Program Name : Diploma in Medical Laboratory Technology

Program Code : ML

Semester : Second

Couse Title : Applied Physics

Couse Code : 24220

1. RATIONALE

This subject is sequel of elementary Physics. It forms a bridge between core subject and basic Physical concepts. It describes ideas and methods of physics origin to implement in 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:

- **Understand physical principles of instruments and phenomena relevant to medical Laboratories.**

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. Measure Blood Pressure.
b. Apply heat concept to sterilization in Medical Laboratories.
c. Use ultrasound waves for clinical applications.
d. Use compound microscope.
e. Use pH meter in Laboratories.

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
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

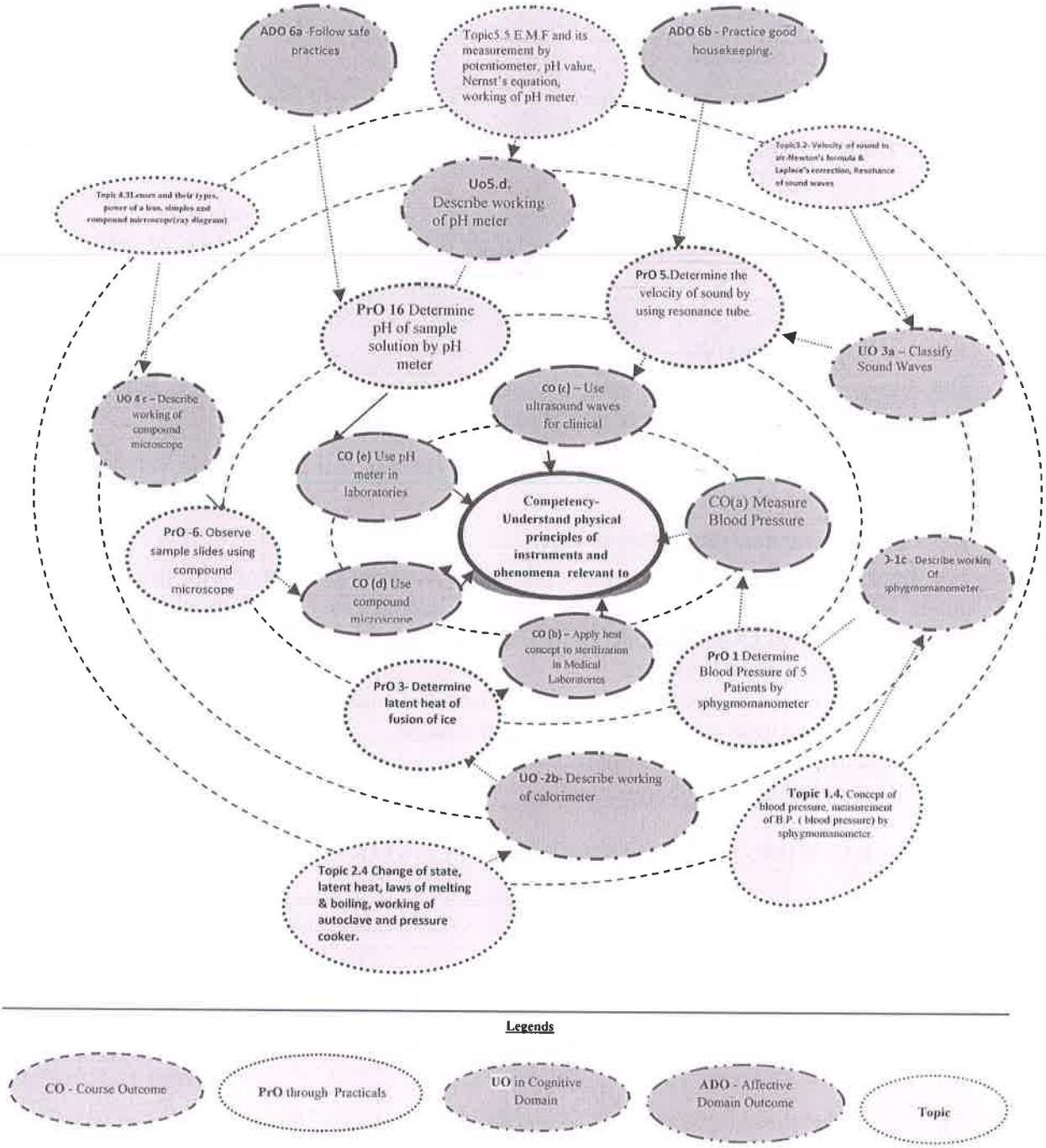

Figure 1 - Course Map

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.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Determine blood pressure of five patients (fellow students) by sphygmomanometer.	I	04*
2	Determine melting point of wax by plotting cooling curve.	II	04*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Determine latent heat of fusion of ice.	II	04*
4	Determine water equivalent of calorimeter by method of mixture.	II	04
5	Determine the velocity of sound by using resonance tube.	III	04*
6	Observe sample slides using compound microscope.	IV	04*
7	Determine refractive index of an organic liquid by spectrometer.	IV	04*
8	Determine the resistance by voltmeter and ammeter.	V	04*
9	Verify the Ohm's Law, using standard resistance.	V	04
10	Verify law of series combination of resistances.	V	04*
11	Verify law of parallel combination of resistances.	V	04*
12	Determine specific resistance by wheatstone's meter bridge.	V	04*
13	Determine emf of a cell by comparison method.	V	04*
14	Determine emf of a cell by sum & difference method.	V	04
15	Determine emf of a cell by single cell method.	V	04
16	Determine pH of sample solution by pH_meter.	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 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	Sphygmomanometer	1
2	Thermometer	2,3
3	Boiling tube with water bath	2
4	Calorimeter	3,4
5	Physical balance, weight box fractional weight box	3,4
6	Compound microscope	5
7	Resonance tube apparatus	6
8	Tuning fork	6
9	Verneir caliper	6
10	Spectrometer, sodium vapour lamp, Hollow prism	7
11	Standard resistance, voltmeter, ammeter	8,9,10,11
12	D.C. Power supply	8 to 15
13	Wheatstone's meter bridge	12
14	Galvanometer, jokey, plug key	12 to 15
15	Potentiometer(4- wire)	13,14,15
16	Standard cell (weston cadmium), Leclanche cell or Daniel cell	13,14,15
17	pH meter	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 Pressure & Its measurement	1a.Identify types of pressure measurement. 1b.Describe working of U tube manometer. 1c. Describe working of sphygmomanometer. 1d.Identify the cases of hypertension & hypotension.	1.1 Concept of pressure, definition of pressure, types of pressure measurement- viz; Atmospheric, gauge and absolute(definitions only) 1.2 Laws of liquid pressure, expression for gauge pressure of liquids at given depth. 1.3 Construction & working of U-tube manometer. 1.4 Concept of blood pressure, measurement of B.P. (blood pressure) by sphygmomanometer.

Unit – II Thermal Physics	2a. Describe working of clinical thermometer. 2b. Describe working of calorimeter. 2c. Describe working of autoclave.	2.1 Concept of heat & temperature, requisites of thermometer, types of thermometers with principles, scales of temperature- Celsius, Fahrenheit & Kelvin, conversion formulae. 2.2 Construction & working of clinical thermometer. 2.3 Measurement of quantity of heat, colorimeter, modes of heat transfer- conduction, convection & radiation (definitions only). 2.4 Change of state, latent heat, laws of melting & boiling, working of autoclave and pressure cooker.
Unit– III Sound waves & Electromagnetic Radiations	3a.Differentiate between mechanical wave & electromagnetic wave. 3b.Classify sound waves. 3c.Classify electromagnetic waves 3d. Describes X-ray generation using Coolidge tube. 3e.Apply U.V. rays in medical treatment	3.1Mechanical wave- sound & its propagation, classification of sound waves, 3.2 Velocity of sound in air- Newton's formula and Laplace's correction, Resonance of sound waves. 3.3 Ultrasonic waves methods of production – Magneto-striction & piezoelectric, medical uses of ultrasonic waves. 3.4 Electromagnetic waves (radiations), E.M. Spectrum, general properties of E.M. radiations. 3.5 Properties and uses of ultraviolet radiations. 3.6 Coolidge tube method of X-ray generation, properties and medical uses of X-rays.
Unit– IV Optics & Optical Instruments	4a. Describe working of spectrometer. 4b. Identify sources of artificial lignt. 4c. Describe working of compound microscope	4.1 Artificial sources of light, reflection and refraction of light. 4.2 Dispersion of light and spectrum; prism spectrum, working of spectrometer. 4.3 Lenses and their types, power of a lens, simple and compound microscope (ray diagram).
Unit – V Electrical measurements	5a. Differentiate between A.C. & D.C. 5b. Describe working of Wheatstone's network 5c. Describe working of potentiometer. 5d. describe working of pH meter	5.1 Concept of charge, Coulomb's inverse square law, electric field, electric intensity electric potential and potential difference. 5.2 Electric current, Ohm's Law, factors affecting resistance of a conductor, specific resistance, laws of series & parallel combination of resistances. 5.3 D.C. circuits, Kirchoff's laws. 5.4 Wheatstone's network and meter bridge. 5.5 E.M.F. and its measurement by potentiometer, pH value, Nernst's equation , working of pH meter.

***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	Pressure and its measurement	10	2	4	4	10
II	Thermal Physics	12	2	4	6	12
III	Sound waves and electromagnetic Radiations	16	2,2	4,4	6	18
IV	Optics and Optical Instruments	12	4	4	6	14
V	Electrical Measurements	14	2	4,4	6	16
Total		**64**	**14**	**28**	**28**	**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 sound waves.
b. Classify Electromagnetic waves and E.M.Spectrum chart.
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 report on different scales of temperature & Types of Thermometers.
b. Visit X-ray Lab. and prepare report.
c. Identity different sources of light and write comprehensive report.
d. Visit ultrasound laboratory and prepare report.

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 XII	Narlikar J.V.; Joshi A. W.; Mathur Anuradha; et al	National Council of Education Research and Training, New Delhi, 2013, ISBN;8174506314
5.	Physics Textbook Part II- Class XII	Narlikar J.V.; Joshi A. W.; Mathur Anuradha; et al	National Council of Education Research and Training, New Delhi, 2013, ISBN;8174506713

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


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