Curriculum for

Diploma Programme in

MEDICAL LAB TECHNOLOGY

For the State of Haryana

(First Year On Annual Pattern)

Prepared by:

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FIRST YEAR`(Medical Lab Technology)

Sr. No.	SUBJECTS	STUDY SCHEME HOURS / WEEK			CREDIT	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1*	English	2	-	2	6	40	25	65	60	3	50	3	110	175
1.2	Anatomy and Physiology	3	-	2	8	40	25	65	60	3	50	3	110	175
1.3	Basic Chemistry	2	-	2	6	40	25	65	60	3	50	3	110	175
1.4	Clinical Micro-Biology	3	-	2	8	40	25	65	60	3	50	3	110	175
1.5	Haematology	3	-	2	8	40	25	65	60	3	50	3	110	175
1.6*	Environmental Studies	2	-	1	5	40	25	65	60	3	50	3	110	175
1.7	Clinical Biochemistry	3	-	2	8	40	25	65	60	3	50	3	110	175
1.8*	Information Technology	-	-	2	2	-	50	50	-	-	50	3	50	100
#	Student Centered Activities (SCA)	-	-	2	2	-	25	25	-	-	-	-	-	25
Total		18	-	17	53	280	250	530	420	-	400	-	820	1350

*Common with other Diploma Programmes

SCA will comprise of co-curricular activities like extension lectures, games, hobby clubs, seminars, declamation contests, educational field visits, N.C.C., N.S.S., Cultural Activities and Disaster management etc.

1.1 ENGLISH

L	T	P
2	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

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

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- Understand the importance of good communication
- Describe process of communication.
- Explain, Compare and re-write the types of communication
- Identify and match the parts of speech
- Rewrite sentences correctly
- Modify sentences and relate them with real life situations.
- Reproduce and match words and sentences in a paragraph.
- Re-write the sentences according to given situation.
- Relate and use various words using proper vocabulary and grammar.
- Write the various types of paragraphs, notices and composition on picture with appropriate format.

DETAILED CONTENTS

1. **Basics of Communication (06 Hrs)**
   - 1.1. Definition and process of communication
   - 1.2. Types of communication – Verbal (Listening, Speaking, Reading and Writing) and Non-verbal

2. **Functional Grammar (22 Hrs)**
   - 2.1. Noun and Pronoun
   - 2.2. Punctuation
   - 2.3. Preposition
   - 2.4. Conjunction
   - 2.5. Tenses (verb (Main verb and Auxiliary verb)

3. **Reading Skills (12 Hrs)**

3.1. Unseen passage for comprehension. Based upon the passage, flowing aspects may be covered

- Questions from the passage
- One-word substitution
- Prefixes and Suffixes
- Antonyms and Synonyms etc.

4. Writing skills (30 Hrs)

4.1. Correspondence – Business and official
4.2. Notice, including Press Releases
4.3. Memos
4.4. Circular
4.5. Basics of Report Writing
4.6. Resume Writing
4.7. Writing E-mail
4.8. Paragraph writing
4.9. Picture composition

LIST OF PRACTICALS

1. Listening Exercises
2. Self and Peer Introduction
3. Debate
4. Situational Conversations: Offering - Responding to offers; Requesting – Responding to requests; Congratulating; Expressing sympathy and condolence; Apologizing and Forgiving; Complaining; Warning; Asking and giving information; Getting and giving permission; Asking for and giving opinions; Talking about likes and dislikes
5. Just a minute sessions – Extempore
6. Group Discussion
7. Newspaper reading
8. Mock Interviews: Telephonic and Personal

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centered activities in class room and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S.Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1.1, 2.1, 4.1	1st Internal	40%	40% (Combined in internal & final assessment) with minimum 25% marks in final assessment)
B	20%	Unit 2.2, 4.2, 4.3	2nd Internal		
C	60%	Unit 1.2, 2.3 to 2.5 , 3, 4.4 to 4.9	FINAL	60%	

1.2 ANATOMY AND PHYSIOLOGY

L	T	P
3	-	2

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.

DETAILED CONTENTS

1. Introduction to human body, anatomy and physiology definition, structure and functions of animal cell. (06 hrs)

2. Elementary tissues of body and their classification along with brief description (06 hrs)

3 Skin (Structure and functions) (04 hrs)

4 Skeletal system (08 hrs)

- 4.1 The skeleton, important bones and their brief description
- 4.2. Articulation of bones – joints

5. Digestive system (14 hrs)

- 5.1 Various organs of digestion and their functions (stomach, small intestine) and accessory organs (liver, pancreas and salivary glands)
- 5.2 Process of digestion of food
- 5.3 Absorption and assimilation of food
- 5.4 Vitamins and minerals

6. Respiratory system (07 hrs)

- 6.1 Organs of respiration and their histology
- 6.2 Respiration (definition and mechanism)
- 6.3 Gas exchange in the lungs
- 6.4 Regulation of respiration
- 6.5 Basal metabolic rate

7. Excretory System (07 hrs)

- 7.1 Organs of excretion (kidneys, ureter, bladder)
- 7.2 Formation of urine and its composition
- 7.3 Structure of nephron

8. Nervous system (8 hrs)

- 8.1 Central nervous system (brain and spinal cord)
- 8.2 Peripheral nervous system (cranial and spinal nerves)
- 8.3 The sense organs (eye, ear, tongue and nose); structure and functions

9. Muscular system (12hrs)
   - 9.1 Brief description of skeletal, smooth and cardiac muscles
   - 9.2 Muscle fatigue

10. Circulatory system (14 hrs)
   - 10.1 Composition and functions of blood
   - 10.2 Anatomy and physiology of Heart
   - 10.3 Circulation of blood, Cardiac Cycle and Conducting System of Heart
   - 10.4 The blood pressure
   - 10.5 Arteries and viens- differences
   - 10.6 Lymph and lymphatic system

11. Endocrine system (10 hrs)
   Description of each endocrine gland its secretions and their effect on the body

12. Reproductive System (12 hrs)
   - 12.1 Male and female reproductive system
   - 12.2 The ovarian cycle and ovulation
   - 12.3 Fertilization

LIST OF PRACTICALS

1. Study of various parts of body through demonstration
2. Study of tissues of body through demonstration
3. Study of various parts of skin (demonstration from models)
4. Study of various bones and joints through demonstration
5. Study of parts of digestive & respiratory system through demonstration
6. Study of various parts of nervous system (brain and spinal cord) (demonstration from model)
7. Study of structure of eye and ear (demonstration from models)
8. Study of structural differences between skeletal, smooth and cardiac muscles (permanent mounts) through demonstration.
9. Study of various parts of circulatory system through demonstration.
10. Examination of stained blood film for blood cells
11. Estimation of blood pressure
12. Study of various parts of excretory and reproductive system (male and female demonstration from models and charts)

RECOMMENDED BOOKS

1. Basic Anatomy and Physiology by N Murugesh; Sathya Publishers, Madurai
2. Ross and Wilson Anatomy and Physiology by Anne Waugh and Kathleen JW Wilson; Curchill Living Stone; London

3. Anatomy and Physiology by Pears; JP Brothers, New Delhi
4. Anatomy and Physiology by Sears; ELBS, London

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1 to 4	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 5 to 7	2nd Internal		
C	60%	Unit 08 to 12	FINAL	60%	

1.3 BASIC CHEMISTRY

L	T	P
2	-	2

RATIONALE

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

DETAILED CONTENTS

1. Basic concepts (08 hrs)
   - 1.1 S.I. units of 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.
   - 1.4 Solution, strength of solutions, molarity (M), molality (m), normality (N), mass fraction, mole fraction and parts per million.

2. Water (07 hrs)
   - 3.1 Sources of water
   - 3.2 Hard and soft water, types of hardness, action of soap on hard water
   - 3.3 Disadvantages of hard water in domestic and industrial uses
   - 3.4 Qualities of drinking water and purification of available water for drinking purposes

3. Equilibrium, Acids and Bases. (07 hrs)
   - 3.1 Equilibrium state, equilibrium constant
   - 3.2 Ionization of electrolyte in aqueous solution, ionic equilibrium, degree of ionization, self-ionization of water and ionic product of water (K_w)
   - 3.3 Concept of pH and pH scale
   - 3.4 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
   - 3.5 Hydrolysis of salts, common ion effect, buffer solutions (acidic and basic), Buffering action of a buffer solution, applications of buffers

4. Electrochemistry. (09 hrs)
   - 4.1 Electronic concept of oxidation, reduction and redox reactions
   - 4.2 Electrolytes and non electrolytes

4.3 Conductors and their types.
4.4 Electrolysis
4.5 Applications of electrolysis

5. Surfaces and Colloids (05 hrs)
5.1 Adsorption and its types
5.2. Applications of adsorption
5.3. Colloidal state and types of colloids
5.4. Preparation and purification of colloids in brief
5.5. Gels and solution, emulsions
5.6. Cleaning action of soaps

6. Organic chemistry (04 hrs)
6.1 Introduction and importance of organic compounds
6.2 Comparison of organic and inorganic compounds
6.3 Properties of carbon and Hydrogen

7. Hydrocarbons (06 hrs)
7.1 Preparation, properties and uses of saturated hydrocarbons
7.2 Preparation, properties and uses of unsaturated hydrocarbons
7.3 Sources of hydrocarbons
7.4 Preparation, properties and uses of Halogen derivatives of hydrocarbons

8. Alcohols and ethers (08 hrs)
General introduction, classification, preparation and properties and uses of:
8.1 Methyl alcohol, Ethyl alcohol and glycerol
8.2 Diethyl ether

9. Aldehydes and ketones (08 hrs)
General introduction, classification, properties and uses of:
9.1 Methanal and ethanal
9.2 Amines:
a) Structure of amines groups (primary, secondary and tertiary)
b) Important methods, preparation and properties

10. Carbohydrates (08 hrs)
10.1. Definition
10.2. Composition, sources its importance
10.3. Classification
10.4. Estimation
10.5. Important monosaccharides, disaccharides, polysaccharides

11. Lipids (08 hrs)
11.1. Definition

11.2. Classification
11.3. Introduction to fatty acids, phospholipids, triglycerides,Cholesterol
11.4. Clinical importance of lipids

12. Proteins (10 hrs)
12.1. Definition
12.2. Classification
12.3. Compositon , molecular weight and hydrolysis
12.4. Name of various amino acids
12.5. Structure and properties of proteins
12.6. Clinical importance of proteins

13. Enzymes (10 hrs)
13.1 Definition
13.2 Classification
13.3 Chemical nature of enzymes
13.4 Properties of Enzymes
13.5 Factors affecting enzyme activity
13.6 Clinical Importance of Enzym

LIST OF PRACTICALS

1. Preparation of standard solutions.
2. To prepare N/10 Sodium carbonate
3. To prepare M/10 oxalic acid solution
4. To prepare 5N HCl from given 12 N HCl, N/10 HCL
5. lodometric titrations
6. Oxidation reduction titrations
7. Acid-base titrations
8. Estimation of carbohydrates by benedicts methods
9. Estimation of proteins by acitic acid & Salphosalicylic acid test
10. Estimation of lipids by direct method

RECOMMENDED BOOKS

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

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A	20%	Unit 1 to 3	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 4 to 7	2nd Internal		
C	60%	Unit 08 to1 3	FINAL	60%	

1.4 CHEMICAL MICROBIOLOGY

L	T	P
3	-	2

The students undergoing training of medical laboratory technology are given the knowledge of basic morphological features of bacteria, their staining characters, sterilization methods, preparation of culture media, biochemical test for identification of bacteria and their anti-microbial sensitivity tests. They are also taught safety measures in microbiology.

DETAILED CONTENTS

1. Microbiology- Introduction, history, importance of microbiology (04 hrs)

2. Anatomical structure of a bacterial cell including spores, flagella and capsules (4hrs)

3. Bacterial growth curve and bacterial nutrition (04hrs)

4. Morphological Classification of bacteria (06 hrs)

5. Microscopy - principle and care, working of compound microscope (04 hrs)
   Principle of (i) dark field microscope (ii) fluorescent microscope
   (iii) phase contrast microscope and (iv) electron microscope

6. Sterilization (06 hrs)
   - Introduction
   - By dry heat,
   - Moist heat,
   - Autoclave & hot air oven- their structure, functioning, controls and sterilization indicators,
   - By filtration

7. Antiseptics and disinfectants- Introduction, types, use of disinfectants and antiseptic (04 hrs)

8. Culture media (06 hrs)

   Ideal culture media and its types (Liquid and Solid media, Defined and Synthetic media, Enriched, Selective, Indicator, and Transport media)

9. Staining techniques (06 hrs)

   Methods of smear preparation, Procedure of Gram stain, Ziehl-Neelson's (Z-N) stain, Albert Stain

10. Identification & characteristics of bacteria by (12 hrs)

i) Microscopic examination ii) Colony characteristics
iii) Motility demonstration methods
iv) Biochemicals such as –

a) Carbohydrate utilization tests (Glucose, Lactose, Sugar, Manitol)
b) Catalase, Oxidase, Coagulase c)
Indole
d) MR & VP
e) Citrate utilization

11. Antibiotic sensitivity (06 hrs)

- Disc Diffusion method – principle, procedure and precautions

12. Bacteriology (20 hrs)

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

- Characteristics and distribution of :-

12.1 Staphylococci
12.2 Streptococci and pneumococci
12.3 Enterobacteriacae - (E coli, Salmonella, Shigella)
12.5 Proteus
12.6 Vibrio Cholerae
12.8 Treponema Pallidium
12.9 Mycobacterium tuberculosis

13. Bacterial pathogenicity (06hrs)

13.1 Introduction of pathogenicity & infection.
13.2 Sources of infection
13.3 Mode of spread of infection
13.4 Types of infection

14. Nosocomial Infection (06 hrs)

14.1 Introduction
14.2 Common types and source of nosocomial infection
14.3 Control of nosocomial infections

15. Laboratory diagnosis of infectious diseases (16 hrs)

15.1 Respiratory tract infections (Throat Swab and Sputum sample)
15.2 Wound infections
15.3 Urinary tract infections
15.4 Enteric fever

15.5 Intestinal infection

LIST OF PRACTICALS

1. Demonstration of safety rules (universal precautions) in a microbiology laboratory
2. Preparation of cleaning agents and techniques of cleaning of glass and plastic ware.
3. Sterilization by autoclave and hot air oven
4. Handling and use of compound microscope
5. Staining techniques: Gram, Albert's, Ziehl – Neelson's
6. Demonstration of motility (Hanging drop method)
7. Preparation and sterilization of various culture media (Nutrient agar, Nutrient broth, Blood agar, Chocolate agar, Mac-Conkey agar, Lowenstein-Jensen Media
8. Antimicrobial susceptibility testing by Stokes disc diffusion method
9. Biochemical testing (Carbohydrate utilization tests, Catalase, Oxidase, Coagulase, Indole, MR & VP, Citrate
10. 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
11. Identification of known bacterial cultures of common pathogens.

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
8. Text book of Medical Microbilogy by Cruckshiank Vol. I and II

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1 to 5	1st Internal	40%	40%(Combined in internal & final

B	20%	Unit 6 to 9	2nd Internal		assessment)with minimum 25% marks in final assessment)
C	60%	Unit 10 to 15	FINAL	60%	

1.5 HAEMATOLOGY

L	T	P
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RATIONALE

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

DETAILED CONTENTS

THEORY

1. Introduction to haematology (08 hrs)

    1.1 Various glassware/ plasticware used in haematology labs.(Hb tube, Hb pipette, RBC pipette, WBC pipette)

2. Apparatus and Instruments used in hematology lab. (08 hrs)

    2.1. Water bath
    2.2. Blood cell counter
    2.3. Blood Mixer
    2.4. Centrifuge

3. Haemopoeisis (09 hrs)

    3.1 Erythropoiesis, leucopoeisis, thrombopoeisis
    3.2 Definition, composition and functions of blood

4. Anticoagulants (05 hrs)

    Definition and various types of anticoagulants alongwith their mode of action and their preparation with merits and demerits of each

5 Collection and preservation of blood (08 hrs)

    5.1 Collection of blood; venous and capillary
    5.2 Various equipment used for collection of blood samples
    5.3. Safety measures at the time of sampling and collection
    5.4 Preservation of processed blood samples in hematology

6 Diluting fluid (Hb, TLC, Platelets, RBC count) (06 hrs)
- Uses, preparation and composition.

7. Romanowsky stains (08 hrs)

7.1. Theory and preparation
7.2. Choice of slide and spreader and preparation of blood film
7.3. Characteristics of good film preparation
7.4. Staining procedure
7.5. Effects of pH on staining

8 Haemoglobinometery (12 hrs)

8.1. Formation of haemoglobin, function and its degradation
8.2. Types of haemoglobin
8.3. Various methods of estimation with specific reference to cyanmethaemoglobin method

9 Haemocytometery (18 hrs)

9.1. Various counting chambers
9.2. Methods of counting of RBC, WBC and platelets, their calculation and reference values.
9.3. Errors involved in haemocytometery and mean to minimize them

10 Differential leucocyte counting (DLC) (10hrs)

10.1. Preparation and staining of blood film
10.2. Performance of DLC
10.3. Normal values and significance of DLC
10.4. Blood cell morphology in health and disease (Peripheral blood film)

11 Quality Assurance in haematology such as accuracy, precision etc. (08hrs)

12 Automation in haematology (10 hrs)

12.1. Various types of Blood cell counter
12.2. Principle and operation of the automated blood cell counters

LIST OF PRACTICALS

1. Demonstration of various parts of centrifuge; its functioning and care
2. Demonstration of various parts of microscope its functioning and care
3. Preparation of various anticoagulants
4. Collection of venous and capillary blood
5. Preparation of peripheral blood film (PBF)
6. To stain a peripheral blood film by Romanowsky stain
7. Preparation and standardization of stains (leishman and giemsa)

8. Preparation of thick and thin blood smear
9. Haemoglobin Estimation by Sahli's method, Oxy-Haemoglobin and Cyanmethaemoglobin method
10. Counting of RBC,WBC, Platelets
11. Absolute eosinophil counting
12. To study abnormal morphology of RBC, WBC and Platelets with the help of stained slide

RECOMMENDED BOOKS

1. Medical Laboratory Technology Vol. 1 by KL Mukherjee; Tata McGraw Hill Publishers, New Delhi
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
6. Medical Laboratory Science Theory and Practical by J Ochei and A Kolhatkar, Tata McGraw Hill Publishing Company Ltd., New Delhi 2000 Ed.
7. Medical Lab. Technology by Satish Gupte, JP Publishers

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1 to 3	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 4 to 7	2nd Internal		
C	60%	Unit 8 to 12	FINAL	60%	

1.6 ENVIRONMENTAL STUDIES

L	T	P
2	-	1

RATIONALE

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 ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Introduction (4 Hrs)
    - Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.

2. Air Pollution (12 Hrs)
    - Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.

3. Water Pollution (16 Hrs)
    - Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O_2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.

4. Soil Pollution (14 Hrs)
    - Sources of soil pollution
    - Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
    - Effect of Solid waste
    - Disposal of Solid Waste- Solid Waste Management

5. Noise pollution (8 Hrs)
    - Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

6. Environmental Legislation (10 Hrs)
    - Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (6 Hrs)
    - Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste
14. To study the effect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-term and end-term written tests

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.

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A	20%	Unit 1,2	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 3	2nd Internal		
C	60%	Unit 4,5,6,7	FINAL	60%	

1.7 CLINICAL BIOCHEMISTRY

L	T	P
3	-	2

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

1. Introduction to biochemistry (04 hrs)
   - 1.1 Definition
   - 1.2 Importance of biochemistry
   - 1.3 SI Units and their use
   - 1.4 Volumetric apparatus and their calibration

2. Cleaning and storage of laboratory, glass and plastic ware (06 hrs)
   - 2.1 Cleaning and care of laboratory glass and plastic ware
   - 2.2 Different cleaning agents (soaps, detergents, chromic acid)
   - 2.3 Methods of cleaning and storage

3. Important instruments; principle, working, handling and care of (16 hrs)
   - 3.1 Balance (Analytical, electrical/electronic)
   - 3.2 Centrifuge
   - 3.3 Colorimeter
   - 3.4 Spectrophotometer
   - 3.5 Ion selective electrodes, concept of flame photometer
   - 3.6 Glucometer
   - 3.7 Distillation Plant/Deionizer apparatus

4. Blood fractions (06 hrs)
   - 4.1 Separation of Serum
   - 4.2. Separation of Plasma
   - 4.3. Different protein precipitating reagents
   - 4.4. Preparation of protein free filtrate (PFF)

5. Collection and preservation of clinical specimens for bio-chemical analysis of: (08 hrs)
   - Blood
   - Urine
   - Stool
   - Other Body Fluids

6. Blood glucose/ sugar estimation, screening test and glucose tolerance test (GTT) (10 hrs)
   - 6.1 Principle and methods of estimation
   - 6.2 Reference values
   - 6.3 Renal threshold
   - 6.4 Clinical importance of blood sugar, ST/GTT

7. Blood urea (8 hrs)
   - 7.1 Formation and excretion of urea
   - 7.2 Principle and procedures of different methods of urea estimation
   - 7.3 Reference values
   - 7.4 Clinical Importance

8. Serum Creatnine (10 hrs)
   - 8.1 Introduction, principle and procedure of various estimation methods
   - 8.2 Reference values
   - 8.3 Clinical importance

9. Serum proteins (10 hrs)
   - 9.1 Introduction
   - 9.2 Different methods of estimation including principles and procedures
   - 9.3 Reference values
   - 9.4 Clinical importance

10. Electrolytes and trace elements (8 hrs)
    - 10.1 Introduction, principles and procedures of estimation of Na^+, K^+, Cl^-.
    - 10.2 Reference values and Clinical importance

11. Uric Acid (8 hrs)
    - 11.1 Introduction, principles and procedures of various estimation methods
    - 11.2 Reference values
    - 11.3 Clinical Importance

12. Quality Assurance in Biochemistry as per National Standards (12 hrs)
    - 12.1. Internal quality assurance
    - 12.2. External quality assurance

LIST OF PRACTICALS

1. Cleaning of glass ware
2. Handling and maintenance of Balance, Centrifuge, Colorimeter, Ion Selective electrode and glucometer , distillation plant/deionizer
3. Collection of blood by various methods including vacutainer system
4. Separation of serum and plasma
5. Preparation of different protein precipitating agents, PFF preparation
6. Preparation of reagents (stock and working)
7. Estimation of blood glucose/sugar (O-toluidine method and enzymatic method)
8. Performance of ST/GTT

9. Serum urea and creatnine estimation
10. Serum uric acid estimation
11. Plasma and serum protein estimation
12. Estimation of electrolyte levels of $Na^{+,}$ K^{+} and Cl^{-} by colorimetric method

RECOMMENDED BOOKS

1. A Procedure Manual for Routine Diagnostic Tests Vol. I by KL Mukherjee; Tata McGraw Hill Publishers, New Delhi
2. Biochemistry Estimations by F.J.Baker
3. A Textbook of Medical Laboratory Technology by P Godkar; Bhalani Publishing House, Mumbai

Section	Percentage of syllabus to be covered	Units to be covered	Type of assessment	Weightage of Marks	Pass Percentage
A	20%	Unit 1 to 3	1st Internal	40%	40%(Combined in internal & final assessment)with minimum 25% marks in final assessment)
B	20%	Unit 4 to 6	2nd Internal		
C	60%	Unit 07 to 12	FINAL	60%	

1.8 INFORMATION TECHNOLOGY

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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 using MS Office/Open Office/Libre Office using internet etc.,. 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 demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.

LEARNING OUTCOMES

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

- Identify Computer hardware components, network components and peripherals.
- Explain the role of an operating System.
- Install system and application software.
- Explain the function of the system components including processor, motherboard and input-output devices.
- Use Word Processing software to prepare document.
- Use spreadsheet software to create workbooks and automate calculation.
- Use presentation software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install antivirus.
- Safeguard against online frauds, threats and crimes.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

   Information Technology concept and scope, applications of IT. in office, Air and Railway Ticket reservation, Banks financial transactions, E-Commerce and E- Governance applications etc., Ethics of IT, concept of online frauds, threats of IT crimes.

2. Computer Hardware:

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

3. Software Concepts:

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

4. Internet Concepts:

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

LIST OF PRACTICAL EXERCISES

1. Given a PC, name its various components and peripherals. List their functions .
2. Installing various components of computer system and installing system software and application software
3 Installation of I/O devices, printers and installation of operating system viz. Windows/BOSS/ LINUX
4. Features of Windows as an operating system
   - Start
   - Shut down and restore
   - Creating and operating on the icons
   - Opening, closing and sizing the windows and working with windows interfacing elements (option buttons, checkbox, scroll etc.)
   - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file and folders
   - Changing settings like, date, time, colour (back ground and fore ground etc.)
   - Using short cuts
   - Using on line help

5. Word Processing (MS Office/Open Office)

a) 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

b) Page set up:
   - Setting margins, tab setting, ruler, indenting

c) Editing a document:
   - Entering text, cut, copy, paste using tool- bars

d) 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, autotext
   - Inserting date, time, special symbols, importing graphic images, drawing tools

e) Tables and Borders:
   - Creating a table, formatting cells, use of 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

f) Using Tools like:
   - Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelops and lables
   - Using shapes and drawing toolbar,
   - Working with more than one window .

6. Spread Sheet Processing (MS Office/Open Office)

a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets

b) Menu commands:

   Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working

c) 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

   Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting

d) 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

e) Retrieve data with query:

Create a pivot table, customizing a pivot table. Statistical analysis of data

f) 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.
   - Opening a new/existing presentation
   - Different views for viewing slides in a presentation: normal, slide sorter.

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
   - Editing objects
   - Working with Clip Art

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, timing, order etc.

f) Use of Pack and Go Options.

8. Internet and its Applications

a) Establishing an internet connection.

b) Browsing and down loading of information from internet.

c) 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

d) Assigning IP Addresses to computers and use of domain names.

9. Functioning of Antivirus

   a) Installation and updation of an antivirus.
   b) How to scan and remove the virus.

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
2. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
3. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
4. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
6. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar