capacity preferably corning	4,5,6
6	Simple pendulum.	7
7	Stop watch (0.1 s least count.)	7,11, 12,16
8	Stop clock (1s least count	8,10
9	Meter scale wooden.	7,10,16
10	Laboratory thermometer (0-100 C)	8
11	Laboratory centrifuge with 6-8 cuvette capacity.	6
12	Constant pressure water tank	10
13	Measuring cylinder (100ml).	10
14	Poiseuille's apparatus.	10
15	steel balls of different sizes	11
16	One meter glass cylinder of uniform area(Stokes apparatus) .	11
17	Ostwald's viscometer.	12
18	Travelling microscope. narrow capillary of uniform area.	13
19	Narrow capillary of uniform area.	13
20	Burette	16

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 Measurement of physical quantity	1a.Use proper units and dimensions . 1b.Classify given physical quantities as scalar and vector . 1c. Calculate % error for given observations. 1d.Verify given equation by dimensional analysis.	1.1Need for measurement, unit, systems of units S.I. System, fundamental and derived units. 1.2 Physical quantities and scalar and vector (vector algebra shall be omitted) 1.3 Accuracy and precision, fault in measurement-mistakes and errors. 1.4 Dimensional analysis.
Unit – II Kinematics	2a. Calculate force for uniform accelerated bodies. 2b. Apply significance of rate to density, rate of reaction and rate of fluid flow. 2c. Identify types of motion. 2d. Differentiate transverse and longitudinal waves. 2e. Derive equation for given physical quantities	2.1 Rate Concept for physical quantities - displacement, speed, velocity and acceleration; average and instantaneous velocity, density. 2.2Newton's laws of motion and concept of force, Kinematical equations. 2.3 Different types of motion, study of simple harmonic motion and wave motion- Longitudinal waves and transverse waves. 2.4 Application of rate concept in fluid flow, rate of reaction and their significance; heart rate and plus rate
Unit– III Work Energy and Power	3a.Identify different forms of energy and their transformation 3b.Calculate work done and power of a machine. 3c.Calculate power of machine and total energy of mechanical system.	3.1 Concept and definition of work and energy. 3.2 Forms of energy, law of conservation of energy. 3.3 Work done in lifting a body, expression for potential energy, Kinetic energy, Calculation of total mechanical energy in a system. 3.4 Power and its calculations
Unit– IV Circular motion	4a. Calculate angular & linear velocity in (UCM) uniform circular motion. 4b.Differentiate between centripetal & centrifugal force. 4c.Describe working of centrifuge.	4.1 Revolution and rotation, Uniform circular motion. 4.2 Angular velocity and its relation with linear velocity; periodic time, frequency an relation with angular velocity, 4.3 Centripetal and centrifugal force. 4.4 Construction and working centrifuge.
Unit– V Fluid properties	5a. Identify streamline & turbulent flow. 5b. Use Ostwald's viscometer for relative viscosity. 5c. To identify proper method for viscosity. 5d. Explain capillary action. 5e. Apply effect of temperature & impurity on surface tension in various conditions.	5.1 Definition of viscosity, velocity gradient. 5.2 Types of fluid flow, Newton's law of viscosity, coefficient of viscosity and it's measurement by Stokes method and Poiseuille's methods. 5.3 Surface tension and its cause based on molecular theory, 5.4 Capillary action and angle of contact. 5.5 Effect of temperature and impurities on surface tension.

***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	Measurement of physical quantity	7	2	6	-	8
II	Kinematics	12	4	4	8	16
III	Work Energy and Power	9	2	4	8	14
IV	Circular motion	10	4	4	8	16
V	Fluid properties	10	4	4	8	16
Total		**48**	**16**	**22**	**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 2-3 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Classify & sort Physical counties.
b. Identify the energy sources.
c. Visit pathology laboratory to identify principles & tech. used.
d. Search software/freeware for the course content and write the report stating their applications.

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.

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 a report on energy resources, conservation and sustainable development.
b. Prepare a report on various electricity generation methods.
c. Visit ad blood bank to observe & report on separation of blood component.
d. Identify various body fluids and prepare a standard report regarding physical parameters.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1.	Physics	Resnik Robert and Walker Jearl	USA,2014 ISBN : 812650823X
2.	Principles of Physics	N. Subrahmniyam & Brijlal	S. Chand & Company,2001, ISBN-13 9788121908856
3.	Concepts of Physics	H.C. Verma	Bharati Bhawan Publishers & Distributors, 2014, ISBN;9788177091878
4.	Physics Textbook Part I-Class XI	Narlikar, J.V.; Joshi, A. W.; Mathur, Anuradha; et al	National Council of Education Research and Training, New Delhi, 2010, ISBN;8174505083
5.	Physics Textbook Part II- Class XI	Narlikar, J.V.; Joshi, A. W.; Mathur, Anuradha; et al	National Council of Education Research and Training, New Delhi, 2015, ISBN;8174505660

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

a. http://physics.infor
b. http://www.kettering.edu/physics/drussell/Demos?wavevacemotion.html

c. http://physics.usask.ca/_hirose/ep225/anim.htm

Videos:

1.http//www.youtube.com/watch? V=v5AxIJSiEEs

2.http//www.youtube.com?v=42

CD : 1.Educational CD of NCERT

2. Educational CD of Pearson Education India.

PPT : www.khanacademy.com