Syllabus

SEMESTER I
1.1 ENGLISH AND COMMUNICATION SKILLS - I

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

RATIONALE

Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this subject is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the subject, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a communication skill laboratory for conducting practicals mentioned in the curriculum.

DETAILED CONTENTS

1. Facets of Literature (14 hrs)

1.1 Short Stories

1.1.1 Homecoming – R.N. Tagore

1.1.2 The Selfish Giant - Oscar Wilde

1.1.3 The Diamond Necklace- Guy- De Maupassantt

1.1.4 The Stick – Justice Surinder Singh

1.2 Prose

1.2.1 I Have A Dream – Martin Luther King

1.2.2 On Habits – A. G. Gardiner

1.2.3 My struggle for An Education- Booker T Washington

1.2.4 Seeing People Off – Max Beerbohm
1.3 Poems

1.3.1 Ozymandias – P.B. Shelley
1.3.2 Daffodils – William Wordsworth
1.3.3 Stopping by Woods on a Snowy Evening – Robert Frost
1.3.4 Forefathers - Edmund Blunden

2. Grammar and Usage (10 hrs)

2.1 Parts of speech

2.1.1 Nouns
2.1.2 Pronouns
2.1.3 Adjectives
2.1.4 Articles
2.1.5 Verbs
2.1.6 Adverbs
2.1.7 Prepositions
2.1.8 Conjunction
2.1.9 Interjection
2.1.10 Identifying parts of speech
2.1.11 Structures: Verb patterns, Question tags,
2.1.12 Subject – Verb agreement (concord)

2.2 Pair of words (Words commonly confused and misused)

2.3 Tenses

2.4 Correction of incorrect sentences

2.5 One word substitution

2.6 Words often misspelled (200 words)

2.7 Forms of verbs (100 words)

3. Translation (04 hrs)
3.1 Glossary of Administrative Terms (English and Hindi)
3.2 Translation from Hindi into English

4. Paragraph of 100-150 words from outlines (08 hrs)

5. Comprehension (04 hrs)

Unseen passages of literature, scientific data/graph based for comprehension exercises

6. Communication (08 hrs)

6.1 Definition, Introduction and Process of Communication
6.2 Objectives of Communication
6.3 Notices

LIST OF PRACTICALS

1. Locating a Book in Library
2. To look up words in a Dictionary: meaning and pronunciation of words as given in the standard dictionary using symbols of phonetics
3. To seek information from an Encyclopedia
4. Listening pre-recorded English language learning programme
5. Paper reading before an audience (reading unseen passages)
6. Study of spelling Rules
7. Study of essentials of a good speech to respond and comprehend visual, oral themes, situations or stimulus and practice before select gathering
8. Exercises on use of different abbreviations
9. Greetings for different occasions
10. Introducing oneself, others and leave taking
11. Exercises on writing sentences on a topic

Note:
1. The Text Book on "English and Communication Skills, Book-I By Kuldip Jaidka et. al. developed by NITTTR, Chandigarh is recommended to be used for teaching and setting-up the question papers.
2. A communication laboratory may be set up consisting of appropriate audio-video system with facility of playing CDs/DVDs and a video camera for recording the performance of each student with play back facility. A set of CDs from any language training organization e.g. British Council etc. may be procured for use of students.
3. Elements of body language will be incorporated in all the practicals
4. The practical exercises involving writing may also be included in Theory Examination.

INSTRUCTIONAL STRATEGY

Looking into the present day needs of effective communication in every field, it is imperative to develop necessary competencies in students by giving practical tips and emphasis on grammar, vocabulary and its usage in addition to practical exercises. The teacher should give report writing assignments, projects etc. while teaching this subject.

RECOMMENDED BOOKS

1. English and Communication Skills, Book-I By Kuldip Jaidka, Alwinder Dhillon and Parmod Kumar Singla, Prescribed by NITTTR, Chandigarh Published By Abhishek Publication, 57-59, Sector-17, Chandigarh
2. Essentials of Business Communication by Pal and Rorualling; Sultan Chand and Sons
3. The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India
4. New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
5. New Design English Reading and Advanced Writing Skills for Class XI and XII by MK Kohli and AL Kohli; Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,
6. A Practical English Grammar by Thomson and Marlinet
7. Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill
8. English Conversation Practice by Grout Taylor; Tata McGraw Hill
9. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
11. Communication Skills by R Datta Roy and KK Dhir; Vishal Publication, Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time Allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>-----</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>No.</td>
<td>English Term</td>
<td>Hindi Term</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Senior</td>
<td>वरिष्ठ</td>
</tr>
<tr>
<td>2.</td>
<td>Cashier</td>
<td>खजानाची, रोकडिया</td>
</tr>
<tr>
<td>3.</td>
<td>Consent</td>
<td>सहमति</td>
</tr>
<tr>
<td>4.</td>
<td>Earned Leave</td>
<td>अर्जित अवकाश</td>
</tr>
<tr>
<td>5.</td>
<td>Under Consideration</td>
<td>विचारार्थी</td>
</tr>
<tr>
<td>6.</td>
<td>Criterion</td>
<td>कसौटी</td>
</tr>
<tr>
<td>7.</td>
<td>Staff</td>
<td>कर्मचारी</td>
</tr>
<tr>
<td>8.</td>
<td>Tenure</td>
<td>कार्य-काल</td>
</tr>
<tr>
<td>9.</td>
<td>Working Committee</td>
<td>कार्य समिति</td>
</tr>
<tr>
<td>10.</td>
<td>Estate</td>
<td>सम्पत्ति</td>
</tr>
<tr>
<td>11.</td>
<td>Self-Sufficient</td>
<td>आपूर्ति</td>
</tr>
<tr>
<td>12.</td>
<td>Emergency</td>
<td>आपूर्तिकाल</td>
</tr>
<tr>
<td>13.</td>
<td>General Body</td>
<td>आम समा</td>
</tr>
<tr>
<td>14.</td>
<td>Exemption</td>
<td>छुट्ट</td>
</tr>
<tr>
<td>15.</td>
<td>Daily Wages</td>
<td>दिनांकी, दैनिक येतन</td>
</tr>
<tr>
<td>16.</td>
<td>Death-Cum Retirement</td>
<td>मृत्यु व निबुद्धि</td>
</tr>
<tr>
<td>17.</td>
<td>Dispatch Register</td>
<td>स्वामी रजिस्टर, प्रेषण रजिस्टर</td>
</tr>
<tr>
<td>18.</td>
<td>Dispatch</td>
<td>स्वামी, प्रेषण</td>
</tr>
<tr>
<td>19.</td>
<td>Stenography</td>
<td>अश्रृंचि</td>
</tr>
<tr>
<td>20.</td>
<td>Assurance</td>
<td>दिलासा, आश्वासन</td>
</tr>
<tr>
<td>21.</td>
<td>Justify</td>
<td>सही सामिट करना</td>
</tr>
<tr>
<td>22.</td>
<td>Superior</td>
<td>बड़िया, उच्चकोटि</td>
</tr>
<tr>
<td>23.</td>
<td>High Commission</td>
<td>उच्चायुक्त</td>
</tr>
<tr>
<td>24.</td>
<td>Simultaneous</td>
<td>साथ-साथ</td>
</tr>
<tr>
<td>25.</td>
<td>Precaution</td>
<td>एहसासयात, सतगतात, सावधानी</td>
</tr>
<tr>
<td>26.</td>
<td>Commanding Officer</td>
<td>कमांडिंग अफसर</td>
</tr>
<tr>
<td>27.</td>
<td>Negligence</td>
<td>लापरवादी</td>
</tr>
<tr>
<td>28.</td>
<td>Performance</td>
<td>निषादन</td>
</tr>
<tr>
<td>29.</td>
<td>Proof Reader</td>
<td>प्रूफ रीडर</td>
</tr>
<tr>
<td>30.</td>
<td>Take Over</td>
<td>काम संगतता</td>
</tr>
<tr>
<td>31.</td>
<td>Timely Compliance</td>
<td>समय दौरान पूरा करना</td>
</tr>
<tr>
<td>32.</td>
<td>Responsibility</td>
<td>जिम्मेदारी</td>
</tr>
<tr>
<td>33.</td>
<td>Chief Justice</td>
<td>मुख्य न्यायाधीश</td>
</tr>
<tr>
<td>34.</td>
<td>Disciplinary Action</td>
<td>अनुशासनिक कार्यवाही</td>
</tr>
<tr>
<td>35.</td>
<td>Efficiency Bar</td>
<td>दक्षता रोक</td>
</tr>
<tr>
<td>36.</td>
<td>Flying Squad</td>
<td>उड़न दर्शन</td>
</tr>
<tr>
<td>37.</td>
<td>Regret</td>
<td>खेतद</td>
</tr>
<tr>
<td>38.</td>
<td>Inconvenience</td>
<td>असुविधा</td>
</tr>
<tr>
<td>39.</td>
<td>Ambiguous</td>
<td>असंभव</td>
</tr>
<tr>
<td>40.</td>
<td>Part Time</td>
<td>अभाजकाल</td>
</tr>
<tr>
<td>41.</td>
<td>Academy</td>
<td>अकादमी</td>
</tr>
<tr>
<td>42.</td>
<td>Disparity</td>
<td>असमानता</td>
</tr>
<tr>
<td>43.</td>
<td>Extraordinary</td>
<td>असाधारण</td>
</tr>
<tr>
<td>44.</td>
<td>Provisional</td>
<td>असाध्यता</td>
</tr>
<tr>
<td>45.</td>
<td>Income Tax</td>
<td>आयकर</td>
</tr>
<tr>
<td>46.</td>
<td>Bona fide</td>
<td>असारी</td>
</tr>
<tr>
<td>47.</td>
<td>Acting in Official Capacity</td>
<td>बैठक पर अधिकारिक हैसियत</td>
</tr>
<tr>
<td>48.</td>
<td>Contractor</td>
<td>ठेकेदार</td>
</tr>
<tr>
<td>49.</td>
<td>On probation</td>
<td>परिशीलता प्रयास</td>
</tr>
<tr>
<td>50.</td>
<td>State</td>
<td>राज्य</td>
</tr>
<tr>
<td>51. Administrator</td>
<td>प्रशासक</td>
<td>पुरी, पुराण, प्रशासनिक अद्यावधि</td>
</tr>
<tr>
<td>52. Admission</td>
<td>प्रवेश</td>
<td>पुरी, पुराण, प्रशासनिक अद्यावधि</td>
</tr>
<tr>
<td>53. Aforesaid</td>
<td>पूर्ववाक्य, उपरोक्त</td>
<td>पुरी, पुराण, प्रशासनिक अद्यावधि</td>
</tr>
<tr>
<td>54. Affidavit</td>
<td>शपथपत्र</td>
<td>पुरी, पुराण, प्रशासनिक अद्यावधि</td>
</tr>
<tr>
<td>55. Agenda</td>
<td>कार्यसूची</td>
<td>पुरी, पुराण, प्रशासनिक अद्यावधि</td>
</tr>
<tr>
<td>56. Alma Mater</td>
<td>विद्यालय जगत की विषयन ने शिक्षा प्राप्त की</td>
<td>सैनिक, वेदांत, पुरी</td>
</tr>
<tr>
<td>57. Appointing Authority</td>
<td>प्रशीत</td>
<td>विशेष विशेषज्ञ, विशेषज्ञ-भर्ती</td>
</tr>
<tr>
<td>58. Apprentice</td>
<td>विशेषज्ञ</td>
<td>विशेष विशेषज्ञ, विशेषज्ञ-भर्ती</td>
</tr>
<tr>
<td>59. Additional</td>
<td>अतिरिक्त</td>
<td>विशेष विशेषज्ञ, विशेषज्ञ-भर्ती</td>
</tr>
<tr>
<td>60. Advertisement</td>
<td>विज्ञापन</td>
<td>शंभु, शंभ</td>
</tr>
</tbody>
</table>
1.2 BASIC CHEMISTRY

L T P
3 - 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.

DETAILED CONTENTS

1. Basic concepts (8 hrs)

1.1 Units and Dimensions, derived units (with special reference to pressure, volume, temperature, density, specific gravity)

1.2 Matter, element, compound and mixtures, atom, molecule, ion, symbols and formulae (recapitulation only)

1.3 Atomic mass (A), molar mass, mole concept and its applications, molar volume of gases

1.4 Solution, strength of solutions, molarity (M), molality (m), normality (N), mass fraction, mole fraction and parts per million.

1.5 Chemical equations and balancing of chemical equations.

1.6 Numerical problems based on mole concept.

2. Atomic structure and Chemical Bonding (8 hrs)

2.1 Fundamental particles i.e. electron, proton and neutron (their masses and charges)

2.2 Postulates of Bohr’s model of atom, success and failures of Bohr model.
2.3 Heisenberg’s uncertainty principle

2.4 Brief idea of modern concept of atom, quantum numbers (significance only), definition of shells, sub shells and orbitals. Difference between orbit and orbital shapes of \( S \) and \( p \) orbitals only.

2.5 Electronic configuration of elements (atomic no. 1-30 only) on the basis of Afban principle, Pauli’s principle and Hund’s rule.

2.6 Modern periodic law, periodicity and its cause, introduction of periodic table, periods and groups.

2.7 Division of the periodic table into \( s \), \( p \), \( d \), and \( f \) blocks (details excluded)

2.8 Chemical bonding and its cause

2.9 Ionic bond, covalent bond, orbital concept of covalent bonding, valence bond theory, sigma (\( \sigma \)) and pi (\( \pi \)) bonds.

2.10 Metallic bonding (electron sea model)

2.11 Coordinate bond with examples of ozone, ammonium chloride, \( H_3N-BF_3 \) complex

3. Water (9 hrs)

3.1 Sources of water
3.2 Hard and soft water, types of hardness, action of soap on hard water
3.3 Degree of hardness in terms of calcium carbonate, Units of hardness in Clark degree, French degree and ppm
3.4 Disadvantages of hard water in domestic and industrial uses
3.5 Qualities of drinking water and purification of available water for drinking purposes
3.6 Chemical analysis: Estimation of alkalinity, estimation of total dissolved solids.

4. Equilibrium, Acids and Bases. (9 hrs)

4.1 Equilibrium state, equilibrium constant and statement of Le-chatelier’s principle with illustration
4.2 Ionization of electrolyte in aqueous solution, ionic equilibrium, degree of ionization, self-ionization of water and ionic product of water (\( K_w \))
4.3 Concept of pH and pH scale
4.4 Various concept of acids/bases; strong acids/bases, weak acids/bases, dissociation constants of acids/bases. Neutralization, acid base titration, choice of indicators for acid base titration

4.5 Hydrolysis of salts, common ion effect, buffer solutions (acidic and basic), buffer action of a buffer solution, applications of buffers

4.6 Simple numerical problems

5. Electrochemistry. (9 hrs)

5.1 Electronic concept of oxidation and reduction, redox reactions

5.2 Electrolytes and non electrolytes

5.3 Conductors and their types.

5.4 Electrolysis, Faraday's laws of electrolysis.

5.5 Applications of electrolysis

5.6 Simple numerical problems related to Faraday’s laws

6. Surfaces and Colloids (5 hrs)

6.1 Adsorption and its types

6.2 Applications of adsorption

6.3 Colloidal state and types of colloids

6.4 Preparation and purification of colloids in brief

6.5 Properties of colloids brownian motion, electrophoresis and Tyndall Effect

6.6 Gels and Sols, emulsions

6.7 Micelles and cleaning action of soaps
LIST OF PRACTICALS

1. Preparation of standard solutions.

2. To prepare N Sodium carbonate
   \[ \frac{10}{10} \]

3. To prepare M oxalic acid solution
   \[ \frac{10}{10} \]

4. To prepare 5N Hcl from given 12 NHcl.

5. To determine strength of given solution of sodium hydroxide by titrating against standard solution of oxalic acid using phenolphthalein indicator.

6. To determine strength of given solution of sulphuric acid by titrating against standard solution of sodium carbonate using methyl orange indicator.

7. To determine %age of purity of green vitriol by using potassium permanganate solution.

8. Determine the normality and strength of Mohr’s salt.

9. To verify the first law of electrolysis

10. To distinguish between aldehyde and ketone

11. To prepare crystals of Mohr’s salt

12. To prepare colloidal solution of starch.
INSTRUCTIONAL STRATEGY

Teacher may take help of various models and charts while giving instructions to make the concepts 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 details, which may find practical applications in their future life.

RECOMMENDED BOOKS


4. Progressive Applied Chemistry – I by Dr. G.H. Hugar Eagle Prakashan Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time Allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

SEMESTER II
2.2 ORGANIC CHEMISTRY

RATIONALE

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

DETAILED CONTENTS

1. Organic chemistry (2 hrs)
   - Introduction and importance of organic compounds
   - Comparison of organic and inorganic compounds
   - Properties of carbon

2. IUPAC Nomenclature of organic compounds (4 hrs)
   - 2.1 Hydrocarbons
   - 2.2 Alcohols and Ethers
   - 2.3 Aldehydes and Ketones
   - 2.4 Carboxylic Acids

3. Hydrocarbons (6 hrs)
   - 3.1 Preparation, properties and uses of saturated hydrocarbons
   - 3.2 Preparation, properties and uses of unsaturated hydrocarbons
   - 3.3 Sources of hydrocarbons
   - 3.4 Preparation, properties and uses of Halogen derivatives of hydrocarbons

4. Alcohols and ethers (5 hrs)
   - General introduction, classification, preparation and properties and uses of:
4.1 Methyl alcohol, Ethyl alcohol and glycerol
4.2 Diethyl ether

5. Aldehydes and ketones (5 hrs)

General introduction, classification, preparation and properties and uses of:

5.1 Methanal and ethanal
5.2 Propanone

6. Carboxylic Acids (5 hrs)

General Introduction, classification, preparation, properties and uses of

Methanoic acid
Ethanoic acid

7. Carbohydrates (6 hrs)

7.1 Definition
7.2 Optical Activity and mutarotation
7.3 Composition and sources
7.4 Classification
7.5 Reactions
7.6 Important monosaccharides, disaccharides, polysaccharides
7.7 Breakage of glucose, fructose, galactose, lactose, maltose
7.8 Role of carbohydrates
8. Lipids

8.1. Definition
8.2. Classification
8.3. Introduction to fatty acids, phospholipids, triglycerides, sterol, ergosterol, cholesterol
8.4. Reactions of fats
8.5. Role of lipids

9. Proteins

9.1. Definition
9.2. Classification
9.3. Composition, molecular weight and hydrolysis
9.4. Name of various amino acids
9.5. Structure and properties of proteins
9.6. Role of proteins
9.7. Colour reactions

10. Enzymes

10.1 Definition
10.2 Classification
10.3 Chemical nature of enzymes
10.4 Properties of Enzymes
10.5 Factors affecting enzyme activity
10.6 Enzyme Inhibitors
10.7 Enzymes of Diagnostic Importance
LIST OF PRACTICALS

1. Iodometric titrations oxidation reduction titrations, Acid-base titrations
2. Saponification of fatty acids
3. Distinction between aldehydes and ketones
4. Detection of carbohydrates
5. Detection of proteins
6. Detection of lipids

RECOMMENDED BOOKS

1. Modern’s Abc of Chemistry Vol I and II by Dr. S.P.Jauhar, Modern Publishers, New Delhi
2. A textbook of Biochemistry and Clinical Pathology by Sukhdev Singh and Om Parkash

SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>9</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
2.3 ANATOMY AND PHYSIOLOGY - II

RATIONALE

The students are supposed to have basic knowledge of structure of body, their anatomical parts, physiological functions. 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.

DETAILED CONTENTS

Theory

1. Nervous system
   1.1 Central nervous system (brain and spinal cord)
   1.2 Peripheral nervous system (cranial and spinal nerves)
   1.3 The sense organs (eye, ear, tongue and nose); structure and functions

2. Muscular system
   2.1 Brief description of skeletal, smooth and cardiac muscles
   2.2 Muscle fatigue

3. Circulatory system
   3.1 Composition and functions of blood
   3.2 Anatomy and physiology of Heart
   3.3 Circulation of blood, Cardiac Cycle and Conducting System of Heart
   3.4 The blood pressure
   3.5 Arteries and viens
   3.6 Lymph and lymphatic system

4. Endocrine system
   (8 hrs)
   Description of each endocrine gland its secretions and their effect on the body

5. Reproductive System
   (8 hrs)
   5.1 Male and female reproductive system
   5.2 Histology of gonads
   5.3 The ovarian cycle and ovulation
   5.4 Fertilization
6. **E.C.G.**  (6 hrs)

6.1 Introduction and basic principle of E.C.G.
6.2 Types of Leads and Importance of E.C.G.
6.3 Care and Maintenance of E.C.G. Machine

**LIST OF EXPERIMENTS**

1. Demonstration of various parts of skin (Demonstration from models)
2. Demonstration of various parts of nervous system (brain and spinal cord) (Model)
3. Structure of eye and ear (demonstration from models)
4. Demonstration of structural differences between skeletal, smooth and cardiac muscles (permanent mounts)
5. Demonstration of various bones and joints
6. Demonstration of various parts of reproductive system (male and female from models and charts)
7. Demonstration of E.C.G. Machine
8. Performance of E.C.G.

**RECOMMENDED BOOKS**

1. Anatomy and Physiology by Pears; JP Brothers, New Delhi
2. Anatomy and Physiology by Sears; ELBS, London
3. Basic Anatomy and Physiology by N Murugesh; Sathya Publishers, Madurai

**SUGGESTED DISTRIBUTION OF MARKS**

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
RATIONALE

The students undergoing training of medical laboratory technology learn the knowledge of basic morphology, staining, culture, biochemical characteristics and lab-diagnosis of pathogenic bacteria. In addition to this, they are also made aware about the examination of bacteria present in milk and water.

DETAILED CONTENTS

Theory

1. Bacteriology (22 hrs)

   - General characteristics of bacteria - morphology, staining, culture, biochemical

   - Characteristics and Lab diagnosis of:

     1.1 Staphylococi
     1.2 Streptococci and pneumococci
     1.3 Corynebacterium diptheria
     1.4 Enterobacteriaceae - I (E coli, Klebsiella, Enterobacter)
     1.5 Enterobacteriaceae – II (Salmonella, Shigella, Proteus)
     1.6 Pseudomonas
     1.7 Vibrio Cholerae
     1.8 Neisseria
     1.9 Clostridium
     1.10 Treponema Pallidium
     1.11 Mycobacterium tuberculosis
2. Bacteriological examination of: (6 hrs)

   2.1 Water
   2.2 Milk

3. Bacterial pathogenicity (4hrs)

   3.1 Definition of pathogenicity, pathogenesis and virulence
   3.2 Sources of infection
   3.3 Mode of spread of infection
   3.4 Types of infection
4. Nosocomial Infection (6 hrs)
   4.1 Introduction
   4.2 Common types and source of nosocomial infection
   4.3 Control of nosocomial infections

5. Laboratory diagnosis of infectious diseases (10 hrs)
   5.1 Respiratory tract infections
   5.2 Wound and skin infections
   5.3 Urinary tract infections
   5.4 Genital tract infection
   5.5 Gastro intestinal infections
   5.6 PUO/Enteric fever

LIST OF PRACTICALS

1. Collection, transportation of clinical samples, processing including culture of following clinical samples for identification of pathogens – Urine, Stool, Sputum, Throat swabs, Pus and Pus swabs, Blood, Skin, Eye and Ear swabs and CSF

2. Identification of pure bacterial cultures of common pathogens.

3. Bacteriological examination of water and milk samples

INSTRUCTIONAL STRATEGY

The teacher should lay stress on general characteristics of bacteria, morphological features, nomenclature of bacterial for common use. The students should be made familiar with common names of bacteria and stress on correct use of bacterial pronunciation and spellings. The students should be taught with illustrations/audio-visual aids.

RECOMMENDED BOOKS

1. Textbook of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
2. Practical Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi

3. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworth – Heinemann; Oxford

4. Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai

5. Medical Laboratory Technology by Kanai Lal Mukherjee; Tata McGraw Hill, New Delhi

6. Medical Laboratory Manual for Tropical Countries Vol. I and II by Monica Cheesbrough; Cambridge University Press; UK

7. Text Book of Microbiology by Ananthanarayan and Paniker; Orient Longman, Hyderabad


9. Textbook of Medical Microbiology by Greenwood, ELBS


SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>100</td>
</tr>
</tbody>
</table>
RATIONAL

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.

DETAILED CONTENTS

Theory

1. Haemoglobinometry (12 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 cyanmethaemoglobin method

2. Haemocytometry (18 hrs)
   2.1 Various counting chambers
   2.2 Methods of counting of RBC, WBC and platelets, their calculation and reference values.
   2.3 Errors involved in haemocytometry and means to minimize them

3. Differential leucocyte counting (DLC) (06 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
4. Quality Assurance in haematology such as accuracy, precision etc. (06 hrs)
5. Automation in haematology such as blood cell counters (06 hrs)

LIST OF PRACTICALS

1. Preparation of peripheral blood film and recognition of different cellular components
2. Preparation and standardization of stains (leishman and giemsa)
3. Preparation of thick and thin blood smear
4. Haemoglobin Estimation by Oxy-Hb and Cyanmethaemoglobin method
5. Counting of RBC
6. Counting of WBC
7. Platelet counting
8. Absolute eosinophil counting
9. Study of morphology of normal RBC and WBC with the help of stained slide
10. To study abnormal morphology of RBC with the help of stained slide
11. To study abnormal morphology of WBC with the help of stained slide
12. To study abnormal morphology of platelet with the help of stained slide

RECOMMENDED BOOKS

2. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinmann, Oxford

3. Medical Laboratory Manual for Tropical Countries by Monica Cheesbrough; Cambridge University Press, UK

4. Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai

5. Practical Haematology by JV Decei; ELBS with Curchill Living Stone; UK


**SUGGESTED DISTRIBUTION OF MARKS**

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>40</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
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 chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of the different tests is obtained. The students are also given basic training in safety measures, quality control and automation

DETAILED CONTENTS

Theory

1. Blood glucose/ sugar estimation, screening test and glucose tolerance test (GTT) (12 hrs)
   1.1 Principle and methods of estimation
   1.2 Reference values
   1.3 True and apparent sugar
   1.4 Renal threshold
   1.5 Importance and Performance of ST/GTT
   1.6 Clinical importance of blood sugar, ST/GTT

2. Blood urea (8 hrs)
   2.1 Formation and excretion of urea
   2.2 Principle and procedures of different methods of urea estimation
   2.3 Reference values
   2.4 Clinical Importance

3. Serum Creatnine (4 hrs)
   3.1 Principle and procedure of various estimation methods
   3.2 Reference values
3.3 Clinical importance

4. Serum proteins (8 hrs)

4.1 Definition and types
4.2 Different methods of estimation including principles and procedures
4.3 Reference values
4.4 Clinical importance

5. Electrolytes and trace elements (8 hrs)

5.1 Functions of electrolytes (Na⁺, K⁺ and Cl⁻).
Other essential elements like P, Ca²⁺, Fe²⁺. Metabolism of these ions
5.2 Principles and procedures of estimation of Na⁺, K⁺, Cl⁻.
5.3 Reference values
5.4 Clinical importance

6. Uric Acid (4 hrs)

6.1 Principles and procedures various estimation methods
6.2 Reference values
6.3 Clinical Importance

7. Quality Assurance in Biochemistry as per National Standards (4 hrs)

7.1. Internal quality assurance
7.2. External quality assurance

LIST OF PRACTICALS

1. Estimation of blood glucose/sugar (Folin-Wu method, O-toluidine method and enzymatic method)

2. Performance of ST/GTT
3. Serum urea estimation
4. Serum creatinine estimation
5. Serum uric acid estimation
6. Plasma and serum protein estimation
7. Estimation of electrolyte levels of Na⁺, K⁺ and Cl⁻ by flame photometer and kit method
8. Preparation of all types of reagents

RECOMMENDED BOOKS
2. A Textbook of Medical Laboratory Technology by P Godkar; Bhalani Publishing House, Mumbai

SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>100</td>
</tr>
<tr>
<td>-------</td>
<td>----</td>
<td>-----</td>
</tr>
</tbody>
</table>

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development

2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table

3. Sources of pollution - natural and man made, their effects on living and non-living organisms

4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms

5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms

6. Sources of noise pollution and its effects

7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods

8. Mining, blasting, deforestation and their effects
9. Legislation to control environment

10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements

11. Current issues in environmental pollution and its control

12. Role of non-conventional sources of energy in environmental protection

SEMESTER III

3.1 CLINICAL MICROBIOLOGY- III
(Parasitology and virology)

<table>
<thead>
<tr>
<th>L</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

RATIONALE

The students undergoing training of medical laboratory technology learn the techniques of collection of samples, their processing and identification of various pathogens like parasites and viruses by using different techniques. In addition to the above, students are given training in the use of safety measures while handling infected materials. The training is aimed at making the students competent to identify the causative parasites and viruses for microbial infections.

DETAILED CONTENTS

Theory

1. Introduction to medical parasitology (2 hrs)

2. General characteristics, morphology, classification (2 hrs)
   
   2.1 Protozoa
   
   2.2 Helminths

3. Laboratory Samples (2 hrs)
Collection, transportation, processing and preservation of samples for routine investigations – Blood, stool

4. Concentration techniques (6 hrs)

- Principle and application of concentration techniques of stool for demonstration of ova and cysts

5. Giardia and Entamoeba histolytica (5 hrs)

- Morphology
- Life cycle
- Lab diagnosis

6. Ancylostoma and Ascaris lumbricoides (6 hrs)

- Morphology
- Life cycle
- Lab diagnosis

7. T solium, T saginata (5 hrs)

- Morphology
- Life cycle
- Lab diagnosis
8. Malarial Parasite (P. Vivax and P. Falciparum) (6 hrs)
   - Morphology
   - Life cycle
   - Lab diagnosis

9. Virology (4 hrs)
   - Introduction
   - General Characteristics, Classification Structure of virus.

10. Medically important viruses (6 hrs)
    Pathogenicity, Lab diagnosis and prevention of –
    - Rabies
    - Polio
    - HIV
    - Influenza

11. Virological Samples (4 hrs)
    - Collection
    - Transportation
    - Storage

LIST OF PRACTICALS

1. Collection and routine stool examination for detection of intestinal parasites
   - Saline preparation
   - Lugol's Iodine preparation
   - Concentration methods
     a) Floatation method (saturated salt solution/zinc sulphate)
     b) Centrifugation method (formal ether)

2. Identification of following adult worms from preserved specimen/slides
   - Tapeworm
   - Roundworm
   - Hookworm
   - Giardia
- Entamoeba hystolytica, E. Coli

3. Preparation and identification of blood parasites
   - Preparation of stains (Leishman, Giemsa Field)
   - Preparation of thin and thick smears
   - Staining of smears by Leishman, Giemsa Field
   - Examination of smears for malarial parasite (P. vivax and P. falciparum)
   - Demonstration of various stages of malarial parasite from stained slides
INSTRUCTIONAL STRATEGY

The teacher should lay emphasis on common names, morphology of helminith and blood parasites. The students should be shown diagrams/illustration/permanent fixed slides and audio-visual aids. The students should be made aware about medically important viruses, collection and cultivation of viruses.

RECOMMENDED BOOKS

1. Parasitology by KD Chatterjee; Chatterjee Medical Publishers, Kolkatta
2. Pledical Parasitology by Arora & Arora
3. An introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinemann Oxford
4. Text Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
5. Textbook of Microbiology by Ananthanarayan and Panikar; Orient Longman, Hyderabad
6. Text Book of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House; Mumbai
7. Medical Laboratory Manual for Tropical Countries Vol. I and II by Monica Cheesbrough; Cambridge University Press; UK
8. Practical Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
9. Medical Laboratory Science Theory and Practice by J Ochei and A Kolhatkar
10. Medical Laboratory Science by J. Achie and Kolhatkar, Tata McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>100</td>
</tr>
</tbody>
</table>
3.2 HAEMATOLOGY - III

L T P
3 - 4

RATIONALE

This subject aims to enable the students to carry out routine clinical laboratory investigation (blood, urine etc). He/she should be able to provide technical help for selected sophisticated hematological techniques with adequate knowledge of various principles. The training in laboratory safety is also provided.

DETAILED CONTENTS

Theory

1. Erythrocyte sedimentation rate (ESR) and packed cell volume (PCV) (12 hrs)
   1.1 Introduction
   1.2 Various methods of estimation of ESR and PCV and their merits and demerits
   1.3 Factors involved in ESR
   1.4 Interpretation of results

2. Red Cell indices (Mean Corpuscular Values) – MCV, MCH, MCHC (5 hrs)
   Theory, reference range, calculation and interpretation

3. Supravital stain and reticulocyte counting (7 hrs)
   3.1 Introduction
   3.2 Principle and procedure of staining and calculation
   3.3 Reference values and interpretation
   3.4 Variation in Physiological Values

4. Anemias (16 hrs)
   4.1 Definition and classification
   4.2 Laboratory diagnosis of:
      (a) Iron deficiency anaemia
      (b) Megaloblastic anaemia
      (c) Haemolytic anaemia
(d) Aplastic anaemia

5. Red cell fragility test (8 hrs)
   5.1 Principle and procedure
   5.2 Clinical importance
LIST OF PRACTICALS

1. ESR estimations (wintrobe and westergren) in blood
2. Determination of PCV (wintrobe and capillary) in blood
3. Counting of Reticulocyte in blood
4. To perform red cell fragility test on blood
5. To perform Sickling test on blood
6. Estimation of foetal haemoglobin by alkali denaturation test
7. Estimation of plasma haemoglobin and G6PD (MRT)

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 audiovisual aids to show specific processes. Experts should be invited to deliver lectures on specific topics and share their experiences.

RECOMMENDED BOOKS

2. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Heinenmann, Oxford
3. Medical Laboratory Manual for Tropical Countries by Monica Cheesbrough; Cambridge University Press; UK
4. Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai
5. Practical Haematology by J.V Decie; ELBS with Churchill Living Stone, UK

**SUGGESTED DISTRIBUTION OF MARKS**

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>35</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
RATIONAL

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 chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of the different tests is obtained. The students are also given basic training in safety measures, quality control and automation.

DETAILED CONTENTS

Theory

1. Serum Bilirubin (6 hrs)
   1.1 Formation and excretion of bilirubin
   1.2 Formation of bile pigments
   1.3 Conjugated and unconjugated bilirubin
   1.4 Principle and procedures of serum bilirubin estimation (Direct & Indirect)
   1.5 Reference values
   1.6 Clinical importance

2. Urinary Proteins and Creatinine (4 hrs)
   2.1 24 hr. urinary proteins and creatinine estimation
   2.2 Reference values
   2.3 Clinical importance

3. SGOT and SGPT (6 hrs)
   3.1 Principle and procedures of estimation
   3.2 Reference values
   3.3 Clinical importance

4. ALP and ACP (6 hrs)
4.1 Principle and procedures of estimation
4.2 Reference values
4.3 Clinical importance
5. Serum Amylase  
   5.1 Principle and procedures of estimation  
   5.2 Reference values  
   5.3 Clinical importance  

6. Renal Function Tests  
   6.1 Renal clearance test-Principle and procedures  
   6.2 Clinical importance  

7. Serum Calcium and Phosphorus  
   7.1 Principle and procedures of estimation  
   7.2 Reference values  
   7.3 Clinical importance  

8. Lipid Profile  
   8.1 Formation of cholesterol  
   8.2 High density and low density cholesterol  
   8.3 Principles and procedures of estimation  
   8.4 Reference value  
   8.5 Clinical importance  
   8.6 Triglycerides  
   8.7 Estimation and importance of various ratios of HDL, LDL and VLDL  

LIST OF PRACTICALS  

1. Serum bilirubin estimation  
2. Phosphorus estimation  
3. Calcium estimation  
4. Renal clearance tests  
5. SGOT estimation  
6. SGPT estimation  
7. ALP estimation  
8. ACP estimation  
9. Total cholesterol estimation
10. Triglyceride estimation
11. Estimation of HDL and calculation of VLDL and LDL
12. Urinary protein and creatinine estimation (24 hr)
13. Estimation of serum amylase
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.

RECOMMENDED BOOKS

3. A Text Book of Medical Laboratory Technology by P Godkar; Bhalani Publishers, Mumbai

SUGGESTED DISTRIBUTION OF MARKS

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
RATIONAL

This part of the 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. Cytology part aims at exposing the students to the latest advancements in cytological investigations.

DETAILED CONTENTS

Theory

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

2. Preparation of Tissue (Different Methods of Preparation of Tissue) (2 hrs)
   2.1 Unfixed Tissue preparations
      2.1.1 Imprint methods – Impression Smears
      2.1.2 Teased preparation
      2.1.3 Squashed preparation
      2.1.4 Frozen section
2.2 Fixed Tissue preparations (introduction only)

2.2.1 Paraffin embedding
2.2.2 Celloidin embedding
2.2.3 Gelatin embedding
3. Reception of Specimen (1 hr)

3.1 Reception, recording, labeling and preservation of histological specimen

4. Fixation (Histological Specimens) (6 hrs)

4.1 Classification of fixatives
4.2 Composition of various fixatives
4.3 Advantages and disadvantages

5. Processing (by Paraffin Technique) (6 hrs)

5.1 Dehydration
5.2 Clearing/Dealcoholization
5.3 Infiltration and impregnation
5.4 Paraffin embedding
5.5 Automation: Histokinete (automatic tissue processor)
  - its types, working, care and maintenance

6. Microtomy (7 hrs)

6.1 Microtome

6.1.1 Types
6.1.2 Advantages and disadvantages
6.1.3 Working principle, care and maintenance

6.2 Microtome Knives

6.2.1 Various types of knives
6.2.2 Sharpening of knives

- Honing technique
- Stropping technique
- Automation: Automatic knife sharpener – uses, care and maintenance
- Uses of abrasives and lubricants

6.3 Section Cutting

6.3.1 Rough cutting
6.3.2 Fine cutting
6.3.3 Use of tissue floatation bath
6.3.4 Use of various adhesive media and lifting of sections to the slide
6.3.5 Errors/cutting faults in sections and their remedies
7. Theory of staining (Routine) (5 hrs)

7.1 Dye Chemistry

7.2 Principle and mechanism of routine stain (Haematoxylin and Eosin)

7.3 Various steps of staining (Haematoxylin and Eosin)

- Deparaffinization
- Hydration
- Nuclear Staining
- Differentiation
- Blueing
- Counterstaining
- Dehydration
- Clearing and Mounting
- Results

7.4 Automation: Use of automatic stainer and coverslipper

8. Mountants (2 hrs)

8.1 Various types of mounting media (aqueous, resinous)

8.2 Advantages and Disadvantages

9. Various Terms associated with staining (4 hrs)

9.1 Solvents
9.2 Mordants
9.3 Metachromasia
9.4 Accelerators
9.5 Progressive and regressive staining
9.6 Use of controls in staining and their significance

10. Cell (2 hrs)

10.1 Definition and function
10.2 Structure

11. Exfoliative Cytology (4 hrs)

11.1 Introduction

11.2 Preparation of vaginal & cervical smears

11.3 Collection and Processing of specimen for cytology

- Urine
- Sputum
- CSF (Cerebro Spinal Fluid)
- Other fluids
12.  Fixation (Cytological Specimen)  

12.1 Definition  
12.2 Various types of Cytological fixatives  
12.3 Advantages and Disadvantages  

13.  Cytological Staining  

Principle, Technique and interpretation of results in  

- Papanicalaou staining  
- May Grunwald & Giemsa staining  
- Haematoxylin and Eosin staining  

14  Role of Laminar airflow and cytotechnician in cytology  

LIST OF PRACTICALS  

1.  Reception of specimen, labeling and preserving the 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 formaline based fixatives  
4.  Preparation of paraffin blocks from various tissue pieces and labeling with emphasis on orientation  
5.  Handling of microtome  
6.  Sharpening of microtome knives  
7.  Preparation of blocks for fine cutting  
   
   - Rough cutting  
   - Trimming  
8.  Practice of fine section cutting  
9.  Practice of lifting of sections on the slides  
10. Performing H&E staining on sections  
11. Mounting and labeling of tissue section using various mounting medias
12. Demonstration of cell
13. Processing of urine samples for malignant cells
14. Processing of sputum sample for malignant cytology
15. To perform PAP stain on given smear
16. To perform MGG stain on given smear
17. 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 audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

1. An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Scientific, London
2. Carleton’s Histological Technique by RAB, Drury, MADM (OXON), FRC Path, Northwick Paru Hospital, Harrow, Middlesex
4. Cellular Pathology Techniques by CFA Culling, Butterworths, London
5. Medical Lab Technology by Dr. Ramnik Sood, MD, Maulana Azad College, New Delhi

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time Allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>---</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
3.5 BASICS OF INFORMATION TECHNOLOGY

RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. 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 tools of MS Office/Open Office using internet etc. form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:
Explanation of Introductory part should be dovetailed 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. Information Technology – its concept and scope, applications of IT, impact of computer and IT in society.
2. Computers for information storage, information seeking, information processing and information transmission
3. Computer Application in office, book publishing, data analysis, accounting, investment, inventory control, graphics, Air and Railway Ticket reservation, robotics, Military, banks, Insurance financial transactions and many more
4. Elements of computer system, computer hardware and software; data types – numeric data, alpha numeric data; contents of a program, processing
5. Computer organization, block diagram of a computer, CPU, memory
6. Input devices; keyboard, Scanner, mouse etc; output devices; VDU and Printer, Plotter
7. Electrical requirements, inter-connections between units, connectors and cables
8. Secondary storage; magnetic disks – tracks and sectors, optical disk (CD, CD-RW and DVD), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
9. Installation concept and precautions to be observed while installing the system and software
10. Introduction about Operating Systems such as MS DOS, Windows, Windows NT etc. as an interface to Computer System

11. Special features, various commands of MS Office/Open Office

12. About the internet – server types, connectivity (TCP/IP, shell); applications of internet like: e-mail and browsing

13. Various Browsers like Internet explorer, Mozilla Firefox, WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)


15. Ethics and information Technology

16. Future with information Technology

LIST OF PRACTICALS

1. **Given a PC, name its various components and peripherals. List their functions**
2. Practice in installing a computer system by giving connection and loading the system software and application software
3. Exercises on entering text and data (Typing Practice)
4. Installation of operating System viz. Windows XP, Windows 2007 etc..

   Features of Windows as an operating system
   - Start
   - Shutdown and restore
   - Creating and operating on the icons
   - Opening closing and sizing the windows
   - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
   - Creating and operating on a folder
   - Changing setting like, date, time, colour (back ground and fore ground)
   - Using short cuts
   - Using on line help

5. **Word Processing (MS Office/Open Office)**
   - File Management:
     - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, Giving password protection for a file
   - Page Set up:
     - Setting margins, tab setting, ruler, indenting
   - Editing a document:
     - Entering text, Cut, copy, paste using tool- bars
Formatting a document:
- Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
- Aligning of text in a document, justification of document, inserting bullets and numbering
- Formatting paragraph, inserting page breaks and column breaks, line spacing
- Use of headers, footers: Inserting footnote, end note, use of comments
- Inserting date, time, special symbols, importing graphic images, drawing tools

Tables and Borders:
- Creating a table, formatting cells, using different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
- Print preview, zoom, page set up, printing options
- Using Find, Replace options
- Using Tools like:
  - Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels
  - Using shapes and drawing toolbar,
  - Working with more than one window in MS Word,
  - How to change the version of the document from one window OS to another
  - Conversion between different text editors, software and MS word

6. Spread Sheet Processing (MS Office/Open Office)
- Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, create chart, printing chart, save worksheet, switching between different spreadsheet sheets
- Menu commands:
  - Create, format charts, organise, manage data, solving problem by analyzing data, exchange with other applications. Programming with Excel Work Sheet, getting information while working
- Work books:
  - Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations, working with arrays
- Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet
- Creating a chart:
  - Working with chart types, changing data in chart, formatting a chart, use chart to analyze data
- Using a list to organize data, sorting and filtering data in list
- Retrieve data with query: Create a pivot table, customising a pivot table. Statistical analysis of data
- Exchange data with other application: embedding objects, linking to other applications, import, export document.

7. PowerPoint Presentation (MS Office/Open Office)
   a) Introduction to PowerPoint
      - How to start PowerPoint
      - Working environment: concept of toolbars, slide layout, templates etc.
      - Opening a new/existing presentation
      - Different views for viewing slides in a presentation: normal, slide sorter etc.
   b) Addition, deletion and saving of slides
   c) Insertion of multimedia elements
      - Adding text boxes
      - Adding/importing pictures
      - Adding movies and sound
      - Adding tables and charts etc.
      - Adding organizational chart
   d) Formatting slides
      - Using slide master
      - Text formatting
      - Changing slide layout
      - Changing slide colour scheme
      - Changing background
      - Applying design template
   e) How to view the slide show?
      - Viewing the presentation using slide navigator
      - Slide transition
      - Animation effects etc.

8. Working with Data Processing (MS Office/Open Office)
   a) Understanding different data types
   b) Creation of table
c) Entering data in a table and modify it.
d) Creating simple Queries

9. Internet and its Applications
   a) Log-in to internet
   b) Navigation for information seeking on internet
   c) Browsing and down loading of information from internet
   d) Sending and receiving e-mail
      - Creating a message
      - Creating an address book
      - Attaching a file with e-mail message
      - Receiving a message
      - Deleting a message

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. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi

9. On Your Marks - Net...Set...Go... Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi

10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar
3.6 TRANSFUSION MEDICINE

(Blood Banking)

L  T  P  

3  -  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.

DETAILED CONTENTS

1. Historical introduction to Transfusion medicine (blood banking ) (2 hrs)

2. Development of ABO antigen in red cells (4 hrs)

3. Glassware used in Blood Banking (3 hrs)
   Types of glassware and cleaning agents used
   Cleaning of new and used glassware/plastic ware
   Care of glassware/plasticware

4. Anticoagulants used in blood bank (3 hrs)
   4.1 Types and composition of various anticoagulants
   4.2 Advantages and disadvantages of various anticoagulants

5. Screening of blood donors for: (10 hrs)
   5.1 MP
   5.2 VDRL
5.3 HIV
5.4 HbsAg
5.5 HCV

6. Antigen and Antibody (3 hrs)
6.1 Definition of antigen and antibody
6.2 Classification of antigens and antibodies.

7. ABO Blood Group System (3 hrs)
7.1 Antigens and antibodies involved
7.2 Principle and procedure of ABO blood grouping
7.3 Various other sub groups A1, A2, A1B, A2B

8. The Rh Blood Group System (3 hrs)
8.1 Antigen and antibody involved
8.2 Principle and procedure of Rh grouping
8.3 Variant of D antigen (Du)

9. Coombs Test (3 hrs)
9.1 Direct coombs test (principle, procedure, importance and application)
9.2 Indirect coombs test (principle, procedure, importance and application)

10. Cross Matching (2 hrs)
10.1 Types of cross matching
10.2 Various methods and their procedures
11. Blood Collection and storage (2 hrs)

11.1 Screening of blood donor and characteristics of ideal blood donor.
11.2 Blood collection procedure
11.3 Transportation and storage

12. Various blood components (Packed cells, Fresh frozen plasma, Cryoprecipitate, PRP(Platelet rich plasma) (4 hrs)

12.1 Preparation
12.2 Preservation

13. Blood Transfusion reactions (6 hrs)

LIST OF PRACTICALS

1. Washing and sterilization of glass ware
2. Performing ABO blood grouping by following method:
   - Direct
   - Tube Test
   - Indirect (reverse)
   - Subgroup

3. Performing-Rh grouping by following techniques:
   - Slide
   - Tube technique

4. Performance of Coombs Test
   - Direct
   - Indirect
5. Cross Matching (compatibility testing)
   - Major
   - Minor

6. Preparation of anticoagulants
   - ACD (Acid Citrate Dextrose)
   - CPD (Citrate Phosphate Dextrose)
   - CPDA (Citrate Phosphate Dextrose Analine)

**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**

2. Text book of Modern Lab Technology by Praful and Godker, Bhalani Publisher, Mumbai
4. Modern Blood Banking and Transfusion Practices by Denise M Harmering, Jay Pee Brothers, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS**

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>
The employment opportunities for diploma holders especially in public sector are dwindling. The diploma holders need to explore the possibilities of becoming entrepreneurs. For this, they must be acquainted with entrepreneurship development, scope of setting up small-scale industry, existing business opportunities, financial support available and various aspects of managing business. In this context, an entrepreneurial awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. may be invited to deliver expert lectures. Successful entrepreneurs may also be invited to interact with the students. Students may be encouraged to read papers or give seminar during the camp on Entrepreneurship Development related topics.

The camp 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 self 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

SEMESTER IV

174 Medical Lab Technology
175 **CLINICAL MICROBIOLOGY- IV**
(Immunology and mycology)

**L T P**
3 - 4

**RATIONALE**
The students undergoing training of medical laboratory technology learn the techniques of collection of samples, their processing and identification of various fungal infections and diagnosis of microbial infections by serological methods. In addition to the above, students are given training in the use of safety measures while handling infected materials. The training is aimed to make the students competent to isolate and identify fungi and do serological tests for various microbial infections.

**DETAILED CONTENTS**
1. Mycology (4 hrs)
   - Characteristics and classification of medically important fungi
2. Fungal Culture media (2 hrs)
   - SDA (Sabouraud’s dextrose agar) with and without antibiotics
   - CMA (Corn meal agar)
   - RSA (Rice Starch Agar)
3. Fungal Staining (2 hrs)
   - KOH preparation
   - LCB (Lactophenol cotton blue)
4. Fungal Cultivation (6 hrs)
   - Medically important fungi - Candida, Dermatophytes and Aspergillus
   - Laboratory Contaminants – Penicillium, Rhizopus, Mucor
5. Introduction to Immunology (6 hrs)
   Immunity:
   - Innate and
   - Acquired
6. Antigens (4 hrs)
   - Definition, types and properties
7. Antibodies (4 hrs)
   - Definition, types and properties
8. Antigen – Antibody Reactions (6 hrs)
   - Principle and applications of agglutination, precipitation and flocculation reactions
9. Serological tests (8 hrs)
   I. Principle, techniques and interpretation of
      - Widal - Tube method
      - Anti streptolysin O
      - C-reactive protein
      - VDRL
   II. Principle, techniques and Interpretations of (6 hrs)
      - Latex agglutination
      - ELISA
      - Widal – latex method

**LIST OF PRACTICALS**
Preparation of different culture media used in mycology - Sabouraud’s dextrose agar with and without antibiotics, Corn meal agar, Rice Starch Agar (RSA)
To perform staining techniques – KOH, LCB
To study characteristics of common laboratory fungal contaminants
Collection and processing of samples for diagnosis of fungal infections in skin, hair, nail scrapings
To perform serological tests
   - Widal test (Both slide and tube method)
   - ASO (slide and tube method)
   - CRP (slide and tube method)
   - RA-Slide method
   - VDRL Test (slide and tube method)
   - HIV Test – Strip/Test card method
   - HBsAg Test- Strip/ Test card method

**INSTRUCTIONAL STRATEGY**
The teacher should describe the morphology of important pathogenic and non-pathogenic fungi. The students should be taught to collect and process samples for isolation and identification of fungi. The teacher should emphasize on antigen and antibody tests and quality control in microbiology. The students should be taught with illustrations/audiovisual aids.

**RECOMMENDED BOOKS**
1. Medical Laboratory Technology by Kanai Lal Mukherjee; Tata McGraw Hill Publishers, New Delhi
2. An introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinemann Oxford
3. Textbook of Microbiology by Ananthanarayan and Panikar; Orient Longman, Hyderabad
4. Practical Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
5. Text Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
6. Medical Laboratory Manual for Tropical Countries Vol. I and II by Monica Cheesberg; Cambridge University Press; UK
7. Text Book of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House; Mumbai
8. Medical Lab Science Theory and Practice by J Ochei and A Kolhatkar
9. Text Book of Medical Microbiology by Greenwood, ELBS

**SUGGESTED DISTRIBUTION OF MARKS**

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>48</td>
<td>100</td>
</tr>
</tbody>
</table>

**4.2 HAEMATOLOGY - IV**

**RATIONALE**

This subject aims to enable the students to carry out routine clinical laboratory investigation (blood, urine etc). He/she should be able to provide technical help for sophisticated hematological techniques with adequate knowledge of various principles. The training in laboratory safety is also provided.

**DETAILED CONTENTS**

**Theory**
1. Introduction to normal haemostasis (22 hrs)
2. Theories of blood coagulation
3. Platelets and their role in haemostasis
4. Bleeding disorders and related diseases
5. Principles, clinical importance, reference values and methods of: prothrombin time, prothrombin time index (PTI) International normalized ratio (INR), Activated Partial Thromboplastin time
(APTT) – bleeding time (BT), Hess test, clotting time (CT), and clot retraction test (CRT)
2. Bone – marrow (5 hrs)
2.1 Composition and function of bone-marrow
2.2 Aspiration of bone-marrow by various methods
2.3 Preparation, staining and examination of bone-marrow smears
2.4 Iron staining (Perls’ reaction)
2.5 Significance of bone-marrow examination
3. Leukemia (10 hrs)
3.1 Definition of leukemias
3.2 Classification (FAB)
3.3 Laboratory diagnosis of various leukemias
4. LE Cell phenomenon (3hrs)
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 biological fluids and interpretation of results (8 hrs)
such as semen, CSF, pleural and ascitic fluids, urine

LIST OF PRACTICALS
Determination of bleeding time by Ivy’s and Dukes method
Determination of clotting time by Lee and white and capillary method
Determination of prothrombin time, index and INR (International Normalised Ratio)
Determination of Activated Partial thrombo plastin time (APTT)
Demonstration of Hess test
Performance of Clot retraction test
Demonstration of LE Cell
Processing of biological body fluids

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
Medical Laboratory Technology Vol. 1 by KL Mukherjee; Tata McGraw Hill Publishing Company, New Delhi
An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Heinenmann, Oxford
Medical Laboratory Manual for Tropical Countries by Monica Cheesberg; Cambridge University Press; UK
Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai
Practical Haematology by J.V Decie; ELBS with Churchill Living Stone, UK
Haematology for Medical Technologists by Charles F. Seiverd 5th Ed. 1983, Lea & Febigne Philadelphia

SUGGESTED DISTRIBUTION OF MARKS
Topic No. Time allotted (Hrs) Marks Allotted (%)
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 chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of different tests is obtained. The students are also given basic training in safety measures, quality control and automation.

DETAILED CONTENTS
Theory
1. Urine Analysis (11 hrs)
   1.1 Normal composition of urine and its properties
   1.2 Clinical importance of urine analysis
   1.3 Qualitative analysis of proteins, sugar, bile salts, bile pigments, urobilinogen and blood.
   1.4 Detailed discussion on glycosuria and albuminuria
   1.5 Ketone bodies, 17 Ketosteroids
2. Stool Chemistry (8 hrs)
   2.1 Physical characteristics and chemical composition of stool
   2.2 Significance of presence of blood and excess fat in stool
   2.3 Occult blood detection
3. Cerebrospinal Fluid (5 hrs)
   3.1 Composition and functions of CSF
   3.2 Methods of determination of proteins, sugar and chloride in CSF
   3.3 Reference Values
   3.4 Clinical importance
4. Biological fluids (5 hrs)
   Formation, composition and significance of biological fluids (peritoneal, pleural, synovial, ascitic fluid and gastric juice)
5. Electrophoresis (4 hrs)
   5.1 Theory
   5.2 Principle and procedure of paper, gel electrophoresis, method of elution
   5.3 Clinical importance
6. Chromatography (4 hrs)
   6.1 Theory of Chromatography, separation between stationary and mobile phases
   6.2 Principle and procedure of Paper chromatography
   6.3 Importance of chromatography
7. Automation in Biochemistry (5 hrs)
8. Thyroid function tests
(6 hrs)
8.1 Functions of thyroid
8.2 Principle, reference values and clinical importance of T3, T4 and TSH

LIST OF PRACTICALS
1. Analysis of urine for sugar and proteins (qualitative and quantitative)
2. Detection of ketone bodies in urine
3. Detection of haematuria
4. Detection of bile pigments, bile salts and urobilinogen
5. Occult blood test for stool specimen
6. Estimation of glucose in CSF
7. Estimation of total proteins and globulins in CSF
8. Estimation of chloride in CSF
9. Titration for acidity determination and qualitative analysis of gastric juice
10. Demonstration of electrophoresis (Paper electrophoresis)
11. Demonstration of chromatography (Paper chromatography)

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
Practical Clinical Biochemistry by Varley; Heinmann Publishers, Oxford
A Text Book of Medical Laboratory Technology by P Godkar; Bhalani Publishers, Mumbai
Medical Laboratory Science Theory and Practice by J Ochaei and A Kolhatkar, Tata McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS
Topic No. Time allotted (Hrs) Marks Allotted (%)
1 11 20
2 8 16
3 5 10
4 5 10
5 4 10
6 4 10
7 5 10
8 6 14
Total 48 100

4.4 HISTOPATHOLOGY AND CYTOLOGY - II
L T P
4 - 4

RATIONALE
This part of the subject is aimed at exposing the students to the latest advancements and automation in the field of histopathology and cytology.

DETAILED CONTENT
Theory
1. Light Microscope (11 hrs)
   1.1 Principles of light microscope
   1.2 Various parts of microscope
   1.3 Uses of microscope
   1.4 Cleaning and maintenance of microscope
   1.5 Various attachments of light microscope (introduction only)
       - Polarizing
       - Dark field
       - Phase contrast
       - Fluorescent
2. Special stains (11 hrs)
   2.1 Principle, significance and interpretation of different types of stains
       - PAS
       - Silver impregnation stain – Reticulin fibre
       - Ziehl Neelson’s – for AFB and Leprae
       - Masson’s trichrome stain
       - Pearl’s Prussian Blue – Iron
       - Oil Red O – fat
       - Gram’s stain – Gram +ve and Gram –ve
3. Decalcification (6 hrs)
   3.1 Process of decalcification
   3.2 Various types of decalcifying methods
   3.3 Their mechanism, advantage, disadvantage and applications
   3.4 Assessment of decalcification
4. Handling of fresh histological tissues (Frozen Section) (6 hrs)
   4.1 Reception and processing of frozen tissue
   4.2 Freezing microtome and cryostat
   4.3 Advantages and dis-advantages of freezing microtome and cryostat
   4.4 Working, care, maintenance of freezing microtome and cryostat
   4.5 Frozen section cutting
   4.6 Staining
       - Rapid H&E
       - Fat stain
   4.7 Mounting of frozen section
5. Museum Techniques (10 hrs)
   5.1 Introduction to museum with emphasis on importance of museum
   5.2 Reception, fixation and processing of various museum specimens
   5.3 Preparation of mounting solutions
   5.4 Technique of mounting specimen
   5.5 Care of mounted specimen
   5.6 Cataloguing of museum specimen
6. Autopsy (2 hrs)
   6.1 Introduction to autopsy technique
   6.2 Use of autopsy
7. Malignant Cells (2 hrs)
   7.1 Characteristics
   7.2 Differences from normal cell
8. Harmonal Assessment (2hrs)
   8.1 Introduction
8.2 Uses
9. Sex Chromatin (Barr bodies) (2 hrs)
9.1 Introduction
9.2 Collection of sample
9.3 Staining
9.4 Interpretation
10. Aspiration Cytology (6 hrs)
10.1 Principle of FNAC (Fine Needle Aspiration Cytology)
10.2 Indications of FNAC
10.3 Uses of FNAC
10.4 Staining Techniques
- MGG (May-Grunwald – Giemsa)
- PAP (Papanicolaou Stain)
- H&E (Haematoxylin & Eosin Stain)
11. Cytological special stains (4 hrs)
Principle, Technique & Interpretation of
11.1. PAS (Periodic Acid Schiff’s reagent Stain)
11.2. Zeihl Neelson’s(ZN) Stain (AFB)
12. Advancement (2 hrs)
12.1 Automation in Cytology- Use of Cytospin

LIST OF PRACTICALS
1. Demonstration of various parts of light microscope (Mechanical & Optical)
2. Demonstration of cryostat
3. Processing of tissue for frozen section
4. Staining and mounting of frozen section using H&E stain (rapid method), Oil Red “O”.
5. Preparation of various mounting reagents for museum specimens
6. Demonstration and care of autopsy instruments
7. Demonstration of malignant cell
8. Preparation, Staining and interpretation of buccal smear
9. Preparation of dry smear and wet smear
10. To perform Pap stain
11. Fixation of smears and staining with MGG

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
An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Scientific, London
Carleton’s Histological Technique by RAB, Drury, MADM (OXON), FRC Path, Northwick Paru Hospital, Harrow, Middlesex
Cellular Pathology Techniques by CFA Culling, Butterworths, London
Medical Lab Technology by Dr. Ramnik Sood, MD, Maulana Azad College, New Delhi
Diagnostic Cytology and its Histopathology Basis by Leo Pold G.Koss; JB Lupein,
4.6 MEDICAL LABORATORY MANAGEMENT

L T P

4 - -

RATIONALE
The students are taught techniques of planning a clinical laboratory. They are also supposed to be taught how to procure chemicals, reagents and equipment. The students are imparted special training in maintaining laboratory equipment, the preventive maintenance and daily up-keeping. They are also given training for the maintenance of stocks and inventory. They are also given knowledge of recording results, interpretation, quality control and reproducibility. Students also learn how to communicate effectively.

DETAILED CONTENTS
1. Introduction, Layout, Facility of Lab (8 hrs)
Role of medical laboratory technology in total health care, principles of management, techniques of planning, physical facilities/equipment – layouts and design
2. Laboratory Organization (10 hrs)
Laboratory organization, operation, job description, evaluation, performance
3. Material Required (6 hrs)
Material management, procurement, financial resources, importing, inventory, control and analysis, inspection, storage etc
4. Quality Assurance (10 hrs)
Analytical control, Internal and external quality assurance in clinical laboratories, precision, accuracy, standard deviation as per national standards
5. Safety Precautions (5 hrs)
Safety measures in clinical laboratories (microbiology, haematology, biochemistry, histopathology and cytology, transfusion medicine), Disposal of Biomedical waste.
6. Human Relations and Motivation (4 hrs)
Inter-personal relations, inter and intradepartmental relations and their importance, concept and importance of motivation-drives and incentives; intrinsic and extrinsic motivation
7. Managing Psychological self ( 2 hrs)
- Stress
- Emotions
- Anxiety
8. Leadership
Concept, types, qualities of good leader ( 3 hrs)
9. Medical Ethics and Code of Conduct (8 hrs)
Ethics and code of conduct - legal aspects – confidentiality malpractice/negligence; legal implications, law suits, consumer protection and insurance for professional health hazards
10. Equipment – Care and Maintenance (5 hrs)
Preventive maintenance and care of various laboratory equipment
11. Role of Computers in Lab (3 hrs)
Storage and retrieval of laboratory data manually and with help of computers

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

**RECOMMENDED BOOKS**
1. Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai (India)
2. Text Book of Medical Laboratory Technology by FJ Baker; Butterworths Heinmann Publishers, Oxford
4. Medical Lab Technology by Ramnik Sood, Jay Pee Brothers, New Delhi
5. District Laboratory Practice in Tropical Countries by Monica Chesbrough, Churchill Livingstone.

**SUGGESTED DISTRIBUTION OF MARKS**

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Time allotted (Hrs)</th>
<th>Marks Allotted (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>64</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**PERSONALITY DEVELOPMENT AWARENESS CAMP**

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person Interviews; Telephonic Interview’ Panel interviews; Group interviews and Video Conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene
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 exercises is suggested below which should be carried out during 5th semester and 6th 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
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

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, wherever 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 PRACTICAL TRAINING

Each concerned teacher will be responsible for a group of students in respective speciality 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 PRACTICAL/PROFESSIONAL TRAINING
Practical training will have 400 marks. Out of which 100 marks will be awarded by the organization where placed for practical/professional training and 300 marks are for external examination. The criteria for internal assessment will be as under:

a) Criteria for internal assessment by organization where placed for practical/professional training

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance/Punctuality</td>
<td>10 percent</td>
</tr>
<tr>
<td>Proficiency in conducting laboratory test</td>
<td>30 percent</td>
</tr>
<tr>
<td>Preparation of portfolio based on day to day work done in various laboratories</td>
<td>20 percent</td>
</tr>
<tr>
<td>Initiative/responsibility exhibited</td>
<td>10 percent</td>
</tr>
<tr>
<td>Interpersonal relations</td>
<td>10 percent</td>
</tr>
<tr>
<td>Behaviour/attitude</td>
<td>10 percent</td>
</tr>
<tr>
<td>Maintenance of equipment and work place</td>
<td>10 percent</td>
</tr>
</tbody>
</table>

GENERAL GUIDELINES

(i) The students are expected to prepare practical record book as per given list of the experiments. Besides, they can also add other experiments as well.

(ii) External examiner along with internal faculty should evaluate the student’s performance through viva voce/spotting/performance and synopsis:
<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last date for readmission cases of 3rd and 5th semester classes</td>
<td>27.07.2012</td>
</tr>
<tr>
<td>Last date for readmission cases of 1st semester classes</td>
<td>27.08.2012</td>
</tr>
<tr>
<td>Last Date for receipt of application for trade change only 3rd Civil,EE,ME</td>
<td>27.07.2012</td>
</tr>
<tr>
<td>Date for hearing UMC cases pertaining to May-2012 Exam</td>
<td>07.08.2012</td>
</tr>
<tr>
<td>Registration of students of 3rd Semester classes</td>
<td>16.07.2012</td>
</tr>
<tr>
<td>Commencement of regular classes of 3rd semester students</td>
<td>17.07.2012</td>
</tr>
<tr>
<td>Registration of students of 5th Semester classes</td>
<td>01.08.2012</td>
</tr>
<tr>
<td>Commencement of regular classes of 5th semester students</td>
<td>02.08.2012</td>
</tr>
<tr>
<td>Janmashtami</td>
<td>10.08.2012</td>
</tr>
<tr>
<td>Independence Day</td>
<td>15.08.2012</td>
</tr>
<tr>
<td>Registration of students of 1st Semester classes</td>
<td>16.08.2012</td>
</tr>
<tr>
<td>Commencement of regular classes of 1st semester students</td>
<td>17.08.2012</td>
</tr>
<tr>
<td>Id-ul-Fitr</td>
<td>20.08.2012</td>
</tr>
<tr>
<td>Gandhi Jayanti</td>
<td>02.10.2012</td>
</tr>
<tr>
<td>Dussehra</td>
<td>24.10.2012</td>
</tr>
<tr>
<td>Valmiki Jayanti</td>
<td>29.10.2012</td>
</tr>
<tr>
<td>MST-II</td>
<td>01.11.2012 to 06.11.2012</td>
</tr>
<tr>
<td>Deepawali</td>
<td>13.11.2012</td>
</tr>
<tr>
<td>Rationalisation of sessional marks 3rd and 5th Semester classes</td>
<td>22.11.2012 to 26.11.2012</td>
</tr>
<tr>
<td>Practical Exam 3rd to 6th semester classes</td>
<td>27.11.12 to 03.12.2012</td>
</tr>
<tr>
<td>Board Examinations 3rd to 6th semester classes</td>
<td>07.12.2012 onwards</td>
</tr>
<tr>
<td>Practical Exam 1st and 2nd semester classes</td>
<td>03.01.2013 to 10.01.2013</td>
</tr>
<tr>
<td>Board Examinations 1st and 2nd semester classes</td>
<td>11.01.2013 onwards</td>
</tr>
<tr>
<td>Start of Even Semester for 4th and 6th semester classes</td>
<td>16.01.2013</td>
</tr>
</tbody>
</table>