Programme Structure for B. Sc. Medical Laboratory Technology (with Minor in Food Processing Technology)

First Year B. Sc. Program Semester I: Teaching Scheme

Course code	Course name	Teaching scheme (Hrs/week)			Credits assigned			Total credits
		Th	Pr	Th	Th	Pr	Tu	
U26PC105	Human Anatomy and Physiology-I	3	-	-	3	-	-	3
U21PC103	Fundamental Chemistry	3	-	-	3	-	-	3
U26IK101	Indian Medical Sciences	2	-	-	2	-	-	2
U03AE002	English	2	-	-	2	-	-	2
U03VE001	Constitution of India	2	-	-	2	-	-	2
UXXOE01X	Open Elective-I	2	-	-	2	-	-	2
U26PC106	Human Anatomy and Physiology Lab-I	-	2	-	-	1	-	1
U21PC104	Fundamental Chemistry Lab	-	2	-	-	1	-	1
U26VS102	Basics in Hematology Lab	-	4	-	-	2	-	2
U26SE101	Fundamental Principles of Medical Laboratory Technology	-	4	-	-	2	-	2
U04CC0XX	Co-curricular Courses I	-	4	-	-	2	-	2
U03VE002	Universal Human Values-I[#]	-	-	-	-	-	-	Audit Course
	Total	**14**	**16**	**-**	**14**	**08**	**-**	**22**

[#]During the Induction program, students would get an initial exposure to human values through Universal Human Values-I

Programme Structure for B. Sc. Medical Laboratory Technology (with Minor in Food Processing Technology)
Semester I: Evaluation Scheme

Course Code	Course Name	Theory Marks					Practical / Tutorial Marks		**Total**
		Internal Assessment*				ESE *	Term work	Practical * Oral/	
		T1	T2	FET	Total				
U26PC105	Human Anatomy and Physiology-I	10	10	5	25	50	-	-	75
U21PC103	Fundamental Chemistry	10	10	5	25	50	-	-	75
U26IK101	Indian Medical Sciences	-	10	5	15	35	-	-	50
U03AE002	English	-	10	5	15	35	-	-	50
U03VE001	Constitution of India	-	10	5	15	35	-	-	50
UXXOE01X	Open Elective-I	-	10	5	15	35	-	-	50
U26PC106	Human Anatomy and Physiology Lab-I	-	-	-	-	-	25	-	25
U21PC104	Fundamental Chemistry Lab	-	-	-	-	-	25	-	25
U26VS102	Basics in Hematology Lab	-	-	-	-	-	25	25	50
U26SE101	Fundamental Principles of Medical Laboratory Technology	-	-	-	-	-	25	25	50
U04CC0XX	Co-curricular Courses I	-	-	-	-	-	50	-	50
U03VE002	Universal Human Values-I	-	-	-	-	-	-	-	Audit Course

* Minimum passing is 40% for all courses and evaluation head mentioned above. FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, Term Work , ESE - End Semester Examination, P/F – Pass/ Fail Course, AU – Audit Course.

Programme Structure for B. Sc. Medical Laboratory Technology (with Minor in Food Processing Technology)
First Year B. Sc. Program Semester II: Teaching Scheme

Course code	Course Name	Teaching scheme (Hrs/week)			Credits assigned			Total credits
		Th	Pr	Tu	Th	Pr	Tu	
U26PC205	Human Anatomy and Physiology -II	3	-	-	3	-	-	3
U21PC203	Chemistry for Biologists	3	-	-	3	-	-	3
UXXMM0XX	Multidisciplinary Minor-I	2	-	-	2	-	-	2
U03AE001	Professional Communication	2	-	-	2	-	-	2
U01VE003	Environment Science	2	-	-	2	-	-	2
UXXOE02X	Open Elective-II	2	-	-	2	-	-	2
U26PC206	Human Anatomy and Physiology Lab-II	-	2	-	-	1	-	1
U21PC204	Chemistry for Biologists Lab	-	2	-	-	1	-	1
U26VS202	Bioanalytical Techniques & Instrumentation	-	4	-	-	2	-	2
U26SE202	Computer Applications for Analysis	-	4	-	-	2	-	2
U04CC0XX	Co-curricular Courses II	-	4	-	-	2	-	2
	Total	**14**	**16**		**14**	**08**		**22**

Programme Structure for B. Sc. Medical Laboratory Technology (with Minor in Food Processing Technology)
First Year B. Sc. Program Semester II: Evaluation Scheme

Course Code	Course Name	Theory Marks					Practical / Tutorial Marks		Total
		Internal Assessment*				ESE*	Term work*/ Tutorial	Practical * Oral/ POE	
		T1	T2	FET	Total				
U26PC205	Human Anatomy and Physiology -II	10	10	5	25	50	-	-	75
U21PC203	Chemistry for Biologists	10	10	5	25	50	-	-	75
UXXMM0XX	Multidisciplinary Minor-I	-	10	5	15	35	-	-	50
U03AE001	Professional Communication	-	10	5	15	35	-	-	50
U01VE003	Environment Science	-	10	5	15	35	-	-	50
UXXOE02X	Open Elective-II	-	10	5	15	35	-	-	50
U26PC206	Human Anatomy and Physiology Lab-II	-	-	-	-	-	25	-	25
U21PC204	Chemistry for Biologists Lab	-	-	-	-	-	25	-	25
U26VS202	Bioanalytical Techniques and Instrumentation	-	-	-	-	-	25	25	50
U26SE202	Computer Applications for Analysis	-	-	-	-	-	25	25	50
U04CC0XX	Co-curricular Courses II	-	-	-	-	-	50	-	50

*Minimum passing is 40% for all courses and evaluation head mentioned above. FET – Faculty evaluation for Theory, T1, T2, Continuous Assessment Test, Term Work , ESE - End Semester Examination, P/F – Pass/ Fail Course

Theory course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
U26PC103	**Human Anatomy and Physiology-I**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation scheme

Course code	Course name	Evaluation scheme (In semester)					End semester exam (ESE)		
U26PC103	**Human Anatomy and Physiology-I**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description: This course takes an overview of major organs in human body. It mainly focuses on study of anatomy and physiology of cells, tissues, blood, respiratory system, digestive system and cardiovascular system.

Pre-requisites: The Students should have basic knowledge of concepts basic biology.

Course Objectives:

- To revisit the fundamental concepts in biology.
- To understand major organs and systems in human body.

Course outcomes: after the end of this course students will able to

CO1 learn the terminology of the subject and basic knowledge of cells & tissues

CO2 understand anatomy and physiology of human body

CO3 develop an understanding of the structure and function of organs and organ systems in normal human body.

Course contents

Module	Unit	Description	Hours
1.0		**Introduction to Cells:**	
1	1.1	Cells: Structure, function and location, Prokaryotic and eukaryotic cells, Cell organelles, Cell division	9
	1.2	Tissue, Types, Structure, Location and Function of Epithelial Tissue, Connective Tissue, Muscle Tissue, Nerve Tissue, Membranes, Glandular tissue.	
2.0		**Introduction to Blood and Lymphatic Systems:**	
2	2.1	Blood-composition, function, cellular component & their function, haemoglobin & anaemia, blood groups and coagulation	9
	2.2	Lymphatic system-Composition & function of lymph, lymphatic tissue, Immunity with the role of thymus	
3.0		**Respiratory System:**	
3	3.1	Respiratory system: Basic anatomy of nose, larynx, trachea, bronchi and lungs Respiratory system: parts of respiratory system, mechanism of respiration, pulmonary function, pulmonary circulation, lungs volume, Gas transport between lungs and tissues	9
	3.2	Definition of hypoxia, dyspnoea, cyanosis, asphyxia and obstructive airways diseases	
4.0		**Digestive System:**	
4	4.1	Digestive system: basic anatomy of oesophagus, stomach, small intestine, large intestine, liver, gall bladder, pancreas	9
	4.2	Gastrointestinal physiology: Organs of GIT and their structure & function, secretion, digestion, absorption and assimilation, gastrointestinal hormones, physiology of digestion of carbohydrates, proteins & lipids, Structure & function of liver, spleen, gall bladder & pancreas, Jaundice, Cirrhosis & Pancreatitis	
5.0		**Cardiovascular System:**	
5	5.1	Cardiovascular system- Basic anatomy of heart.	9
	5.2	Cardiovascular system-general arrange, heart, arteries, veins and capillaries, heart structure and function, cardiac cycle, heart sounds, heart rate, blood pressure, mechanism of circulation, definition of hypertension & shock	

References

1 Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
2 Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
3 Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
4 Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications
5 Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
6 Chaurasia B D, (2016), Human Anatomy, 7th edition, CBS publishers
7 Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley Publications

- Internal Assessment (T1, T2 and FET):
  1. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
  2. Fifth module will be assessed for 5 marks separately.
- End Semester Examination:
  1. Question paper will comprise of 5 questions, each carrying 10 marks.
  2. The duration of end semester examination shall be 3 hours.
  3. The students need to solve all 5 questions.
  4. Question No.1 will be compulsory and based on entire syllabus.
  5. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U21PC103	General Chemistry	3	-	-	3	-	-

Evaluation Scheme

Course code	Course name	Evaluation scheme (In semester)					End semester exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U21PC103	General Chemistry	10	10	5	25	40%	50	40%	75

Course Description: This course is being offered to nonchemistry biology majors. This course takes an overview of concepts in chemistry and biology of everyday life.

Pre-requisites: The Students should have basic knowledge of concepts in chemistry and basic biology.

Course Objectives:

- To revisit the fundamental concepts in chemistry
- To correlate the principles of chemistry and biology.

Course Learning Outcomes: At the end of this course, students will be able to,

CO1 Recall[1] the concepts of chemistry.
CO2 Relate[3] fundamental chemistry to everyday life.
CO3 Understand[2] the principles of chemistry that are relevant to biology.
CO4 Understand[2] the concepts of organic chemistry.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction:**	
1	1.1	Introduction to Chemistry, what is Chemistry? Matter, Measurements: Numbers, Units & conversions, Significant Figures, Atoms: Review of Bohr's theory and its limitations, Dual behaviour of matter and radiation, de Broglie's relation, Heisenberg uncertainty principle. Shapes of atomic orbital. Molecules, Mass of Atoms and Molecules, Ions and ionic compounds.	9
	1.2	Periodic table: Historical perspectives, Period arrangements of elements and periodic trends, Periodic table for biology.	
2.0		**Stoichiometry and Chemical Reactions:**	
2	2.1	Mole concept: Determination of molecular weight by gram molecular volume relationship, Problems based on mole concept. Methods of expressing concentrations, strength, normality, molarity, molality, %w/v, %v/v, ppm, Standardization of solutions, Primary and secondary standards.	9
	2.2	Stoichiometry: Definition and balancing equations, Chemical reactions: Limiting reagents, yields and types of reactions. Chemical reactions in biological systems.	
3.0		**Gases, Energy and Chemistry, Chemical bonding:**	
3	3.1	Gases: Kinetic theory of Gases, Pressure, Gas laws, Idea gas laws. Gas mixtures, Law of conservation of Energy, Work and Heat, Enthalpy and Chemical Reactions.	9
	3.2	Chemical Bonding: Lewis dots and Ionic bonding (salts), and Covalent bonding (Vitamins and Minerals), Different aspects of covalent bonding.	
4.0		**Solids, Liquids and Solutions, Acids, Bases, Chemical Equilibrium:**	
4	4.1	Intermolecular forces, Phase transitions: Melting, Boiling and Sublimation, Properties of liquids, Solutions: Dilutions and Collegative properties, Solids: General Properties and Types.	9
	4.2	Theories of Acids and Bases, Strong and Weak acid and base, Titrations, pH and buffers, Chemical equilibrium, Equilibrium constants.	

5.0		**Oxidation and Reduction, Organic Chemistry**:	
5	5.1	Oxidation and Reduction reactions, Balancing redox reactions, redox reactions and Voltaic cell,	9
	5.2	Organic Chemistry: Hydrocarbons and functional groups, Basic Concepts in Organic chemistry. Polymers and biopolymers.	

References

1. David W Ball, The Basics of General, Organic, and Biological Chemistry, Saylor Foundation.
2. A. K. Day, Environmental Chemistry, New Edge International Ltd.
3. www.beyondbenign.com

- Internal Assessment (T1, T2 and FET):

T1 should be based on first two modules, T2 should be based on third and fourth modules, for 10 marks.

Fifth module will be assessed for 5 marks separately.

- End Semester Examination:

1. Question paper will comprise of 5 questions, each carrying 7 marks.
2. The duration of end semester examination shall be 2 hours.
3. The students need to solve all 5 questions.
4. Question No.1 will be compulsory and based on entire syllabus.
5. Remaining question (Q.2 to Q.5) will be selected from all the modules

Theory Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U26IK101	Indian Medical Sciences	02	-	-	02	-	-

Evaluation Scheme

Course Code	Course Name	Evaluation Scheme (In Semester)					End Semester Exam (ESE)		
		T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
U26IK101	Indian Medical Sciences	-	10	5	15	40%	35	40%	50

Course Description: This course will focus on and explore the ideas from viewpoint of Understanding mind and its dynamics through knowledge of Ayurveda and Yoga and using the knowledge to maintain harmony between body and mind to achieve perfect mental health.

Course Objectives:

1.Understanding the fundamental principles of Indian health systems such as Ayurveda and yoga which are useful in maintaining the health of a healthy person.

2.Practical implementation of health principles to correct the intake of our food, air, water and sunlight to achieve perfect health.

3.Understanding traditional way of cleansing the body regularly, strengthening body with Yogic exercises, maintaining the internal balance to prevent diseases.

Course Outcomes: after the end of this course students will able to

CO1 Estimate[2]The introduction of Indian medical science.
CO2 Identify[2]The Understanding eight steps of Ashtanga yoga.
CO3 Describe[3] The Concept of Manas in Ayurveda and understanding.
CO4 Analyze[2] Understanding healthy.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction**	
1	1.1	Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age.	6
	1.2	Brief Introduction of Hatha yoga, Raja yoga, Karma yoga, Gyana Yoga, Bhakti yoga Understanding eight steps of Ashtanga yoga, Understanding Shatkriyas , the six cleansing procedures of Yoga.	
2.0		**Concept of Ayurveda**	
2	2.1	Concept of Manas in Ayurveda and understanding Mind Body harmony, Triguna based Psychology in Ayurveda and Yoga.	6
	2.2	Influence of Tri dosha on Mind, Mind body intellect and consciousness complex.	
3.0		**Health Regimen**	
3	3.1	Understanding Swastha vritta, the healthy regimen to maintain state of wellbeing Dinacharya.	6
	3.2	The Daily regimen including Daily detoxification, exercise.	
4.0		**Understanding healthy**	
4	4.1	Intake of Food, Water, Air and Sunlight, work and ergonomics, Rest and sleep hygiene, Rest and sleep hygiene.	6
	4.2	Ritu charya, the seasonal regimen, Sadvritta and the concept of social wellbeing.	
5.0		**Daily detoxification**	
5	5.1	Understanding trividha upastambhas, three pillars to health.	6
	5.2	Concept of Shadrasa in choosing appropriate. nourishment to the body and mind.	

1. **Text Books**

Dr Deepak Chopra, Perfect Health--Revised and Updated: The Complete Mind Body Guide, Harmony publication, 2001

Vasant lad, Ayurveda, the Science of Self-healing: A Practical Guide: Science of Self-healing, lotus press, 1984

References

1.The Charaka Samhita.
2. The Susruta Samhita.
3. Teh Ashtanga Hridaya.

- Internal Assessment (T1, T2 and FET):
  3. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
  4. Fifth module will be assessed for 5 marks separately it will be taken as seminar.
- End Semester Examination:
  6. Question paper will comprise of 5 questions, each carrying 10 marks.
  7. The duration of end semester examination shall be 2 hours.
  8. The students need to solve all 5 questions.
  9. Question No.1 will be compulsory and based on entire syllabus.
  10. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Lab course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
U26PC104	**Human Anatomy and Physiology Lab-I**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	02	-	-	01	-

Evaluation Scheme

Course code	Course Name	In semester evaluation		End semester exam (OE/POE)		
U26PC104	**Human Anatomy and Physiology Lab-I**	FEP	Min pass	Marks	Min pass	Total (Marks)
		25	40%	-	-	25

Course Description: This course is based on the knowledge of anatomy and physiology of human body. This course covers the basic laboratory skills in common techniques used in pathological labs.

Pre-requisites: Basic knowledge of theory of anatomy and physiology of human body.

Course outcomes: after the end of this course students will able to

CO1 **Understand** fundamentals Anatomy of Major organs

CO2 **Understand** fundamentals Physiology of Major organs

List of experiments

1	Demonstration of Major organs through models and permanent slides.
2	To measure pulse rate
3	To measure blood pressure
4	To perform Hemoglobin by Sahli's Method
5	To perform Hemoglobin by CMG method.
6	To perform Total RBC and WBC count.
7	To perform bleeding time.
8	To perform clotting time.

References

1 Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
2 Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
3 Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
4 Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications
5 Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition, Elsevier Publications
6 Chaurasia B D, (2016), Human Anatomy, 7th edition, CBS publishers
7 Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley Publications

- Evaluation Scheme

1. FEP assessment must be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per ‘credit and grading system’ manual and should be added and averaged.
3. Based on above scheme grading and FEP assessment should be done.

Lab Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U21PC104	**General Chemistry Lab**	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term Work	Min pass %	Marks	Min pass %	Total (Marks)
U21PC104	**General Chemistry Lab**	25	40	-	-	25

Course Description: This course is a foundation course in chemistry for non-chemistry majors. This course covers the basic laboratory skills in chemistry.

Pre-requisites: Basic knowledge of chemicals and basic laboratory equipments.

Course Outcomes: after the end of this course students will able to,

CO1 Understand[1] common laboratory techniques.
CO2 Understand[2] the purification methods for compounds.
CO3 Demonstrate[3] the basic laboratory skills of chemistry.

List of Experiments

1.	Introduction to good laboratory safety practices.
2.	Preparation of solutions. (2 examples of each) a. Normal b. Molar c.% solution
3.	To standardise NaOH solution & find the strength of given HCl solution
4.	Determination of alkalinity in given water sample.
5.	Determination of chloride content in given water sample
6.	Determination of amount of acetic acid in commercial vinegar.
7.	Determination of Physical constant. (BP, MP)
8.	To purify the given organic compound by sublimation method.
9.	Preparation of buffer solution of pH 7 and 4.
10.	Synthesis of polymer (Bakelite resin)

	Reference Books
1	Vogel's Textbook of Practical Organic Chemistry
2	Albert D. R., Chemistry Techniques and Explorations an Introductory Chemistry Laboratory Manual by PA-ADOPT.

- **Evaluation Scheme**

1. Teamwork assessment of 25 marks shall be based on the overall performance of the student with every assignment graded from time to time.
2. The grades will be converted to marks as per the ‘credit and grading system’ manual and should be added and averaged.
3. Based on the above scheme grading and Teamwork assessment should be done.

Lab course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
U26VS101	**Basics of Hematology Lab**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	04	-	-	02	-

Evaluation scheme

Course code	Course name	In semester evaluation		End semester exam (OE/POE)		
U26VS101	**Basics of Hematology Lab**	FEP	Min pass	Marks	Min pass	Total (Marks)
		50	40%	-	-	50

Course description: This course is at odd semester of first year of B.Sc. MLT. It is a foundation course in MLT and pre-requisites for other courses. It covers fundamental concepts of Hematology.

Course outcomes: after the end of this course students will able to

CO1: Study basics of Hematological instruments.

CO2: Different types of Blood collection

CO3: Different blood tests that are carried out in a pathological lab.

List of Experiments

1	Demonstration of Hematological instruments
2	Different types of Blood collection A. Capillary method B. Vein puncture method
3	Demonstration of different types of Anticoagulants
4	Hb detection by Sahli's method
5	Hb detection by Drabskin method
6	Detection of blood group
7	Smear preparation in hematology
8	Detection of differential count
9	Detection of WBC by Neubaur's method

References

1 Praful Godkar, Darshan Godkar (2014). Textbook of Medical lab technology. Bhalani

Publishing House. 3

rd Edition, Vol 2. 2 Ochei and Kolatkar (2000). Medical Laboratory Science: Theory and Practice. McGraw

Hill Education. Reference Books

3 Dacie and Lewis practical hematology

4 Dr. Gayathri Prakash. Lab Manual on Blood Analysis and Medical Diagnostics. S Chand

publication house, New Delhi.

- Evaluation Scheme

4. FEP assessment must be based on the overall performance of the student with every assignment graded from time to time.
5. The grades will be converted to marks as per ‘credit and grading system’ manual and should be added and averaged.
6. Based on above scheme grading and FEP assessment should be done.

Lab course With POE

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
U26SE101	Fundamental Principles of Medical Laboratory Technology	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
U26SE101	Fundamental Principles of Medical Laboratory Technology	Term Work	Min pass %	Marks	Min pass %	Total (Marks)
		25	40	25	40	50

Course description: This course is at odd semester of first year of B.Sc. MLT. It is a foundation course in MLT and pre-requisites for other courses. It covers fundamental Principles of Medical Laboratory Technology.

Course Outcomes: after the end of this course students will able to

CO1 **Analyze**[3] basics of clinical lab and its functioning.

CO2 **Demonstrate**[2] various lab instruments, their working principles and functions.

CO3 **Apply**[3] knowledge of instrumentation in sampling and diagnostics.

List of Experiments

- Basics of Laboratory set up.
- Lab safety and entry exit protocols.
- Use of Glassware and lab utilities.
- Demonstration of working of Hot Air Oven.
- Demonstration of working of Weighing Balance.
- Demonstration of working of Laboratory Incubators.
- Demonstration of working of Centrifuge.
- Demonstration of working of Autoclave (Steam Sterilizer)
- Demonstration of working of Laminar Air Flow.
- Demonstration of working of Water Bath.

Text Book

1 Praful Godkar, Darshan Godkar (2014). Textbook of Medical lab technology. Bhalani Publishing House. 3rd Edition, Vol 2.

2 Ochei and Kolatkar (2000). Medical Laboratory Science: Theory and Practice. McGraw Hill Education.

Reference Books

3 T. Rajlaskhmi (2009). Biomedical Instrumentation. SAMS Publication, New Delhi.

4 Dr. Gayathri Prakash. Lab Manual on Blood Analysis and Medical Diagnostics. S Chand publication house, New Delhi.

- Evaluation Scheme

4. Termwork assessment shall be based on the overall performance of the student with every assignment graded from time to time.
5. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
6. Based on above scheme grading and Termwork assessment should be done.
7. OE/POE shall be based on all Termwork and work carried out during semester.

Theory course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
U26PC203	**Human Anatomy and Physiology-II**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		03	-	-	03	-	-

Evaluation scheme

Course Code	Course name	Evaluation scheme (in semester)					End semester exam (ESE)		
U26PC203	**Human Anatomy and Physiology-II**	T1	T2	FET	Total	Min pass	Marks	Min pass	Total (Marks)
		10	10	5	25	40%	50	40%	75

Course Description: This course aims to help students understand the structure and functioning of reproductive, nervous, endocrine and excretory systems. This course also offeres knowledge of sensory organs such as eyes, ears and nose.

Pre-requisites: The Students should have basic knowledge of basic biology.

Course Objectives:

- To understand structure and functioning of major systems of human body such as reproductive, nervous, endocrine and excretory systems.
- To understand structure and functioning of sensory organs such as eyes, ears and nose.

Course outcome(s):

After successful completion of this course, students will able to

CO1 understand the basic anatomy of reproductive, nervous, endocrine and excretory systems.

CO2 understand the basic physiology of reproductive, nervous, endocrine and excretory systems.

Course Contents

Module	Unit	Description	Hours
1.0		**Reproductive System**	
1	1.1	male & female reproductive organs	9
	1.2	sex hormones, secondary sexual characteristics, puberty, spermatogenesis, oogenesis, menstrual cycle, pregnancy, menopause	
2.0		**Nervous System**	
2	2.1	Basic anatomy of brain and spinal cord, meninges and cerebrospinal fluid, Cranial Nerves	9
	2.2	general organization of CNS, function of important structure and spinal cord, neuron, nerve impulse, type of nerves according to function	
3.0		**Endocrine System**	
3	3.1	Brief anatomy of Pituitary, Thyroid, Pancreas, Adrenal gland	9
	3.2	Brief introduction about endocrine glands and their secretion, common endocrinological disorder such as diabetes mellitus, hyper & hypothyroidism, dwarfism, gigantism, tetany	
4.0		**Special Senses**	
4	4.1	Basic anatomy of eye,	9
	4.2	Basic anatomy of ear and nose	
5.0		**Excretory system**	
5	5.1	Basic anatomy of kidney and associated organs	9
	5.2	Mechanism of Excretion, Urine formation, Electrolytes: their balances and imbalances Introduction of acidosis and alkalosis	

- Internal Assessment (T1, T2 and FET):
  5. T1 should be based on first two modules and T2 should be based on next two modules, for 10 marks each.
  6. Fifth module will be assessed for 5 marks separately.
- End Semester Examination:
  11. Question paper will comprise of 5 questions, each carrying 10 marks.
  12. The duration of end semester examination shall be 3 hours.
  13. The students need to solve all 5 questions.
  14. Question No.1 will be compulsory and based on entire syllabus.
  15. Remaining question (Q.2 to Q.5) will be selected from all the modules.

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Theory Course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U21PC203	**Chemistry for Biologist**	3	-	-	3	-	-

Evaluation Scheme

Course Code	Course name	Evaluation scheme (In semester)					End semester exam (ESE)		
		T1	T2	FE T	Total	Min pass	Marks	Min pass	Total (Marks)
U21PC203	**Chemistry for Biologist**	10	10	5	25	40%	50	40%	75

Course Description: *Chemistry for Biologists* course aim to help you understand the chemistry and chemical principles that underlie a good deal of biology. This course is offered to non-chemistry biology majors. This course deals with structure and properties of biomolecules, such as amino acids, proteins, carbohydrates, lipids, and nucleic acids. The focus of this course will be on the relationship between protein structure and its biological function.

Pre-requisites: The Students should have basic knowledge of concepts in chemistry and basic biology.

Course Objectives:

- Understand the structure and properties of biomolecules.
- Correlate their pathways inside body.

Course Learning Outcomes: At the end of this course, students will be able to,

CO1 Understand[1] the fundamental concepts in biology, chemistry and biochemistry.

CO2 Apply[3] basic principles of chemistry to biological systems and molecular biology.

CO3 Relate[2] various interrelated physiological and metabolic events.

Course Contents

Module	Unit	Description	Hours
1.0		**Introduction**	
1	1.1	Introduction to Chemistry of life, Organic Molecules for Biology, functional groups.	9
	1.2	Inorganic Ions: Plants, Nutrients, Cations and Anions in Mammelian diet. Water and Living Organisms: Water molecule, Solvent, Proton transfer reactions, Buffer, Metabolites and living environment, Amino acids, Concept of Chirality.	
2.0		**Carbohydrates, Proteins and Enzymes**	
2	2.1	Carbohydrates: Monosaccharides and Disaccharides, Polysaccharides, Glycogen and Cellulose. Lipids: Glycerol, Fatty acids, Esters, Triglycerides, Phospholipids.	9
	2.2	Proteins Importance of Proteins, Amino acids, Peptide bond formation, Primary and Three-dimensional structure and functions. Enzymes: Concept of Catalysis, General Properties of Enzymes, Function and structures, Enzyme catalysis.	
3.0		**Nucleic Acids, Cells and Metabolism**	
3	3.1	Nucleic Acids: Introduction, Sugars-Phosphates-Bases, Formation of nucleotides, Structure of DNA and hydrogen bonding.	9
	3.2	In and Out of Cell: Cells, Membranes and walls. Phospholipids, Proteins, Plant cell walls, Passive and active transport. Metabolism and Energy: Chemical reactions in cell, Anabolism and catabolism, Chemical reactions during metabolism.	
4.0		**Energy**	
4	4.1	Energy flow: Energy and chemical compounds, Photosynthesis, Transfer of energy through energy cycles. Gas Exchange during respiration and in flowering plants.	9
	4.2	Transport of Oxygen in blood: Blood, Red blood cells and Haemoglobin, Effect of CO_2 in blood. Respiration: ATP and cells, Oxidation and reduction, Aerobic and anaerobic respiration.	

5.0		**Biochemical transformations**	
5	5.1	Photosynthesis: Leaves and leaf structure, stages of photosynthesis, light dependent and light independent reactions. ATP from ADP.	9
	5.2	Excretion and the Liver: Excretion in mammals and function of liver, amino acid regulations, detoxification in liver. Nerves and Hormones: Nervous coordination in mammals. Carbonyl chemistry: Aldol reaction, Claisen Reaction, Prenyl Transfer Reaction.	

References

4. Carol Higginbotham, Introductory Biochemistry
5. Chemistry for Biologists (rsb.org.uk)

Internal Assessment (T1, T2 and FET):
T1 should be based on first two modules, T2 should be based on third and fourth modules, for 10 marks.

Fifth module will be assessed for 5 marks separately.

- End Semester Examination:

6. Question paper will comprise of 5 questions, each carrying 7 marks.
7. The duration of end semester examination shall be 2 hours.
8. The students need to solve all 5 questions.
9. Question No.1 will be compulsory and based on entire syllabus.
10. Remaining question (Q.2 to Q.5) will be selected from all the modules

Lab course

Course code	Course name	Teaching scheme (Hr/week)			Credits assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U26PC204	**Human Anatomy and Physiology Lab-II**	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		FEP	Min pass	Marks	Min pass	Total (Marks)
U26PC204	**Human Anatomy and Physiology Lab-II**	25	40%	-	-	25

Course Description: This course aims to help students to study different pathological examinations of biological samples from reproductive, nervous, endocrine and excretory systems. This course also offeres knowledge of sensory organs such as eyes, ears and nose with demonstrations.

Pre-requisites: The Students should have basic knowledge of basic biology.

Course Objectives:

❖ To study different pathological examinations of biological samples from human reproductive, nervous, endocrine and excretory systems.

❖ To understand structure and functioning of sensory organs such as eyes, ears and nose.

Course outcomes: after the end of this course students will able to

CO1: **Perform** various methods of Urine tests

CO2: **Demonstrate** structure of sense organs

List of experiments

1	1. To study about intrauterine contraceptive devices.
2	To perform protein test by various methods.
3	Physical examination of urine
4	Urine sugar determination by Benedict's metod.
5	Bile salt, Bile pigments and Urobilinogen determination
6	Determination of Ketone bodies
7	Determination of various parameters of urine by uristik method.
8	Structure of eye and ear
9	To study about CSF examination.

Reference

1. Ross & Wilson,(2014),Anatomy & Physiology in health & illness,11th edition,Elsevier Publications
2. Chaurasia B D, (2016), Human Anatomy, 7th edition,CBS publishers
3. Gerard J. Tortora and Bryan H.Derrickson,(Principles of Anatomy and Physiology,14th edition,Wiley publications
4. Sujit Chaudhury,(2011),Concise Medical Physiology,6th edition, NCBA
5. Sembulingam k,(2012),Essentials of Medical Physiology,6th edition, Jaypee Publications
6. Guyton and Hall,(2011) Textbook of Medical Physiology,12th Edition,Saunder/Elsevier

- Evaluation Scheme

7. FEP assessment must be based on the overall performance of the student with every assignment graded from time to time.
8. The grades will be converted to marks as per ‘credit and grading system’ manual and should be added and averaged.
9. Based on above scheme grading and FEP assessment should be done.

Lab Course

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U21PC204	**Chemistry for Biologist Lab**	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term Work	Min pass %	Marks	Min pass %	Total (Marks)
U21PC204	**Chemistry for Biologist Lab**	25	40			25

Course Description: This course is a foundation course in chemistry for non chemistry majors. This course covers the basic laboratory skills in chemistry that are relevant to biology majors.

Pre-requisites: Basic knowledge of chemistry, biology and basic laboratory equipments.

Course Outcomes: after the end of this course students will able to,

CO1 Understand[1] and relate theory to common laboratory techniques.

CO2 Understand[2] the isolation and purification methods for biological samples.

CO3 Demonstrate[3] the basic laboratory skills of biochemistry.

List of Experiments

11.	Preparation of reagents, buffers etc. for biological samples
12.	Determination of total amino acid concentration by ninhydrin method.
13.	Estimation of protein concentration by- i) Biuret method ii) Lowry method iii) Spectrophotometric method.
14.	Estimation of reducing sugar concentration by DNSA method
15.	Estimation total sugar concentration by i) Phenol-H_2SO_4 method ii) Anthrone method
16.	Determination of fructose concentration by resorcinol method
17.	Isolation of DNA and RNA.
18.	Estimation of DNA and RNA a] Estimation of DNA by diphenyl amine method. b] Estimation of DNA by Spectrophotometric method.

	c] Estimation of RNA by orcinol method.
19.	Isolation of Characterization of casein from milk
20.	Isolation and characterization of starch from potato
21.	Isolation of cholesterol and lecithin from egg yolk
	Reference Books
1	Boyer, Rodney F.; Biochemistry laboratory: Modern theory and techniques
2	Philip L.R. Bonner, Alan J. Hargreaves, Basic Bioscience Laboratory Techniques, Wiley Blackwell.
3	E. Dilipan, Methods and Protocols: A Laboratory Manual for Biochemistry and Biotechnology, INSC International Publishers.

- **Evaluation Scheme**

8. Teamwork assessment of 25 marks shall be based on the overall performance of the student with every assignment graded from time to time.
9. The grades will be converted to marks as per the ‘credit and grading system’ manual and should be added and averaged.
10. Based on the above scheme grading and Teamwork assessment should be done.

Lab course With POE

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
		Theory	Practical	Tutorial	Theory	Practical	Tutorial
U26VS202	Bioanalytical techniques and Instrumentation	-	02	-	-	01	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
		Term Work	Min pass %	Marks	Min pass %	Total (Marks)
U26VS202	Bioanalytical techniques and Instrumentation	25	40	25	40	50

Course Description: This course is a foundation course in medical laboratory techniques. This course covers the basic knowledge of principals and handling laboratory instruments that are used in medical laboratory techniques labs.

Pre-requisites: Basic knowledge of physics, biology and basic laboratory equipments.

Course Outcomes: after the end of this course students will able to

CO1 **Analyze**[3] various lab instruments, their working principles, functions and applications.

CO2 **Demonstrate**[2] the various types of spectroscopic methods.

CO3 **Apply**[3] the various types of spectroscopic methods.

List of Experiments

- Demonstration of Microscope
- Demonstration of UV visible spectroscope
- Demonstration of colorimeter
- Determination of R_f by TLC
- Demonstration of column chromatography
- Estimation of serum proteins.

Text Book

1 Praful Godkar, Darshan Godkar (2014). Textbook of Medical lab technology. Bhalani Publishing House. 3rd Edition, Vol 2.

2 Ochei and Kolatkar (2000). Medical Laboratory Science: Theory and Practice. McGraw Hill Education.

Reference Books

3 T. Rajlaskhmi (2009). Biomedical Instrumentation. SAMS Publication, New Delhi.

4 Dr. Gayathri Prakash. Lab Manual on Blood Analysis and Medical Diagnostics. S Chand publication house, New Delhi.

- Evaluation Scheme

11. Term work assessment shall be based on the overall performance of the student with every assignment graded from time to time.
12. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
13. Based on above scheme grading and Term work assessment should be done.
14. OE/POE shall be based on all Term work and work carried out during semester.

Lab course With POE

Course code	Course name	Teaching Scheme (Hr/week)			Credits Assigned		
U26SE202	**Computer Applications of for Analysis**	Theory	Practical	Tutorial	Theory	Practical	Tutorial
		-	04	-	-	02	-

Evaluation Scheme

Course Code	Course Name	In Semester Evaluation		End Semester Exam (OE/POE)		
U26SE202	**Computer Applications of for Analysis**	Term Work	Min pass %	Marks	Min pass %	Total (Marks)
		25	40	25	40	50

Course Description: This course offers basic knowledge of handling computers. It also includes some computer applications used in medical laboratory techniques.

Pre-requisites: Basic knowledge of computers.

Course Outcomes: after the end of this course students will able to

CO1 Identify[2] and use MS-Word, Excel, Operating System
CO2 Examine[3]Importance Hospital Information Systems
CO3 Apply[2] Computers in clinical settings.

List of Experiments

1. Introduction to computer.
2. Input output devices.
3. MS-Word: introduction, components of a word window, creating, opening and inserting files, editing a document file
4. Excel: introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs
5. Operating System: introduction, operating system concepts, types of operating system.
6. Internet and its Applications: definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW).
7. Application of Computers in clinical settings
8. Demonstration of the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats.
9. Demonstration of recent trends in Hospital Information Systems.

Text Book

1 Mausner & bahn : Epidemiology-An Introductory text, 2nd Ed.,W.B.Saunders Co.
2 Richard f. Morton & j. Richard hebd : A study guide to Epidemiology and Biostatistics. 2nd Ed., University Park Press, Baltimore.

Reference Books

3 Sylvia W Smoller, J Smoller, Biostatistics & Epidemiology A Primer for health and Biomedical professionals, 4th edition, Springs, 2015

- Evaluation Scheme

15. Term work assessment shall be based on the overall performance of the student with every assignment graded from time to time.
16. The grades will be converted to marks as per 'credit and grading system' manual and should be added and averaged.
17. Based on above scheme grading and Term work assessment should be done.
18. OE/POE shall be based on all Term work and work carried out during semester.