

NSQF ALIGNED CURRICULUM

DIPLOMA IN MEDICAL LABORATORY TECHNOLOGY

**PUNJAB STATE BOARD OF TECHNICAL EDUCATION
&
INDUSTRIAL TRAINING**



Developed By
Curriculum Development Center
National Institute of Technical Teachers Training & Research
(Ministry of Education, Government of India)
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FOREWORD

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket of standard of life as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different cultures and environments together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the license-based closed economy to knowledge and market based open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the State Board of Technical Education, Punjab to revise the existing curricula of diploma programmes as per the needs of the industry and making them National Skill Qualification Framework (NSQF) compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon effective implementation of its curricula. Howsoever best the curriculum document is designed, if it is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected that the polytechnics carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and get the faculty members regularly trained and upskilled. So that it can infuse the much needed dynamism in the system. They are welcome to reach NITTTR Chandigarh whenever they want to train the faculty members and get the curricula revised.

Director
National Institute of Technical Teachers
Training & Research, Chandigarh

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- i) Chairperson, Punjab State Board of Technical Education and Industrial Training, Chandigarh for entrusting this project of curriculum revision to NITTTR, Chandigarh.
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- vi) Faculty from different departments of NITTTR, Chandigarh for content updation.

Coordinator

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN MEDICAL LABORATORY TECHNOLOGY

- 1) Name of the Programme : Diploma Programme in Medical Laboratory Technology
- 2) Duration of the Programme : Three years (Six Semesters)
- 3) Entry Qualification : Matriculation or equivalent NSQF Level as prescribed by State Board of Technical Education, Punjab
- 4) Intake : As prescribed by the Board
- 5) Pattern of the Programme : Semester Pattern
- 6) NSQF Level : Level - 5
- 7) Ratio between theory and Practice : 27 : 73
- 8) Industrial Training:
Four weeks of industrial training is included after IV semester or in the beginning of V semester.
- 9) Ecology and Environment :
As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.
- 10) Energy Conservation:
An Energy Conservation Awareness Camp has been included in the curriculum to sensitize the students about significance and various aspects of energy conservation. Concepts of Energy Conservation have also been included in the subject of Environmental Studies.
- 11) Entrepreneurship Development:
An Entrepreneurial Awareness Camp and a full subject on Generic Skills and Entrepreneurship Development have been incorporated in the curriculum.
- 12) Camps on “Traffic Awareness and Road Safety” have been added in semester I & II under Student Centered Activities.
- 13) “Drugs Use and Abuse Awareness Camp” have been added in IIIrd Semester under Student Centered Activities.

14) Personality Development

A camp focusing on personality development of students has been incorporated in the curriculum.

15) Student Centred Activities:

A provision of 3-6 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co-curricular activities such as expert lectures, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities etc.

16) Professional Training

To develop practical skills in the students, professional training in various medical colleges/hospitals/clinical laboratories have been incorporated in fifth and sixth semesters.

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN MEDICAL LABORATORY TECHNOLOGY

A diploma holder in Medical Laboratory Technology may be employed in the following organizations:

1. Government Hospitals/Private Hospitals/ Primary Health Centres/Private Nursing Homes/Clinics/National Institute of Communicable diseases/Blood Banks
2. Medical Colleges (Clinical Laboratories)
3. Medical Research Laboratories/Reference laboratories/R&D Laboratories
4. Pharmaceutical Firms dealing in analytical kits and instruments
5. Educational Institutions
6. Self-employment

After first year, the NSQF Level – 3 pass out students have avenues to work as semi skilled employee. Similarly, after second year, the NSQF Level – 4 pass out students have wide scope to work as skilled employee in medical clinical laboratories.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN MEDICAL LABORATORY TECHNOLOGY

After due completion of the course, a diploma holder will be able to:

1. Communicate effectively in English with others
2. Apply knowledge about basic anatomical structure of human body and physiological functions
3. Describe different laboratory hazards and safety precautions during sample collections and laboratory investigations and biological waste management
4. Collect, prepare, transport and preserve clinical samples such as blood, urine, stool, sputum, swabs etc. and carry out laboratory investigations for diagnostic purposes
5. Operate, handle, care and preventive maintenance of various types of laboratory equipment (routine and sophisticated)
6. Procure materials, prepare, standardization and storage of different laboratory reagents for laboratory investigations
7. Apply reference values for various types of clinical investigations and ability to ensure quality control.
8. Manage medical lab and record keeping
9. Use computer for information storage and retrieval pertaining to laboratory investigations
10. Use knowledge of automation in Medical Laboratory Technology
11. Use understanding of importance of human relations, professional ethics, medico legal aspects and communication skills for effective functioning in the field of medical lab technology
12. Demonstrate self-learning and independent thinking for solving problems related to the field of Medical Laboratory Technology
13. Apply understanding of basic principles of management of manpower, material and resources for their optimum utilization and effectiveness.
14. Explore interest and passion in areas other than professional stream

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum areas have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	– English and Communication Skills
2.	Apply Knowledge about basic anatomical structure of human body and physiological functions	– Anatomy and Physiology
3.	Describe different laboratory hazards and safety precautions during sample collections and laboratory investigations and biological waste management	– Environmental Studies – Medical Laboratory Management
4.	Collect, prepare, transport and preserve clinical samples such as blood, urine, stool, sputum, swabs etc. and carry out laboratory investigations for diagnostic purposes	– Clinical Microbiology – Haematology – Clinical Biochemistry – Histopathology & Cytology – Transfusion Medicine
5.	Operate, handle, care and preventive maintenance of various types of laboratory equipment (routine and sophisticated)	– Clinical Microbiology – Haematology – Clinical Biochemistry – Histopathology & Cytology – Transfusion Medicine
6.	Procure materials, prepare, standardization and storage of different laboratory reagents for laboratory investigations	– Organic Chemistry – Basic Chemistry – Clinical Microbiology – Haematology – Clinical Biochemistry – Histopathology & Cytology – Transfusion Medicine

7.	Apply reference values for various types of clinical investigations and ability to ensure quality control.	– Clinical Microbiology – Haematology – Clinical Biochemistry – Histopathology & Cytology – Transfusion Medicine
8.	Manage medical lab and record keeping	– Medical Laboratory Management
9.	Use computer for information storage and retrieval pertaining to laboratory investigations	– Basics of Information Technology
10.	Use knowledge of automation in Medical Laboratory Technology	– Clinical Microbiology – Haematology – Clinical Biochemistry – Histopathology & Cytology – Transfusion Medicine
11.	Use understanding of importance of human relations, professional ethics, medico legal aspects and communication skills for effective functioning in the field of medical lab technology	– English and Communication Skills – Generic Skills and Entrepreneurship Development – Medical Laboratory Management – Industrial Training
12.	Demonstrate self-learning and independent thinking for solving problems related to the field of Medical Laboratory Technology	– Professional Training – Industrial Training
13.	Apply understanding of basic principles of management of manpower, material and resources for their optimum utilization and effectiveness	– Medical Laboratory Management
14.	Explore interest and passion in areas other than professional stream	– Open Elective

5. ABSTRACT OF THE CURRICULUM AREAS

a) Humanities and Social Science Courses

1. English and Communication Skills
2. Generic Skills and Entrepreneurship Development
3. Basics of Information Technology
4. Environmental Studies

b) Basic/Applied Science Courses

5. Basic Chemistry
6. Organic Chemistry

c) Foundation Courses

7. Anatomy and Physiology

d) Core Courses

8. Clinical Microbiology
9. Haematology
10. Clinical Biochemistry
11. Histopathology & Cytology
12. Transfusion Medicine
13. Medical Laboratory Management

e) Electives

14. Open Electives

f) Professional Training, Seminar and Industrial Training

15. Professional Training
16. Industrial Training

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Hours per week in Various Semesters					
		I	II	III	IV	V	VI
1.	English and Communication Skills	5	5	-	-	-	-
2.	Basic Chemistry	4	-	-	-	-	-
3.	Anatomy and Physiology	6	6	-	-	-	-
4.	Clinical Microbiology	6	6	6	6	-	-
5.	Haematology	6	6	6	6	-	-
6.	Clinical Biochemistry	6	6	6	6	-	-
7.	Organic Chemistry	-	4	-	-	-	-
8.	Histopathology & Cytology	-	-	6	6	-	-
9.	Transfusion Medicine	-	-	4	-	-	-
10.	Basics of Information Technology	-	-	2	-	-	-
11.	Environmental Studies	-	-	2	-	-	-
12.	Generic Skills and Entrepreneurship Development	-	-	-	3	-	-
13.	Medical Laboratory Management	-	-	-	4	-	-
14.	Open Elective (Offline/MOOCs)	-	-	-	2	-	-
15.	Professional Training	-	-	-	-	40	40
16.	Student Centred Activities	2	2	3	2	-	-
Total		35	35	35	35	40	40

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN MEDICAL LAB TECHNOLOGY

FIRST SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*English and Communication Skills – I	3	2	4	20	10	30	50	3	20	3	70	100
1.2	Basic Chemistry	2	2	3	20	10	30	50	3	20	3	70	100
1.3	Anatomy and Physiology-I	2	4	4	20	10	30	50	3	20	3	70	100
1.4	Clinical Microbiology-1	2	4	4	20	10	30	50	3	20	3	70	100
1.5	Haematology-1	2	4	4	20	10	30	50	3	20	3	70	100
1.6	Clinical Biochemistry-I	2	4	4	20	10	30	50	3	20	3	70	100
#Student Centred Activities including Traffic Awareness & Road Safety Camp(1)		-	2	-	-	-	-	-	-	-	-	-	-
Total		13	22	23	120	60	180	300	-	120	-	420	600

* Common with other diploma programmes

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

SECOND SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*English and Communication Skills – II	3	2	4	20	10	30	50	3	20	3	70	100
2.2	Organic Chemistry	2	2	3	20	10	30	50	3	20	3	70	100
2.3	Anatomy and Physiology-II	2	4	4	20	10	30	50	3	20	3	70	100
2.4	Clinical Microbiology-II	2	4	4	20	10	30	50	3	20	3	70	100
2.5	Haematology-II	2	4	4	20	10	30	50	3	20	3	70	100
2.6	Clinical Biochemistry-II	2	4	4	20	10	30	50	3	20	3	70	100
#Student Centred Activities including Traffic Awareness & Road Safety Camp(1I)		-	2	-	-	-	-	-	-	-	-	-	-
Total		13	22	23	120	60	180	300	-	120	-	420	600

* Common with other diploma programmes

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

THIRD SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Clinical Microbiology- III	2	4	4	20	10	30	50	3	20	3	70	100
3.2	Haematology-III	2	4	4	20	10	30	50	3	20	3	70	100
3.3	Clinical Biochemistry-III	2	4	4	20	10	30	50	3	20	3	70	100
3.4	Histopathology & Cytology-I	2	4	4	20	10	30	50	3	20	3	70	100
3.5	Transfusion Medicine	2	2	3	20	10	30	50	3	20	3	70	100
3.6	* Basics of Information Technology	-	2	1	-	40	40	-	-	60	3	60	100
3.7	*Environmental Studies	2	-	2	50	-	50	50	3	-	-	50	100
	# Student Centred Activities including Energy Conservation Awareness Camp & Drug Use and Abuse Awareness Camp	-	3	-	-	-	-	-	-	-	-	-	-
Total		12	23	22	150	90	240	300	-	160	-	460	700

* Common with other diploma programmes

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

FOURTH SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Generic Skills and Entrepreneurship Development	3	-	3	50	-	50	50	3	-	-	50	100
4.2	Clinical Microbiology-IV	2	4	4	20	10	30	50	3	20	3	70	100
4.3	Haematology-IV	2	4	4	20	10	30	50	3	20	3	70	100
4.4	Clinical Biochemistry-IV	2	4	4	20	10	30	50	3	20	3	70	100
4.5	Histopathology & Cytology-II	2	4	4	20	10	30	50	3	20	3	70	100
4.6	Medical Laboratory Management	4	-	4	50	-	50	50	3	-	-	50	100
4.7	Open Elective (Offline/MOOCs)	2	-	2	50	-	50	50	3	-	-	50	100
	# Student Centred Activities including Entrepreneurial Awareness camp	-	2	-	-	-	-	-	-	-	-	-	-
Total		17	18	25	230	40	270	350	-	80	-	430	700

* Common with other diploma programmes

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and other activities to promote experiential learning.

Industrial/Professional Training - After 4th Semester, students shall undergo full One Year Professional Training. First 4 Weeks out of this professional training will be devoted for this industrial/professional training and the students will be submitting report for the same. It shall be evaluated during 5th semester by his/her teacher for 50 marks. The students shall also prepare a report at the end of this industrial/professional training and shall present it in a seminar, which will be evaluated for another 50 marks. This evaluation will be done by HOD and lecturer in charge – training in the presence of one representative from training organizations.

FIFTH SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
-	Industrial Training after 4 th Semester	-	-	2	-	50	50	-	-	50	3	50	100
5.1	Professional Training-I	-	40	20	-	50	50	-	-	50	3	50	100
Total		-	40	22	-	100	100	-	-	100	-	100	200

SIXTH SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT								
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	Professional Training-II	-	40	20	-	50	50	-	-	50	3	50	100
Total		-	40	20	-	50	50	-	-	50	-	50	100

1.1 ENGLISH AND COMMUNICATION SKILLS – I

L	P
3	2

RATIONALE

Communication skills play an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Pronounce properly.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper prospective.
- Read various genres adopting different reading techniques.
- Converse logically.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Basics of Communication | (12 hrs) |
| 1.1 | Definition and process of communication | |
| 1.2 | Introduction to types of communication - formal and informal, oral and written, verbal and non-verbal | |
| 1.3 | Objectives of communication | |
| 1.4 | Essentials of communication | |
| 1.5 | Introduction to channels of communication - formal (upward, downward, diagonal, horizontal), informal (grapevine, consensus) | |
| 1.6 | Barriers to communication | |
| 2. | Functional Grammar and Vocabulary | (12 hrs) |
| 2.1 | Parts of speech | |
| 2.2 | Article | |
| 2.3 | Tenses | |
| 2.4 | Subject verb agreement sentences | |
| 2.5 | Active and passive voice | |
| 2.6 | Synonyms and antonyms | |
| 2.7 | Pair of words | |
| 2.8 | Correction of incorrect sentences | |

3. Listening (04 hrs)
- 3.1 Meaning of listening
 - 3.2 Listening and hearing
 - 3.3 Importance of listening
 - 3.4 Active listening – Meaning and strategies
 - 3.5 Methods to improve listening skills
4. Speaking (03 hrs)
- 4.1 Importance
 - 4.2 Methods to improve speaking
5. Reading (12 hrs)
- 5.1 Meaning
 - 5.2 Techniques of reading: skimming, scanning, intensive and extensive reading
 - 5.3 Comprehension, vocabulary enrichment and grammar exercises based on following readings:
- Section - I
- My Struggle for an Education – Booker T. Washington
 - Abraham Lincoln's letter to his son's headmaster – Abraham Lincoln
 - Gateman's Gift – R.K Narayan
 - The Selfish Giant - Oscar Wilde
- Section - II
- Say Not, the Struggle Nought Availeth – A H Clough
 - Stopping by Woods on a Snowy Evening – Robert Frost
 - Where the Mind is Without Fear – Rabindranath Tagore
6. Writing (02 hrs)
- 6.1 Significance and effectiveness of writing
 - 6.2 Paragraph writing – Word choice, sentence formation and construction of paragraph.

LIST OF PRACTICALS

1. Self and peer introduction
2. Newspaper reading
3. Just a Minute session – extempore
4. Situational conversation and role play
5. Language learning using open source software.
6. Greetings for different occasions
7. Improving pronunciation through tongue twisters.

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, “Communicating Effectively in English, Book-I”, Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, “Developing Communication Skills (2nd Edition)”, Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, “Oxford Practice Grammar”, Oxford University Press, London
4. Chadha, R. K., “Communication Techniques and Skills”, Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, “High School English Grammar and Composition”, S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. <http://www.mindtools.com/page 8.html>
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	12	12
3	04	6
4	03	3
5	12	15
6	02	2
Total	45	50

1.2 BASIC CHEMISTRY

L	P
2	2

RATIONALE

The role of chemistry and chemical products in every field of life is expanding greatly. Now a days various products of chemical industries are playing important role in the medical field and the number of such products is increasing. Chemistry is one of the important subjects for diploma students in Medical Lab. Technology for developing in them scientific temperament and understanding other subjects in their profession. Efforts should be made to teach the subject through demonstration and with the active involvement of students.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Prepare solution of required concentration.
- State properties of compounds like NaCl & glucose.
- Explain sources of water & various characteristics of potable water.
- Explain causes & factors which can adversely affect natural water quality and remedial measures available for water purification to achieve water quality standards required for domestic and medical applications.
- Prepare solution of required pH.
- Prepare buffer solution and understand their significance in medical field.
- State radioactive substances, radioactivity & half life.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Basic concepts of Chemistry | (07 hrs) |
| 1.1 | Definition of Melting point, boiling point, vapour pressure, freezing point (definitions & examples). | |
| 1.2 | S.I. units of pressure, volume, temperature, density, specific gravity. | |
| 1.3 | Knowledge of distillation, sublimation & sedimentation. | |
| 1.4 | Element, compound & mixtures, atom, molecule, ion, symbols and calculation of formulae of compounds (recapitulation only). | |
| 1.5 | Atomic mass (A), molar mass, mole concept and its applications. | |
| 1.6 | Solutions, Methods of expressing Concentration of a solution-like strength, mass percent w/w, volume percent v/v & w/v, molarity (M), molality (m), normality (N), mass fraction, mole fraction and parts per million (ppm). | |

2. Atomic Structure & Chemical Bonding (04 hrs)
- 2.1 Fundamental particles of atom i.e., electron, proton & neutron (their masses & charges)
 - 2.2 Bohr's model of atom (qualitative treatment only).
 - 2.3 Atomic number, atomic mass number, isotopes and isobars.
 - 2.4 Concept of orbit & orbitals. Shapes of s & p orbitals.
 - 2.5 Electronic configuration of elements upto atomic number (Z) = 30 only.
 - 2.6 Chemical bonding and cause of bonding and types of chemical bonding; Ionic bond (example NaCl) and Covalent bond -sigma (σ) and pi (π) bonds) with simple example . Examples and Properties of ionic & covalent compounds
3. Water (04 hrs)
- 3.1 Sources of water
 - 3.2 Hard and soft water, types of hardness
 - 3.3 Disadvantages of hard water in medical field.
 - 3.4 Qualities of drinking water and purification of available water for drinking purposes
 - 3.5 De-ionized water and double distilled water & their applications in medical field.
 - 3.6 Diffusion, Osmosis, osmotic pressure, Reverse osmosis, Semi-permeable membrane. (Definitions only)
- 4 Acids -Bases and Electrochemistry (05hrs)
- 4.1 Arrhenious concept of acids/bases; strong acids/bases, weak acids/bases, Neutralization, acid base titration, choice of indicators for acid base titration
 - 4.2 Concept of pH and pH scale
 - 4.3 Buffer solutions & types (acidic and basic), Physiological buffers & its applications in medical field.
 - 4.4 Electronic concept of oxidation, reduction and redox reactions
 - 4.5 Electrolytes and non electrolytes
 - 4.6 Electrolysis & process of electrolysis (take example of NaCl).

5. Surfaces and Colloids (05 hrs)

- 5.1 Adsorption and its types, applications of adsorption
- 5.2 Colloids and types of colloids
- 5.3 Preparation and purification of colloids in brief
- 5.4 Properties of colloids – Coagulation, denaturation, Brownian motion, electrophoresis & tyndall effect
- 5.5 Gels and emulsions

6. Spectroscopy (03 hrs)

- 6.1 Nature of light, Electromagnetic spectrum
- 6.2 Emission & Absorption spectra
- 6.3 Beer Lambert's Law, spectrophotometer, colorimeter, photometer, fluorimeter. (definitions only)

7. Radioactivity (02 hrs)

- 7.1 Radioactive substances, radioisotopes, half life, radioactive emissions α , β , γ rays

PRACTICAL EXERCISES

Preparation of standard solutions.

- 1. To prepare N/10 Sodium carbonate
- 2. To prepare M/10 oxalic acid solution
- 3. To prepare 5N HCl from given 12 N HCl
- 4. To prepare 5%, 10%, 15% & 20% w/v solution of NaCl
- 5. To prepare 5%, 10%, 15% & 20% v/v aqueous solution of ethanol
- 6. To prepare Normal saline solution.

Acid-Base Titrations

- 7. To determine strength of given solution of sodium hydroxide by titrating against standard solution of oxalic acid using phenolphthalein as indicator.
- 8. To determine strength of given solution of sulphuric acid by titrating against standard solution of sodium carbonate using methyl orange as indicator.

Redox Titration

- 9. To determine %age purity of green vitriol ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$), 14g of which have been dissolved per litre of the solution. Provided N/20 KMnO_4 solution.

pH Value

- 10. To determine pH of given solution using pH meter.

Colloids

11. To prepare colloidal solution of starch.

Chromatography

12. To separate two compounds by paper chromatography & determine R_f value.

INSTRUCTIONAL STRATEGY

Teacher may take help of various models and charts while giving instructions to make the concept clear. More stress may be laid on practical applications of various chemical processes and reactions. In addition, students should be encouraged to study those processes in detail, which may find practical applications in their future medical field.

RECOMMENDED BOOKS

1. Kuricose, J.C., and J. Rajaram, "Chemistry in Engineering", Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Jain, P.C., and Monika Jain, "Engineering Chemistry", Dhanapat Rai Publishing Company, New Delhi.
3. Chawla, Shashi, "Engineering Chemistry", Dhanpat Rai & Co., Delhi.
4. Hugar, Dr. G.H., "Progressive Applied Chemistry-I", Eagle Prakashan, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	7	12
2	4	7
3	4	7
4	5	8
5	5	8
6	3	5
7	2	3
Total	30	50

1.3 ANATOMY & PHYSIOLOGY -I

L	P
2	4

RATIONALE

The students of Medical Laboratory Technology (MLT) dealt with the life of human body either by direct contact or indirect contact, either through blood or other body fluids. They come in direct contact with patients a number of times and occasions. Hence they are supposed to have the basic knowledge of different parts of human body, their anatomical parts, structures and physiological functions.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Identify basic tissues of the body
- Explain skeletal system in humans.
- Explain the muscular system.
- Explain the respiratory system.
- Explain the excretory System
- Explain the structure and function of skin

DETAILED CONTENTS

- | | | |
|-----|---|---------|
| 1. | General Anatomy | (5 hrs) |
| 1.1 | Introduction to Anatomy & Physiology. | |
| | a) Levels of organization, parts of human body | |
| | b) Structure of human cell | |
| 1.2 | Basic tissues of the body (Definition, Gross structure and functions) | |
| | a) Epithelial tissue | |
| | b) Connective tissue | |
| | c) Muscular tissue | |
| | d) Nervous tissue | |
| 2. | Skeletal System | (6 hrs) |
| 2.1 | Gross structure, function and classification. | |
| 2.2 | Bones of appendicular and axial skeleton | |

- a) Bones of Pectoral girdle and upper limbs.
 - b) Bones of Pelvic girdle and lower limbs.
- 2.3 Joints & Articulations: Types of joints (Structural and functional classification).
- 2.4 Bones forming major synovial joints (Shoulder, Elbow, wrist, hip, knee, ankle and intervertebral joints)

- 3. Digestive system (10 hrs)
 - 3.1 Diagrammatic representation of Digestive System
 - 3.2 Function of Various parts of Digestive System
 - 3.3 Structure and function of Liver
 - 3.4 Definition
 - Digestion
 - Absorption
 - Assimilation
 - Differentiation between Fat soluble and Water soluble Vitamin
 - Minerals (Na,K, Phosphorus, Calcium, Iron)

- 4 Excretory System (4 hrs)
 - 4.1 Organs of Excretory System (Structure and Function)
 - 4.2 Structure of nephron
 - 4.3 Formation of Urine

- 5. Respiratory System (4 hrs)
 - 5.1 Structure of Respiratory System
 - 5.2 Functions and mechanism of Respiratory system
 - 5.3 Gas exchange in lungs.
 - 5.4 Control of respiration.
 - 5.5 Basal Metabolic Rate (BMR)

- 6 Skin (1 hr)
 - 6.1 Structure and Function of Skin

PRACTICAL EXERCISES

1. Demonstration of different parts of body
2. Demonstration of basic tissues of the body
3. Demonstration of various parts of bones
4. Demonstration of major joints of the body
5. Demonstration of structural differences between: - Skeletal muscle - Smooth muscle and - Cardiac muscle
6. Demonstration of Excretory System
7. Demonstration of Parts of Excretory System
8. Demonstration of various parts of respiratory system
9. Demonstration of Structure of Skin

NOTE: 1. There should be Anatomy & Physiology lab. Human skeleton (articulated or disarticulated), Anatomical Charts and models should be there for demonstration purposes.

2. Anatomy museum should be set up.

INSTRUCTIONAL STRATEGY

Teachers should lay more emphasis on the structure location and functions of different organs of a system, proper labeling of diagrams of different organs with correct names. In the practical work, visits to hospital/medical colleges should be planned to demonstrate the structures/processes. It is important to make use of models and audio-visual aids to show specific processes. Experts should be invited to deliver lectures on specific topics and share their experiences.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (Out of 50)
1	5	8
2	6	10
3	10	15
4	4	7
5	4	7
6	1	3
Total	30	50

1.4 CLINICAL MICROBIOLOGY-1

L	P
2	4

RATIONALE

In this course the students are given the basic knowledge of medical microbiology, pathogenicity, sterilization methods, the basic techniques of preparation of culture media, culture techniques for microbial culture, preliminary processing of cultures, knowledge of microscopes, their parts and functions. They are also made aware of the spread and types of microbial infections and are taught the safety measures in microbiology laboratory. Topics are designed to impart knowledge to the students in the field of medical microbiology and also to provide hands-on experiences to the students.

LEARNING OUTCOMES

After the successful completion of this course, the students will be able to:

- Explain Medical Microbiology and types of microorganisms
- Explain Microscopy as well as parts and working of microscope
- Identify, use and preparation of Culture Media
- Perform various culture techniques independently.
- Describe the pathogenicity and types of infections caused by microorganisms
- Knowledge of Nosocomial infections and the importance of control
- Discuss the importance of sterilization and perform sterilization work in the laboratory.

DETAILED CONTENTS

1. Introduction to Microbiology with Special Reference to Medical Microbiology (4hrs)
 - 1.1 Definition, Branches, Relationship of micro-organisms to man.
 - 1.2 Safety guidelines in a microbiology laboratory, universal precautions.
 - 1.3 Types of microorganisms- Prokaryotic and Eukaryotic.

2. Sterilization-Definition and Types (8hrs)
 - 2.1 Physical methods of sterilization:
 - a) Sterilization by dry heat—Hot air oven —principle, construction, operation, sterilization control and sterilization indicators.
 - b) Sterilization by moist heat- Autoclave- principle, construction, operation, sterilization control and sterilization indicators.
 - c) Sterilization by radiation
 - d) Sterilization by filtration (SEITZ, HEPA)
 - e) Sonic and ultrasonic vibrations
 - 2.2 Chemical methods of Sterilization:

Antiseptics and disinfectants— Definition, characteristics of ideal antiseptics and disinfectants and uses of common disinfectants (formaldehyde, chlorine, iodine, ethylene oxide, phenol compounds).
3. Microscopy (2hrs)
 - 3.1 Handling of a compound microscope- Principle, construction, working, care and maintenance of different parts of a compound microscope.
 - 3.2 Principle of a fluorescent microscope, Electron microscope and Darkfield microscope.
4. Culture Media and Culture Techniques (8hrs)
 - 4.1 Basic requirements and characteristics of ideal culture medium.
 - 4.2 Types of culture media: liquid, and solid media, routine laboratory media (Basal, Enriched, selective, enrichment, indicator, transport, and storage) with examples of each type.
 - 4.3 Inoculation of culture media, Types of bacterial culture: broth culture, slant culture. Culture techniques: streak plate, pour plate/spreading culture, Aerobic and anaerobic culture, Isolation of pure cultures.
5. Pathogenicity (4hrs)
 - 5.1 Definition of pathogenicity, pathogen and virulence
 - 5.2 Sources of infection
 - 5.3 Mode of the spread of infection
 - 5.4 Types of infection

6. Nosocomial Infections (4hrs)

6.1 Types, source, Prevention and control of nosocomial infections.

PRACTICAL EXERCISES

1. Demonstration of safety rules (Universal precautions) in a microbiology laboratory.
2. Preparation of cleaning agents and techniques for cleaning glassware.
3. Sterilization by autoclave
4. Sterilization by hot air oven
5. Sterilization by filtration
6. Handling, care and use of a compound microscope
7. Preparation and sterilization of various culture media-
 - Nutrient agar and Nutrient broth
 - MacConkey Agar and MacConkey Broth
 - Blood Agar
 - Chocolate agar
 - LJ media
8. Inoculation of culture media by following techniques-
 - Streak plate, Pour plate, Agar slant, liquid media

INSTRUCTIONAL STRATEGY

The teacher should lay stress on safety guidelines while working in the microbiology laboratory. The student should be familiar with the definition of pathogenicity, toxicity of pathogenic microorganisms, pathogenic infections, how they are spread and controlled, stress on microscopes and their parts, sterilization techniques, culture media and their culture techniques. The student should be taught with charts and audio-visual aids. The subject teacher should try to give topic wise assignment for assessing the learning of students and encourage them to present at least one assignment in class. As far as possible, the teacher should try to cover the theory and practical for a topic simultaneously.

RECOMMENDED BOOKS

1. Gupta, Satish, "Textbook of Medical Microbiology", JP Brothers, New Delhi.
2. Gupta, Satish, "Practical Book of Medical Microbiology", JP Brothers, New Delhi.
3. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworth – Heinemann; Oxford.

4. Godkar, Praful B, "Textbook of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
5. Mukherjee, Kanai Lal, "Medical Laboratory Technology", Tata McGraw Hill, New Delhi.
6. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries Vol. I and II", Cambridge University Press; UK.
7. "Ananthanarayan and Paniker's Textbook of Microbiology", Universities Press (India).
8. Jockie and Kolhatkar, "Medical Laboratory Science", Tata McGraw Hill.
9. Chakraborty, Pranabeswar, "Textbook of Microbiology", Central Book Agency.
10. Wani, Dr Imtiyaz, "New Concepts in Microbiology", S.Vikas and Company, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (Out of 50)
1	4	4
2	8	14
3	2	8
4	8	12
5	4	6
6	4	6
Total	30	50

1.5 HEMATOLOGY-I

L P
2 4

RATIONALE

The main objective of recommended curriculum is to make the students competent to handle sophisticated machinery and advanced protocols. They should have theoretical and practical knowledge about principle, procedure, interpretation and preparation of reagents for routine haematological investigations. Emphasis will be laid on the various safety precautions to be observed in clinical laboratory.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- State the principle of blood Composition
- Collect blood samples
- Identify and use various Anticoagulants
- Identify and use various stains

DETAILED CONTENTS

1. Introduction to hematology and laboratory organization(03 hrs)

- 1.1 Various apparatus used in haematology lab.
- 1.2 Precautions to be taken while working in lab.

2. Apparatus and Instruments (08 hrs)

Principle, Care & Safe Operating Procedure and Application of following:

- 2.1 Compound Microscope
- 2.2 Centrifuge
- 2.3 Water Bath
- 2.4 Hot Air Oven
- 2.5 Incubator
- 2.6 Hand tally counter
- 2.7 Blood mixer

3. Introduction to blood(06 hrs)
 - 3.1 Definition, Composition& functions of blood
 - 3.1.1 Cells-WBC, RBC &Platelets
 - 3.1.2 Plasma & its contents
 - 3.2 Formation of blood (Erythropoiesis, Leukopoiesis & Thrombopoiesis)
4. Collection of blood (05 hrs)
 - 4.1 Venous blood collection (Venipuncture)
 - 4.1.1 Venipuncture site
 - 4.1.2 Materials and equipment required for venipuncture
 - 4.1.3 Preparation of patients for venipuncture
 - 4.1.4 Selection and preparing the venipuncture site
 - 4.1.5 Performing venipuncture
 - 4.1.6 Care of venipuncture site
 - 4.1.7 Disposal of blood, syringes, needle and lancets.
 - 4.2 The capillary puncture
 - 4.2.1 Capillary puncture site
 - 4.2.2 Materials and equipment required for capillary puncture site
 - 4.2.3 Selecting and preparing the puncture site
 - 4.2.4 Performing capillary puncture
 - 4.2.5 Collection of blood sample
 - 4.2.6 Care of thecapillary puncture site
5. Anticoagulants (EDTA, Oxalate, Citrate & Heparin)(02 hrs)
 - 5.1 Definition
 - 5.2 Various types along with their mode of action, merits and demerits of each
 - 5.3 Anticoagulant vials
6. Romanowsky Stains (Leishman, Giemsa, Wright, Jenner, Field & JSB)(06 hrs)
 - 6.1 Preparation and theory
 - 6.2 Choice of slide and spreader
 - 6.3 Preparation of blood film
 - 6.4 Characteristics of good blood smear
 - 6.5 Staining procedure
 - 6.6 Examination of blood smear
 - 6.7 Identification of blood cells

PRACTICAL EXERCISES

1. Demonstration of various parts of microscope: Its function and care.
2. Demonstration of various parts of centrifuge: Its function and care.
3. Cleaning and drying of glassware and plasticware.
4. Preparation of various anticoagulants.
5. Collection of blood: Venous and Capillary
6. Separation of serum and plasma.
7. Preparation of Romanowsky stains
8. Preparation of thick and thin smear.
9. Staining of blood film by Romanowsky stains.

INSTRUCTIONAL STRATEGY

Emphasis should be laid to clear the basic concepts of haematology. Teacher may take the help of various charts, models and different online platforms to make the students conversant with the basic haematological techniques like blood collection.

RECOMMENDED BOOKS

1. Mukherjee, KL, "Medical Laboratory Technology Vol. 1", Tata McGraw Hill Publishers, New Delhi.
2. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworth Heinmann, Oxford.
3. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries", Cambridge University Press, UK.
4. Godkar, Praful B, "Textbook of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
5. Decei, JV, "Practical Haematology", ELBS with Curchill Living Stone, UK.
6. Ochei, J, and A Kolhatkar, "Medical Laboratory Science Theory and Practical", Tata McGraw Hill Publishing Company Ltd., New Delhi 2000 Ed.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out Of 50)
1	03	5
2	08	14
3	06	9
4	05	9
5	02	4
6	06	9
TOTAL	30	50

1.6 CLINICAL BIOCHEMISTRY –I

LP
2 4

RATIONALE

In Medical laboratory many types of instruments are used for analysis of samples. Students of MLT are required to learn the proper handling of various instruments. The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the technique of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of metabolites which are routinely estimated in different diseases.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Use the concept of the calibration of volumetric glassware.
- Describe the knowledge of preparation of reagents
- Handle laboratory glassware efficiently
- Describe the calibration methods of various volumetric apparatus
- Prepare different protein precipitating agents and anticoagulants
- Apply the concept of preparing various reagents

DETAILED CONTENTS

1. Introduction to Biochemistry (5hrs)
 - 1.1 Definition and Importance of Biochemistry
 - 1.2 Scope of Biochemistry
 - 1.3 Volumetric apparatus and their calibration
 - 1.4 Cleaning and care of laboratory Glass and Plasticware
 - 1.5 Different cleaning agents (soaps, detergents, chromic acid)
 - 1.6 Methods of cleaning and storage
2. Important Instruments (15 hrs)

Principle, Working, Handling, Care and Maintenance of

 - 2.1 Balances

- 2.2 Centrifuges
- 2.3 pH Meter
- 2.4 Ion Selective Electrodes
- 2.5 Hot Plate and Magnetic stirrer
- 2.6 Water Bath
- 2.7 Hot Air Oven
- 2.8 Incubator
- 2.9 Distillation unit
- 2.10 Colorimeter
- 2.11 Flame Photometer
- 2.12 Photometer
- 2.13 Fluorimeter
- 2.14 Spectrophotometer
- 2.15 Urinometer
- 2.16 Glucometer (Rapid Diagnostic Technique)
- 2.17 Cholesterol Strip (Rapid Diagnostic Technique)
- 2.18 Different types of syringes and vacutainers used for blood collection.
- 2.19 Biochemistry Analyzers

- 3. Anticoagulants (2hrs)
 - 3.1 Introduction
 - 3.2 Types
 - 3.3 Uses
 - 3.4 Merits and Demerits

- 4. Patient identification, Collection, Preservation, Transport and Disposal of clinical specimen (4hrs)
 - 4.1 Blood
 - 4.2 Urine
 - 4.3 Stool
 - 4.4 Other body Fluid

- 5. Blood Fractions (4hrs)
 - 5.1 Preparation of Serum
 - 5.2 Preparation of Plasma
 - 5.3 Different protein precipitating reagents
 - 5.4 Preparation of protein free filtrate (PFF)

PRACTICAL EXERCISES

1. To prepare cleaning agents (Chromic acid, HCl, Nitric acid and other agents).
2. To clean and preserve laboratory Glasswares (Glass Pipette, Burette, Test Tube, Conical Flask and Beaker).
3. Standardization and Calibration of volumetric Glasswares (Glass Pipette, volumetric Flask and measuring Cylinder).
4. Handling and maintenance of Weighing Balance, Water Bath, Centrifuge and distillation plant/deionizer.
5. Handling and maintenance of Colorimeter and Spectrophotometer.
6. Calibration of pH meter using various standard solutions.
7. To prepare EDTA vials/containers.
8. To collect sample in different vacutainers.
9. To prepare precipitating agents of protein.
10. To separate plasma and serum from blood.
11. To prepare a filtrate free of protein.
12. To prepare various disinfectants used in laboratory (70% ethanol, 6% sodium hypochlorite, 3% phenol).
13. To demonstrate the functioning of Glucometer.
14. To demonstrate the Cholesterol strip test.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually but under supervision. Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audio-visual aids to show specific processes. Experts should be invited to deliver lectures on specific topics and share their experiences.

RECOMMENDED BOOKS

1. Kanai, I Mukherjee, "Medical Laboratory Technology (Volume I)", Swarajit Ghosh, McGraw Hill Education.
2. Satyanarayana U., and Chakrapani U., "Biochemistry", New Central Book Agency Pvt. Ltd.
3. Ochei J, and Kolhatkar A, "Medical Laboratory Science: Theory and Practice", McGraw Hill Education.
4. Chattejee, M.N., Shinde, R., "Text Book of Medical Biochemistry", Jaypee Brothers Medical Publishers Pvt. Ltd.

5. Gupta R.C, and Bhargava. S, "Practical Biochemistry", CBS Publishers & Distributors Pvt. Ltd.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	05	08
2	15	20
3	02	06
4	04	08
5	04	08
TOTAL	30	50

TRAFFIC AWARENESS & ROAD SAFETY CAMP (I)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety. By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Road safety Scenario
2. School bus and traffic management
3. Awareness of Traffic Signs
4. Speeding Limit
5. Always Wear your Shields
6. Overtaking
7. Awareness through Hoardings
8. Walking & Safe cycling

2.1 ENGLISH AND COMMUNICATION SKILLS - II

L	P
3	2

RATIONALE

Communication skills play an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Make proper oral presentations.
- Speak confidently.
- Debate properly.
- Write accurate official/business letters.
- Respond to telephone calls effectively.
- Overcome communication barriers.

DETAILED CONTENTS

- | | | |
|----|-----------------------------------|----------|
| 1. | Functional Grammar and Vocabulary | (12 hrs) |
|----|-----------------------------------|----------|

Theory and Practical exercises on following:

- 1.1 One word substitution
- 1.2 Functional Grammar and Vocabulary
- 1.3 Prefixes and Suffixes
- 1.4 Punctuation
- 1.5 Narration
- 1.6 Idioms and Phrases

- | | | |
|----|---------|---------|
| 2. | Reading | (9 hrs) |
|----|---------|---------|

Comprehension, Vocabulary enrichment and grammar exercises based on the following readings:

Section-I

- The Last Leaf - O' Henry

- Sparrows - K A Abbas
- The Postmaster - Rabindra Nath Tagore

Section-II

- Night of the Scorpion - Nissim Ezekiel
- All the World is a Stage - William Shakespeare
- Success – Emily Dickenson
- Daffodils – William Wordsworth

3. Writing (24 hrs)

- 3.1 Writing Resume and Cover letter
- 3.2 Correspondence: Business and Official
- 3.3 Report Writing – Introduction and features of good report.
- 3.4 Press Release
- 3.5 Memos and Circulars
- 3.6 Notices (lost, found, and auction)
- 3.7 Agenda and Minutes of Meetings
- 3.8 Filling-up different forms such as bank form and on-line form for placement etc.
- 3.9 Precis Writing
- 3.10 E mail writing

LIST OF PRACTICALS

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Debate
4. Manners and Etiquette
5. Power point presentation
6. Telephonic conversation: General etiquette for making and receiving calls.
7. Mock interviews

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, “Communicating Effectively in English, Book-I”, Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, “Developing Communication Skills (2nd Edition)”, Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, “Oxford Practice Grammar”, Oxford University Press, London
4. Chadha, R. K., “Communication Techniques and Skills”, Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, “High School English Grammar and Composition”, S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	9	12
3	24	26
Total	45	50

2.2 ORGANIC CHEMISTRY

L P
2 2

RATIONALE

Diploma holders in Medical Laboratory Technology are supposed to know about the chemical properties and biological importance of various biomolecules. For this purpose, it is essential that they should be equipped with knowledge and skill covering topics of organic chemistry such as hydrocarbons, alcohols, ethers, carbohydrates, lipids, proteins, nucleic acids, enzymes and vitamins etc., so as to enable them to perform various activities in a medical laboratory effectively.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Identify chemical elements of carbohydrates and the difference between simple sugars and complex carbohydrates.
- Compare and contrast the structure and functions of important carbohydrates like glucose, fructose, glycogen, starch & cellulose.
- Identify chemical elements and functional groups of proteins.
- Recognize the structure of an amino acid and the peptide bond that connects di-, tri, and polypeptides.
- Recognize the presence of 20 amino acids and that not all are essential amino acids.
- Explain protein denaturation and the effect of heat on protein structure and function.
- Describe the structure and biological importance of fats and lipids
- Distinguish between saturated and unsaturated fats.
- Explain bio-catalysts i.e., enzymes, their chemical & specific nature and biological importance of enzymes.

DETAILED CONTENTS

- | | | |
|-----|---|----------|
| 1. | Organic chemistry | (03 hrs) |
| 1.1 | Introduction and importance of organic compounds. | |
| 1.2 | Comparison of organic and inorganic compounds. | |
| 1.3 | Properties of carbon – Tetravalency, catenation. | |
| 1.4 | Structural & condensed formulae of organic compounds. | |
| 1.5 | Classification of Organic compounds- open chain & closed chain compounds. | |

- 1.6 Homologous series & Functional groups (identification of functional groups of alcohols, aldehydes, ketones, carboxylic acids, esters, ethers and amines).
2. Nomenclature of Organic Compounds (05 hrs)
 - 2.1 Nomenclature of Aliphatic Hydrocarbons – alkanes, alkenes & alkynes
 - 2.2 Nomenclature of Compounds containing Functional groups – alcohols, aldehydes, ketones, carboxylic acids, esters, ethers and amines
3. Carbohydrates (05 hrs)
 - 3.1 Definition
 - 3.2 Composition and sources
 - 3.3 Classification
 - 3.4 Estimation of glucose
 - 3.5 Important monosaccharides, disaccharides and polysaccharides.
 - 3.6 Breakage of glucose, fructose, galactose, lactose, maltose
 - 3.7 Role of Carbohydrates & clinical significance.
4. Lipids (04 hrs)
 - 4.1 Definition
 - 4.2 Classification
 - 4.3 Introduction to fatty acids, phospholipids, triglycerides, sterol, ergosterol, Cholesterol
 - 4.4 Reactions of fats
 - 4.5 Clinical importance of Lipids
5. Proteins (05 hrs)
 - 5.1 Definition
 - 5.2 Classification
 - 5.3 Names of various amino acids
 - 5.4 Structure & properties of proteins
 - 5.5 Role of proteins
 - 5.6 Colour reactions of proteins
6. Nucleic acids (02 hrs)
 - 6.1 Nucleic acids & types (DNA & RNA)

- 6.2 Chargaff's Rule
- 6.3 Double helical three dimensional structure
- 6.4 Role of nucleic acids

- 7. Enzymes (04 hrs)
 - 7.1 Definition
 - 7.2 Classification
 - 7.3 Chemical & specific nature of enzymes
 - 7.4 Characteristics of enzymes
 - 7.5 Factors affecting enzyme activity
 - 7.6 Enzyme inhibitors
 - 7.7 Mechanism of enzyme action
 - 7.8 Enzymes of Diagnostic importance

- 8. Vitamins (02 hrs)
 - 8.1 Introduction
 - 8.2 Classification of vitamins (fat soluble & water soluble)
 - 8.3 Important Vitamins (Characteristics, Sources and deficiency diseases) (e.g., Vitamin A, B complex, C, D, E & vitamin K)
 - 8.4 Recommended dietary allowance

LIST OF PRACTICALS

1. To detect carbohydrates by following simple tests.
 - a. Molisch's Test
 - b. Benedict's Test
 - c. Tollen's reagent Test
 - d. Fehling solution test (Test for Reducing sugars)
 - e. Barfoed's Test (Test for monosaccharides)
2. To detect proteins by following simple tests.
 - a. Biuret Test
 - b. Xanthoprotic test
 - c. Millon's Test
 - d. Ninhydrin Test
3. To detect Lipids by following simple tests.
 - a. Solubility test
 - b. Translucent spot test
 - c. Acrolein test

4. Distinction between aldehydes & ketones
5. Saponification of fatty acids
6. Estimation of glucose
7. To determine acid value of fats.

INSTRUCTIONAL STRATEGY

Teacher may take help of various models and charts & videos while giving instructions to make the concept clear. More stress may be laid on practical applications of various chemical processes and reactions. In addition, students should be encouraged to study those processes in detail, which may find practical applications in their future medical field.

RECOMMENDED BOOKS

1. Jauhar, Dr. S.P., "Modern's Abc of Chemistry Vol I and Vol II", Modern Publishers, New Delhi.
2. Malhotra, S.K., "Companion Chemistry Vol I & Vol II", S.Dinesh & Co., Jalandhar City.
3. Singh, Sukhdev, and Om Parkash, "A textbook of Elementary Biochemistry and Clinical Pathology", Pee Vee Books.
4. Hugar, Dr. G.H., "Progressive Applied Chemistry –I", Eagle Prakashan, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (Out of 50)
1	3	5
2	5	8
3	5	8
4	4	7
5	5	8
6	2	3
7	4	7
8	2	4
Total	30	50

2.3 ANATOMY AND PHYSIOLOGY-II

L	P
2	4

RATIONALE

The basic knowledge of structure of body, their anatomical parts and physiological functions is very important for the student of Medical Lab Technology as he has to take samples like blood, body fluid, skin tissue etc. from different parts of body. After studying this subject, the students shall be able to understand various parts of body and their anatomical positions along with functions. Students are also supposed to have basic operational skill of E.C.G and BP monitoring.

LEARNING OUTCOMES

After studying the course content, the student will be able to

- Identify/understand various organs/systems of the body like nervous system, sense organs, muscles, heart, lymphatic system and reproductive system.
- Explain function of different organs, glands and hormones.
- Operate E.C.G machine and BP apparatus.

DETAILED CONTENTS

- | | | |
|-----|---|--------|
| 1. | Nervous System | (4hrs) |
| 1.1 | Definition and parts of nervous system | |
| 1.2 | Central nervous system (brain and spinal cord): Definitions, diagrammatic representation and functions | |
| 1.3 | Peripheral nervous system (cranial and spinal nerves): Definitions, names and functions of different nerves | |
| 2. | Sense Organs (Eye, Ear, Tongue and Nose) | (3hrs) |
| 2.1 | Diagrammatic representation and functions | |

3. Muscular System(3hrs)

- 3.1 Definition and types
- 3.2 Skeletal, smooth and cardiac muscles: Definitions, diagrammatic representation and functions
- 3.3 Muscle fatigue

4. Circulatory System (6hrs)

- 4.1 Definition and types of blood circulation: Coronary, Systemic, Pulmonary and Hepatic
- 4.2 Definition of heart, diagrammatic representation showing external and internal features, functions and working
- 4.3 Cardiac Cycle
- 4.4 Major arteries and veins functions
- 4.5 Conducting System of Heart
- 4.6 Lymphatic system: Definition, name of parts constituting it and functions, definition and functions of lymph

5. ECG and BP Monitoring (3hrs)

- 5.1 Principle of E.C.G. and Types of Leads
- 5.2 Importance of E.C.G. Care and Maintenance of E.C.G. Machine
- 5.3 The blood pressure

6. Reproductive System (6hrs)

- 6.1 Male and female reproductive system: Definition, diagrammatic representation and functions

7. Endocrine System (5hrs)

- 7.1 Definition and classification
- 7.2 Names, structure and location of each glands
- 7.3 Hormones functions and associated diseases (GSH, TSH, thyroid, parathyroid, insulin, adrenaline, non adrenaline, testosterone and oxytocin)

PRACTICAL EXERCISES

1. Demonstration of structure of brain
2. Demonstration of structure spinal cord
3. Demonstration of structure of eye
4. Demonstration of structure of ear
5. Demonstration of structure of nose
6. Demonstration of structure tongue
7. Demonstration of structure of heart
8. Measurement of Blood Pressure
9. Principle and performance of ECG
10. Demonstration of structure male reproductive system
11. Demonstration of structure of female reproductive system

There should be Anatomy & Physiology lab. Human skeleton (articulated or disarticulated), Anatomical Charts and models should be there for demonstration purposes.

INSTRUCTIONAL STRATEGY

Teachers should lay more emphasis on the structure, location and functions of different organs of a system, proper labeling of diagrams of different organs with correct names. In the practical work, visits to hospital/medical colleges should be planned to demonstrate the structures/processes. It is important to make use of models and audio-visual aids to show specific processes. Experts should be invited to deliver lectures on specific topics and share their experiences.

RECOMMENDED BOOKS

1. Pears, "Anatomy and Physiology", JP Brothers, New Delhi.
2. Sears, "Anatomy and Physiology", ELBS, London.
3. Murugesh, N, "Basic Anatomy and Physiology", Sathya Publishers, Madurai.
4. Waugh, Anne, and Kathleen JW Wilson, "Ross and Wilson Anatomy and Physiology" by Churchill Living Stone; London.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (Out of 50)
1	4	7
2	3	5
3	3	5
4	6	10
5	3	5
6	6	10
7	5	8
Total	30	50

2.4 CLINICAL MICROBIOLOGY -II

L P
2 4

RATIONALE

In this course, the students will learn the morphological features of bacteria, staining techniques and staining characters of bacteria, biochemical characteristics and lab diagnosis of pathogenic bacteria. They will learn the techniques of collection of samples, their processing and identification of various pathogens. In addition to this, they are also made aware of the sensitivity of bacteria towards antibiotics. This course is designed to impart fundamental knowledge and professional skills required for facilitating microbial testing in various hospitals and clinical services.

LEARNING OUTCOMES

After the successful completion of this course, the students will be able to:

- Explain the structure, morphological characteristics and growth curve of bacteria
- Perform staining techniques on their own.
- Identify pathogenic bacteria based on their characteristics.
- Identify the causative organisms.
- Understand the principle and procedure of antibiotic sensitivity
- Perform Laboratory diagnosis of infectious diseases and interpret lab investigations.

DETAILED CONTENTS

1. Morphology of bacteria (5hrs)
 - 1.1 Structure of bacteria cell
 - 1.2 Bacterial growth curve, factors affecting growth
2. Staining methods (5hrs)
 - 2.1 Method of smear preparation
 - 2.2 Differential staining method –i) Gram staining, ii) AFB staining, iii) Albert's staining

3. Biochemical Tests and Motility Test (6hrs)
 - i) Catalase, ii) Coagulase, iii) Oxidase, iv) Indole, v) MR vi)VP
 - Hanging drop method
4. Antibiotic Sensitivity (2hrs)
 - 4.1 Disc Diffusion method- Principle, procedure and precautions.
5. Characteristics of Bacteria-morphology, staining, culture, biochemical characteristics, pathogenicity and lab diagnosis of following organisms: (7hrs)
 - 5.1 Staphylococci (*S.aureus*)
 - 5.2 Streptococci(*S.pyogenes*)
 - 5.3 Pneumococci (*P. pneumonia*)
 - 5.4 Clostridium (*Cl.tetani*)
 - 5.5 Escherichia (*E.coli*)
 - 5.6 Vibrio (*V.cholerae*)
6. Laboratory Diagnosis of Infectious Diseases (5hrs)
 - 6.1 Respiratory tract infections
 - 6.2 Gastrointestinal tract infections
 - 6.3 Urinary tract infections

PRACTICAL EXERCISES

1. Staining techniques: Principle, Requirements, Procedure, Observation and Precaution for
 - i) Gram staining
 - ii) ZiehlNeelson staining
 - iii) Albert's staining
2. Biochemical testing- Principle, Requirements, Procedure, Observation and Precaution for
 - i)Catalase
 - ii) Coagulase
 - iii) Oxidase
 - iv) Indole
 - v) MR
 - vi)VP
3. Demonstration of bacterial motility by hanging drop technique.

4. Antimicrobial sensitivity testing by Disc diffusion method.
5. Collection, transportation, and processing of following clinical samples for lab diagnosis and identification of pathogens –
 - i) Urine
 - ii) Sputum
 - iii) Throat swabs
 - iv) Blood

INSTRUCTIONAL STRATEGY

The teacher should lay stress on the structure and morphological characteristics of bacteria, and the nomenclature of bacteria for common use. The student should be familiarized with staining techniques, morphological features, culture characteristics, biochemical characteristics, and motility identification and also train them in performing antibiotic sensitivity tests independently. The student should be able to identify microorganisms from infectious sample. The student should be taught with positive samples, charts, and audio-visual aids. The subject teacher should try to give topic wise assignment for assessing the learning of students and encourage them to present at least one assignment in class. As far as possible, the teacher should try to cover the theory and practical for a topic simultaneously.

RECOMMENDED BOOKS

1. Gupta, Satish, "Textbook of Medical Microbiology", JP Brothers, New Delhi.
2. Gupta, Satish, "Practical Book of Medical Microbiology", JP Brothers, New Delhi.
3. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworth – Heinemann; Oxford.
4. Godkar, Praful B, "Textbook of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
5. Mukherjee, Kanai Lal, "Medical Laboratory Technology", Tata McGraw Hill, New Delhi.
6. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries Vol. I and II", Cambridge University Press; UK.
7. "Ananthanarayan and Paniker's Textbook of Microbiology", Universities Press (India).
8. Jockie and Kolhatkar, "Medical Laboratory Science", Tata McGraw Hill.
9. "Textbook of Microbiology", Pranabeswar Chakraborty publishers Central Book Agency.
10. Wani, Dr Imtiyaz, "New Concepts in Microbiology", S.Vikas and Company, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hours)	Marks Allotted (Out of 50)
1	5	7
2	5	7
3	6	11
4	2	4
5	7	14
6	5	7
Total	30	50

2.5 HAEMATOLOGY - II

L P
2 4

RATIONALE

The training in haematology is imparted to enable the students to know the principle of tests, methodology of routine as well as advanced procedures being carried out in the laboratory by using routine as well as sophisticated instruments. Stress is also given in use of safety measures in the laboratory

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- State the principle of Haemoglobinometry
- Perform Haemocytometry
- Identify Blood cell morphology in health and disease
- Automation in haematology

DETAILED CONTENTS

- 1 Haemoglobinometry (10 hrs)
 - 1.1 Formation of haemoglobin, function and its degradation
 - 1.2 Types of haemoglobin
 - 1.3 Various methods of estimation with specific reference to Sahli's and cyanmethaemoglobin method
2. Haemocytometry (10 hrs)
 - 2.1 Neubauer counting chamber
 - 2.2 Methods of counting of RBC, WBC and platelets, their calculations and reference values.
 - 2.3 Errors involved in haemocytometry and means to minimize them
3. Differential leucocyte counting (DLC) (6 hrs)
 - 3.1 Preparation and staining of blood film
 - 3.2 Performance of DLC
 - 3.3 Normal values and significance of DLC

3.4 Blood cell morphology in health and disease (Peripheral blood film)

4. Automation in haematology (4 hrs)

4.1 Various types of Blood cell counter

4.2 Principle and operation of the automated blood cell counters

PRACTICAL EXERCISES

1. Haemoglobin Estimation by Sahli's method
2. Haemoglobin Estimation by Cyanmethaemoglobin method
3. Counting of RBC
4. Counting of WBC
5. Platelet count
6. Absolute eosinophil count
7. Performance of DLC
8. Study of morphology of normal RBC and WBC with the help of stained slide
9. To study abnormal morphology of RBC with the help of stained slide
10. To study abnormal morphology of WBC with the help of stained slide
11. To study abnormal morphology of platelet with the help of stained slide

INSTRUCTIONAL STRATEGY

Emphasis should be laid to clear the basic concepts of haematology. Teacher may take the help of various charts, models and different online platforms to make the students conversant with the basic haematological techniques like identification of various blood cells and their count.

RECOMMENDED BOOKS

1. Mukherjee, KL, "Medical Laboratory Technology Vol. 1", Tata McGraw Hill Publishers, New Delhi.
2. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworth Heinmann, Oxford.
3. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries", Cambridge University Press, UK.
4. Godkar, Praful B, "Textbook of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
5. Decei, JV, "Practical Haematology", ELBS with Curchill Living Stone, UK.

6. Ochei, J, and A Kolhatkar, “Medical Laboratory Science Theory and Practical”, Tata McGrawHill Publishing Company Ltd., New Delhi 2000 Ed.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out Of 50)
1	10	17
2	10	17
3	06	8
4	04	8
TOTAL	30	50

2.6 CLINICAL BIOCHEMISTRY –II

L P
2 4

RATIONALE

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the technique of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of metabolites which are routinely estimated in different diseases.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Determine the need and importance of biochemical tests in diagnosis.
- Perform the biochemical tests for the diagnosis of various clinical diseases.
- Analyze the normal and abnormal biochemical reports.
- Discuss the concept of clinically important blood metabolites and their importance
- Apply the diagnostic procedure for evaluating different health conditions.
- Relate abnormal metabolite values with different clinical conditions

DETAILED CONTENTS

1. Blood Glucose and Glucose Tolerance Test (GTT) (10hrs)
 - 1.1 Introduction
 - 1.2 Principle and different methods of estimation
 - 1.3 Reference values
 - 1.4 True and Apparent sugar
 - 1.5 Renal Threshold
 - 1.6 Glucose Tolerance Test (GTT)
 - 1.7 Glycated Hemoglobin (HbA1c)
 - 1.8 Clinical Significance

2. Blood Urea (6hrs)
 - 2.1 Introduction
 - 2.2 Principle and different methods of estimation
 - 2.3 Reference values

- 2.4 Clinical Significance
3. Serum Creatinine (2 hrs)
 - 3.1 Introduction
 - 3.2 Principle and different methods of estimation
 - 3.3 Reference values
 - 3.4 Clinical Significance
4. Serum Proteins (4hrs)
 - 4.1 Introduction
 - 4.2 Principle and different methods of estimation
 - 4.3 Reference values
 - 4.4 Clinical Significance
5. Electrolytes (4hrs)
 - 5.1 Introduction
 - 5.2 Principle and different methods of estimation (Na^+ , K^+ , Cl^- , P , Ca^{2+} , Mg^{2+} and Fe^{2+}).
 - 5.3 Reference values
 - 5.4 Clinical Significance
6. Uric Acid (4hrs)
 - 6.1 Introduction
 - 6.2 Principle and different methods of estimation
 - 6.3 Reference values
 - 6.4 Clinical Significance

PRACTICAL EXERCISES

1. Preparation of Reagents (Stock and Working)
2. Estimation (quantitative) of Blood Glucose by Folin-Wu method.
3. Estimation (quantitative) of Blood Glucose by O-toluidine method.
4. Estimation (quantitative) of Blood Glucose by GOD-POD enzymatic method.
5. Estimation of Blood Urea.
6. Estimation of Serum Creatinine.
7. Estimation (quantitative) of Protein by Burette method.

8. Estimation of Electrolyte (Na^+ , K^+ and Cl^-) by Flame Photometer and Kit method.
9. Estimation of Uric Acid.
10. Estimation of Plasma and Serum Protein.
11. To perform Glucose Tolerance Test (GTT).

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually but under supervision. Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audio-visual aids to show specific processes. Experts should be invited to deliver lectures on specific topics and share their experiences

RECOMMENDED BOOKS

1. L Mukherjee, Kanai, and Swarajit Ghosh, "Medical Laboratory Technology (Volume I)", McGraw Hill Education.
2. Satyanarayana U. Chakrapani U., "Biochemistry", New Central Book Agency Pvt Ltd.
3. Ochei J, Kolhatkar, "A Medical Laboratory Science: Theory and Practice", McGraw Hill Education.
4. Chatterjee, M.N. and R. Shinde, "Text Book of Medical Biochemistry", Jaypee Brothers Medical Publishers Pvt. Ltd.
5. Gupta R. C, and Bhargava S, "Practical Biochemistry", CBS Publishers & Distributors Pvt. Ltd.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	10	10
2	06	08
3	02	04
4	04	06
5	04	06
6	04	06
TOTAL	30	50

TRAFFIC AWARENESS & ROAD SAFETY CAMP (II)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety. By obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of District Traffic police. There will be no exam for this camp.

1. Time management
2. Traffic light signals
3. Speed limits of vehicles
4. Schedule of offences
5. Dividing lines
6. Proper road Maintenance and Warnings
7. Test yourself

3.1 CLINICAL MICROBIOLOGY - III

L P
2 4

RATIONALE

The students undergoing training in clinical microbiology in this semester learn the techniques of collection of samples and their processing by using different techniques. This training is aimed at making the students competent to identify the causative parasites and viruses for microbial infections. In addition to the above, students are given training in the safety measures to be followed while handling infectious samples.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Explain types of parasites.
- Describe the characteristics of Protozoa and Helminths.
- Explain the characteristics of viruses and will have knowledge of Hepatitis and HIV.
- Collect the samples and process them independently to identify the parasites.
- Prepare thin and thick smears of blood and perform its stainings.
- Identify all stages of malarial parasites.

DETAILED CONTENTS

1. Introduction to Medical Parasitology (3 hrs)
 - 1.1 Definition of parasite, host, and their types
 - 1.2 Relationship of Host and Parasite-Definition of commensalism, parasitism, symbiosis, mutualism.
 - 1.3 General characteristics of Protozoa
 - 1.4 General characteristics of Helminths
2. Laboratory Samples (7 hrs)
 - 2.1 Collection, transportation, processing and preservation of stool sample for routine investigations.
 - 2.2 Principle and procedure of following concentration techniques of stool
 - Simple sedimentation
 - Formal ether concentration technique (FEC)
 - Simple flotation

- Zinc sulphate (ZNSO₄) flotation technique.

3. Morphology, pathogenicity, life cycle, lab-diagnosis and prevention of (4 hrs)
 - 3.1 Entamoebahistolytica
 - 3.2 Giardia lamblia
- 4 Morphology, pathogenicity, life cycle, lab-diagnosis and prevention of (4 hrs)
 - 4.1 Ascarislumbricoides
 - 4.2 Ancylostoma duodenale
- 5 Morphology, pathogenicity, life cycle, lab-diagnosis and prevention of Malarial Parasite (Plasmodium. falciparum) (4 hrs)
- 6 Virology (2hrs)
 - 6.1 Definition of virus
 - 6.2 Morphology of virus
 - 6.3 Effect of physical and chemical agents on viruses.
 - 6.4 Collection and transportation of samples for viral diagnosis.
7. Morphology, Pathogenicity, Lab diagnosis and prevention of following viruses (6 hrs)
 - 7.1 Hepatitis
 - 7.2 HIV

PRACTICAL EXERCISES

1. Collection and preservation of stool sample.
2. Microscopic examination of stool.
3. Identification of parasites by wet mount of stool in saline preparation.
4. Identification of parasites by wet mount of stool in Lugol's Iodine preparation
5. Identification of parasites from stool by Zinc sulphate flotation technique.
6. Identification of parasites from stool by Formal ether sedimentation technique.
7. Identification of Entamoeba histolytica from slide/specimen.
8. Identification of the Giardia lamblia from slide/specimen.
9. Identification of the Ascaris lumbricoides from slide/specimen.
10. Identification of the Ancylostomaduodenalae from slide /specimen.
11. Preparation of thin and thick blood smears.

12. Staining of blood smears by Leishman stain for the identification of Malarial parasite(MP test)
13. Staining of blood smears by Field stain for the identification of Malarial parasite.(MP test)
14. Demonstration of PAN malaria card test in the laboratory.
15. Demonstration of various stages from Malarial parasite slides / charts.

INSTRUCTIONAL STRATEGY

The teacher should lay stress on safety guidelines while working in the microbiology laboratory with parasites. The students should be familiar with the definition of parasite and virus, their pathogenicity, morphology, life cycle, lab-diagnosis, how they are spread and controlled. The students should be made aware of medically important viruses and collection of virological samples. During practical exercises, the student should be encouraged to perform individually but under expert supervision. They should be taught with charts and audio-visual aids. The subject teacher should try to give topic-wise assignment for assessing the learning of students and encourage them to present at least one assignment in class. As far as possible, the teacher should try to cover the theory and practical topics simultaneously.

RECOMMENDED BOOKS

1. Chatterjee, KD, "Parasitology Protozoology and Helminthology", CBS Publishers New Delhi.
2. Arora, D.R., and B.B. Arora, "Medical Parasitology", CBS Publishers New Delhi.
3. Baker, FJ, "An introduction to Medical Laboratory Technology", Butterworth Heinemann Oxford.
4. Gupte, Satish, "Text Book of Medical Microbiology", JP Brothers Publishers, New Delhi.
5. Ananthanarayan, R, and CK Jayaram PanikerReba Kanungo Ananthanarayan and Paniker's, "Textbook of Microbiology", Universities Press (India) Pvt. Ltd.
6. Godkar, Praful B, "Text Book of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
7. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries Vol. I and II", Cambridge University Press, UK.
8. Ochei, J, and A Kolhatkar, "Medical Laboratory Science Theory and Practice", Tata McGraw Hill Publishers; New Delhi.
9. Mukherjee, Kanai Lal, "Medical Laboratory Technology", Tata McGraw Hill Publishers, New Delhi.
10. Wani, Dr. Imtiyaz, "New Concepts in Microbiology", S. Vikas and Company, Jalandhar.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (Out of 50)
1	3	4
2	7	10
3	4	8
4	4	8
5	4	8
6	2	2
7	6	10
Total	30	50

3.2 HAEMATOLOGY - III

L P
2 4

RATIONALE

The subject aims to enable the students to carry out routine haematological investigations like ESR, PCV, Red cell indices and reticulocyte count. He/She should be able to provide technical help for selected sophisticated haematological techniques with adequate knowledge of various principles. Stress is also given on quality measures in the laboratory

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Explain the principle of ESR and PCV
- Calculate red cell indices
- Perform reticulocyte count
- Identify Red Blood cell morphology in Various Anaemias
- Perform Red cell fragility test
- Assure Quality control in haematology

DETAILED CONTENTS

1. Erythrocyte sedimentation rate (ESR) and packed cell volume(PCV) (8 hrs)
 - 1.1. Introduction
 - 1.2. Various methods of estimation of ESR and PCV
 - 1.3. Factors involved in ESR
 - 1.4. Interpretation of results
2. Red cell indices (Mean corpuscular values)- MCV, MCH, MCHC (2 hrs)
 - 2.1. Introduction
 - 2.2. Calculation
 - 2.3. Reference range
 - 2.4. Interpretation of results

3. Supravital stain and reticulocyte counting (3 hrs)
 - 3.1. Introduction
 - 3.2. Principle and procedure of staining and calculation
 - 3.3. Reference range
 - 3.4. Interpretation of results

4. Anemia (9 hrs)
 - 4.1. Definition and brief classification
 - 4.2. Laboratory diagnosis of :
 - Iron deficiency anemia
 - Megaloblastic anemia
 - Haemolytic anemia
 - Aplastic anemia

5. Red cell fragility test (4 hrs)
 - 5.1 Principle and procedure
 - 5.2 Clinical importance

6. Quality assurance in haematology (4 hrs)
 - 6.1 Definition and importance
 - 6.2 Aspects of quality control:
 - Internal quality control
 - External quality control
 - Standardization of methods
 - Proficiency surveillance
 - 6.3 Accuracy and precision

PRACTICAL EXERCISES

1. ESR Estimation in blood (Wintrobe and Westergren method)
2. PCV Estimation in blood (Wintrobe and capillary method)
3. Calculation of various red cell indices
4. Counting of Reticulocytes in blood
5. Identification of abnormalities in red blood cells associated with anemia (Macrocytic, Microcytic, hypochromic and sickle cell anemia)
6. To perform red cell fragility test

7. Calculation of Mean and SD value

INSTRUCTIONAL STRATEGY

Emphasis should be laid to clear the basic concepts of haematology. Teacher may take the help of various charts, models and different online platforms to make the students conversant with the basic haematological techniques.

RECOMMENDED BOOKS

1. Mukherjee, KL, "Medical Laboratory Technology Vol. 1", Tata McGraw Hill Publishers, New Delhi.
2. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworth Heinmann, Oxford.
3. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries", Cambridge University Press, UK.
4. Godkar, Praful B, "Textbook of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
5. Decei, JV, "Practical Haematology", ELBS with Curchill Living Stone, UK.
6. Ochei, J, and A Kolhatkar, "Medical Laboratory Science Theory and Practical", Tata McGraw Hill Publishing Company Ltd., New Delhi 2000 Ed.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	8	12
2	2	5
3	3	7
4	9	12
5	4	7
6	4	7
Total	30	50

3.3 CLINICAL BIOCHEMISTRY-III

L P
2 4

RATIONALE

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the techniques of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of metabolites which are routinely estimated for the diagnosis of different diseases.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Appraise the biochemical tests for the diagnosis of various clinical diseases.
- Discuss the concept of clinically important metabolites and their importance.
- Describe the diagnostic procedure for evaluating different health conditions.
- Analyze the normal and abnormal biochemical reports.
- Relate abnormal metabolite values with different clinical conditions.

DETAILED CONTENTS

1. Serum Bilirubin (6 hrs)
 - 1.1 Formation and excretion of bilirubin
 - 1.2 Formation of bilepigments
 - 1.3 Conjugated and unconjugated bilirubin
 - 1.4 Principle and procedures of serum bilirubin estimation (Direct & Indirect)
 - 1.5 Reference values
 - 1.6 Clinical Significance
2. Serum Glutamic Oxaloacetic Transaminase (SGOT) and Serum Glutamic Pyruvic Transaminase (SGPT) (3 hrs)
 - 2.1 Principle and procedures of estimation
 - 2.2 Reference values
 - 2.3 Clinical Significance\

3. Alkaline Phosphatase (ALP) and Acid Phosphatase (ACP) (3 hrs)
 - 3.1 Principle and procedures of estimation
 - 3.2 Reference values
 - 3.3 Clinical Significance
4. Serum Amylase and Lipase (2 hrs)
 - 4.1 Principle and procedures of estimation
 - 4.2 Reference values
 - 4.3 Clinical Significance
5. Renal Function Tests (3 hrs)
 - 5.1 Renal Clearance Test-Principle and Procedures
 - 5.2 Clinical Significance
6. Serum Calcium and Phosphorus (4 hrs)
 - 6.1 Principle and procedures of estimation
 - 6.2 Reference values
 - 6.3 Clinical Significance
7. Lipid Profile (5 hrs)
 - 7.1 Cholesterol
 - 7.2 High density and low density cholesterol
 - 7.3 Triglycerides
 - 7.4 Principles and procedures of estimation
 - 7.5 Estimation and importance of various ratios of HDL, LDL and VLDL
 - 7.6 Reference value
 - 7.7 Clinical Significance
8. Thyroid function tests (4 hrs)
 - 8.1 Functions of Thyroid
 - 8.2 Principle, reference values and Clinical Significance of T_3 , T_4 and TSH estimation.

PRACTICAL EXERCISES

1. Estimation of Serum Bilirubin.
2. Estimation of Serum Phosphorus.
3. Estimation of Serum Calcium.
4. Renal Clearance tests.
5. Estimation of Serum Glutamic Oxaloacetic Transaminase (SGOT).
6. Estimation of Serum Glutamic Pyruvic Transaminase (SGPT).
7. Estimation of Alkaline Phosphatase (ALP).
8. Estimation of Acid Phosphatase (ACP).
9. Estimation of Total Cholesterol.
10. Estimation of Serum Triglycerides by enzymatic method.
11. Estimation of Serum High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Very Low Density Lipoprotein (LDL) and calculations.
12. Estimation of Serum Amylase
13. Estimation of Serum Lipase

RECOMMENDED BOOKS

1. Mukherjee, KL, "A Procedure Manual for Routine Diagnostic Tests Vol. I, II & III", Tata Mc Graw Hill Publishers, New Delhi.
2. M N, Chatterjee, and Shinde Rana, "A Text book of Medical Biochemistry", Jaypee Brothers Medical Publishers Pvt. Ltd.
3. Ochaie, J, and A Kolhatkar, "Medical Laboratory Science Theory and Practice", Tata McGraw Hill Education, New Delhi.
4. Varley, H., "Practical Clinical Biochemistry", Heinmann Publishers, Oxford.
5. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries", Cambridge University Press, UK.
6. Satyanarayana, U., and U. Chakrapani, "Essentials of Biochemistry", New Central Book Agency Pvt. Ltd.
7. Gupta, RC, and S Bhargava, "Practical Biochemistry", CBS Publishers & Distributors Pvt. Ltd.

WEBSITE FOR REFERENCE

1. PSBTE- eEDUCATION:- <https://youtube.com/channel/UC35EU-7StdIWgTAYV65LQMg>

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on the basic concepts and principles while covering the course contents. During practical exercises, the students should be encouraged to perform individually but under expert supervision. Visits to hospitals, diagnostic laboratories and medical colleges should be planned to so as to expose the students to the latest diagnostic techniques and instruments. Charts, models and audio-visual aids should be used as pedagogical strategies. Guest lectures and workshops should be organized on the emerging techniques and topics related to clinical biochemistry.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	03	5
3	03	5
4	02	3
5	03	5
6	04	7
7	05	8
8	04	7
TOTAL	30	50

3.4 HISTOPATHOLOGY AND CYTOLOGY-I

L P
2 4

RATIONALE

This subject is aimed at introducing the students to the various types of tissue preparations and developing expertise in the students to cut very thin tissue sections from tissue blocks and facilitate visualization using various stains and dyes.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Label, preserve and mount the histological specimen
- Prepare various smears by unfixed methods
- Prepare different fixatives
- Prepare paraffin blocks from various tissue pieces
- Perform H&E on given smear

DETAILED CONTENTS

1. Introduction and definition of (1 hr)
 - 1.1 Histology
 - 1.2 Histopathology
 - 1.3 Biopsy
 - 1.4 Autopsy
 - 1.5 Autolysis
 - 1.6 Putrefaction
 - 1.7 Fixation
 - 1.8 Deparaffinization
 - 1.9 Blueing
2. Preparation of Tissue (3 hrs)
 - 2.1 Unfixed Tissue preparations: Imprint methods – Impression Smears, Teased preparation, Squashed preparation, Frozen section.
 - 2.2 Fixed Tissue Preparations: Paraffin embedding, Celloidin embedding, Gelatin embedding

3. Reception of Specimen (1 hr)
 - 3.1 Reception, recording, labelling and preservation of histological specimen
4. Fixation (Histological Specimens) (3 hrs)
 - 4.1 Introduction
 - 4.2 Classification & Composition of various fixatives
 - 4.3 Advantages/Disadvantages of various fixatives
5. Decalcification (2 hrs)
 - 5.1 Introduction
 - 5.2 Principle & Procedure of Acid Method of Decalcification
6. Processing (by Paraffin Technique) (5 hrs)
 - 6.1 Dehydration
 - 6.2 Clearing
 - 6.3 Infiltration and Impregnation
 - 6.4 Paraffin embedding
7. Microtomy (4 hrs)
 - 7.1 Microtome & Microtome Knives
 - 7.1.1 Types of Microtome
 - 7.1.2 Principle and Working of Rotary Microtome & Freezing Microtome
 - 7.1.3 Types of Microtome knives
 - 7.1.4 Sharpening of knives (Honing & Stropping technique)
 - 7.1.5 Care and Maintenance of Microtome & its Knives
8. Section Cutting (3 hrs)
 - 8.1 Process of section cutting
 - 8.2 Errors /cutting faults in sections and their remedies
9. Frozen section technique (3 hrs)
 - 9.1 Process of Frozen section Technique
 - 9.2 Principle, Procedure & Interpretation of H&E, Polychrome Methylene Blue

10. Routine & Special Stains (4 hrs)
- 10.1 Principle, Procedure & Interpretation of Routine Stain: Haematoxylin and Eosin
- 10.2 Principle, Procedure & Interpretation of Special Stains:
- PAS
 - SILVER IMPREGNATION
 - OIL RED O
 - MASSON TRICHROME
 - PEARL'S PRUSSIAN BLUE
 - Ziehl's Neelson : AFB
11. Automation (1 hr)
- 11.1 Histokinete (Automatic tissue processor): Use, Care, & Maintenance
- 11.2 Automatic Knife Sharpener: Use, Care, & Maintenance

PRACTICAL EXERCISES

1. Reception of specimen, labelling and preserving and mounting of the histological specimen
2. Preparation of various smears by unfixed methods
 - Imprint smears
 - Teased smears
 - Squashed smears
3. Preparation of different fixatives with special emphasis on preparation of form a line based fixatives
4. Preparation of paraffin blocks from various tissue pieces.
5. Demonstration of Rotary microtome.
6. Demonstration of Freezing microtome.
7. Processing of sections for frozen section.
8. Performing H&E on given smear.
9. Sharpening of microtome knives (Honing & Stropping technique)

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually. Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific

processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

1. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworths Scientific, London.
2. RAB, Drury, "Carleton's Histological Technique", Northwick Paru Hospital, Harrow, Middlesex
3. D. Bancroft, John, "Theory and Practice of Histological Technique", Churchill Livingstone, London.
4. Culling, CFA, "Cellular Pathology Techniques", Butterworths, London.
5. Sood, Dr. Ramnik, "Medical Lab Technology", Maulana Azad Medical College, New Delhi.
6. Koss, Leo Pold G., "Diagnostic Cytology and its Histopathology Basis", JB Lupein, Philadelphia.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	1	3
2	3	5
3	1	2
4	3	5
5	2	4
6	5	7
7	4	6
8	3	5
9	3	5
10	4	6
11	1	2
Total	30	50

3.5 TRANSFUSION MEDICINE

L	P
2	2

RATIONALE

Blood transfusion has become a life saving procedure in modern medical sciences. To avoid any mistake, the students must understand to learn the blood bank procedures, such as ABO & Rh blood grouping carefully and accurately. He must also have an adequate knowledge of cross matching both major and minor procedures as well as selection of a suitable donor. He should be competent enough to collect blood and its long-term preservation for safe blood transfusion.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Apply blood bank and blood transfusion knowledge to make appropriate and effective on-job professional decisions.
- Perform and interpret commonly utilized procedures/Tests in blood bank.
- Apply immune haematology laboratory techniques and procedures.
- Explain separation and importance of various blood components and various types of transfusion reactions.

DETAILED CONTENTS

- | | | |
|-----|---|---------|
| 1. | Introduction and Historical development of Transfusion medicine | (4 hrs) |
| 1.1 | Definition and important events in transfusion medicine | |
| 1.2 | Development of ABO antigen in red cells | |
| 2. | Anticoagulants | (3 hrs) |
| 2.1 | Different types and composition of various anticoagulants | |
| 2.2 | Advantages and disadvantages of various anticoagulants | |
| 2.3 | Color codes of vials used for different anticoagulants | |
| 3. | ABO Blood Group System | (3 hrs) |
| 3.1 | Antigens and antibodies involved | |
| 3.2 | Principle and procedure of ABO blood grouping | |

- 3.3 Various other sub groups A1, A2, A1B, A2B
- 4. The Rh Blood Group System (3 hrs)
 - 4.1 Antigen and antibody involved
 - 4.2 Principle and procedure of Rh grouping
 - 4.3 Variant of D antigen (Du)
- 5. Coombs Test (3 hrs)
 - 5.1 Direct coombs test (principle, procedure, importance and application)
 - 5.2 Indirect coombs test (principle, procedure, importance and application)
- 6. Cross Matching (3 hrs)
 - 6.1 Types of cross matching
 - 6.2 Various methods and their procedures
- 7. Donor Selection and Blood Collection (4 hrs)
 - 7.1 HIV
 - 7.2 HbsAg
 - 7.3 HCV
 - 7.4 Characteristics of ideal blood donor.
 - 7.5 Blood collection procedure.
 - 7.6 Transpotation and storage.
- 8. Preparation and Preservation of Various Blood Components (4 hrs)
 - 8.1 Packed cells
 - 8.2 Fresh frozen plasma
 - 8.3 Cryoprecipitate
 - 8.4 PRP (Platelet rich plasma)
- 9. Blood Transfusion Reactions (3hrs)
 - 9.1 Classification of transfusion reactions

PRACTICAL EXERCISES

1. Demonstration of glassware used in transfusion medicine
2. Washing and sterilization of glassware
3. Perform ABO blood grouping by following method:
 - Direct
 - Tube Test
 - Indirect (reverse)
 - Subgroup
4. Perform Rh grouping using slide and tube method
5. Perform direct and indirect Coombs Test
6. Perform major matching test (compatibility testing)
7. Perform minor matching test (compatibility testing)
8. Preparation of ACD (Acid Citrate Dextrose) anticoagulant
9. Preparation of CPD (Citrate Phosphate Dextrose) anticoagulant
10. Preparation of CPDA (Citrate Phosphate Dextrose Analine) anticoagulant

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually. Visits to hospital/medical colleges/Blood bank should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

1. Baker, FJ, "Introduction to Modern Lab Technology", Butterworth, Heinemann Publishers Oxford.
2. Praful and Godker, "Text book of Modern Lab Technology", Bhalani Publisher, Mumbai.
3. Mukerjee, Kanai L., "Modern Lab Technology – A Procedure Manual for Routine Diagnostic Test", Volume 1, Tata McGraw Hill Publishing, New Delhi.
4. Harmering, Denise M, "Modern Blood Banking and Transfusion Practices", Jaypee Brothers, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	6
2	3	5
3	3	5
4	3	5
5	3	5
6	3	5
7	4	7
8	4	7
9	3	5
Total	30	50

3.6 BASICS OF INFORMATION TECHNOLOGY

L	P
-	2

RATIONALE

Information technology has great influence on all aspects of life. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various office automation tools using MS Office/Open Office/Libre Office, and internet concepts. This exposure will enable the students to enter their professions with confidence.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Identify computer hardware components, network components and peripherals.
- Install application and utility software.
- Use word processing software to prepare document.
- Use spreadsheet software to create workbook and automate calculation.
- Use presentation software to create interactive presentation.
- Browse information on the Web.

Note: Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

Information Technology concept and scope, applications of IT.

2. Computer Hardware:

Block diagram of a computer, components of computer system, CPU, Memory, Input devices; keyboard, Scanner, mouse etc; Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory: RAM, ROM, tracks and sectors, optical disk (CD, DVD & Blue Ray Disk.), USB/Flash Drive, HDD, SSD

3. Software Concepts and Programming:

System software, Application software, Virtualization software and Utility software, Introduction of Operating System, Installation of Application software, Features of OPEN OFFICE/MS OFFICE(MS word, Excel, PowerPoint).

Flow chart using algorithm development, Input Output statement, Control structures

4. Internet Concepts:

Basics of Networking – LAN, WAN, PAN, MAN, and sharing of printers and other resources, Concept of IP addresses, introduction of internet, applications of internet like: e-mail and browsing, concept of search engine and safe searching. Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox, WWW (World Wide Web), hyperlinks, introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, identify its basic hardware components, network components and peripherals. List their functions .
2. Installation of various application software and utility software.
- 3 Installation of I/O devices like scanner, printer and plotter.
4. Practice on various features/functions of Windows Operating System..

Word Processing (MS Word/Open Office Writer/Libre Office Writer)

5. Creating/opening, saving and printing a document
6. Editing and formatting a document
7. Setting paragraph and page margins.
8. Adding header, footer and page numbering
9. Creating, inserting and formatting a table.
10. Spell checker, inserting date, time, special symbols, importing graphic images, drawing tools.

Spread Sheet Processing (MS Excel/Open Office Calc/Libre Office Calc)

- 11 Creating/opening, saving and printing a worksheet.
- 12 Editing and formatting of worksheets including changing colour, size, font, alignment of text and cell formatting.
- 13 Using statistical functions like sum, avg, min, max, if, count and countif, lookup.
- 14 Creating and formatting a chart, Using charts to analyse data. Use of filters.

Presentation Software (MS Power Point/Open Office Impress/Libre Office Impress)

15. Creating, saving, opening and printing a presentation.
16. Different views of a slide.
17. Using slide layout and template.
18. Editing and formatting slides by adding titles, subtitles, text, background, watermark, table, charts, images and sound.
19. Viewing the slide show with slide transition, animation effect, timing and order.

Programming

20. Printing of name 100 times using loop statement.

Internet and its Applications

21. Creating an e mail account. Sending and receiving e-mail.
22. Browsing and down loading of information from internet.
23. Surfing different websites like institute website, State Board PSBTE website, DTE website, NITTTR, Chandigarh website, AICTE website, various search engines like google, bing etc.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office in addition to working on internet. The student should be made capable of working on computers independently.

RECOMMENDED BOOKS

1. Arora, Vipin, “Computer Fundamentals and Information Technology”, Eagle Parkashan, Jalandhar
2. Sinha, PK, “Computer Fundamentals”, BPB Publication, New Delhi
3. Rajaraman V, “Fundamentals of Computer”, Prentice Hall of India Pvt. Ltd., New Delhi
4. Saxena, Sanjay, “MS Office for Everyone”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Leon and Leon, “Fundamentals of Information Technology”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

3.7 ENVIRONMENTAL STUDIES

L	P
2	-

RATIONALE

Engineering activities require the use of natural resources which results in wide-ranging adverse effects on the environment. Natural replenishment of these resources is practically impossible. This necessitates that all technicians should know about the basics of ecology, environment and its functions, environmental pollution and management and environmental legislation which will enable them to accomplish their professional work with environmental compatibility. Hence this subject.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and environment.
- Demonstrate interdisciplinary nature of environmental issues.
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of environmental pollutions.
- Compute the impact of human activities on the environment.
- Understand purpose of environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.

DETAILED CONTENTS

1. Introduction: (4 hrs)
Basics of ecology, eco system and environment. Review of carbon, nitrogen, sulphur and water cycle)
2. Conservation of land reforms: (3 hrs)
Desertification, Causes, effects and prevention. rain water harvesting, maintenance of ground water, deforestation – its effects and control measures
3. Environmental Pollution: (10 hrs)
Sources of pollution - natural and man made, causes, effects and control measures of pollution (air, water, noise, soil and radioactive). Concept of BOD, COD and AQI, Prevention of Pollution- Introduction to Cleaner Production Technologies, Waste Minimization Techniques, Concept of Zero Discharge, Impact of Energy Usage on Environment: Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain.

4. Solid Waste management (3 hrs)
Classification of refuse material, sources, effects and control measures. Introduction to E-waste Management
5. Environmental Legislation (4 hrs)
Introduction to Water (prevention and control of pollution) Act, Air (Prevention and Control of Pollution) Act and Environmental Protection Act, Role and Function of State Pollution Control Board, Introduction to Energy Conservation Act & its importance, Concept of Environmental Impact Assessment (EIA)
6. Energy Conservation and Sustainable Development (6 hrs)
Introduction to Energy Management, Energy Conservation, Energy efficiency and its need. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio mass energy, hydro energy) in environmental protection. Sustainable development, Concept of Green building and eco friendly materials.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits etc. may also be organized.

RECOMMENDED BOOKS

1. Sharma, BR, "Environmental and Pollution Awareness", Satya Prakashan, New Delhi.
2. Khitoliya, Dr. RK, "Environmental Pollution", S Chand Publishing, New Delhi.
3. Deswal and Deswal, "Environmental Science", Dhanpat Rai and Co. (P) Ltd. Delhi.
4. Bharucha, Erach, "Environmental Studies", University Press (India) Private Ltd., Hyderabad.
5. Dhamija, Suresh K, "Environmental Engineering and Management", SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	3	05
3	10	16
4	3	05
5	4	06
6	6	12
Total	30	50

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy
2. Introduction to energy management, energy conservation, energy efficiency and its need
3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance
4. Standards and Labeling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Punjab Energy Conservation Building Code (ECBC)
6. General Energy Saving Tips in:
 - Lighting System
 - Room Air Conditioners
 - Refrigerators
 - Water Heater
 - Computers
 - Fans, Heaters, Blowers and Washing Machines
 - Colour Television
 - Water Pumps
 - Kitchens
 - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

This is to be organized at a stretch for two to three days during third semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Drugs Use and Abuse in Society
 - b. Concept and overview
 - c. Extent of the problem
 - d. Drug use as a social problem
 - e. Causes of Drug Use: Biological, Socio-cultural, psychological
2. Types of Dugs and identification of Abuse
 - a. Familiar drugs: Tabacco, Caffeine, over the counter drugs
 - b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
 - c. Reformance enhancing drugs
 - d. Uppers and Downers: Stimulants and Depressants
3. Impact of Drug Abuse
 - a. Individual level biological and psychological
 - b. Family social, National
4. Management and Prevention of Drug Abuse
 - a. Medical and psychological
 - b. Role of family Schol , Media and Legislation

4.1 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L	P
3	-

RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma pass-outs for enhancing their employability and self confidence.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Explain the importance of generic skills
- Manage himself/herself physically, intellectually and psychologically
- Work effectively as a team member
- Manage tasks effectively
- Develop an entrepreneurial mindset.
- Identify entrepreneurial support system for new ventures and small businesses.
- Recognize a business opportunity.
- Conduct market survey and prepare project report.

DETAILED CONTENTS

- | | | |
|-----|---|----------|
| 1. | Introduction to Generic Skills | (04 hrs) |
| 1.1 | Importance of Generic Skill Development | |
| 1.2 | Life Long Learning and associated importance of Generic Skill Development | |

2. Managing Self (07 hrs)
 - 2.1 Knowing Self for Self Development
 - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
 - 2.2 Managing Self - Physical

Personal grooming, Health, Hygiene, Time Management
 - 2.3 Managing Self – Intellectual development
 - Information Search: Sources of information
 - Communication: Official & business correspondence, Job application covering letter and resume
 - 2.4 Managing Self – Psychological
 - Stress, Emotions, Anxiety-concepts and significance
 - Techniques to manage stress
3. Managing in Team (06 hrs)
 - 3.1 Team - definition, team dynamics
 - 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
- 4 Task Management (03 hrs)
 - 4.1 Task Initiation, planning, execution, close out
 - 4.2 Exercises/case studies on task planning towards development of skills for task management
5. Problem Solving (05 hrs)
 - 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
 - 5.2 Different approaches for problem solving.
 - 5.3 Steps followed in problem solving.
 - 5.4 Exercises/case studies on problem solving.
6. Entrepreneurship (20 hrs)
 - 6.1 Introduction

- Concept/Meaning and its need
 - Qualities of an entrepreneur
 - Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.
- 6.2 Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yojana (PMMY), Make in India, Start up India, Stand up India, National Urban Livelihood Mission (NULM); Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).
- 6.3 Market Survey and Opportunity Identification (Business Planning)
- How to start a small scale unit/ industry
 - Procedures for registration of small-scale unit /industry
 - Assessment of demand and supply in potential areas of growth.
 - Understanding business opportunity
 - Considerations in product selection
- 6.4 Project Report Preparation
- Preliminary Project Report
 - Techno-Economic Feasibility Report
 - Exercises on preparation of Detailed Project Report

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Balasubramanian, S., “Soft Skills for Interpersonal Communication”, Orient Black Swan, New Delhi.
2. “Lifelong learning”, Policy Brief (www.oecd.org).
3. Rathore, BS, and Dr JS Saini, “A Handbook of Entrepreneurship”, Aapga Publications, Panchkula (Haryana).
4. Gupta, CB, and P Srinivasan, “Entrepreneurship Development”, Sultan Chand and Sons, New Delhi.
5. “Entrepreneurship Development”, Tata McGraw Hill Publishing Company Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	04	06
2.	07	08
3.	06	06
4.	03	04
5.	05	06
6.	20	20
Total	45	50

4.2 CLINICAL MICROBIOLOGY – IV

L	P
2	4

RATIONALE

The students undergoing training in clinical microbiology in this semester learn the morphological features and lab diagnosis of medically important fungi. They are given training in collection of samples and their processing for identification of fungi causing infection. In addition, the students are also introduced to immunology and are made competent to perform various serological tests to diagnose microbial infections.

LEARNING OUTCOMES

After undergoing training in this subject, the students will be able to:

- Explain morphological features of fungi.
- Collect and process samples for diagnosis of fungal infections.
- Perform staining and culture techniques for fungi.
- Perform serological tests for instant diagnosis of microbial infections.

DETAILED CONTENTS

- | | | |
|-----|---|---------|
| 1. | Introduction to fungi | (2 hrs) |
| 1.1 | Definition, morphological forms, pathogenicity (mycosis and its types) and lab diagnosis. | |
| 2. | Staining of Fungi | (2 hrs) |
| 2.1 | KOH (Potassium hydroxide) preparation | |
| 2.2 | LCB (Lactophenol Cotton Blue) preparation | |
| 3. | Culture media for culture of fungi: Composition & preparation of | (3 hrs) |
| 3.1 | SDA (Sabouraud's Dextrose Agar) | |
| 3.2 | CMA (Corn Meal Agar) | |
| 3.3 | RSA (Rice Starch Agar) | |

4. General characteristics of medically important fungi (Morphology, pathogenicity, microscopy and culture characteristics) of (7 hrs)
 - 4.1 Candida
 - 4.2 Dermatophytes
 - 4.3 Aspergillus
 - 4.4 Rhizopus
 - 4.5 Mucor

5. Introduction to Immunology (8 hrs)
 - 5.1 Innate immunity& Acquired immunity –its types with examples
 - 5.2 Antigens: Definition, types and properties
 - 5.3 Antibodies: Definition, types and properties
 - 5.4 Antigen-antibody Reactions: Principle & applications of agglutination, and flocculation

6. Serological Tests - Principle, procedure and interpretation of (both qualitative & quantitative methods) (6 hrs)
 - 6.1 Widal test
 - 6.2 VDRL (Venereal disease research laboratory) test
 - 6.3 CRP (C-reactive protein) test
 - 6.4 ASO (Anti streptolysin O) test

7. ELISA (2 hrs)
 - 7.1 Principle, procedure and interpretation

PRACTICAL EXERCISES

Mycology

1. Preparation of Sabouraud's dextrose agar with and without antibiotics
2. Preparation of Corn meal agar
3. Preparation of Rice starch agar (RSA)
4. KOH staining technique
5. LCB staining technique
6. Collection and processing of skin sample for diagnosis of fungal infections
7. Collection and processing of hair sample for diagnosis of fungal infections
8. Collection and processing of nail sample for diagnosis of fungal infections

9. To culture Rhizopus and Mucor and study their characteristics
10. To culture Candida and study its characteristics
11. To culture Dermatophytes and study its characteristics
12. To culture Aspergillus and study its characteristics

Serology

13. To perform Widal test (Qualitative & Quantitative)
14. To perform VDRL test (Qualitative & Quantitative)
15. To perform CRP (C-reactive protein) (Qualitative & Quantitative)
16. To perform ASO (Anti streptolysin O) (Qualitative & Quantitative)
17. HIV Test – Strip/Test card method
18. HBsAg Test - Strip/Test card method

INSTRUCTIONAL STRATEGY

The teacher should describe the morphology of medically important fungi with diagrams, charts and models. Teacher should teach the collection and processing of samples for isolation & identification of fungi causing infections. Teacher should clarify antigen-antibody structures and types of their reactions. Teacher should emphasize on detailed and step-wise performance of serological tests. During practical exercises, the student should be encouraged to perform individually but under expert supervision. Teacher must use audio-visual aids for teaching.

RECOMMENDED BOOKS

1. Mukherjee, Kanai Lal, “Medical Laboratory Technology”, Tata McGraw Hill Publishers, New Delhi.
2. Baker, FJ, “An introduction to Medical Laboratory Technology by; Butterworth Heinemann Oxford.
3. Ananthanarayan, and Panikar, “Textbook of Microbiology”, Orient Longman, Hyderabad.
4. Gupta, Satish, “Textbook of Medical Microbiology”, JP Brothers, New Delhi.
5. Godkar, Praful B, “Textbook of Medical Laboratory Technology”, Bhalani Publishing House, Mumbai.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs.)	Marks Allotted (Out of 50)
1.	2	4
2.	2	4
3.	3	6
4.	7	8
5.	8	12
6.	6	12
7.	2	4
Total	30	50

4.3 HAEMATOLOGY-IV

L	P
2	4

RATIONALE

The main objective of recommended curriculum is to make the students competent to carry out special investigations (Bone marrow, CSF and other body fluids). He/She should be able to provide technical help for using sophisticated machinery and advanced protocols. He/She should have theoretical and adequate practical knowledge of various principles. Emphasis will be laid on the various safety precautions to be observed in clinical laboratory.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Explain the principles of various bleeding and coagulation tests
- Describe composition and importance of bone marrow examination
- Classify the leukemia
- Identify LE cells
- Process various body fluids

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Introduction to normal haemostasis | (14 hrs) |
| 1.1 | Clotting factors | |
| 1.2 | Platelets and their role in haemostasis | |
| 1.3 | Brief introduction of various bleeding disorders | |
| 1.4 | Principles, clinical importance, reference values and methods of Bleeding time, Clotting time, Hess test, clot retraction time, Prothrombin time, Prothrombin time index, international normalized ratio and activated partial thromboplastin time | |
| 2. | Bone marrow | (05 hrs) |
| 2.1 | Composition and functions of bone marrow | |
| 2.2 | Aspiration of bone marrow by various methods | |
| 2.3 | Preparation, staining and examination of bone marrow smear | |
| 2.4 | Iron staining (Perls' reaction) | |

- 2.5 Significance of bone marrow examination
- 3. Leukemia (04 hrs)
 - 3.1 Definition of leukemias
 - 3.2 Classification (FAB)
 - 3.3 Laboratory diagnosis of various Leukemias
- 4. LE cell phenomenon (02 hrs)
 - 4.1 Phenomenon of LE cell, its Differentiation from tart cell
 - 4.2 Demonstration of LE cell by various methods
 - 4.3 Clinical importance
- 5. Processing of various biological fluids and interpretation of results (05hrs)
 - 5.1 CSF
 - 5.2 Pleural fluid
 - 5.3 Synovial fluid
 - 5.4 Ascitic fluid
 - 5.5 Semen

PRACTICAL EXERCISES

1. Determination of bleeding time by Ivy's and Duke's method
2. Determination of Clotting time by Lee white and capillary method
3. Determination of Prothrombin time, index and INR(International Normalized Ratio)
4. Determination of Activated partial thromboplastin time
5. Demonstration of Hess test
6. Performance of clot retraction test
7. Demonstration of LE cell
8. Demonstration of Processing of biological fluids

INSTRUCTIONAL STRATEGY

Emphasis should be laid to clear the basic concepts of haematology. Teacher may take the help of various charts, models and different online platforms to make the students conversant with the basic haematological techniques

Visit to hospitals/ medical colleges should be planned to demonstrate the process.

RECOMMENDED BOOKS

1. KL, Mukherjee, “Medical Laboratory Technology Vol. 1”, Tata McGraw Hill Publishers, New Delhi.
2. Baker, FJ, “An Introduction to Medical Laboratory Technology”, Butterworth Heinmann, Oxford.
3. Cheesbrough, Monica, “Medical Laboratory Manual for Tropical Countries”, Cambridge University Press, UK.
4. Godkar, Praful, “B Textbook of Medical Laboratory Technology”, Bhalani Publishing House, Mumbai.
5. Decei, JV, “Practical Haematology”, ELBS with Curchill Living Stone, UK.
6. Ochei, J, and A Kolhatkar, “Medical Laboratory Science Theory and Practical”, Tata McGraw Hill Publishing Company Ltd., New Delhi 2000 Ed.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs.)	Marks Allotted (Out Of 50)
1	14	22
2	5	8
3	4	6
4	2	6
5	5	8
TOTAL	30	50

4.4 CLINICAL BIOCHEMISTRY-IV

L	P
2	4

RATIONALE

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the techniques of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of metabolites which are routinely estimated for the diagnosis of different diseases. The students are also imparted basic training in automation.

LEARNING OUTCOMES

After studying this subject, students should be able to:

- Appraise the biochemical tests for the diagnosis of various clinical diseases
- Discuss the concept of clinically important metabolites and their importance.
- Use the diagnostic procedure for evaluating different health conditions.
- Analyze the normal and abnormal biochemical reports.
- Relate abnormal metabolite values with different clinical conditions.

DETAILED CONTENTS

1. Urine Examination (07 hrs)
 - 1.1 Normal composition of urine.
 - 1.2 Physical examination (Volume, Colour, Odour, pH and Specific Gravity etc.)
 - 1.3 Chemical examination of Blood, Protein, Sugar, Creatinine, Bile salts, Bile Pigments, Urobilinogen, Ketone bodies and 17-Ketosteroids.
 - 1.4 Glycosuria and Albuminuria.
 - 1.5 Reference values and clinical significance of urine examination.
2. Stool Examination (05 hrs)
 - 2.1 Physical characteristics and chemical composition of stool.
 - 2.2 Examination of blood and excess fat in stool.
 - 2.3 Occult Blood-Detection.

3. Biological fluids (05 hrs)

Formation, Composition and Significance of Biological fluids (Cerebrospinal Fluid, Peritoneal, Pleural, Synovial, Ascitic fluid and Gastric juice).
4. Cerebrospinal Fluid Examination (04 hrs)
 - 4.1 Composition and functions of CSF.
 - 4.2 Examination of Protein, Sugar and Chloride in CSF.
 - 4.3 Reference values and clinical significance of CSF examination.
5. Electrophoresis (03 hrs)
 - 5.1 Principles and classification.
 - 5.2 Procedure of Paper, Gel electrophoresis and method of elution.
 - 5.3 Clinical applications.
6. Chromatography (03 hrs)
 - 6.1 Principles and classification.
 - 6.2 Procedure of Paper, Column and Thin Layer Chromatography.
 - 6.3 Clinical applications.
7. Automation in Biochemistry (03 hrs)
 - 7.1 Principle
 - 7.2 Instrumentation, types of Analysers and benefits of automation.

PRACTICAL EXERCISES

1. Estimation of Sugar in urine sample (Qualitative and Quantitative).
2. Estimation of Proteins in urine sample (Qualitative and Quantitative).
3. Estimation of Ketone Bodies in urine sample.
4. Estimation of Bile pigments, Bile salts and Urobilinogen in urine.
5. Estimation of Creatinine in urine sample.
6. Estimation of Hematuria.
7. Estimation of Glucose in CSF.
8. Estimation of Total Proteins and Globulins in CSF.
9. Estimation of Chloride in CSF.
10. Occult blood test for stool specimen.

11. Demonstration of electrophoresis (Paper electrophoresis).
12. Demonstration of chromatography (Paper chromatography).
13. Demonstration of Semi Auto-analyser.

RECOMMENDED BOOKS

1. KL, Mukherjee, "A Procedure Manual for Routine Diagnostic Tests Vol. I, II & III", Tata Mc Graw Hill Publishers, New Delhi.
2. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworth Heinmann, Oxford.
3. Godkar, P, "A Text book of Medical Laboratory Technology", Bhalani Publishing House, Mumbai.
4. M N, Chatterjee, and Shinde Rana, "A Text book of Medical Biochemistry", Jaypee Brothers Medical Publishers Pvt. Ltd.
5. Ochaie, J, and A Kolhatkar, "Medical Laboratory Science Theory and Practice", Tata McGraw Hill Education, New Delhi.
6. Baker, F.J., "Biochemistry Estimations".
7. Varley, H., "Practical Clinical Biochemistry", Heinmann Publishers, Oxford.
8. Cheesbrough, Monica, "Medical Laboratory Manual for Tropical Countries", Cambridge University Press, UK.
9. Satyanarayana, U., and U. Chakrapani, "Essentials of Biochemistry", New Central Book Agency Pvt. Ltd.
10. Gupta, RC, and S Bhargava, "Practical Biochemistry", CBS Publishers & Distributors Pvt. Ltd.

WEBSITE FOR REFERENCE

1. PSBTE- eEDUCATION:- <https://youtube.com/channel/UC35EU-7StdIWgTAYV65LQMg>

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on the basic concepts and principles while covering the course contents. During practical exercises, the students should be encouraged to perform individually but under expert supervision. Visits to hospitals, diagnostic laboratories and medical colleges should be planned to so as to expose the students to the latest diagnostic techniques and instruments. Charts, models and audio-visual aids should be used as pedagogical strategies. Guest lectures and workshops should be organized on the emerging techniques and topics related to clinical biochemistry.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (Out of 50)
1	07	12
2	05	07
3	05	07
4	04	06
5	03	06
6	03	06
7	03	06
TOTAL	30	50

4.5 HISTOPATHOLOGY AND CYTOLOGY-II

L	P
2	4

RATIONALE

The students of Medical Laboratory Technology (MLT) must have basic knowledge/skill about cell, its functioning, fixation and staining of cell, identification of malignant cell. This course not only covers basic techniques but also latest advancements in the field of cytology thus imparting the latest technological skill used in laboratory.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- Explain structure and functions of cell
- Collect and process cytological specimen
- Perform fixation and staining of specimen
- Identify malignant cell from normal cells
- Explain principle of FNAC(Fine Needle Aspiration Cytology)

DETAILED CONTENT

- | | | |
|----|--|---------|
| 1. | Cytology | (2 hrs) |
| | 1.1 Definition of cell | |
| | 1.2 Structure and function of cell | |
| 2. | Exfoliative Cytology | (4 hrs) |
| | 2.1 Introduction | |
| | 2.2 Preparation of vaginal & cervical smears | |
| | 2.3 Collection and Processing of specimen for cytology | |
| | - Urine | |
| | - Sputum | |
| | - CSF (Cerebro Spinal Fluid) | |
| | - Other fluids | |

3. Fixation (Cytological Specimen) (2 hrs)
 - 3.1 Definition
 - 3.2 Various types of Cytological fixatives
 - 3.3 Advantages and Disadvantages
4. Cytological Staining (6 hrs)
 - 4.1 Principle, Technique and interpretation of results of
 - Papanicolaou staining
 - May Grunwald & Giemsa staining
 - Haematoxylin and Eosin staining
 - 4.2 Principle, Technique & Interpretation of PAS (Periodic Acid Schiffs reagent Stain)
5. Autopsy (2 hrs)
 - 5.1 Introduction to autopsy technique
 - 5.2 Use of autopsy
6. Malignant Cells (2 hrs)
 - 6.1 Characteristics
 - 6.2 Differences from normal cell
7. Sex Chromatin (Barr bodies) (2 hrs)
 - 7.1 Introduction
 - 7.2 Collection of sample
 - 7.3 Staining and Interpretation
8. Aspiration Cytology (6 hrs)
 - 8.1 Principle of FNAC (Fine Needle Aspiration Cytology)
 - 8.2 Indications of FNAC
 - 8.3 Uses of FNAC
 - 8.4 Staining Techniques
 - MGG (May-Grunwald – Giemsa)
 - PAP (Papanicolaou Stain)
 - H&E (Haematoxylin & Eosin Stain)

- | | | |
|-----|---|---------|
| 9 | Automation in Cytology | (2 hrs) |
| | | |
| 9.1 | Use of Cytospin | |
| | | |
| 10. | Role of Laminar airflow and cyto-technician in cytology | (2 hrs) |

PRACTICAL EXERCISES

1. Demonstration of cell
2. Demonstration of malignant cell
3. Processing of urine samples for malignant cells
4. Processing of sputum sample for malignant cytology
5. Demonstration and care of autopsy instruments
6. Preparation of dry smear and wet smear
7. Preparation and staining of buccal smear
8. To perform Pap stain
9. Fixation of smears and staining with MGG
10. To perform H&E on given smear

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually.

Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audio visual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

1. Baker, FJ, "An Introduction to Medical Laboratory Technology", Butterworths Scientific, London.
2. Drury, RAB, "Carleton's Histological Technique", Northwick Paru Hospital, Harrow, Middlesex.
3. Bancroft, John D., "Theory and Practice of Histological Technique", Churchill Livingstone, London.
4. Culling, CFA, "Cellular Pathology Techniques", Butterworths, London.
5. Sood, Dr. Ramnik, "Medical Lab Technology", MD, Maulana Azad College, New Delhi.

6. Koss, Leo Pold G., “Diagnostic Cytology and its Histopathology Basis”, JB Lupein, Philadelphia.

WEBSITE REFERENCE

1. <https://youtube.com/channel/UC35EU-7StdIWgTAYV65LQMg>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (Out of 50)
1	2	4
2	4	6
3	2	4
4	6	8
5	2	4
6	2	4
7	2	4
8	6	8
9	2	4
10	2	4
Total	30	50

4.6 MEDICAL LABORATORY MANAGEMENT

L P
4 -

RATIONALE

In this subject the students are given basic training to organize a Clinical Laboratory. They are imparted knowledge about the basic principles of Medical Lab Management. They are given expertise about the material management, accreditation and treatment of biomedical waste. They are taught to follow the safety measures and medical ethics in a Lab. The students also learn to maintain the Lab data with the help of computers and presentation of reports in better way.

LEARNING OUTCOMES

After undergoing training in this subject, the students will be able to:

- Describe the concepts of Medical Lab Management.
- Organise a Clinical Laboratory and learn inventory control.
- Adopt the safety measures while working in Labs.
- Apply the proper methods of disposal of Biomedical Waste in Lab.
- Follow Medical Ethics and code of conduct.

DETAILED CONTENTS

1. Introduction to Medical Lab Management (4 hrs)
 - 1.1 Principles of Lab Management.
 - 1.2 Role of Medical Lab Technology in total healthcare.
2. Laboratory Organization (10 hrs)
 - 2.1 Functional components of Laboratory (Microbiology, Biochemistry, Haematology, Histopathology and Cytology, Anatomy and Physiology).
 - 2.2 Physical setup of Lab with all the facilities (Space, Heating, Ventilation, Lighting, Fire prevention facility, electrical installation, Storage facility and Lab Equipment).
 - 2.3 Laboratory Personnel (Administrator, Pathologist, Supervisor, Lab Technician, Helpers).

3. Accreditation (4 hrs)
 - 3.1 Introduction and Importance.
 - 3.2 Accreditation body (National and International).
4. Material Management (8 hrs)
 - 4.1 Objectives of Material management.
 - 4.2 Procurement.
 - 4.3 Financial resources.
 - 4.4 Inventory control and inventory analysis.
 - 4.5 Storage and handling of reagents.
5. Lab Safety Measures (8 hrs)
 - 5.1 General safety measures in different clinical laboratories.
 - 5.2 First Aid in Lab (For acid burn, alkali burn, Accidental trauma, Electric shock, Bleeding, Gas inhalation and Spillage).
6. Disposal of Biomedical Waste (10 hrs)
 - 6.1 Sources of Biomedical Waste.
 - 6.2 Hazards related to Biomedical Waste.
 - 6.3 Advantages and Legal aspects of Biomedical Waste Management.
 - 6.4 Categorization and treatment of Biomedical Waste.
 - 6.5 Segregation, Packaging, Storage and Transport of Biomedical Waste Management
7. Medical Ethics and code of conduct (8 hrs)
 - 7.1 Introduction.
 - 7.2 Code of conduct.
 - 7.3 Medico Legal aspects (Confidentiality, Malpractices, Medical Negligence, Consumer protection act).
8. Lab Information System (8 hrs)
 - 8.1 Types of Clinical Laboratory Records (Requisition records, Accession Records)

- 8.2 Basic format for test report, Reported reference range and clinical alerts (abnormal results).
- 8.3 Storage and retrieval of Lab Data with the help of computers.
- 8.4 Importance of Storage and retrieval of laboratory data.

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles of Lab Management while covering the subject contents. Teachers should make sure that students follow safety measures while working daily in Labs. Visits to Biomedical waste treatment plants should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lectures on specific topics and share their experiences.

RECOMMENDED BOOKS

- 1. Godkar, Praful B, “Medical Laboratory Technology”, Bhalani Publishing House, Mumbai (India).
- 2. Baker, FJ, “Text Book of Medical Laboratory Technology”, Butterworths Heinmann Publishers, Oxford.
- 3. Mukherjee, KL, “Text Book of Medical Laboratory Technology Vol I, II and III”, Tata McGraw Hill Publishers, New Delhi.
- 4. Sood, Ramnik, “Medical Lab Technology”, Jay Pee Brothers, New Delhi.
- 5. Chesbrough, Monica, “District Laboratory Practice in Tropical Countries”, Churchill Livingstone 189.

WEBSITES FOR REFERENCES

- 1. <https://youtube.com/channel/UC35EU-7StdiWgTAYV65LQMg>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	03
2	10	10
3	4	03
4	8	06
5	8	06
6	10	10
7	8	06
8	8	06
TOTAL	60	50

4.7 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open Elective refers to a course that students can opt for in addition to their primary area of study. The open elective is from an unrelated discipline with the intention to provide exposure in that discipline. It provides the students the opportunity to select and learn a subject related to his/her interest, thus allowing them to explore their passion.

LIST OF SUGGESTED OPEN ELECTIVES

The student can opt one course out of the following:

- 1 Foreign Language
- 2 NCC
- 3 Yoga
- 4 First Aid
- 5 Creative Writing
- 6 Sketching, Drawing and Colour Studies
- 7 Gardening
- 8 Photography
- 9 Legal Studies
- 10 Event Management
- 11 Diet and Nutrition

Open elective can be offered online or offline.

4.7.1 FOREIGN LANGUAGE (French, Japanese, German, Spanish)

L P
2 -

RATIONALE

This course is an introduction to the specific language. Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of the language as a cultural space are the overall objectives of the course. The student should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Enhance the level of vocabulary in specific language.
- Manage situational communication in specific language.

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Introduction | (06 hrs) |
| | Self introduction, Numbers, Days, Months, Date, Time, and Counting | |
| 2. | Vocabulary | (06 hrs) |
| | My home, My family, My friend, Daily routine, Hobbies, Food, Greeting and Thanking | |
| 3. | Grammar | (12 hrs) |
| | Verb and Verb forms, Articles, Possessive pronouns, Auxiliary verbs, Questions, Present and Past tense | |
| 4. | Theme | (06 hrs) |
| | Means of transport, Basic directions, Food, Drink, Family, Groceries and Meals | |

RECOMMENDED BOOKS

1. Annie Berthet, Hugot et al, “Alter Ego - Méthode de Français”, Hachette.
2. 3 A Corporation, “Minna no Nihongo”, Goyal Publishers, New Delhi.
3. Stefanie Dengler, “NETZWERK Deutsch als Fremdsprache A1”, Goyal Publishers, New Delhi.
4. Jaime Corpas et.al, “Aula International 1”, Difusión, Madrid.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	12	20
4	06	10
Total	30	50

4.7.2 NATIONAL CADET CORPS (NCC)

L P
2 -

RATIONALE

This course is structured to instil in the students qualities like nationalism, patriotism, discipline, team spirit, esprit-de-corps, leadership, self-confidence, national integration and improve their personality. The objective of the course is to expose the students to a regimental way of life, which is essential to inculcate in them the values of discipline, duty, punctuality, orderliness, smartness, and respect for authority, correct work ethos and self-confidence. In addition, it will inculcate defence services work ethos, which is characterized by hard work, sincerity of purpose, honesty, ideals of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Explain aims and objectives of NCC.
- Understand the importance of national integration.
- Assist Civil Administration in performance of selective duties during disasters.
- Perform drill without arms.
- Contribute towards nation building.
- Provide voluntary social service.

DETAILED CONTENTS

1. Introduction (08 hrs)

Aims and objectives of NCC, Organisation structure and training, NCC Song, National Integration and awareness, Religions, Culture, Traditions and Customs of India, National Integration: Importance and Necessity. Freedom Struggle and Nationalist Movement in India, Problems/ Challenges of national integration, Unity in diversity, Famous leaders of India, Images/ Slogans for national integration, Contribution of youth to nation building

2. Civil Affairs (04 hrs)

Civil Defence Organization and its duties/ NDMA, Types of emergencies/ Natural Hazards, Role of NCC during Natural Hazards/ Calamities

3. Drill Without Arms (08 hrs)

General and Words of Command, Attention, Stand at Ease and Stand Easy, turning and inclining at the halt, Sizing, forming up in three ranks and numbering, open and close order march and Dressing, Saluting at the halt, Getting on parade, dismissing and falling out, Marching, length of pace and time of marching in quick time and halt, slow march and halt, Turning on the march and wheeling, Saluting on the March Individual word of command

4. Personality Development and Leadership (04 hrs)

Personality development, self-awareness, Leadership, life/soft skills, time management and character building.

5. Social Service (06 hrs)

Basics of Social service, and its needs, Social/ Rural Development Projects: MNREGA, SGSY, NSAP; Literacy enhancement and poverty alleviation, Social evils, Contribution of youth towards social welfare.

RECOMMENDED BOOKS

- 1 “Cadet Hand Book (Common Subjects)”, published by DG, NCC.
- 2 “Grooming Tomorrow’s Leaders”, published by DG, NCC.
- 3 “Youth in Action”, published by DG, NCC.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	04	06
3	08	14
4	04	06
5	06	10
Total	30	50

4.7.3 YOGA

L	P
2	-

RATIONALE

Yoga is a practice that connects the body, breath, and mind. It uses physical postures, breathing exercises, and meditation to improve overall health. It not only improves physical health but also mental and spiritual well-being, which are the foundations of life. The course is aimed at developing skills in yoga for strength, flexibility and relaxation.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Explain the importance of yoga and its effect on health
- Perform yoga in various forms and combinations
- Understand the philosophy of heartfulness meditation.
- Promote positive health and holistic wellness through yoga and meditation.

DETAILED CONTENTS

1. Yoga (4 hrs)

Concept, need and importance, Yogic principles, Rules and precautions to be followed by yoga practitioners, Introduction to Ashtanga yoga and Yoga sutra

2. Asanas and Mudras (14 hrs)

Basic asanas, Asanas in different postures - Sukshma Vayayam, Pawan Mukhtasan, Surya Namaskar, Hasta Utthanasana, Padahasthasana, Tadasana, Vrikshhasana, Tirayak Tadasana, Natarajasana, Vajrasana, Padmasana, Bhujangasana.

Mudras - Concept, Important mudras - Prana Mudra, Varuna Mudra, Prithvi Mudra, Aakash Mudra, Gyana Mudra.

3. Pranayama (6 hrs)

Kapalbhati Pranayama, Nadi Shodhan Pranayama (Anulom Vilom), Bhastrika Pranayama, Ujjayi Pranayama.

4. Meditation (3 hrs)

Heartfulness meditation, Practice on meditation

5. Health Benefits of Yoga and Meditation (3 hrs)

Benefits and effect of Asanas, Mudras and Pranayama on various systems and organs of human body. Relaxation and wellness through meditation

RECOMMENDED BOOKS

1. Saraswati, Swami Satyananda, "Asana, Pranayama, Mudra and Bandha", Yoga Publication Trust, Bihar.
2. BKS Iyengar, "Light on Yoga", George Allen and Unwin.
3. Mudras by Heartfulness; Heartfulness Education Trust.
4. Kamlesh D Patel, "The Way of the Heart", Spiritual Hierarchy Publication Trust
5. Goel, Aruna, "Yoga Education: Philosophy and Practice", Deep & Deep Publications, New Delhi.
6. Nagendra, H R, and R Nagarathna, "Yoga for Promotion of Positive Health". Swami Vivekananda Yoga Prakashan.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	14	24
3	06	10
4	03	05
5	03	05
Total	30	50

4.7.4 FIRST AID

L P
2 -

RATIONALE

First aid is a valuable and life-saving course. The objective of this course is to impart knowledge and skills to the students necessary in an emergency to help sustain life, reduce pain, and minimize the consequences of injury or sudden illness until professional medical help arrives.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Administer basic life support skills including cardiopulmonary resuscitation
- Provide first aid of simple and multiple system trauma.

DETAILED CONTENTS

1. Basics of First Aid (4 hrs)

First aid, importance of first aid, first aider, laws of first aid, contents of an ideal first aid kit, dealing with an emergency.

2. Emergency Response (10 hrs)

CPR, steps for performing CPR, CPR for newborns and infants, recovery position, first aid in drowning, fractures of bones, causes and types of fractures, dislocation.

3. First Aid in Burns (4 hrs)

Types of burns, danger of burns, first aid in dry burns and scalds, electrical burns, chemical burns, sunburn, heatstroke.

4. First Aid in Wounds and Injuries (6 hrs)

Types of wounds- small cuts and abrasions, Head injury- nose bleed, bleeding gums, bleeding from varicose veins, Shocks- causes of shock and its first aid.

5. First Aid in Poisoning (3 hrs)

Poisoning by swallowing, gases, injections, skin absorption, Animal bites, snake bites and insect stings.

6. First Aid in Foreign Objects Entering the Sense Organs: (3 hrs)

Foreign body in the eye, ear, nose, skin, swallowing of foreign objects.

Note : Persons from Civil Defence/ National Disaster Response Force (NDRF) etc. can be invited for conduct of first aid classes and demonstration of first aid practices.

RECOMMENDED BOOKS

1. Gauri Goyal, Dr. Kumkum Rajput, Dr. Manjul Mungali,, “First Aid and Health”, SBPD Publishing House
2. Williamson, Swapna Naskar and Goswami Mala, “First Aid and Emergency Care”, Kumar Publishing House, New Delhi.
3. Mahopatra, R., “First Aid for You and Me”, Academic Publishers, New Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	10	18
3	04	06
4	06	10
5	03	05
6	03	05
Total	30	50

4.7.5 CREATIVE WRITING

L P
2 -

RATIONALE

Creative writing is a written art form that uses the imagination to tell stories and compose essays, poetry, screenplays, novels, lyrics, and more. The objective of this course is to acquaint the students with ideas related to creative writing including art, craft and basic skills required for a creative writer.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Distinguish between literary genres.
- Practice various forms of creative writing.
- Write for various media.

DETAILED CONTENTS

1. Fundamentals of Creative Writing (06 hrs)

Meaning and significance of creative writing, Genres of creative writing: poetry, fiction, Non-fiction, Drama and other forms, Research for creative writing

2. Elements of Creative Writing (10 hrs)

Plot, Setting, Character, Dialogue, Point of view, Literary devices and figurative language, Elements of style, Grammar and the structure of language, Proof reading and editing

3. Traditional Forms of Creative Writing (10 hrs)

Fiction: short story, novella and novel, Poetry, Drama, Essay, Fable, Biography, Memoire and autobiography, Travelogues, Diaries, Self-narrative writing

4. Writing for Media (04 hrs)

Print media, Broadcast media, Internet - Web content writing and blog writing, Advertising

RECOMMENDED BOOKS

1. Anjana Neira Dev. Anuradha Marwah, Swati Pal, “Creative Writing: A Beginner’s Manual”, Pearson Longman, Delhi.
2. Robert Scholes, Nancy R. Comley, Carl H. Klaus, Michael Silverman, “Elements of Literature: Essay, Fiction, Poetry, Drama, Film”, Delhi.
3. Bell, Julia and Magrs, Paul, “The Creative Writing Course-Book”, Macmillan, London.
4. Gardner, John, “The Art of Fiction”, Vintage, New York.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	6	10
2	10	16
3	10	16
4	4	08
Total	30	50

4.7.6 SKETCHING, DRAWING AND COLOUR STUDIES

L	P
2	-

RATIONALE

This course is aimed to develop aesthetic sense of students. It also encompasses training in sketching, drawing and colouring to develop their mental faculties of observation, imagination and creation.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Sketch common objects and various geometrical and non-geometrical forms found in life and nature.
- Use different medium and materials.
- Use colour judiciously in creation of visual work.
- Prepare collage using various paper and materials.

DETAILED CONTENTS

1. Sketching of Objects and Nature (8 hrs)

Sketching of objects at home like cup, plate, glass, book, pencil box etc.
Sketching of tree, mountain, hills, vegetables flower etc. for Nature study using Pencil, colour Pencil
2. Drawing of Human and Animal Figures (10 hrs)

Drawing of Human and animal form with the help of Basic Geometrical shapes
3. Collage Making (4 hrs)

Creating Collage with the help of coloured cut out papers, picture from a magazine or any easily available materials

4. Colours (8 hrs)

Water colour, Poster colour, Colour theory – Colour system, Colour wheel, Colour dimensions, Drawing with oil pastel colour and dry pastel.

RECOMMENDED BOOKS

1. Betty Edwards, “Color: A Course in Mastering the Art of Mixing Colors”, Penguin Group Inc., New York.
2. Feisner, E., “Colour Studies”, Fairchild Publications, USA.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	10	16
3	04	06
4	08	14
Total	30	50

4.7.7 GARDENING

L	P
2	-

RATIONALE

Gardening activities are fantastic for helping students engage in a way that is more difficult in the classroom. Watching plants grow is a fun and educational experience for them. Their enormous curiosity and excitement over anything new makes them natural for gardening. Growing plant seeds teaches them how nature works and adds to their interest in environmental sustainability.

LEARNING OUTCOMES

At the end of the course, the students will be able to :

- Explain various techniques of gardening, cultivation, multiplication, raising of seedlings of garden
- Discuss new and modern techniques of plant propagation.
- Develop interest in nature and plant life.

DETAILED CONTENTS

1. Gardening (6 hrs)

Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design.

2. Gardening Operations (14 hrs)

Soil laying, manuring, watering, management of pests and diseases and harvesting.

3. Sowing/Raising of Seeds and Seedlings (10 hrs)

Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification. Transplanting of seedlings.

RECOMMENDED BOOKS

1. Bose T.K., Mukherjee, D., “Gardening in India”, Oxford & IBH Publishing Co. New Delhi.
2. Kumar, N., “Introduction to Horticulture”, Rajalakshmi Publications. Nagercoil, Tamil Nadu.
3. Sandhu, M.K., “Plant Propagation”, New Age International Publishers.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	14	24
3	10	16
Total	30	50

4.7.8 PHOTOGRAPHY

L P
2 -

RATIONALE

Photography is a unique and creative medium of self-expression that requires aesthetic sense as well as technical expertise. Students who are highly passionate about learning the workings of cameras and different technologies based on them can pursue this course. The objective of this course is to enable the candidates to understand the utility of different camera parts and the art of taking candid shots.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Explain the principles of photography.
- Handle various cameras for taking photographs.
- Apply aesthetics of photography.

DETAILED CONTENTS

1. Basic Photography (04 hrs)

Meaning and definition of photography, Basic principle in the film and digital photography, History of photography.
2. Camera Function and Accessories (04 hrs)

Basic camera, Different parts of camera and their basic functions, Camera Accessories
3. Main Controls of Camera (10 hrs)

Parts of Camera, Types of lenses, Shutter, Diaphragm, Exposure, Film and digital image sensor, Depth of field, Lighting, Photography with flash, Filters in photography.

4. Digital Camera (05 hrs)

Process of digital imaging, Types of digital cameras, Menu operationsof digital cameras, Introduction to colors.

5. Aesthetics of Photography (07 hrs)

Definition of lighting, Principles of lighting, Reflection, Light characteristics, Color, Direct light and indirect light, Light and subject, Light as subject, Shadow as subject, Light sources, Natural light and artificial light, Principles of visualization, Composition guidelines

RECOMMENDED BOOKS

1. Dilwali, Ashok, "All about Photography", National Book Trust, New Delhi.
2. Sharma, O.P., "Practical Photography", Hind Pocket Books.
3. Freeman, "The Photographer's Guide to Light", John Collins & Brown

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	04	08
3	10	16
4	05	08
5	07	12
Total	30	50

4.7.9 LEGAL STUDIES

L	P
2	-

RATIONALE

The course introduces the students to Indian legal system, contracts management, and legal documentation. Further, the course familiarizes students with basic knowledge of labour laws that would be useful.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Understand the Indian Legal System.
- Discuss Indian Contract Act.
- Explore labour laws and laws related to women.

DETAIL CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction to Indian Legal System | (4 hrs) |
| | Constitution of India, Sources of Law and Judicial system. | |
| 2. | The Indian Contract Act | (6 hrs) |
| | Contract – meaning and kinds. Essentials of a valid contract, Discharge of a contract, Contract of Agency | |
| 3. | Legal Documentation | (10 hrs) |
| | Drafting of legal documents including Non-Disclosure Agreements (NDA), Request for Proposal (RFP), collaboration agreements, joint venture agreements, tendering and subcontracting | |
| 4. | Labour Laws | (6 hrs) |
| | Provident Fund, ESIC, Gratuity and Bonus | |

5. Legislation Related to Women (4 hrs)

Sexual harassment at Work place (Prevention, Prohibition and Redressal), Protection of Women from Domestic Violence Act, Criminal Law (Amendment) Act, The Indecent Representation of Women (Prohibition) Act.

RECOMMENDED BOOKS

1. Joseph Minattur, "Indian Legal System", Indian Law Institute, New Delhi.
2. Srivastava, S.C., "Industrial Relations and Labour Laws", Vikas Publishing House Pvt. Ltd.
3. Aggarwal, S K, "Business Law", Galgotia Publishers, Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	07
2	06	10
3	10	16
4	06	10
5	04	07
Total	30	50

4.7.10 EVENT MANAGEMENT

L	P
2	-

RATIONALE

Event Management is a course which deals with the planning, coordinating, and organising of events for people and communities. It is a part of the mass communication course which is offered by many prestigious colleges in India. Event management course aims to imbibe knowledge on analysing, marketing, planning and strategies in business administration to its students.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Explain the purpose of special events in an organization.
- Use techniques and strategies required to plan successful special events.
- Promote and conduct special events.
- Assess the quality and success of special events.

DETAILED CONTENTS

1. Principles of Event Management (04 hrs)

Introduction to event management, size & type of event, event team, code of ethics, principles of event management, role of event manager – planning, organising, leading and controlling an event

2. Event Planning (08 hrs)

Objective of event, use of planning tools, protocols, dress codes, staging, staffing.

3. Event Marketing (04 hrs)

Advertising, publicity, event marketing process, even hospitality

4. Event Leadership (06 hrs)

Teambuilding & work distribution, managing team, managing meetings, written & verbal communication.

5. Event Safety and Security (04 hrs)

Role of Security, Safety, Crowd management, Risk management.

6. Event Accounting (04 hrs)

Budget, Cash flow analysis, Profit & loss statement, Balance sheet.

RECOMMENDED BOOKS

1. Singla, Sita Ram, "Event Management", ATH Publishers, New Delhi.
2. Sharma, Divakar, "Event Planning and Management", Deep & Deep Publication.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	8	12
3	4	08
4	6	10
5	4	08
6	4	06
Total	30	50

4.7.11 DIET AND NUTRITION

L	P
2	-

RATIONALE

The objective of this course is to help the students to understand the concept of diet and nutrients and provide knowledge about causes and symptoms of Nutrition-related disorders.

LEARNING OUTCOMES

On completion of this course, the students will be able to:

- Comprehend the nutritional value of different food items.
- Explain the need of nutrition during the normal stages of life.
- Calculate normal dietary requirements and balanced diet.

DETAILED CONTENTS

1. Introduction (04 hrs)

Basic concepts of health, Nutrition, Nutrients, Nutrition requirement, Balanced diet. Relationship between health & nutrition, Assessment of nutritional status.

2. Nutrients (16 hrs)

Nutrients & their classification. Macro Nutrients –Sources, Functions and Effects on the Body; Micro nutrients - sources, Functions and effects on the Body; Fat soluble nutrients - sources, Functions and effects on the body, Water soluble nutrients - Sources, Functions and effects on the body, Digestion, Absorption of carbohydrates, Lipids, Proteins and energy.

3. Energy and Nutrition-related Disorders (06 hrs)

Basic concepts, Definition and components of energy requirement, Protein malnutrition, Iodine deficiency disorders, Disease and disorder caused by imbalance of nutrients, Food allergies.

4. Nutritional Needs (04 hrs)

Nutritional need during normal stages of life - Infancy, Childhood, Adolescence, Pregnancy, Lactation and Old age, Disease management with diet.

RECOMMENDED BOOKS

1. Antia, F.P., "Clinical Dietetics and Nutrition", Oxford University Press.
2. Swaminathan, "Essentials of Food and Nutrition", Ganesh and Co., Madras.
3. Subhangini Joshi, "Nutrition and Dietetics", McGraw Hill Publishers.
4. B.S. Narsinga Rao et al, "Nutritive Value of Indian Foods", National Institute of Nutrition, Hyderabad.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	16	28
3	06	10
4	04	06
Total	30	50

ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks, State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business
11. Preparation of Project Report

INDUSTRIAL/PROFESSIONAL TRAINING OF STUDENTS

It is needless to emphasize further the importance of Industrial/Professional Training of students during their 3 years of studies at Polytechnics. It is industrial/professional training, which provides an opportunity to students to experience the environment and culture of clinical medical labs. It prepares student for their future role as medical lab technicians in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial/professional training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial/professional training of a minimum of 4 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, various diagnostic equipment, particularly sophisticated ones which are used in the field of medical laboratory technology.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. A minimum of one visit per week by the teacher is recommended. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An internal assessment of 50 and external assessment of 50 marks have been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional/industrial training report through viva-voce/presentation aims at assessing students understanding of various practices being used in the clinical medical labs and their ability to engage in activities related to application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

- | | | |
|----|---|-----|
| a) | Punctuality and regularity | 15% |
| b) | Initiative in learning new things | 15% |
| c) | Relationship with workers | 15% |
| d) | Industrial/Professional training report | 55% |

5.1 PROFESSIONAL TRAINING-I

L P
- 40

RATIONALE

Professional Training aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem by undertaking a project. In addition, the professional training is intended to place students in actual work situation for the stipulated period.

LEARNING OUTCOMES

After undergoing the professional training, students will be able to:

- Apply in totality the knowledge and skills gained through the course work in the solution of particular problem.
- Develop understanding regarding the size and scale of operations and nature of field- work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop abilities like interpersonal skills, communication skills, positive attitude and values etc.

OBJECTIVE

The objective of providing professional training is to:

1. Create confidence in the students to work in world of work by developing practical skills pertaining to laboratory management and diagnostic skills in the field of clinical haematology, transfusion medicine blood banking, clinical biochemistry, clinical microbiology, histopathology and cytology and ensuring laboratory safety and quality assurance.
2. Create necessary awareness regarding use of various types of diagnostic equipment, particularly sophisticated ones which are used in the field of medical laboratory technology.
3. Develop appreciation regarding size and scale of operations, environment and other related aspects like value of team work, interpersonal relations and professional ethics in the field of medical laboratory technology.

4. Develop necessary traits for starting small clinical laboratories as per requirements.

SELECTION OF TRAINING PLACES

The institute offering diploma programme in Medical Laboratory Technology should establish contact/rapport by personal visit to following types of organizations:

1. Medical Colleges/Research institutions
2. Civil Hospitals at District Headquarters having well equipped laboratory
3. Hospitals in private sector
4. Well established clinical laboratories being run by a qualified person

LIST OF PRACTICALS

List of practical exercises is suggested below which should be carried out during 5th semester.

During 5th Semester

1. Preparation of various anticoagulants/containers
2. Collection of various clinical samples
3. Haemoglobin estimation
4. TLC, DLC, ESR, PCV, BT & CT
5. Absolute Eosinophil Count
6. APTT/PTTK
7. Prothrombin Time & calculation of INR
8. Blood Sugar – Random/Fasting/PP
9. GTT/ST
10. Urine – Complete examination
11. Stool – Complete examination
12. RA/RF factor
13. ABO and Rh blood grouping
14. Widal test
15. VDRL test
16. Cleaning of glassware
17. Disposal of Medical wastes (use of bags)
18. Staining of blood film
19. H&E staining
20. Spotting

In addition to the above, students are expected to learn various tests being conducted at the training centre, where ever they are undergoing training.

Note:

1. The Principal of the institute where diploma programme in Medical Laboratory Technology is being offered, with the help of Directorate of Technical

Education/Secretary, Technical Education may approach Director, Health Services/Director, Medical Education/Secretary, Health to collaborate in offering structured and supervised project work/practical training of students in above organizations. It will be worthwhile to sign a "Memorandum of Understanding" regarding the involvement of students in undergoing practical training

2. The Principal of the institute may also approach regional Apprenticeship Adviser (Northern Region), Kanpur to provide training seats under Apprenticeship Act to the students

METHODOLOGY OF ORGANIZING PROFESSIONAL TRAINING

Each concerned teacher will be responsible for a group of students in respective specialty to plan, supervise and monitor the progress when placed in different organizations for practical training. For this purpose, necessary recurring expenditure for making payment of TA/DA to the faculty of institute and the experts may be worked out by respective institutes, keeping in view, number of visits and the distances involved in such travelling. The concerned teacher will have to continuously interact with training centres to monitor the progress of the students

EVALUATION OF STUDENTS FOR PROFESSIONAL TRAINING

A suggestive criterion for assessing student performance by an external and an internal (teacher) examiner is given in the table below:

Sr. No.	Performance Criteria	Max. Marks	Rating Scale						
			Outstanding	Excellent	Very Good	Good	Above Average	Average	Pass
1.	Planning	10	10	9	8	7	6	5	4
2.	Execution	30	30	27	24	21	18	15	12
3.	Quality of Training	20	20	18	16	14	12	10	8
4.	Report Writing	20	20	18	16	14	12	10	8
5.	Presentation/ Viva voce	20	20	18	16	14	12	10	8
Total marks		100	100	90	80	70	60	50	40

Important Note

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner may be a person from industry/organization, who has been associated with the professional training of the students or a senior faculty from technical institute.
4. The students are expected to prepare practical record book as per given list of the practicals. Besides, they can also add other experiments as well.

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days. Extension lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this camp.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussion Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene

6.1 PROFESSIONAL TRAINING- II

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RATIONALE

Professional Training aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem by undertaking a project. In addition, the professional training is intended to place students in actual work situation for the stipulated period.

LEARNING OUTCOMES

After undergoing the professional training, students will be able to:

- Apply in totality the knowledge and skills gained through the course work in the solution of particular problem.
- Develop understanding regarding the size and scale of operations and nature of field- work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop abilities like interpersonal skills, communication skills, positive attitude and values etc.

OBJECTIVE

The objective of providing professional training is to:

1. Create confidence in the students to work in world of work by developing practical skills pertaining to laboratory management and diagnostic skills in the field of clinical haematology, transfusion medicine blood banking, clinical biochemistry, clinical microbiology, histopathology and cytology and ensuring laboratory safety and quality assurance.
2. Create necessary awareness regarding use of various types of diagnostic equipment, particularly sophisticated ones which are used in the field of medical laboratory technology.
3. Develop appreciation regarding size and scale of operations, environment and other related aspects like value of team work, interpersonal relations and professional ethics in the field of medical laboratory technology.

4. Develop necessary traits for starting small clinical laboratories as per requirements.

SELECTION OF TRAINING PLACES

The institute offering diploma programme in Medical Laboratory Technology should establish contact/rapport by personal visit to following types of organizations:

1. Medical Colleges/Research institutions
2. Civil Hospitals at District Headquarters having well equipped laboratory
3. Hospitals in private sector
4. Well established clinical laboratories being run by a qualified person

LIST OF PRACTICALS

List of practical exercises is suggested below which should be carried out during 6th semester.

During 6th Semester

1. Reticulocyte count
2. Platelet count
3. Peripheral blood film examination
4. Sputum examination for AFB
5. Serum calcium
6. CSF examination
7. Lipid profile
8. Liver function test
9. Renal function test
10. Stool for occult blood
11. Urine for culture and sensitivity
12. Blood for culture and sensitivity
13. Semen culture
14. Pus culture and sensitivity
15. Staining of smears by various staining procedures
16. Biochemical testing
17. HIV Test
18. Hbs Ag test
19. ASO
20. CRP
21. Pregnancy test
22. Spotting

In addition to the above, students are expected to learn various tests being conducted at the training centre, where ever they are undergoing training.

Note:

1. The Principal of the institute where diploma programme in Medical Laboratory Technology is being offered, with the help of Directorate of Technical Education/Secretary, Technical Education may approach Director, Health Services/Director, Medical Education/Secretary, Health to collaborate in offering structured and supervised project work/practical training of students in above organizations. It will be worthwhile to sign a "Memorandum of Understanding" regarding the involvement of students in undergoing practical training
2. The Principal of the institute may also approach regional Apprenticeship Adviser (Northern Region), Kanpur to provide training seats under Apprenticeship Act to the students

METHODOLOGY OF ORGANIZING PROFESSIONAL TRAINING

Each concerned teacher will be responsible for a group of students in respective specialty to plan, supervise and monitor the progress when placed in different organizations for practical training. For this purpose, necessary recurring expenditure for making payment of TA/DA to the faculty of institute and the experts may be worked out by respective institutes, keeping in view, number of visits and the distances involved in such travelling. The concerned teacher will have to continuously interact with training centres to monitor the progress of the students

EVALUATION OF STUDENTS FOR PROFESSIONAL TRAINING

A suggestive criterion for assessing student performance by an external and an internal (teacher) examiner is given in the table below:

Sr. No.	Performance Criteria	Max. Marks	Rating Scale						
			Outstanding	Excellent	Very Good	Good	Above Average	Average	Pass
1.	Planning	10	10	9	8	7	6	5	4
2.	Execution	30	30	27	24	21	18	15	12
3.	Quality of Training	20	20	18	16	14	12	10	8
4.	Report Writing	20	20	18	16	14	12	10	8
5.	Presentation/ Viva voce	20	20	18	16	14	12	10	8
Total marks		100	100	90	80	70	60	50	40

Important Note

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.
3. The external examiner may be a person from industry/organization, who has been associated with the professional training of the students or a senior faculty from technical institute.
4. The students are expected to prepare practical record book as per given list of the practicals. Besides, they can also add other experiments as well.

9. RESOURCE REQUIREMENTS

9.1 Physical Resources

9.1.1 Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

9.1.2 Equipment requirement:

Note:

- All the glasswares to be of Borosil make
- The chemicals may be purchased of reputed make.
- Adequate number of glassware commonly used in the laboratory should be provided in each laboratory.
- Stains/Reagents/Culture Media/Consumable items should be procured as per requirement. Readymade stains/media/reagents from reputed manufacturer can also be used where ever available.

a) REQUIREMENTS FOR MICROBIOLOGY LAB

Sr. No.	Item	Quantity
Discs (Commercial)		
1	Antibiotic Discs (Commercial)/ Combidiscs	Adequate
	IMVIC kit	Adequate
2	Oxidase discs	Adequate
Kits (Commercial)		
1.	Widal Test kit	2 No
2	RA Test Kit	2 No
3.	VDRL Kit	2 No
4.	ASO	2 No
5.	CRP	2 No.
6.	Hbs Ag (strips)	Adequate
7.	HIV Tridot test cards	Adequate
8.	Pregnancy Cards	Adequate
9.	Pan malaria Cards	Adequate
EQUIPMENTS		
1.	Binocular optical microscopes with 100x , 40x and 10x	5
2.	Monocular Microscopes	15
3.	Autoclave (vertical)	2
4.	Hot air oven	2
5.	Water bath	1
6.	Vacuum pump	1

7.	Anaerobic jar	2
8.	Colony counter	2
9.	VDRL Rotator	1
10.	Laminar air flow	1
11.	Incubator	2
12.	Autopipette 10 µl, 100 µl, 1ml	2each
13.	pH meter (electronic)	1
14.	Bunsen Burner	10
15.	Chemical balance (electronic/digital)	1
16.	Single Pan balance	1
17.	Membrane filter (metal)	1
18.	Centrifuge machine (medium)	2
19.	Magnetic stirrer with heater	1
20.	Vortex Mixer	1
21.	AC (Air Conditioner 2.0 Ton)	1
22.	Refrigerator	1
TEACHING AIDS		
1.	Charts – related to Microbiology	Adequate
2.	Preserved specimen /Preserved slides	Adequate
	- Tapeworm	
	- Round worm	
	- Hook worm	
	- Giardia	
	- E. histolytica	
LAB EQUIPMENTS FOR HISTOPATHOLOGY AND CYTOLOGY		
1	Hot air oven	2 Nos.
2	Moulds (Leuckart's) assorted & base steel moulds	15 pairs & 15 pieces
3	Incubators for paraffin wax (37 – 100° C)	1 No.
4	Diamond Pencils	15
5	Automatic Tissue Processor	1 No.
6	Microtome knives/disposable Microtome blades	15 each
7	Plastic embedding rings	1 dozen each
8	Senior Rotary microtomes	2 Nos.
9	Tissue floatation bath	2 Nos.
10	Hones (Belgium and plate glass)	15 Nos. each
11	Automatic knife sharpner	1 No.
12	Strop horse (leather)	15 Nos. each
13	Binocular Microscopes (with 4x,10x, 40x and 100x)	10 Nos.
14	Refrigerator (165 Lt)	1 Nos.
15	Slide warmer (upto 100 C) (Cu-plate) rectangular	1 No.
16	Bone cutter (hand saw stainless steel)	2 Nos.
17	Centrifuge (12 tubes) – Remi; Max speed: 5000 rpm-6000 rpm	2 Nos.
18	Magnetic stirrer	1
19	Cryostat	1
20	Paraffin Wax Dispensor	1

21	Electronic Balance	1 each
22	Timer	15 Nos.
23	Wax Block Cabinets Card board boxes for storage	1 No.
24	Tissue Capsules small and medium or cassettes	1 dozen
25	AC (Air Conditioner 2.0 Ton)	01
REQUIREMENTS FOR BIOCHEMISTRY		
Kits (Commercial)		
1.	Renal Function Kit	Adequate
2.	Liver Function Kit	Adequate
3.	Lipid Profile Kit	Adequate
4.	Calcium and Phosphorus estimation Kit	Adequate
5.	Total Protein and Albumin estimation Kit	Adequate
6.	Electrolytes estimation kit	Adequate
7.	Serum Amylase estimation kit	Adequate
8.	Serum Lipase estimation kit	Adequate
9.	Serum Glucose estimation kit	Adequate
REQUIREMENT OF EQUIPMENT (BIOCHEMISTRY)		
1.	Centrifuge Machine (Remi)	03
2.	Photoelectric colorimeter	01
3.	Water bath electric (Boiling water)	01
4.	Incubator 37°C	01
5.	Hot air oven	01
6.	Flame photometer	01
7.	Electrophoretic apparatus	01
8.	Complete equipment for the thin layer chromatography	01
9.	UV-Spectrophotometer	01
10.	Digital Electronic Balance	01
11.	Urinometer	03
12.	Distillation plant	01
13.	Refrigerator (300 litre)	01
14.	Auto/Semi Auto Analyser for Biochemistry	01
15.	pH meter	02
16.	Glucometer	01
17.	AC (Air Conditioner 2.0 Ton)	01
18.	Microscope Binocular	02
19.	Automatic pipette (20 µl, 50 µl and 100 µl)	05
20.	Microcentrifuge	01
21.	Vortex Mixer	02
22.	Hot plate	01
23.	Lab Microwave Oven (100 liters)	01
REQUIREMENTS FOR HAEMATOLOGY		
Kits (Commercial)		
1.	Haemoglobin estimation Kit	Adequate
2.	PT/INR Kit	Adequate
3.	APTT Kit	Adequate

REQUIREMENT OF EQUIPMENTS FOR HAEMATOLOGY LABORATORY

1. Centrifuge Machine (Remi)	2
2. Microscope Monocular	10
3. Microscope Binocular	10
4. Hot air Oven (Tem. Range 0-200° C) 18" x 18" x 18"	2
5. Incubator (medium size)	2
6. Digital or Electronic Balance (Single pan)	2
7. Refrigerator	1
8. Sahli's Haemoglobinometer	20
9. Westergren pipette with stand	30
10. Wintrobe tube with stand	30
11. Water Bath 12"x10"x10", Temp 0°C-100° C	2
12. Colorimeter (Digital) or Photo electric colorimeter	2
13. Improved Neubauer counting chamber	10
14. Automatic pipette (20 µl, 50 µl and 100 µl)	5 each
15. Fuchs Rosenthal Counting Chamber	1
16. Microcentrifuge/Hematocrit centrifuge machine with hematocrit reader	01
17. Sphygmomanometer(BP apparatus)	4
18. Table Lamp	2
19. Vortex Mixer	2
20. Stop watch	5
21. Hot plate	1
22. Distillation plant	1
23. Hand tally counter	5
24. AC (Air Conditioner 2 Ton)	2

Kits (Commercial)

1. Blood Group estimation kit	Adequate
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LAB EQUIPMENTS FOR BLOOD BANK

1. Hot air oven	1
2. Refrigerator (165 Lt)	1
3. Centrifuge (12 tubes) – Remi; Max speed: 5000 rpm-6000 rpm	2
4. Electronic Balance	1
5. Incubator	1
6. Water bath	1
7. Blood Mixer	1
8. Plasma Expressor	1
9. Binocular Microscope	2
10. Monocular Microscope	10

REQUIREMENT OF EQUIPMENT FOR ANATOMY AND PHYSIOLOGY LABORATORY

1. Skelton (Human) Articulated and disarticulated	1 set each
2. Microscopes Monocular	10
3. Sphygmomanometer with stethoscope	5 each
4. Overhead projector	1
5. Slide Projector	1

6. ECG machine	1
7. ECG Table and Trolley for machine	As required
8. ECG Gel	As required
9. Models	
Brain and spinal cord, Heart, Kidney, liver, Stomach, Eye, Ear, Lungs, Male and female reproductive system, Skin	1 set each
10. Charts	
Cardiovascular system, Reproductive system, Urinary system, endocrine system, CN, Tissues of body, Skeletal system. Digestive system, Respiratory system.	1 set each

9.1.3 Furniture Requirement

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

9.2 Human Resources:

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

s10. LIST OF CONTRIBUTORS/EXPERTS

- a) Online Curriculum Workshops for Designing the Contents of First Year Subjects for Diploma Programmes for Punjab State on 22nd April, 2022, 26th April, 2022, 28th April, 2022, 12th May, 2022 13th May, 2022, 16th May, 2022, 17th May, 2022, 24th May, 2022 and 6th June, 2022 at NITTTR, Chandigarh.

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35.	Mr. Gurjit Singh, Foreman Instructor, Govt Polytechnic College Bathinda
36.	Mr. H S Kalra, Ex-Principal, ITI, Sector 28, Chandigarh
37.	Mr. Balwan Singh, Officer Incharge- Mechanical Workshop, ABIT
38.	Mr. SS Ubhi, Ex Workshop Supdtt., Guru Nanak Dev Polytechnic College, Ludhiana
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40.	Mr. Manmohan Krishan, Senior Lecturer, Govt Polytechnic College Kotkapura
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44.	Mr. Rajesh Kumar, Lecturer Env. Studies, Mehr Chand Poly Jalandhar
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46.	Mr. Ajay Kumar, Lecturer, Chemistry, Pt JR Govt Polytechnic Hoshiarpur
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59.	Ms. Sharanjit Kaur, Lecturer, Mehr Chand Polytechnic
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61.	Ms. Tarandeep Kaur, Lecturer, CSE, Thapar Polytechnic, Patiala
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65.	Mr. Kulwinder Singh Pannu, HOD, Electronics & Communication Engineering, SGHS GPC, Ranwan
66.	Dr. A B Gupta, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh

- b) Online Curriculum Workshops for Designing the Contents of Open Electives for Diploma Programmes for Punjab State on 27th March, 2023, and 8th May, 2023, at NITTTR, Chandigarh

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16.	Dr. A B Gupta, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh

- c) Online Workshops to Develop the Curriculum of Diploma Programme in 'Medical Lab Technology' for the State of Punjab on 17th May, 2022, 30th May, 2022, 17th June, 2022, 22nd August, 2022, and 17th August, 2023 at NITTTR, Chandigarh

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1.	Dr. Surinder Kumar Sharma, Department of Bio-chemistry, PGIMER, Chandigarh
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