

BACHELOR OF SCIENCE CLINICAL LABORATORY TECHNOLOGY

SYLLABUS: 2017-18 Onwards



Dr. N.G.P ARTS AND SCIENCE COLLEGE (Autonomous)

(Re-Accredited with A Grade by NAAC)

(Affiliated to Bharathiar University,)

Dr. N.G.P. Nagar - Kalapatti Road

Coimbatore-641 048

B.SC. CLINICAL LABORATORY TECHNOLOGY

REGULATIONS

ELIGIBILITY :

A pass in Higher Secondary Examination with Physics, Chemistry and Biology as subjects, and as per the norms prescribed by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed there to are permitted to appear and qualify for the **Bachelor of Clinical Lab Technology Degree Examination** of this College after a course of study of three academic years.


PROGRAMME EDUCATIONAL OBJECTIVES:


The Curriculum is designed to achieve the following learning goals which students shall accomplish by the time of their graduation:

1. Attain careers as practicing laboratory technicians in fields such as clinical laboratories, hospitals, clinical research centers, biotechnology laboratories, equipment manufacturing industries.
2. Attain advanced studies in disciplines such as Microbiology, Medical Laboratory Technology, Biochemistry, Biotechnology, Hospital Administration, Hospital Records Management, etc.,
3. Assume professional leadership roles

SCHEME OF EXAMINATIONS

Course Code	Course	Hrs of Instruction	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
Part - I							
17UTL11T	Tamil - I	5	3	25	75	100	3
17UHL11H	Hindi - I						
17UML11M	Malayalam - I						
17UFL11F	French - I						
Part - II							
17UEG12E	English-I	5	3	25	75	100	3
Part - III							
17UCL13A	Core - I: Human Anatomy & Physiology	4	3	20	55	75	4
17UCL13B	Core - II: Fundamentals of Biochemistry	4	3	20	55	75	4
17UCL13P	Core Practical - I: Biochemistry- I	4	3	30	45	75	2
17UIT1AA	Allied - I: Fundamentals of Information Technology	4	3	20	55	75	3
	Allied Practical- I: OfficeAutomation	2	-	-	-	-	-
Part - IV							
17UFC1FA	Environmental Studies	2	2	-	50	50	2
		30				550	21
Second Semester							
Part - I							
17UTL21T	Tamil -II	5	3	25	75	100	3
17UHL21H	Hindi - II						
17UML21M	Malayalam - II						
17UFL21F	French - II						


 BoS Chairman/HoD
 Department of Clinical Laboratory Technology
 Dr. N. G. P. Arts and Science College
 Coimbatore - 641 048


 Dr. P. R. MUTHUSWAMY
 PRINCIPAL
 Dr. NGP Arts and Science College
 Dr. NGP - Kalapatti Road
 Coimbatore - 641 048
 Tamilnadu, India

Part - II							
17UEG22F	English-II	5	3	25	75	100	3
Part - III							
17UCL23A	Core - III: Analytical Techniques	4	3	20	55	75	3
17UCL23B	Core-IV: Good Clinical Laboratory Practices	3	3	20	55	75	3
17UCL23P	Core Practical - II: Biochemistry-II	5	6	30	45	75	2
17UIT2AA	Allied - II: Office Automation	4	3	20	55	75	3
17UIT2AP	Allied Practical - I: Office Automation	2	3	20	30	50	2
Part - IV							
17UFC2FA	Value Education - Human Rights	2	2	-	50	50	2
	Total	30				600	21
Third Semester							
Part - III							
17UCL33A	Core - V: Intermediary Metabolism	4	3	20	55	75	4
17UCL33B	Core - VI: Clinical Pathology	4	3	20	55	75	4
17UCL33C	Core - VII: Histopathology	3	3	20	55	75	3
17UCL33P	Core Practical - III: Pathology	4	3	30	45	75	2
17UCY3AA	Allied - III: Chemistry for Biologist's	4	3	20	55	75	3
17UCY3AP	Allied Practical - II: Chemistry	4	3	20	30	50	2

17UCL3SA	Skill based Course - I: Bio-safety & Bio-waste management	3	3	20	55	75	3
Part - IV							
	NMEC I	2	2	-	50	50	2
17UFC3FA 17UFC3FB 17UFC3FC 17UFC3FD 17UFC3FE	Tamil/ Advanced Tamil (OR) Non-major elective-I (Yoga for Human Excellence) / Women's Rights/ Constitution of India	2	2	-	50	50	2
	Total	30				600	25
Fourth Semester							
Part - III							
17UCL43A	Core - VIII: Microbiology- I	4	3	25	75	100	4
17UCL43B	Core - IX: Clinical Biochemistry-I: Metabolic disorders	4	3	20	55	75	4
17UCL43C	Core - X: Clinical Biochemistry-II: Functional tests	4	3	20	55	75	4
17UCL43P	Core Practical - IV: Clinical Biochemistry	6	6	30	45	75	3
17UCL4AA	Allied - IV: Drug Biochemistry	4	3	20	55	75	3
17UCL4SA	Skill based Course - II: Laboratory Automation	4	3	20	55	75	3

Part-IV							
	NMEC -II:	2	2	-	50	50	2
17UFC4FA 17UFC4FB 17UFC4FC	Tamil/Advanced Tamil (OR) General Awareness	2	2	-	50	50	2
	Total	30				575	25
Fifth Semester							
Part - III							
17UCL53A	Core - XI: Microbiology- II	4	3	25	75	100	4
17UCL53B	Core - XII: Hematology	4	3	20	55	75	4
17UCL53C	Core - XIII: Blood Banking	3	3	20	55	75	3
17UCL53P	Core Practical-V: Hematology	6	6	30	45	75	3
17UCL53Q	Core Practical-VI: Microbiology-I	6	9	30	45	75	3
	Elective - I :	4	3	25	75	100	4
17UCL5SA	Skill Based Course -III: Basics of Molecular Biology	3	3	20	55	75	3
Part-IV							
17UCL53T	Industrial Training	Grade A to C					
	Total	30				575	24
Sixth Semester							
Part - III							
17UCL63A	Core -XIV: Immunology	4	3	25	75	100	4
17UCL63B	Core-XV: Cytology	4	3	25	75	100	4
17UCL63P	Core Practical-VII:	6	9	30	45	75	3

	Microbiology- II						
	Elective - II:	4	3	25	75	100	4
	Elective - III:	4	3	25	75	100	4
17UCL6SV	Skill based Course - IV: Mini Project	8	3	30	45	75	3
Part V							
17UEX65A	Extension Activity	-	-	50	-	50	2
	Total	30				600	24
Grand Total						3500	140

ELECTIVE - I

(Student shall select any one of the following Course as Elective-I in fifth semester)

S.No	Course Code	Name of the Course
1	17UCL5EA	Organisation of Clinical Laboratory
2	17UCL5EB	Introduction to Biomaterials
3	17UCL5EC	Plant & Animal Biotechnology

ELECTIVE - II

(Student shall select any one of the following Course as Elective-II in sixth semester)

S.No	Course Code	Name of the Course
1	17UCL6EA	Quality Control and Biostatistics
2	17UCL6EB	Nanomaterials and Nanomedicine
3	17UCL6EC	Genetic Engineering and Bioprocess Technology

ELECTIVE - III

(Student shall select any one of the following Course as Elective-III in sixth semester)

S.No	Course Code	Name of the Course
1.	17UCL6ED	Tumor markers and Immunohistochemistry
2.	17UCL6EE	Nanobiotechnology
3.	17UCL6EF	Plant Therapeutics

NON MAJOR ELECTIVE COURSES

- The Department offers the following two papers as Non Major Elective Courses for other than the Clinical Laboratory Technology students.
- Student shall select any one of the following Course as Non Major Elective Courses during their III and IV semester

S. No.	Semester	Course Code	Course Title
1.	III	17UNM34D	Anatomy, Physiology & Laboratory Science
2.	IV	17UNM44D	Concepts of Health

Total Credit Distribution

Courses	Credit	Total Marks		Credits	Cumulative Total
Part I: Tamil	3	2 X 100 =	200	06	12
Part II: English	3	2 X 100 =	200	06	
Part III:					
Core Theory	3	4 X 75 =	300	12	114
Core Theory	4	7 X 75=	525	32	
Core Theory	4	4 X 100 =	400	12	
Core Practical	2	3 X 75=	225	06	
Core Practical	3	4 X 75 =	300	12	
Allied theory	3	4 X 75 =	300	12	
Allied practical	2	2 X 50 =	100	04	
Skill based Courses	3	4 X 75 =	300	12	
Electives	4	3 X 100 =	300	12	
Part IV:					
Value Education	2	1 X 50 =	50	02	12
Environmental Studies	2	1X50	50	02	
Foundation Course	2	2X50=	100	04	
NMEC	2	2 X 50 =	100	04	
Part V:					
Extension Activity	2	1 X 50 =	50	02	02
Total			3500	140	140

FOR PROGRAMME COMPLETION

Students shall complete:

1. Language papers (Tamil/Malayalam/French/Hindi, English) in I, II, III and IV semester.
2. Environmental Studies in I semester
3. Value Education in II and III semesters respectively
4. General awareness in IV semester
5. Allied papers in I, II, III and IV semesters.
6. Students must undergo industrial training for 15 - 30 days during IV semester summer vacation. Evaluation of the report done by the internal and external examiner in the V semester. Based on their performance grade will be awarded as A to C.
7. A - 75 marks and above
8. B - 60 - 74 marks
9. C - 40 - 59 marks
 - a. Below 40 marks Reappear (RA)
10. One Non Major Elective Course (NMEC) each in the third and fourth semesters
11. Skill based papers in III, IV, V and VI semesters
12. Elective papers in the fifth and sixth semesters.
13. An in-house project at the end of VI semester.
14. Extension activity in VI semester.

Earning Extra credits is not mandatory for course completion

Extra credits

Course	Credit	Total credits
BEC/ Self study courses	1	1
Hindi / French/ Other foreign Language approved by certified Institutions	1	1
Type Writing / Short Hand Course	1	1
Diploma/certificate/CPT/ ACS Inter/ NPTEL Course	1	1
Representation - Academic/Sports /Social Activities/ Extra Curricular / Co-Curricular activities at University/ District/ State/ National/ International	1	1
Total		5

Rules:

The students can earn extra credits only if they complete the above during the Programme period (I to V sem) and based on the following criteria. Proof of Completion must be submitted in the office of the Controller of Examinations before the commencement of the VI Semester. (Earning Extra credits are not mandatory for Programme completion)

1. Student can opt BEC course/ Self study course to earn one credit. They have to Enroll and complete any one of the course during their Programme period before fifth semester (I sem to V sem).

**Self study paper offered by the Clinical Laboratory Technology
Department**

S. No.	Semester	Course Code	Course Title
1.	III	17UCLSS1	Disaster Management
2.		17UCLSS2	Health and Hygiene

2. Student can opt Hindi/ French/ Other foreign Language approved by certified Institutions to earn one credit. The certificate(Hindi) must be obtained from **Dakshina Bharat Hindi Prachar Sabha** and He/ she has to enroll and complete during their Programme period (**first to fifth semester**)
3. Student can opt for Type writing /short hand course to earn one extra credit. He/she has to enroll and complete the course during their Programme period to obtain certificate through **Tamil Nadu Board of Technical Education**
4. Student can opt for Diploma/certificate/CPT/ACS Inter/ NPTEL Course to earn one extra credit. Student who opt for Diploma/ Certificate course have to enroll any diploma/certificate course offered by Bharathiar University through our Institution. Student who opt for CPT/ ACS/CMA have to enroll and complete the foundation level during the course period. Students who opt for NPTEL course should complete the course certificate through NPTEL.
5. Award Winners in Academic/ Representation in Sports /Social Activities/ Extra Curricular/ Co-Curricular Activities at University/ District/ State/ National/ International level can earn one extra credit.

PROGRAMME OUTCOMES

On successful completion of programme, the following are the expected outcomes.

PO Number	PO Statement
PO 1	The students are familiarized with theoretical and practical aspects of life science education.
PO 2	Students are encouraged to recognize and appreciate life processes taking place in human body.
PO 3	Students are exposed to modern tools and techniques adopted in the medical field and are motivated to apply the contextual knowledge for analysis and interpretation of data.
PO 4	Students are kindled to realize the need for life long learning and need for sustainable development.
PO 5	Students are encouraged to understand and follow ethical principles and practices and function effectively as an individual or team thereby achieve employability/entrepreneurship skills.

17UCL13A	CORE - I: HUMAN ANATOMY AND PHYSIOLOGY	SEMESTER - I
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Total Credits: 4
Hours /week: 4

PREAMBLE:

To understand the terminologies used in human anatomy and study various organs of the human body and their physiological functions.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the definition of anatomical terms, general anatomy and physiology of central nervous system	K ₁ ,K ₂
CO 2	Know the circulatory system and understand the principles of cardiac system and measurement of cardiac output.	K ₁ ,K ₂ , K ₃
CO 3	Describe the anatomy and physiology of respiratory and digestive system.	K ₁ ,K ₂ , K ₃
CO 4	Understands the structure and functions of excretory and reproductive system.	K ₁ ,K ₂ , K ₃
CO 5	Know the anatomy and physiology of lymphatic and sensory systems and appreciate the anatomical techniques	K ₁ ,K ₂ , K ₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL13A	CORE - I: HUMAN ANATOMY AND PHYSIOLOGY	SEMESTER - I
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Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

General Anatomy: Introduction to anatomical terms and organization of the human body. Tissues -Definitions, Types, characteristics, classification, location, functions and formation. Blood - morphology, composition, functions.

Central Nervous system: Spinal cord, Anatomy, Functions. Structure of neuron, nerve impulse, myelinated and non-myelinated nerve. Brief account of resting membrane potential, action potential and conduction of nerve impulse.

UNIT-II

Cardiovascular System: Circulatory system - Structure of the Heart, Structure of Blood Vessels - arterial and venous system. Definitions of cardiac output, stroke volume, principles of measurements of cardiac output. Normal values of blood pressure, heart rate and their regulation in brief.

UNIT-III

Respiratory System: Parts, Nasal cavity and Paranasal air sinuses, trachea, Gross and microscopic structure of lungs, Diaphragm and Pleura. Principles of respiration, respiratory muscles, lung volumes and capacities, collection

and composition of inspired alveolar and expired airs. Transport of oxygen and carbondioxide.

Digestive System: Parts, Structure of Tongue, Salivary glands, stomach, Intestines, Liver, Pancreas. functions of G.I secretions, principles of secretion and movements of GIT.

UNIT-IV

Excretory system: Parts, structure of Kidney, Ureters, Urinary Bladder and Urethra, Structure of Nephron, measurement and regulation of GFR, mechanism of urine formation. Clearance tests & values of inulin, PAH and urea clearance.

Reproductive System: Parts of the system. Gross structure of both male and female reproductive organs.

UNIT-V

Lymphatic System: Gross and microscopic structure of lymphatic tissue.

Special Senses: Structure of Skin, Eye, Nose, Tongue (Auditory and Olfactory apparatus).

Anatomical Techniques: Embalming of human cadaver, Museum Techniques, Basic principles of Karyotyping.

TEXT BOOKS :

1. *Chatterjee, C C*, 2005. **Human Physiology**, 10th Edition, Medical Allied Agency, Kolkata.
2. *Khurana I and Khurana A* 2014. **Textbook of Anatomy and Physiology for Nurses and Allied Health Sciences**, 1st Edition, CBS Publishers and Distributors, New Delhi

REFERENCE BOOKS :

1. *Sembulingam K and Sembulingam P*, 2010, **Essentials of Medical Physiology**, 5th Edition, Jaypee Medical Pub, New Delhi
2. *Arnould-Taylor W E* 2001, **A Textbook of Anatomy and Physiology**, 3rd Edition, Stanley Thomas publishers, UK.

17UCL13B	CORE - II: FUNDAMENTALS OF BIOCHEMISTRY	SEMESTER - I
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Total Credits:4
Hours /week:4

PREAMBLE:

- To understand the basic structure, classification and functions of various biomolecules such as carbohydrates, proteins, lipids, nucleic acids, enzymes and hormones
- To appreciate the complex architecture and functioning of cells.

COURSE OUTCOME:

On the successful completion of the course, students will be able to

CO Number	CO statement	Knowledge level
CO 1	Describe the distinguishing characteristics of prokaryotic and eukaryotic cells and to understand the structure and functions of cell organelles	K₁, K₂
CO 2	Understand the types, properties and significance of major biomolecules.	K₁, K₂, K₃
CO 3	Understand the structure and functions of nucleic acids and to recall the types, sources and functions of vitamins and minerals	K₁, K₂
CO 4	Understand the classification, structure, mechanism of action and diagnostic importance of enzymes.	K₂, K₃
CO 5	Understand the types and functions of various endocrine hormones and their disorders	K₁, K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	M	M	M
CO 3	S	S	S	M	M
CO 4	S	S	S	S	M
CO 5	S	S	S	S	M

S- Strong, M - Medium, L - Low

17UCL13B	CORE - II: FUNDAMENTALS OF BIOCHEMISTRY	SEMESTER - I
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Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

An overview of cells and their molecular composition:- prokaryotic and eukaryotic cells and their comparison. Cell organelles and their functions: Cell membrane, Endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes and glyoxysomes. Mitochondria, Cytoskeleton, Nucleus: Chromosomes; chromatin structure.

UNIT-II

Carbohydrates: Classification, Properties, biological significance and functions of monosachharides, disachharides and polysaccharides.

Amino acids: Definitions, classification of essential and non essential amino acids. Chemical reactions of amino acids. Classification, structure and properties of peptides and proteins, Examples: albumin, globulins. Protein denaturation.

Lipids: Definition; classification, significance and functions of lipids-simple, compound and derived lipids. Steroids- functions.

UNIT-III

Nucleic acids: Structure of purines and pyrimidines; nucleotides and nucleosides, DNA. Double helical structure, A, B & Z forms of DNA; DNA denaturation and renaturation, functions. RNA: Types and functions.

Vitamins: Definition, classification, Sources and physiological functions of water and fat soluble vitamins. **Minerals:** Mineral requirement, essential macro and micro minerals: - Sources and functions.

UNIT-IV

Enzymes: International classification of enzymes, six main classes of enzymes. Factors affecting enzyme activity. Active site & Mechanism of enzyme action- example- trypsin.

Enzyme Inhibition: Competitive, Non-competitive and uncompetitive enzyme inhibition. Coenzymes. Diagnostic importance of enzymes.

UNIT-V

Hormones - Names of endocrine glands & their secretions, functions of various hormones- Pituitary, thyroid, parathyroid, pancreatic, adrenal, testosterone, progesterone and estrogen. Brief account of these hormonal disorders.

TEXT BOOKS:

1. *Gupta S N*, 2011, **Biochemistry, Rastogi publication**, 1st Edition New Delhi.
2. *Jain J L, Jain S and Jain N*, 2012, **Biochemistry**, 1st Edition, S. Chand and Company pvt Ltd, New Delhi.

REFERENCE BOOKS:

1. *Deb, AC*, 2001, **Fundamentals of Biochemistry**, 7th Edition New central Agency, Calcutta.
2. *Cooper, G M and Hausman R E*, 2013, **The cell: A Molecular Approach**, 6th Edition, Sinauer Associates, Inc.Publishers, Sunderland, Massachusetts.

17UCL13P	CORE PRACTICAL - I: BIOCHEMISTRY- I	SEMESTER - I
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Total Credits: 2
Hours /week: 4

CONTENTS

1. Qualitative analysis of carbohydrates:

- a. Monosaccharides - Pentose - Arabinose. Hexoses - Glucose, Fructose,
- b. Disaccharides - Sucrose, Maltose and Lactose
- c. Polysaccharide - Starch

2. Qualitative analysis of Amino acids:

- a. Histidine
- b. Tyrosine.
- c. Tryptophan
- d. Arginine

3. Analysis of lipids:

- a. Estimation of Acid Number
- b. Estimation of Iodine Number
- c. Estimation of Saponification Number

REFERENCE BOOKS :

1. *Sadasivam S and Manikam A* 1996 **Biochemical methods** 2nd edition, New Age International publishers, New Delhi.
2. *Plummer D T* 2004 **An Introduction to practical Biochemistry**, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd, New Delhi

17UIT1AA	ALLIED - I : FUNDAMENTALS OF INFORMATION TECHNOLOGY	SEMESTER - I
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Total Credits: 3

Hours /week: 4

PREAMBLE:

- To be aware about classification and components of computer.
- To know about basics of Internet.

COURSE OUTCOME:

On the successful completion of the course, students will be able to

CO Number	CO statement	Knowledge level
CO 1	To know about the types and generations of computers.	K1, K2
CO 2	To understand the hardware components of the computer.	K1,K2
CO 3	To be aware of input and output devices of the computer.	K1, K2
CO 4	To be acquainted with the hardware, software and operating system and its operations	K1, K2,K3
CO 5	To understand the basics of Internet and its operations.	K1, K2,k3

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	M	M	M	M	M
CO 2	M	M	M	M	M
CO 3	M	M	M	M	M
CO 4	M	M	S	S	S
CO 5	S	M	S	S	S

S- Strong, M - Medium, L - Low

17UIT1AA	ALLIED - I : FUNDAMENTALS OF INFORMATION TECHNOLOGY	SEMESTER - I
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Total Credits: 3
Hours /week: 4

CONTENTS

UNIT- I

Introduction: Computers - Characteristics - Classification - Micro, Mini, Mainframes and super computer. ALU - history of computer - Generation of computer hardware, software, human ware.

UNIT-II

Main Memory: ROM - RAM - EPROM - EPRAM - FLASH Memory - Auxiliary memory - magnetic tape. Hard disk - floppy disk - CD-ROM.

UNIT-III

I/O Devices: Input Devices - Key board - Mouse - Track ball - Joystick - Scanner - MICR - OCR - OMR - Bar code reader - Light pen. Output Devices - VCD - Classification and Characteristics of Monitor - Printers - Plotters - Sound card - Speaker.

UNIT- IV

Introduction to computer software operating system - Classification and function of operating system, Programming language - Machine language - Assembly language-High level language. Types of High level language - Compiler - Interpreters.

UNIT-V

Internet: Internet - basics, World Wide Web, web pages - web browser, searching the web - Internet Access

Electronic Mail: Introduction - Electric mail - basics - Advantage of creating mail ID, E-commerce - Introduction and application.

Interfacing of Laboratory equipments- Laboratory information system(LIS), hospital information system(HIS), Matching LIS to HIS, Merits of LIS. unidirectional and bidirectional interfacing.

REFERENCE BOOKS:

1. *Alexis Leon, Mathews Leon* - **Fundamentals of Information technology**,
Second Edition.
2. *C.S.V Moorthi* **Information Technology**
3. *R.Paramaswaran* **Computer applications in Business**.

17UCL23A	CORE - III: ANALYTICAL TECHNIQUES	SEMESTER - II
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Total Credits: 3
Hours /week: 4

PREAMBLE:

- To understand the principle and working of various instruments commonly used in clinical laboratories.
- To appreciate the applications of various instruments in separation, purification and analysis of biomolecules and in disease diagnosis.

COURSE OUTCOME:

On the successful completion of the course, students will be able to

CO Number	CO statement	Knowledge level
CO 1	Describe the principle & working of pH meter, buffer preparations and to recall the basic units of expressing solute and solvent concentration	K₁, K₂, K₃
CO 2	Understand the principle, methodology and applications of various techniques applied for separation of biomolecules.	K₁, K₂, K₃
CO 3	Appreciate the applications of electrophoretic and immunological techniques in disease diagnosis.	K₂, K₃
CO 4	Describe the procedures for determination of concentration of various substances by spectroscopic methods.	K₂, K₃
CO 5	Understand the techniques applied for separation, purification and determination of concentration of biological samples.	K₁, K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	M	M
CO 2	S	S	S	S	S
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL23A	CORE - III: ANALYTICAL TECHNIQUES	SEMESTER - II
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Total Credits: 3

Hours / week: 4

CONTENTS

UNIT-I

pH meter- pH scale, Henderson- Hasselbach equation, Buffer solutions, Buffer systems of blood-Hb, Protein and Phosphate buffer system. Various ways of expressing the solute and solvent concentrations - molality, molarity, normality, mole fraction.

UNIT-II

Chromatography-principle, materials, methods and applications of paper chromatography, TLC, GLC, Adsorption, Ion-exchange, Affinity chromatography and Molecular sieve. HPLC, FPLC and GC-MS [principles only].

UNIT-III

Electrophoresis - principles and applications of paper, agar gel, starch gel, SDS-PAGE, immuno electrophoreses, isoelectric focusing; Immunoassays- RIA, ELISA, fluoroimmuno assay, chemiluminescence immune assay (Principles Only).

UNIT-IV

Principles and application of Colorimetry, Spectrophotometry, Fluorimetry and Flame photometry.

UNIT-V

Centrifuges - Bench top, high speed, Ultra centrifuge, analytical centrifuge - Principles and applications. Determination of Molecular weight by Sedimentation velocity method. Separation of Cell Organelles.

TEXT BOOKS :

1. *Sharma B K* 1981. **Instrumental method of chemical analysis**, 11th Edition, Goel publications, New Delhi.
2. *Kudesia V P and Sawhaney H* 1989. **Instrumental method of chemical analysis**, Pragati Prakashan Meerut, Uttar Pradesh.

REFERENCE BOOKS :

1. *Plummer D T* 2004 **An introduction to Practical Biochemistry**, 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd, New Delhi.
2. *Wilson K and Walker J*, 2000. **Practical Biochemistry**. 5th Edition, Cambridge University Press, UK.

17UCL23B	CORE IV: GOOD CLINICAL LABORATORY PRACTICES	SEMESTER II
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Total Credits: 3
Hours / week: 3

PREAMBLE:

- On completion of the course the student will understand the principles, concept and practices of a good clinical laboratory.
- To appreciate the concepts of laboratory facilities and quality assurance.

COURSE OUTCOME:

On the successful completion of the course, students will be able to

CO Number	CO statement	Knowledge level
CO 1	Describe the scope and level of laboratories and ethical considerations to be followed in a laboratory	K₁, K₂
CO 2	Understand the principle and applications of laboratory facility and laboratory equipments	K₁, K₂
CO 3	Appreciate the protocol followed in the laboratory with regard to patient and data management.	K₂, K₃
CO 4	Describe the procedures for documentation to be followed in the laboratory.	K₂, K₃
CO 5	Understand the techniques applied for quality assurance in the laboratory.	K₁, K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	M	S	S	S
CO 2	S	M	S	S	M
CO 3	S	S	S	S	S
CO 4	S	M	S	S	S
CO 5	S	M	S	S	S

S- Strong, M - Medium, L - Low

17UCL23B	CORE IV: GOOD CLINICAL LABORATORY PRACTICES	SEMESTER II
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Total Credits: 3
Hours / week: 3

CONTENTS

UNIT-I

Scope, Levels of laboratories, Infrastructure, Personnel, Training & development, Equipment, Reagents and materials, Standard operating procedure, Safety in laboratories, Ethical considerations.

UNIT-II

Laboratory facilities- design and physical aspects of design. Laboratory equipment management:- Instrument selection, budgeting, installation, training and maintenance.

UNIT-III

Requisition form, Accession list, specimen collection, worksheet, reporting test results, specimen rejection record, data management

UNIT-IV

Good documentation practices, purpose of laboratory documentation, types of documentation and records, documentation process and errors, principles of good documentation practices and benefits.

UNIT-V

Quality assurance, quality assurance programme, internal quality control, external quality assessment, internal audit, summary of QAP activities

REFERENCE BOOKS :

1. Good Clinical Laboratory Practices, Indian Council of Medical Research, 2008
2. Good Clinical Laboratory Practices, World Health Organisation, 2009
3. Understanding the principles of Good Clinical Laboratory Practices (GCLP), Global Health Laboratories, 2014

17UCL23P	CORE PRACTICAL - II: BIOCHEMISTRY -II	SEMESTER - II
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Total Credits: 2
Hours /week: 5

CONTENTS

I BASIC TECHNIQUES

1. Preparation of buffers
2. Measurement and adjustment of pH

II QUANTITATIVE ANALYSIS IN URINE

1. Urea
2. Uric acid
3. Creatinine
4. Phosphorus
5. Protein
6. Sodium
7. Potassium

III STRIP TEST METHOD [DEMONSTRATION]

1. Pregnancy
2. Glucose

IV SEPARATION TECHNIQUES [DEMONSTRATION]

1. Separation of amino acids by paper chromatography
2. Separation of sugars by thin layer chromatography
3. Separation of serum proteins by electrophoresis.

REFERENCE BOOKS :

1. *Sadasivam S and Manickam A.* 2008. **Biochemical methods.** Revised second edition, New age International, New Delhi.
2. *Plummer D T,* 2002. **Practical Biochemistry.** 3rd Edition, Tata McGraw Hill Publisher Pvt. Ltd, New Delhi

17UIT2AA	ALLIED - II: OFFICE AUTOMATION	SEMESTER - II
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Total Credits: 3
Hours/week: 4

PREAMBLE:

- To aware about the overall view of Ms Office packages.
- To understands the operations of word processor, spreadsheet, PowerPoint and access.

COURSE OUTCOME:

On the successful completion of the course, students will be able to

CO Number	CO statement	Knowledge level
CO 1	To know about recent packages and their operations	K1,k2
CO 2	To understand the functions of word processor.	K1,k2,k3
CO 3	To understand the procedures and formulas to work in Excel sheet	K1,k2,k3
CO 4	To know about operations of insert, delete and update in the database.	K1,k2,K3
CO 5	To present a slideshow based upon the concepts using PowerPoint.	K1,k2,k3

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	M	M	M	M	M
CO 2	S	M	S	S	S
CO 3	S	M	S	S	S
CO 4	S	M	S	S	S
CO 5	S	M	S	S	S

S- Strong, M - Medium, L - Low

17UIT2AA	ALLIED - II: OFFICE AUTOMATION	SEMESTER - II
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Total Credits: 3**Hours /week: 4****CONTENTS****UNIT- I**

Introduction to office automation A. brief about latest packages - introduction to windows - creation of Icons - introduction to MS-Office - importance of word processor - spreadsheet - database - an presentation in office environment

UNIT-II

Word Basics - editing with word - copying and moving text - searching - replacing pictures in documents - printing documents - for making with work - for making photographs - sections dealing from letters - tables tool notes spell checking - grammar checking- sorting- fields, annotation book marks and cross reference.

UNIT-III

Creating worksheet - entering and editing text, numbers, formulas - saving - Excel functions modifying worksheet range - selection copying and moving data - defining names - inserting of deleting rows of columns - moving around worksheet naming worksheet, copying inserting of deleting worksheet - formatting, auditing, heading - displaying value- changing of selecting fonts, protesting data using style so templates - reprinting worksheet creating charts - managing date - what if tables paste tables, macros, linking worksheets.

UNIT-IV

Creating new database - modifying database structure- entering data relieving data running queries - changing screen displays - searching the databases- sorting - updating report generation - mailing levels working with numbers, dates and yes/no fields - working with multiple tables.

UNIT-V

Basics of power point - creating of editing slides - Formatting slides - masters slides- templates objects- transitions heading slides- using clip art gallery - chart creation managing files.

REFERENCE BOOKS:

1. *Taxali RK. 2000 PC Software for windows*, Tata Mc Graw-Hill Publications
2. *Nellai Kannan C. 2004 MS Office*, Nels Publications.

17UIT2AP	ALLIED PRACTICAL- I: OFFICE AUTOMATION	SEMESTER- II
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Total Credits: 2
Hours/week: 2

CONTENTS

1. Create a paragraph of ten lines and perform the following using MS Word: i) Bold ii) Underline iii) Font Change iv) Sizing v) Color Background vi) Color Foreground vii) Spell Check viii) Line Spacing ix) Center Heading x) Page Numbering and Preview
2. Create Invitation card for college cultural function using MS word.
3. Create Mail Merge in MS word and maintain atleast 10 addresses.
4. Create a banner about blood donation using MS word.
5. Entering the data, changing the fonts, changing the row height and column width, formatting the data, sorting the data using MS Excel.
6. Maintain worksheet of mark list of your class for a semester using MS excel.
7. Draw graph to illustrate class performance subject wise using graph, include three types of charts in MS excel: i) Line ii) Bar iii) Pie chart for overall performance.
8. Create a consolidating of the entire sheet in a new sheet of work sheet to get consolidated and perform table analysis and stimulated the table for date and year of deposit of a bank of your choice using MS excel.
9. To use data entry forms for entering data in a worksheet and perform the following: Maintain the sales details of 5 products of company for 6 days in a week for 5 branches of a company and perform following operation sorting, conditional reporting for following conditions,

- i) Sales details of branch B ii) Highest sales Product wise iii) Sales details Branch wise iv) Sales detail day wise.
10. Create a table for a saving under various choices among year, rate of interest & initial deposit using workbook.
 11. Create database in MS Access for maintaining the address of your choice classmate with the following constraints, i) Roll No should be primarily ii) Name should not empty maintain atleast 10 address.
 12. Create Retrieve information according to name, pin code, place and city using MS Access.
 13. Sort information and displaying it in sorted order perform sorting on name, pin code and place using MS Access.
 14. Create MS PowerPoint to design a slide for the news headlines of a popular TV channels by giving animations:
 15. i) Top down ii) Bottom down iii) Zoom in iv) Zoom Out
 16. Create a presentation using various auto layouts, charts, table, bullets and clipart.

REFERENCE BOOKS :

1. *Taxali RK. 2000 PC Software for windows*, Tata Mc Graw-Hill Publications
2. *Nellai Kannan C. 2004 MS Office*, Nels Publications.

17UCL33A	CORE - V: INTERMEDIARY METABOLISM	SEMESTER-III
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Total Credits: 4
Hours /week: 4

PREAMBLE:

To understand the metabolic processes taking place in different types of human cells and understand the integration and regulation of metabolism.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the introduction about metabolic reactions, types, Principles of thermodynamics and Biological oxidation	K₁,K₂, K₃
CO 2	Know the metabolism of carbohydrates and understand the individual pathway and its alternative pathway	K₁,K₂, K₃
CO 3	Describes the lipid metabolism and Biosynthesis of saturated and unsaturated fatty acids.	K₁,K₂, K₃
CO 4	Understands the Protein metabolism, Biosynthesis and degradation of purine and pyrimidine nucleotides	K₁,K₂, K₃
CO 5	Know the Biological oxidation and :- structure of ATPase complex and Mitochondrial shuttle system	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL33A	CORE - V: INTERMEDIARY METABOLISM	SEMESTER-III
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Total Credits: 4
Hours /week: 4

CONTENTS

UNIT - I

Introduction to metabolism: Types of metabolic reactions. Bioenergetics - Principles of thermodynamics, concepts of free energy, standard free energy, Biological oxidation- reduction reactions, redox potential, and high energy phosphate compounds.

UNIT - II

Carbohydrate metabolism: Glycolysis, TCA cycle and its energy production. Glycogen metabolism: Glycogenesis and Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis, glucuronic acid pathway.

UNIT - III

Lipid metabolism: Fatty acid oxidation - α , β , ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides and ketone bodies.

UNIT - IV

Protein metabolism: Ketogenic and Glucogenic amino acids. Degradation of proteins:- Deamination, Transamination and Decarboxylation, Urea cycle. Nucleic acid metabolism: Biosynthesis and degradation of purine and pyrimidine nucleotides.

UNIT - V

Biological oxidation: Mitochondrial Electron Transport Chain: electron carriers, sites of ATP production, inhibitors of ETC, Oxidative phosphorylation:- structure of ATPase complex, chemiosmotic theory, inhibitors of oxidative phosphorylation and uncouplers, Mitochondrial shuttle system.

TEXT BOOKS

1. *Murray et al.*, 2012. **Harper's Biochemistry**, 29th Edition, McGraw Hill Medical Publication.
2. *Nelson, D.L. and Cox, M.M.* 2013. **Lehninger Principles of Biochemistry**, 6th Edition, W.H. Freeman & Co.
3. *Berg, J.M. et al.*, 2012. **Biochemistry**, 7th Edition, W. H. Freeman & Co.

REFERENCE BOOKS

1. *Voet, D. et al.*, 2012. **Fundamentals of Biochemistry: Life at the Molecular level**, 4th Edition, John Wiley and Sons.
2. *Zubey, G.L.* 1998. **Biochemistry**, Wm.C. Brown Publishers.
3. *Garrett, R. and Grisham, C.* 2010. **Biochemistry**, 4th Edition, Saunders College Publishing.

17UCL33B	CORE - VI: CLINICAL PATHOLOGY	SEMESTER - III
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Total Credits: 4
Hours /week: 4

PREAMBLE:

To understand the techniques in Clinical pathology and normal and abnormal components of body fluids

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the overall organization, functioning and dynamics of a clinical laboratory, flow of work in the laboratory, importance and significance of documentation and quality control in the laboratory	K₁,K₂, K₃
CO 2	Demonstrate a working understanding of the urine chemistry and its significance in the pathogenesis of a variety of common and uncommon diseases.	K₁,K₂, K₃
CO 3	Demonstrate a working understanding of the stool chemistry and its significance in the pathogenesis of a variety of common and uncommon diseases.	K₁,K₂, K₃
CO 4	Understand the various body fluids and will demonstrate the ability to interpret laboratory data to help in the clinical decision making process.	K₁,K₂, K₃
CO 5	Know the basics of semen collection and analysis. Interpret and evaluate clinical laboratory examination of Seminal fluid	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	M	S	S	S
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	S	M

S- Strong, M - Medium, L - Low

17UCL33B	CORE - VI: CLINICAL PATHOLOGY	SEMESTER - III
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Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

Importance of pre-analytical measures, generation of request, Instructions for sample collection, Reception of specimen, Specimen collection and preservation, despatch of reports, records keeping, coding and indexing.

UNIT-II

Urine Chemistry: Formation of urine, Physical examination - Colour, transparency, pH and Sp gravity. Chemical examination - Protein, reducing sugar, Ketone bodies, Bile pigment/salt, Creatinine, Blood, Microscopical examination - Cells (RBC, WBC, Epith), casts, crystals, Detection of microalbumin & 24 hours urine protein estimation.

UNIT-III

Stool Chemistry: - Faeces - Collection and preservation, examination of motion for colour, mucus, consistency, ova, ameba, cysts, parasites, pus cells, RBC (isomorphic and dismorphic) and crystals. Detection of occult blood in stool, concentration techniques.

UNIT-IV

Examination of body fluids & cell counts: Ascitic fluid, pleural fluid, synovial fluid, pericardial fluid, Cerebro Spinal Fluid.

UNIT-V

Semen analysis - Containers and method of collection examination of semen for time for liquefaction, volume, colour, reaction pH, motility of sperm, sperm count and other findings. Staining, morphological study, pathophysiology and vitality of spermatozoa, semen fructose determination, Antisperm antibodies

TEXT BOOKS :

1. *Mukherjee KL 2010. Medical Laboratory Technology-A procedure manual for routine Diagnostic tests -Volumes I, II, III.* Tata McGraw Hill Publishing Company Ltd. New Delhi
2. *Sood R 1996. Laboratory technology (Methods and interpretations) 4th Ed.* J.P. Bros, New Delhi.

REFERENCE BOOKS:

1. *Satish K. Gupta, 1991. Text book of medical laboratory for technicians, J.P. Bros, New Delhi. 8th edition.*
2. *Dacie and Lewis 2012 - Practical haematology. 11th edition, Churchill Livingstone.*

17UCL33C	CORE - VII: HISTOPATHOLOGY	SEMESTER - III
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Total Credits: 3

Hours/week: 3

PREAMBLE:

To understand the basics of histopathology and various techniques and instruments used in histopathology

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand basic concepts, techniques and methods in histopathology.	K₁,K₂, K₃
CO 2	Description of instruments and its applications employed in histotechniques.	K₁,K₂, K₃
CO 3	Learn about principle, working, instrumentation, types and applications of microscopes	K₁,K₂, K₃
CO 4	Understand principle, concepts, techniques of section making, staining and mounting process.	K₁,K₂, K₃
CO 5	Know about record maintenance, microphotography, museum techniques and ICDS classifications.	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL33C	CORE - VII: HISTOPATHOLOGY	SEMESTER - III
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Total Credits: 3
Hours /week: 3

CONTENTS

UNIT-I

Introduction to histopathology: Receiving specimen in laboratory - Specimen Containers, Collection of specimen in laboratory, Grossing, Preservation and Preservatives-Variou fixatives - Mode of action, Indications, preparation, decalcification of calcified tissue before sectioning, Processing of tissues for routine paraffin sections and other methods of embedding.

UNIT-II

Instrumentation:

a) Tissue Processor- Automated and manual tissue processor b) types of microtome c) types of Microtome knives and Knife sharpener d) Instruments for grossing, e) introduction on different types of stains- Automatic slide stainer.

UNIT-III

Microscopy - Tissue preparation, Fixatives and section cutting for different types of microscopy Use of microscope - polarisers, Introduction to Electron Microscopy, Introduction to immunohistochemistry and Technique of preparing slides - Types of Glass slides and Cover slips.

UNIT-IV

Frozen section techniques: Co2 Freezing, Cryostat and freezing microtome. Principles and techniques of sections cutting, Routine staining and special staining (commonly used), Mounting techniques.

UNIT-V

Maintenance of records, filing and storage of slides, Microphotography - Photography and interfacing technique. Museum technology - preservation and organisation, Coding - ICDS - Classification.

TEXT BOOKS:

1. *Mukherjee K L 2010. Medical Laboratory Technology-A procedure manual for routine Diagnostic tests -Volumes I, II, III.* TataMcGraw Hill Publishing Company ltd. New Delhi
2. *Sood R 1996. Laboratory technology (Methods and interpretations) 4th Ed.* J.P. Bros, New Delhi.

REFERENCE BOOKS:

1. *Todd J C, Davidson I and Henry J B 1974. Clinical diagnosis by laboratory methods.* 22nd Edition, Saunders Publications Pvt. Ltd, Pennsylvania
2. *Culling C F A, 1974. Histopathology Techniques.* 3rd Edition. Butterworth-Heinemann Publication, London.
3. *Matthew J Lynch, 1976. Lynch's medical laboratory Technology.* 3rd Edition, W.B Saunders Co Publications.

Web Links:

NABH NIBL & NABL Guidelines, Clinical Laboratory manual, WHO Manual, CLSI Manual.

17UCL33P	CORE PRACTICAL - III: PATHOLOGY	SEMESTER - III
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Total Credits: 2

Hours/week: 4

CONTENTS

1. Complete Urine examination
2. Complete Stool examination
3. Preparation of various fixatives, routine processing and tissue embedding
4. Section cutting, staining and mounting of tissues.

REFERENCE BOOKS :

1. *Mukherjee, KL* 2010. **Medical Laboratory Technology-A procedure manual for routine diagnostic Tests - Volume 1, 2 and 3**, Tata McGraw Hill Publishing Company ltd, New Delhi.
2. *Sood R*, 1994 **Medical Laboratory Technology**, Jaypee Brothers, New Delhi.

17UCY3AA	ALLIED-III: CHEMISTRY FOR BIOLOGIST'S	SEMESTER-III
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Total Credits: 3
Hours / week: 4

PREAMBLE:

- This course gives an overview on basics of chemistry.
- Students can gain basic knowledge and key understanding on chemical bonding in bio-molecules, IUPAC nomenclature of organic compounds, enzyme kinetics and chemical principles that underlie techniques employed in biochemistry.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO number	CO Statement	Knowledge Level
CO1	To know the position of the elements in the periodic table and their properties. To compare and correlate the periodic behavior of elements and their properties.	K1, K2 & K3
CO2	Recall basics of chemistry which helps students to understand bonding in molecules, crystals structures and evaluate their bonding characteristics.	K1 & K2
CO3	Understand and apply concepts of bonding in organic molecules, and relate their displacement reactions with mechanism.	K2 & K3
CO4	Design a demonstration that enables the students to prepare laboratory solutions.	K1 & K2
CO5	To study the spontaneity of the reaction, the nature of catalyst and reaction pathway.	K1 & K2

MAPPING WITH PROGRAMME OUTCOMES:

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	M	M	M
CO3	S	S	S	M	M
CO4	S	S	S	M	M
CO5	S	S	S	M	M

L-Low; M-Medium and S-Strong.

17UCY3AB	ALLIED-III: CHEMISTRY FOR BIOLOGIST'S	SEMESTER-III
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Total Credits: 3
Hours / week: 4

CONTENTS

UNIT-I

Periodic Table

Long form of periodic table – Classification of elements on the basis of electronic configuration – Periodicity in properties – Causes of periodicity and factors affecting the magnitude of atomic and ionic radii, electron affinity, ionization energy, electronegativity.

UNIT-II

Chemical bonding

1. Molecular Orbital Theory- bonding, anti-bonding and non-bonding orbitals. MO-configuration of H₂, N₂, O₂, F₂- bond order- diamagnetism and paramagnetism.
2. Ionic Bond: Nature of ionic bond, structure of NaCl and CsCl, factors influencing the formation of ionic bond.
3. Covalent Bond: Nature of covalent bond, structure of CH₄, NH₃, H₂O, shapes of BeCl₂, BF₃, based on VSEPR theory and hybridization.

UNIT-III

1. Electron displacement effect in organic compounds- Inductive effect- Electromeric effect- Resonance effect, Hyperconjugation and Steric effect.

2. Isomerism, Symmetry of elements (Plane, Centre and Axis of symmetry), Molecules with one chiral carbon and two adjacent chiral carbons- Optical isomerism of lactic acid and tartaric acid, Enantiomers, Diastereomers, Separation of racemic mixture (chemical, mechanical, biochemical and kinetic), Geometrical isomerism (maleic and fumaric acid).

UNIT-IV

Solutions

1. Normality, molarity, molality, mole fraction, mole concept.
2. Preparation of standard solutions- primary and secondary standards.
3. Principle of Volumetric analysis.
4. Strong and weak acids and bases- Ionic product of water- pH, pKa, pKb, Buffer solution, pH and pOH simple calculations.

UNIT-V

Chemical Kinetics

1. Rate of reaction, rate law, order, molecularity, first order rate law, half life period of first order equation, pseudo first order reaction, zero and second order reactions. Derivation of rate expression for I- and II- order kinetics.
2. Catalysis- homogenous, heterogeneous and enzyme catalysis (definition only), enzymes used in industry, characteristics of catalytic reactions.

TEXT BOOKS:

1. *R. D. Madan. 2001. Modern Inorganic Chemistry.* S. Chand & Company, New Delhi.
2. *B.S.Bhal , Arun Bhal,1997. Advanced Organic Chemistry,* S. Chand & Co Limited, New Delhi.
3. *M. K. Jain, S. C. Sharma. 2001. Organic Chemistry,* Shoban Lal Nayin Chand, Jalandhar.
4. *Puri, Sharma, Pathania. 2004. Principles of Physical Chemistry,* Vishal Publishing Company, Jalandhar.
5. *Gopalan R. 1991.Elements of Analytical Chemistry,* Sultan Chand & Sons, New Delhi.

17UCY3AP	ALLIED PRACTICAL-II: CHEMISTRY	SEMESTER-III
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Total Credits: 2
Hours / week: 4

CONTENTS

I. Volumetric analysis

1. Estimation of Sodium Hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Oxalic acid using standard Sulphuric acid.
4. Estimation of Ferrous sulphate using standard Mohr salt solution.
5. Estimation of Oxalic acid using standard Ferrous sulphate solution.
6. Estimation of Ferrous ions using Mohr salt solution.

II. Organic Analysis

1. To distinguish between aliphatic & aromatic.
2. To distinguish between saturated & unsaturated.
3. Detection of Elements (N, S, Halogens).
4. Functional group tests for phenols, acids (mono & di), aromatic primary amine, monoamide, diamide, carbohydrate.
Functional group characterized by Confirmatory test.

TEXT BOOK:

1. *V. Venkateswaran, R. Veeraswamy & A. R. Kulandaivelu. 2004. **Basic Principles of practical chemistry**, Sultan Chand & Co.*

17UCL3SA	SKILL BASED COURSE- I: BIO-SAFETY & BIO-WASTE MANAGEMENT	SEMESTER - III
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Total Credits: 3

Hours /week: 3

PREAMBLE:

- Understand safety practices, bioethics in biomedical laboratories.
- Understand the generation and disposal of biowastes, and biowastes management

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the safety guidelines and practices in clinical laboratory	K₁,K₂, K₃
CO 2	Realize the significance of bioethics and responsibilities of clinicians in laboratory	K₁,K₂, K₃
CO 3	Know the Indian regulations regarding biowastes segregation and disposal.	K₁,K₂, K₃
CO 4	Identify the sources of biowastes, types and segregation	K₁,K₂, K₃
CO 5	Understand the need for biowaste management and the technologies applied for biowaste management	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL3SA	SKILL BASED COURSE- I: BIO-SAFETY & BIO-WASTE MANAGMENT	SEMESTER - III
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Total Credits: 3
Hours /week:3

CONTENTS

UNIT-I

Biosafety - Biosafety in laboratory, Laboratory associated infections and other hazards; Code of good and safe laboratory practice for support staff and responsibilities of the workers regarding biosafety. Personal safety measures- Use of glove, mask and personal grooming. Set up of a laboratory on the basis of safety priority and Laboratory Biosafety Guidelines. Laboratory Biosafety Level Criteria (BSL-1-4).Chemical, electrical, fire and radiation safety. General Safety checklist, Hazardous properties of instruments and Laboratory chemicals.

UNIT-II

Bioethics - Co-operation and working relationship with other health professionals, Confidentiality of patient information and test result- dignity and privacy of patient, Responsibility from acquisition of the specimen to the production of data, Accountability for quality and integrity of clinical laboratory services. Institutional ethical committee and its role, Health & Medical surveillance.

UNIT-III

Biowaste regulations - Categories of Biomedical waste- Regulatory Requirements. Indian regulations regarding biomedical waste disposal and management:

UNIT-IV

Types of biowaste & segregation: Sources of biomedical waste; Types of health care waste: Infectious and non-infectious waste, hazardous waste, solid and liquid waste, biodegradable and non-biodegradable waste.

UNIT-V

Biowaste management - Wastes management- life cycle of bio-medical wastes. Decontamination and disposal: Disinfection methods - Sterilization - steam sterilizing (Auto claving) -Non-burn treatment technology- Microwave, wet thermal treatment, dry thermal treatment, chemical based technologies. Disposal of hazardous wastes and radioactive wastes.

TEXT BOOKS :

1. *Joshi RM*, 2006. Biosafety and Bioethics. Gyan Books Pvt Ltd, India
2. *Singh A, Kaur S* 2012. Biomedical waste disposal, Jaypee Publishers, India

REFERENCE BOOKS :

1. *Fleming DO, Hunt DL*, 2006. **Biological Safety: Principles and Practices**, ASM Press, Washington DC.
2. *Kishore J and Ingle GK*, 2004. **Biomedical waste management in India**. Century Publications, New Delhi
3. *NABH guidelines, WHO guidelines*.

17UCL43A	CORE - VIII: MICROBIOLOGY-I	SEMESTER - IV
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Total Credits: 4
Hours /week: 4

PREAMBLE:

1. To understand the general characters of bacteria and methods of their identification
2. To understand the general methods of sterilization and disinfection in microbiology
3. Identify general culture media used in microbiology

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Relate the Historical introduction Summarize the importance of Microbiology in laboratory Medicine	K₁,K₂
CO 2	Classification of microorganisms and techniques used in their staining Understand and compare the different types of Microscopy	K₁,K₂
CO 3	Define sterilisation-definition, physical agents employed with example	K₁
CO 4	Explain the bacterial growth and nutrition	K₁,K₂
CO 5	Identify the bacterial morphology, culture, biochemical reactions, antigenic character, typing of bacteria	K₁,K₂,K₃

MAPPING WITH PROGRAMME OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5
CO1	M	S	M	M	M
CO2	M	M	S	S	M
CO3	M	M	S	M	M
CO4	S	M	M	S	M
CO5	S	S	M	S	M

S-Strong, M-Medium, L-Low

17UCL43A	CORE - VIII: MICROBIOLOGY-I	SEMESTER - IV
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Total Credits: 4**Hours /week: 4**

CONTENTS

UNIT-I

Historical introduction with special reference to the contribution of Louis Pasteur, Joseph Lister, Robert Koch, Edward Jenner and Alexander Fleming; Importance of Microbiology in laboratory Medicine.

UNIT-II

Classification of microorganisms; Microscopy- Light microscope, Dark-ground microscope, Fluorescent microscope, Phase contrast microscope, and Electron microscope; Observation of micro-organism - Wet preparations, Staining preparations; Anatomy of Bacterial cell; Morphological Classification of bacteria with examples.

UNIT-III

Sterilisation -Definition, Physical agents employed with example, Sterilization controls; Disinfection-Definition, Classification of Chemical methods of disinfection, its mechanism; Testing of disinfectants.

UNIT-IV

Bacterial growth and nutrition; Bacterial metabolism; Bacterial genetics and variation; Bacteriological culture media.

UNIT-V

Identification of bacteria-Morphology, Culture, Biochemical reactions, antigenic Character, typing of bacteria.

TEXT BOOKS :

1. *Ananthanarayan R and Panicker C K J* 2005. **Textbook of Microbiology**, 3rd edition, Orient Longman Private Limited, Hyderabad
2. *Chakraborty P* 2005. **Medical Parasitology**, 2nd edition, New Central Book Agency Pvt. Ltd, Kolkata

REFERENCE BOOKS :

1. *Pelczar M J, Chan, E C S and Krieg, N R* 1986. **Microbiology**, MC Graw Hill Publishers, New York, USA
2. *Prescott L M, Harley JH and Klein DA* 1993. **Microbiology**, 2nd edition, Brown Publishers, Iowa, USA

17UCL43B	CORE - IX: CLINICAL BIOCHEMISTRY -I : METABOLIC DISORDERS	SEMESTER - IV
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Total Credits: 4
Hours /week: 4

PREAMBLE:

To understand the basis of metabolic disorders, their symptoms and means of diagnosis

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the abnormal conditions associated with carbohydrate metabolism and describe the types of diabetes mellitus and techniques used in differential diagnosis	K₁,K₂, K₃
CO 2	Understand the abnormal conditions associated with lipoproteins including those of genetically inherited diseases	K₁,K₂, K₃
CO 3	Understand the normal levels of lipids in blood and its components, describe the different types of diseases associated with lipid metabolism	K₁,K₂, K₃
CO 4	Understands the abnormalities associated with protein and nitrogen metabolism, discriminate between different amino acid diseases of genetic origin.	K₁,K₂, K₃
CO 5	Understand the significance of uric acid level in blood, know the diseases caused by abnormal metabolism of purines and pyrimidines	K₁,K₂

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL43B	CORE - IX: CLINICAL BIOCHEMISTRY -I : METABOLIC DISORDERS	SEMESTER - IV
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Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

Disorders of carbohydrate metabolism: Normal glucose level in blood, renal threshold and regulation of blood glucose concentration. Hypoglycemia - Definition and causes. Hyperglycemia - Definition and causes. Diabetes mellitus: Introduction, aetiology, types of diabetes mellitus, clinical pathology and diagnosis. Urine testing, random blood glucose and GTT. Glycosuria, differential diagnosis of glycosuria, complication of diabetes mellitus- Diabetic ketoacidosis, Diabetic coma, Fructosuria, pentosuria, Galactosemia, and Glycogen storage diseases.

UNIT-II

Disorders of Lipid Metabolism: Plasma lipids and lipoproteins - Introduction. Hyperlipoproteinemia - Type I, II, III, IV, V and alpha-lipoproteinemia. Hypolipoproteinemia - A - beta lipoproteinemia, Hypo-beta - lipoproteinemia, Tangier's disease and LCAT (Lecithin Cholesterol Acyl Transferase) deficiency

UNIT-III

Lipid storage diseases: Artherosclerosis. Fatty liver and hyperlipidemia, Hypercholesterolemia and Hypocholesterolemia, Lipidosis and Xanthomatosis. Tay Sach's disease, Niemann - Pick disease. Lipid Profile: Total Cholesterol, HDL, LDL, VLDL cholesterol and triglycerides

UNIT-IV

Aminoacid Metabolism: Plasma proteins. Abnormalities: Total plasma (serum) proteins, Fibrinogen, Albumin, Pre-albumin, and Globulins. Abnormal Non- protein Nitrogen: Urea, Uric acid, Creatinine, and Ammonia, Prophyria.

Disease of Aminoacid Metabolism: Cysteinuria, Phenylketonuria, Maple Syrup Disease, Alkalptonuria, Albinism, and Hartnup disease.

UNIT-V

Disorders of Purine and Pyrimidine metabolism:

Disorders of purine metabolism: Normal level of uric acid in blood and urine, miscible uric acid pool. Hyperuricemia and Gout; Hypouricemia - Xanthinuria and Xanthine lithiasis.

Disorders of Pyrimidine metabolism: Orotic aciduria

TEXT BOOKS :

1. *Burtis CA, Ashwood ER and Bruns DE (eds), (2005) Tietz Textbook of Clinical Chemistry and Molecular Diagnosis (5th edition). William Heinmann, Medical Books Ltd. New Zealand.*
2. *Mayne PD 1998. Clinical Chemistry in Diagnosis and Treatment, 6th Edition, Hodder Arnold Publications, London*

REFERENCE BOOKS :

1. *Swaminathan R*, 2004. **Handbook of Clinical Biochemistry**, 1st Edition, Oxford University Press, London.
2. *Devlin T M*, 1997. **Textbook of Biochemistry with Clinical Correlations**. 1st Edition, John Wiley & Sons, New York

17UCL43C	CORE - X: CLINICAL BIOCHEMISTRY II: FUNCTIONAL TESTS	SEMESTER - IV
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Total Credits: 4

Hours /week: 4

PREAMBLE:

- Understand the significance of organ function tests in diagnosis.
- To describe the function of human body, common pathophysiological mechanisms, common diseases and the chemical and biochemical methods used in their study.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Examine in detail on conditions and biochemical tests involving the Gastric secretions	K₁,K₂, K₃
CO 2	Evaluate in detail on functions, conditions and biochemical test involving Pancreatic secretions.	K₁,K₂, K₃
CO 3	Analyse in detail on functions, conditions and biochemical test involving Intestinal secretions	K₁,K₂, K₃
CO 4	Estimate in detail on functions, conditions and biochemical detection in Liver secretions.	K₁,K₂, K₃
CO 5	Analyse and estimate the functions, conditions and biochemical tests in kidney secretions.	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL43C	CORE - X: CLINICAL BIOCHEMISTRY II: FUNCTIONAL TESTS	SEMESTER- IV
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Total Credits: 4**Hours /week: 4****CONTENTS****UNIT-I**

Gastric function: Introduction, Tests for gastric function - The Insulin Stimulation test, determination of Gastrin in serum and Tubeless gastric analysis.

UNIT-II

Pancreatic function: Introduction, pancreatic function tests, serum amylase and lipase; direct stimulation test, indirect stimulation test.

UNIT-III

Intestinal function: Introduction, Test used in the diagnosis of malabsorption, determination of total faecal fat (fat balance test), test of monosaccharide absorption (Xylose excretion test) and determination of total protein- Albumin globulin ratio.

UNIT-IV

Liver function: Introduction, bilirubin metabolism and jaundice, Liver function tests: Estimation of conjugated Unconjugated and total bilirubin in serum (Diazo method), detection of bilirubin and bile salts in urine (Fouchet's test and Hay's sulphur test), Prothrombin time. Serum enzymes in liver disease - Alkaline Phosphatase, SGPT, SGOT, Gamma GT and Lactate dehydrogenase (LDH).

UNIT-V

Kidney Function: Introduction, physical examination of urine, elimination tests, Clearance tests - Inulin clearance, creatinine clearance and Urea clearance tests, Micro albumin and Electrolytes in Urine, protein creatinine ratio, renal blood flow and filtration fraction.

TEXT BOOKS:

1. *Burtis CA, Ashwood ER and Bruns DE (eds), (2005) Tietz Textbook of Clinical Chemistry and Molecular Diagnosis (5th edition).* William Heinmann, Medical Books Ltd. New Zealand
2. *Mayne PD 1998. Clinical Chemistry in Diagnosis and Treatment, 6th Edition, Hodder Arnold Publications, London*

REFERENCE BOOKS:

1. *Swaminathan R, 2004. Handbook of Clinical Biochemistry, 1st Edition, Oxford University Press, London.*
2. *Deolin T M, 1997. Textbook of Biochemistry with Clinical Correlations. 1st Edition, John Wiley & Sons, New York*

17UCL43P	CORE PRACTICAL - IV: CLINICAL BIOCHEMISTRY	SEMESTER - IV
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Total Credits: 3
Hours/week: 6

CONTENTS

I. QUANTITATIVE ANALYSIS IN SERUM

1. Urea
2. Uric acid
3. Creatinine
4. Phosphorus
5. Protein
6. Glucose
7. Cholesterol
8. Sodium
9. Potassium
10. Bicarbonate
11. Chloride

II. ENZYMOLOGY

1. Acid phosphatase
2. Alkaline phosphatases
3. Alpha- Amylase
4. SGPT
5. Gamma GT
6. LDH

REFERENCE BOOKS:

1. *Wilson K and Walker J*, 2000. **Practical Biochemistry**. 5th Edition, Cambridge University Press, UK.
2. *Plummer D T*, 2004. **Practical Biochemistry**. 3rd Edition, Tata McGraw Hill Publisher Pvt. Ltd, New Delhi.
3. *Sadasivam,S. and Manickam,A.* 2008. **Biochemical methods**. Revised second edition, New age International, New Delhi.

17UCL4AA	ALLIED - IV: DRUG BIOCHEMISTRY	SEMESTER-IV
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Total Credits: 3
Hours /week: 4

PREAMBLE:

1. To understand the types of drugs, their routes of administration and their metabolism in the human body.
2. To understand the toxicological principles of drugs and other poisons.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the History and development of medicinal plants, Routes of drugs administration, Factors modifying drug action, tolerance and dependence	K₁,K₂, K₃
CO 2	Know the metabolism of phase I and Phase II of Drugs and understand the excretion of drugs.	K₁,K₂, K₃
CO 3	Describes the Adverse drug reactions and factors affecting drug metabolism and its chemical aspects	K₁,K₂, K₃
CO 4	Understands the chemotherapy of microbial diseases, parasite infections, gene therapy and free radical biology	K₁,K₂, K₃
CO 5	Know the General and systemic toxicology and its principle , mechanism and treatment	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL4AA	ALLIED - IV: DRUG BIOCHEMISTRY	SEMESTER-IV
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Total Credits: 3
Hours /week: 4

UNIT- I

Sources and classification of drugs, Routes of drugs administration. Drug absorption, Drug distribution, Mechanism of action of drugs, combined effect of drugs. Factors modifying drug action, tolerance and dependence.

UNIT- II

Drug metabolism – general pathways of drug metabolism different types of reaction in phase I and phase II with examples, and Organs involved in excretion - excretion of drugs.

UNIT- III

Adverse drug reactions and treatment of poisoning. Drug interactions, factors affecting drug metabolism including stereo chemical aspects, significance of drug metabolism in medicinal chemistry.

UNIT- IV

General and systemic toxicology: Basic principles of diagnosis. Mechanism of toxic effect, toxicokinetics – chemical carcinogens and teratogens, treatment of intoxication.

UNIT- V

Toxic effects of metals - Lead, Arsenic, selenium, mercury. Drug abuse and dependence, Antidotes in the management of poisoning.

REFERENCE BOOKS

1. The pharmacology volume I and II - Goodman and Gillman
2. Basic pharmacology - Foxter Cox
3. **Principles of medicinal chemistry** 4th edition by *William.O.Foye*, B.I. Waverks, LW&W., (1995)
4. **Burgers medicinal chemistry and drug discovery-** principles and practice- Manfred. *E.Wolf*
5. **Oxford text book of clinical pharmacology and drug therapy**, *D.G Grahme Smith and J.K.Aronson*
6. **Pharmacology and pharmatherapeutics-** R.S. Satoskr, S.D.Bhandhakar and
7. **Essential of pharmacotherapeutics**, *Barav.F.S.K*
8. **Introduction to medicinal chemistry**, *Batrick.G.L*
9. **Lippincotts illustrated review pahamacology**, *Mary. J.Mcek, Richarts, Pamela.C.*

17UCL4SA	SKILL BASED COURSE - II: LABORATORY AUTOMATION	SEMESTER - IV
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Total Credits: 3
Hours/week: 4

PREAMBLE:

Understand the significance of laboratory organization and to describe the function of automated analysers.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the organization of clinical Laboratory and basic needs of clinical laboratory	K₁,K₂, K₃
CO 2	Know the maintenance and care of common laboratory glassware and common equipments	K₁,K₂, K₃
CO 3	Know Common terms used in Quality control, Internal and External Quality control	K₁,K₂, K₃
CO 4	Understand the Autoanalyzer and different types of analyzers and barcoding.	K₁,K₂, K₃
CO 5	Perceive the Laboratory informatics, laboratory information management system	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL4SA	SKILL BASED COURSE - II: LABORATORY AUTOMATION	SEMESTER - IV
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Total credits: 3**Hours/week: 4****UNIT I**

Functional components of clinical laboratories, cleanliness, precautions to be taken WRT patients, reports, analysis. Communication between physician, patients, and the medical laboratory professional, basic needs of clinical laboratory technician, awareness of soft skills.

UNIT II

Identification, use, maintenance and care of common laboratory glassware and equipments, handling of all glassware ,use, principle and care of centrifuge, colorimeter, oven, incubator, microscope, Neubaur' s chamber, Autoclave.etc .

UNIT III

Quality Assurance in clinical Laboratory - Introduction, Common terms used in Quality control Westgard rules L.J. Chart, External QC and Internal QC -Assessment, corrective action and preventive action, Total Quality management- water quality, electrical stability, equipment calibration, glassware and preventive measures

UNIT IV

Automation and Recent advances - Need for Automation, Advantages of Automation Types of Auto Analysers-Semi and Fully automated, Routine biochemistry analysers, Immuno-based analysers, Hematology analysers -

Cell counters, Coagulometers, Bar coding and Total Laboratory Automation (TLA)

UNIT V

Laboratory informatics- data acquisition, data processing, laboratory information management system, scientific data management and knowledge management .

TEXT BOOKS:

1. Kanai L. Mukherjee, 2007, Medical laboratory technology Vol.1.Tata McGraw Hill
2. Fischbach, 2005. Manual of lab and diagnostic tests, Lippincott Williams Wilkins, New York.

REFERENCE BOOKS:

1. Gradwohls, 2000. Clinical laboratory methods and diagnosis. (ed) Ales C. Sonnenwirth and Leonard Jarret, M.D.B.I., New Delhi.
2. J Ochei and Kolhatkar, 2002. Medical laboratory science theory and practice, Tata McGraw- Hill, New Delhi.

17UCL53A	CORE - XI: MICROBIOLOGY- II	SEMESTER - V
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Total Credits: 4
Hours /week: 4

PREAMBLE:

Understand the morphology, the culture, spread, biochemical activities, antigenic characters, pathogenesis, laboratory diagnosis, treatment & prevention & control measures of each pathogenic microbe.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Compare and classify the organism	K₁,K₂, K₃
CO 2	Understand the general characteristics of various organisms	K₁,K₂, K₃
CO 3	Recall the general characters of important pathogenic fungi	K₁,K₂, K₃
CO 4	Understand the general characters of important pathogenic viruses including diagnosis of <i>Influenza viruses, Herpes viruses, HIV</i>	K₁,K₂, K₃
CO 5	Know the general characters of <i>E.histolytica, Plasmodium, Roundworm, Hookworm, Pinworm, Tape worm and Filarial worm</i>	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL53A	CORE - XI: MICROBIOLOGY- II	SEMESTER - V
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Total Credits: 4

Hours /week: 4

CONTENTS

UNIT-I

Host - parasite interactions; Bacteriology: Factors determining bacterial pathogenicity. Bacterial toxins. Brief general characters including colony morphology, identification characters, laboratory diagnosis and prophylaxis of the following microorganisms: Staphylococci, Streptococci, Pneumococci, Neisseria, Corynebacterium diphtheriae, Bacillus anthracis, Clostridium perfringens, Cl. tetani, Cl. botulinum, Actinomyces, Nocardia, Streptomyces.

UNIT-II

Bacteriology: Coliform bacilli, Salmonellae, Shigellae, Vibrio cholerae, Pseudomonas aeruginosa, Non-fermenting gram negative bacilli including Acinetobacter sp., Mycobacterium tuberculosis, Atypical mycobacteria, M. leprae, Treponema pallidum, Leptospira, Borrelia sp., Mycoplasmas, Chlamydiae, Rickettsiae

UNIT-III

Mycology: General characters of important pathogenic fungi including morphology, methods of cultivation and identification, infections caused and laboratory diagnosis of Candida albicans, Cryptococcus neoformans, Dermatophytes, Mycetoma, Dimorphic fungi

UNIT-IV

Virology: General characters of important pathogenic viruses including morphology, methods of cultivation and identification, infections caused and laboratory diagnosis of Poliovirus, Influenza viruses, ARBO viruses, Herpes viruses, HBV, Retroviruses: HIV

UNIT-V

Parasitology: Brief study of *E. histolytica*, Plasmodium, Round worm, Hook worm, Pin worm, Tape worm and Filarial worm

TEXT BOOKS:

1. *Ananthanarayan R and Panicker C K J* 2005. **Textbook of Microbiology**, 3rd edition, Orient Longman Private Limited, Hyderabad

REFERENCE BOOKS :

1. *Atlas R M*, 1993. **Microbiology - Fundamentals and Applications**, 3rd edition, Macmillan Publishing Company, New York.
2. *Pelczar M J, Chan, E C S and Krieg, N R*1986. **Microbiology** ,Mc Graw Hill Publishers, New York, USA
3. *Prescott L M, Harley JH and Klein DA*1993.**Microbiology**, 2nd edition, Brown Publishers, Iowa, USA

17UCL53B	CORE - XII: HEMATOLOGY	SEMESTER - V
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Total Credits: 4
Hours/week: 4

PREAMBLE:

To gain knowledge in diagnosis of various diseases with reference to hematology and know the advancements in laboratory automation.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the principles and procedures of the basic tests carried out in haematology laboratory, know to assess blood test results and their involvement in the assessment of different pathologies.	K₁,K₂, K₃
CO 2	Know the patho-physiology of different types of anemias, know the principles involved in the differential diagnosis of anemias	K₁,K₂, K₃
CO 3	Know the mechanism of coagulation, understand the investigations used in differential diagnosis of hemorrhagic disorders	K₁,K₂, K₃
CO 4	Understands the normal process of fibrinolysis and know the principles of tests used to detect abnormalities in fibrinolysis	K₁,K₂
CO 5	Understand the principles involved in automation in haematology, overall organization and functioning and dynamics of a haematology laboratory.	K₁,K₂,K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	M	M	S	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	S	M

S- Strong, M - Medium, L - Low

17UCL53B

CORE - XII: HEMATOLOGY

SEMESTER - V

Total Credits: 4

Hours /week: 4

CONTENTS

UNIT-I

1. Introduction - Blood
2. Blood collection
3. Anticoagulants used in Haematology
4. Normal values in Haematology
5. Basic Haematological techniques: a. RBC Count b. Haemoglobin estimation c. Packed cell volume d. WBC counts - Total and differential e. Absolute eosinophil Count f. Platelet count g. Erythrocyte sedimentation rate h. Reticulocyte count
6. Preparation of blood films
7. Stains used in Haematology
8. Morphology of red cells
9. Morphology of Leukocytes and platelets
10. Bone marrow a. Techniques of aspiration, preparation and staining of films
b. Bone marrow biopsy
11. Preparation of buffy coat smears.
12. Quantitative buffy coat (QBC) assay

UNIT-II

1. Laboratory methods used in the investigation of anemia: a. B12 and folate assay b. Serum iron and iron bonding capacity
2. Laboratory methods used in the investigation of haemolytic anaemias: a. Osmotic fragility b. Investigation of G-6 PD deficiency c. Test for sickling d. Estimation on of Hb-F,Hb-A2 e. Haptoglobin, demonstration of haemosiderin in urine f. Haemoglobin electrophoresis g. Test for auto immune hemolytic anaemias h. Measurements of abnormal Hb pigments.

UNIT- III

Investigation of Haemorrhagic disorders:

- a. Mechanism of coagulation
- b. Collection and anticoagulants used in coagulation studies
- c. Bleeding time and clotting time
- d. Other coagulation studies: PT, APTT, Fibrinogen, etc.,
- e. Assay of clotting factors.

UNIT-IV

Test for blood fibrinolytic activity and detection of D-dimers. Platelet function tests. Demonstration of LE cells.

UNIT-V

Automation in haematology. Organization and quality control in haematology laboratory. Mean Prothrombin Time (MPT)

TEXT BOOKS :

1. *Sood R 1996. Laboratory technology- Methods and interpretations 4 th Ed. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi*
2. *Talib V H 2000 Handbook of Medical Laboratory Technology 2nd Edition, CBS Publishers and Distributors, New Delhi*

REFERENCE BOOKS:

1. *Gupte, S 1998. A Short Text Book of Medical Laboratory for Technicians. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi*
2. *Bain B J, Bates I, Laffan M A and Lewis M 2011. Dacie and Lewis Practical Haematology, 11th edition, Churchill Livingstone, China*

17UCL53C	CORE - XIII: BLOOD BANKING	SEMESTER - V
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Total Credits: 3**Hours /week: 3****PREAMBLE:**

- Emphasize the basic concept of blood grouping and transfusion process.
- Understand the organization and functioning of blood bank

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the basic concepts of blood grouping system	K₁,K₂
CO 2	Apply screening methods of cross matching	K₁,K₂, K₃
CO 3	Know the criteria for donor selection and screening tests	K₁,K₂, K₃
CO 4	Understand blood transfusion reactions	K₁,K₂, K₃
CO 5	Understand the organization and functioning of blood bank	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	M
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL53C	CORE - XIII: BLOOD BANKING	SEMESTER - V
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Total Credits: 3

Hours /week: 3

CONTENTS

UNIT-I

ABO Blood group system, Rh typing and weaker variants in Rh system, Subgroup and weaker variants of A and B and Bombay phenotype.

UNIT-II

Preparation and standardization of anti human globulin reagent, Auto and allo antibodies, Coomb's cross matching, Blood grouping.

UNIT-III

Donor selection – donor eligibility criteria, Phlebotomy- Blood collection methods , screening test on donor’s blood sample- .

Autologous donation and Specialized donation-apheresis and plasmapheresis.

Role of irradiation, Discarding of positive and expired blood.

UNIT-IV

Storage of whole blood, Preparation of blood components , Preservation and storage. Hemolytic disease of newborn, blood transfusion reaction-acute transfusion reactions and delayed transfusion reactions, Transfusin related complications- Transfusion-related acute lung injury (TRALI), Transfusion-associated circulatory overload, investigation of transfusion reaction.

UNIT-V

Organization of blood bank: Area for whole blood and components, staff requirement, equipment requirement for whole and component blood preparation, process of licensing.

TEXT BOOKS :

1. *Mukherjee KL 2010. Medical Laboratory Technology-A procedure manual for routine Diagnostic tests -Volumes I, II, III.* Tata McGraw Hill Publishing Company Ltd. New Delhi
2. *Sood R 1996. Laboratory technology (Methods and interpretations) 4th Ed.* J.P. Bros, New Delhi.
3. *Satish Gupte 2000. The Text book of Blood Bank and Transfusion Medicine,* Jaypee Brothers Medical Publishers (P) Ltd., New Delhi.

REFERENCE BOOKS :

1. *Blaney K D and Howard P R. Basic & Applied Concepts of Blood Banking and Transfusion Practices.* 3rd Ed. Elsevier Mosby publishers, Missouri.
2. *Rudmann S V 2005. Textbook of Blood Banking and Transfusion Medicine.* 2nd Ed. Elsevier Saunders publishers, Pennsylvania.

17UCL53P	CORE PRACTICAL -V: HEMATOLOGY	SEMESTER - V
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Total Credits: 3
Hours /week: 6

CONTENTS

1. Haemoglobin estimation by cyanmethaemoglobin method.
2. R.B.C total count.
3. W.B.C total count-Micropipette method and bulk dilution.
4. Platelet count-Direct and indirect method.
5. Absolute eosinophil count.
6. Reticulocyte count.
7. Preparation of blood smears and staining with Leishmann's stain.
8. Differential W.B.C Count.
9. Packed cell volume- Wintrobe's method.
10. Calculation of erythrocyte indices.
11. Erythrocytes sedimentation rate- Westergreen methods.
12. Osmotic fragility test.
13. Sickling test
14. Bleeding time and clotting time.
15. Preparation of buffy coat smears.
16. Demonstration of L.E cells.
17. Bone marrow smear preparation and staining procedure.
18. Demonstration of malarial parasites and microfilaria by smear and fluorescent method.

TEXT BOOKS:

1. *Sood R 1996. Laboratory technology- Methods and interpretations 4 th Ed. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi*
2. *Talib V H 2000 Handbook of Medical Laboratory Technology 2nd Edition, CBS Publishers and Distributors, New Delhi*

REFERENCE BOOKS:

1. *Gupta, S 1998. A Short Text Book of Medical Laboratory for Technicians. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi*
2. *Bain B J, Bates I, Laffan M A and Lewis M 2011. Dacie and Lewis Practical Haematology, 11th edition, Churchill Livingstone, China*

17UCL53Q	CORE PRACTICAL - VI: MICROBIOLOGY-I	SEMESTER - V
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Total Credits: 3
Hours/week: 6

CONTENTS

1. Safety precautions in microbiology Laboratory
2. Handling, Use and Care of Instruments- Inoculation loop, Balance, Refrigerator, Hot air oven, Autoclave, Incubator, Anaerobic Jar, Centrifuge and Metabolic shakers.
3. Staining technique - Simple staining and Gram staining,
4. Staining technique- Motility-Hanging drop and SIM
5. Staining technique- Negative, Spore and AFB
6. Preparation and Inoculation of Culture media-Solid and Liquid
7. Morphological characterization of Bacteria
8. Tests for the identification of Bacteria-IMViC
9. Tests for the identification of Bacteria Sugar fermentation (Carbohydrate fermentation and TSI)
10. Tests for the identification of Bacteria- Oxidase, Catalase, Urease, H₂S production test

REFERENCE BOOKS :

1. *SundaraRajan S*, 2001. **Practical Manual of Microbiology**, Anmol Publications Pvt.Ltd, New Delhi.
2. *Kannan N*, 2002.**Laboratory Manual in General Microbiology**, 1stEdition, Published by Panima Book Distributors, New Delhi

17UCL5EA	ELECTIVE- I: ORGANISATION OF CLINICAL LABORATORY	SEMESTER- V
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Total Credits: 4
Hours /week: 4

PREAMBLE:

To understand the organisation and establishment of clinical laboratory and to know the principle and significance of various automated analysers.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the components, physical aspects and Medico legal Aspects of clinical laboratory and its practice	K₁,K₂, K₃
CO 2	Know the causes and types of laboratory hazards, biosafety and biomedical waste management	K₁,K₂, K₃
CO 3	Describes the sterilization techniques by heat, filtration, chemical and radiation	K₁,K₂, K₃
CO 4	Understands the disinfection, evaluation of antimicrobial potency and its technique	K₁,K₂, K₃
CO 5	Know the types of analyzers, random access of analyzer and responsibilities in maintenance of analyzer	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL5EA	ELECTIVE- I: ORGANISATION OF CLINICAL LABORATORY	SEMESTER- V
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Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

Introduction, Functional Components of Clinical Laboratories, Clinical Laboratory Set up Laboratory building and space, Physical aspects of laboratory, Universal work precautions (UWP) for lab personnel (HIV), Medico-legal aspects of clinical practice.

UNIT-II

Laboratory Safety - Common causes of Laboratory Hazards, Types of laboratory hazards, Biomedical Waste -Classification, treatment and disposal, Biosafety Levels.

UNIT-III

Sterilization techniques - Sterilization by heat (Hot air oven, Autoclave), Sterilization by filtration (Membrane filter & HEPA), Sterilization by radiation (Ionizing and Non- ionizing), Sterilization by chemicals (Alcohol, Phenols, Aldehydes, Ethylene oxide).

UNIT-IV

Disinfection- Ideal characteristic of ideal disinfectant, Mode of action, Selection of antimicrobial chemical agent, Evaluation of antimicrobial

potency, Tube- dilution technique, Phenol-coefficient technique, Agar plate technique.

UNIT-V

Manual Vs Automation in Clinical Laboratory - Types of analyzers -Semi-auto analyzer -Batch analyzer -Random Access auto analyzers. Steps in the automated systems - Responsibilities of a technician in the maintenance of the analyzers.

TEXT BOOKS :

1. *Kanai L. Mukherjee, 2010. Medical Laboratory Technology-A Procedure Manual for Routine Diagnostic Tests*Volume- 1 , Tata McGraw-Hill Pub Publishing Company Ltd.
2. *Ramnik Sood, 1996. Medical laboratory technology, Methods and Interpretation, Sixth edition, Jaypee publishers.*

REFERENCE BOOKS :

1. *A.Kolhatkar , J Ochei , 2000. Medical Laboratory Science- Theory and Practice, Tata McGraw-Hill Pub*
2. *P. B. Godkar , D.P. Godkar, 2003. Textbook of Medical Laboratory Technology, 2nd Edition, Bhalani Pub.*
3. *Monica cheesbrough, District Laboratory Practice in Tropical Countries, 2006. Part 1, Cambridge Edition*

17UCL5EB	ELECTIVE- I: INTRODUCTION TO BIOMATERIALS	SEMESTER-V
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Total credits: 4
Hours/week: 4

PREAMBLE:

To understand various concepts and various generations of biomaterials and to gain knowledge in nanotechnology and its medical applications..

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the concepts of biomaterials and first generation biomaterials	K₁,K₂, K₃
CO 2	Know the significance of second generation biomaterials	K₁,K₂, K₃
CO 3	Describes the synthesis and applications of third generation biomaterials	K₁,K₂, K₃
CO 4	Understands the principles and applications of nanotechnology	K₁,K₂, K₃
CO 5	Know the applications of advanced microscopic and spectroscopic techniques for analysis of sample	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL5EB	ELECTIVE- I: INTRODUCTION TO BIOMATERIALS	SEMESTER-V
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Biomaterials and biological materials – examples and uses: first generation biomaterials – general characteristics – naturally occurring biomaterials – pure metals – alloys – ceramics – polymers – composites.

UNIT-II

Second generation biomaterials and their properties – bioactive and biodegradable ceramics – biodegradable polymers – hydrogels.

UNIT-III

Third generation biomaterials – characteristics – biomaterials in tissue engineering – enzyme conjugates, DNA conjugates – DNA- protein Conjugates – microarray technologies – micronanotechnology – microfabrication – nanofabrication – interaction between biological materials, molecular – biomolecules and nanomaterials.

UNIT-IV

Nanobitechnology – introduction – DNA nanotechnology – structural DNA assembly –nanopore and nanoparticles – biological arrays – nanoprobes for analytical applications – nanosensors – nanoscale organization – characterization – quantum size effects – nanobiosensors – sensors of the future.

UNIT-V

Microscopies - SEM - TEM - modern advances - microanalysis - optical detection of single molecules - applications in single molecule spectroscopy - single molecule DNA detection, sorting, sequencing - DNA nanoparticles studies by AFM - DNA computer - PCR amplification of DNA fragments - molecular surgery of DNA.

TEXT BOOKS :

1. Nano: The essentials: Pradeep .T, 2007, Tata McGraw-Hill Publishing Company Ltd. *B.Sc. Bio-Chemistry (Colleges-revised) 2008-09 Annexure No. 26 A Page 30 of 37 SCAA Dt. 21.05.2009*
2. Nanoparticles assemblies and Superstructures: Nicholas A.Kotov, 2006, CRC Press.
3. Nanoscale Technology in Biological Systems: Editors: Ralph et al, 2005, CRC Press.

REFERENCE BOOKS

1. Micromachines as Tools for Nanotechnology: H.Fujitha, 2003, Springer Verlag.
2. Nanobiotechnology: Concepts, Applications and Perspectives, C.M.Niemeyer & C.A. Mirkin, 2004, Willey VCH Verlag GMBH &co.
3. Biomaterials: An introduction. 1992. By Park JB, Lakes RS.
4. Advances in Biomaterials, Drug delivery - AICHE. J 2003, 49(12): 2990 - 3006.

17UCL5EC	ELECTIVE-I: PLANT & ANIMAL BIOTECHNOLOGY	SEMESTER -V
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Total credits: 4

Hours/week: 4

PREAMBLE:

To understand the principle and applications of mammalian and plant cell CULTURE.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the basic concepts of media preparation for plant tissue culture	K₁,K₂, K₃
CO 2	Know the significance culture technique for gene transfer	K₁,K₂, K₃
CO 3	Describe the basic concepts of mammalian cell culture	K₁,K₂, K₃
CO 4	Understand the principles and applications of gene technology in production of therapeutic compounds	K₁,K₂, K₃
CO 5	Describe the production of recombinant proteins	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL5EC	ELECTIVE-I: PLANT & ANIMAL BIOTECHNOLOGY	SEMESTER -V
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Total credits: 4**Hours/week: 4****CONTENTS****UNIT-I**

Plant tissue culture: - Media composition, nutrients & growth regulators, MS medium & B5 medium. Callus & suspension culture. Initiation & differentiation of PTC. Micropropagation:- Methods, Production of haploid plants, phytochemicals from plant tissue culture.

UNIT-II

Protoplast technology:- Isolation, fusion of protoplasts, Electroporation, Biolistics, Regeneration of plants from protoplasts. Gene Transfer in plants:- Ti plasmid vectors, mechanism of T- DNA transfer, Vir genes. Transgenic plants:- Herbicide, Virus, Pest resistance plants, Male infertility, Genetic engineering of plant oils.

UNIT-III

Mammalian cell culture:- Establishment of cell in culture: Requirements for invitro growth; importance of serum. Cell-lines; cell transformation - properties of transformed cells, cell separation, Mass cultivation of cells: suspension culture; immobilized cultivation.

UNIT-IV

Genetic Engineering of Animal cells: - Mammalian cell culture in protein production. Gene transfer into mammalian cells, Selectable markers pSV plasmids; retroviral vectors; Expression vectors; reporter genes.

UNIT-V

Animal Biotechnology:- Artificial insemination and embryo transfer, In vitro fertilization (IVF): embryo cloning. Human embryo research, transgenic mice, Gene therapy; the Human Genome Project.

Recombinant proteins from cell cultures: - Interferons, Viral vaccines, Hybridoma technology- Monoclonal antibodies- production and applications.

TEXT BOOKS:

1. Plant tissue culture; Razdan; Oxford IBH publishers, 1994.
2. *Freshney*; Animal cell culture; IRL press.

REFERENCE BOOKS :

1. *D. Balasubramanian* and others, Concepts in Biotechnology, Universal press India 1996.
2. BIOTOL series, In vitro cultivation of animal cells- Butler worth Heineman, 1993
3. *Walsh Gary and Headon R. Denis*, Protein Biotechnology. John Wiley publishers, 1994.

17UCL5SA	SKILL BASED COURSE -III: BASICS OF MOLECULAR BIOLOGY	SEMESTER - V
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Total credits: 3

Hours/week: 3

PREAMBLE:

To understand fundamental knowledge in molecular biology and to apply the recent molecular techniques for disease diagnosis and treatment.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the basic concepts behind genetic material and central dogma of life	K ₁ ,K ₂
CO 2	Know the mechanism of RNA synthesis and processing	K ₁ ,K ₂ , K ₃
CO 3	Understand protein synthesis and regulatory mechanism and application in disease diagnosis	K ₁ ,K ₂ , K ₃
CO 4	Understand the concept of mutation and repair mechanism	K ₁ ,K ₂ , K ₃
CO 5	Appreciate the principle and applications of various molecular techniques	K ₁ ,K ₂ , K ₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL5SA	SKILL BASED COURSE - III: BASICS OF MOLECULAR BIOLOGY	SEMESTER- V
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Total credits: 3

Hours/week: 3

CONTENTS

UNIT I:

DNA as a genetic material: Identification of DNA as genetic materials- Griffith, Hershey -Chase experiment.

DNA replication in Prokaryotes and Eukaryotes - enzymes and accessory proteins involved in DNA replication.

UNIT II:

Transcription: prokaryotic and eukaryotic transcription, RNA polymerase, transcription factors, regulatory elements involved in transcription. Post transcriptional modification-Capping, polyadenylation, splicing, RNA editing.

UNIT III:

Translation: Protein synthesis in prokaryotic and eukaryotes- activation, initiation, elongation and termination of protein synthesis. Inhibitors of protein synthesis, Post translational modification, Gene regulation- Operon model - lac and trp operons.

UNIT IV: Mutation- definition, causes of mutation; mutagens; Types of mutation-missense, nonsense, insertion, deletion, duplication, frameshift mutation; transposon mutagenesis. DNA repair mechanisms-Direct

enzymatic repair, Base excision repair, Nucleotide excision repair, Mismatch repair, Recombinational repair mechanism.

UNIT V:

Molecular techniques: Blotting- Southern, Northern and western blotting, Southern hybridization, FISH DNA microarray, PCR-types and applications, RAPD, RFLP.

TEXT BOOKS :

1. *Robert Schleif* (1993), *Genetics and Molecular Biology*; 2nd Edition The Johns Hopkins University Press Ltd; London.
2. *Cell and Molecular Biology*, 3rd Edition. Rastogi, S.C. New age International Publishers, India 2012.
3. *Biochemistry*, 3rd Edition. Sathyanarayana U, New Central Book Agency (p) Ltd 1999.

REFERENCE BOOKS:

1. *The cell: Molecular approach*, 5th Edition. Cooper, G.M., Hausman, R.E, American Society of Microbiology press, USA 2009.
2. *Cell and Molecular Biology: Concepts and Experiments*. 5th Edition. Karp, G. John Wiley and Sons, USA 2007.
3. *Molecular cell biology*, 5th Edition. Lodish, H. Berk, A., Matsudaira, P., Kaiser, C. A., Krieger, M., Scott, M.P. Lawrence Z., Darnell, J. W. H. Freeman, USA 2003.

17UCL63A	CORE - XIV: IMMUNOLOGY	SEMESTER - VI
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Total credits: 4
Hours/week: 4

PREAMBLE :

- Understand the immunological reactions and manifestation of immunological diseases
- Appreciate the applications of advanced techniques in disease diagnosis and therapy

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Know the basics of immunity and organs involved in immunology	K ₁ ,K ₂
CO 2	Understand the antigen and antibody reactions	K ₁ ,K ₂ , K ₃
CO 3	Appreciate the techniques involved in detection and quantification of immune components	K ₁ ,K ₂ , K ₃
CO 4	Gain knowledge on manifestation of various immune diseases	K ₁ ,K ₂ , K ₃
CO 5	Understand immunotherapy and vaccination	K ₁ ,K ₂ , K ₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL63A	CORE - XIV: IMMUNOLOGY	SEMESTER - VI
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Historical development of the science of the immunology. Innate and acquired immunity, Antibody mediated and cell mediated immunity. Primary and secondary lymphoid organs. Cells of immune system- T, B and NK cells. Receptors on the surface of lymphocytes. Structure and functions of neutrophils, Macrophages (phagocytosis and inflammation), eosinophils and basophils.

UNIT-II

Antigen: Properties, Specificity and Cross reactivity, antigenicity, immunogenicity, antigen determinants, Haptens, adjuvants, Self antigens (MHC) an outline only. Antibodies: Properties, classes and subclasses of immunoglobulin: Structure, specificity and distribution, Clonal selection theory of antibody formation. Cytokines and their functions. Complement components.

UNIT-III

Antigen-antibody interaction - Precipitation and agglutination . Precipitation in gel. Immuno diffusion and Immuno electrophoresis Agglutination: Slide agglutination, Widal test. Principle and application of RIA, ELISA, Flouresent antibody technique. Applications of imuno assay-

turbidometric, electrochemi luminescence assay. Monoclonal antibodies and their application.

UNIT-IV

Allergy and Hypersensitivity - Type I, II, III and IV, their clinical manifestations. Immuno Disease: Rheumatoid arthritis, Myasthenia gravis. Immunity to bacteria and viruses. Skin Test: Montex and Penicillin test.

UNIT-V

Transplantation: Tissue cross matching, HLA - class I & II. Allograft rejection: Graft Vs Host Diseases: Immuno suppressors: mechanism of graft rejection. Resistant to tumors: NK Cells: Tumor immuno therapy. Vaccination: Passive and active immunization, Recombinant vaccines: DNA vaccines. Benefits and adverse effects of vaccination. AIDS- structure of HIV and clinical manifestation.

TEXT BOOKS :

1. *Tizzard J R*, 1995. **Immunology** - An introduction. Saunders College Pub., Philadelphia
2. *Kindtt T J, Gosby R A, Osborne BA and Kuby J* 1997 **Immunology**, 3rd edition, W.H. Freeman and Company. New Delhi

REFERENCE BOOKS :

1. *Roitt I, Brastoff J and Male D*, 1993 - **Immunology** , Mosby - Elsevier, 3rd ed.
2. *Ananthanarayan R and Panicker C K J* 2005. **Textbook of Microbiology**, 3rd edition, Orient Longman Private Limited, Hyderabad

17UCL63B	CORE - XV: CYTOLOGY	SEMESTER- VI
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Total credits: 4
Hours/week: 4

PREAMBLE:

- To understand the basic cell types and their functions, basic techniques in sampling and staining of cytology samples.
- To understand the various types of cytological samples, and morphological differences
- To understand the advanced principles of automation and immunohistochemistry

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Know the normal cell structure and function, histology and cytology of epithelial and connective tissue. Understand the principles involved in collection, preparation, fixation and staining of samples	K₁,K₂
CO 2	Understand the normal and malignant cytology of FNAC and non gynae cytology	K₁,K₂, K₃
CO 3	Understand the normal and malignant cytology of cervix, Know the techniques involved in cervical specimen collection. Understand the significance of cervical screening	K₁,K₂, K₃
CO 4	Understands the principle and procedure of flow cytometry, analyse and interpret data from flow cytometry	K₁,K₂, K₃
CO 5	Understand the principles involved in production and use of monoclonal antibodies. Know the principle and interpretation of immunohistochemical analysis	K₁,K₂,K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL63B	CORE - XV: CYTOLOGY	SEMESTER- VI
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Normal cell structure and function, Normal Histology and cytology of epithelial and connective tissue, Collection and preparation of samples Fixation, fixatives, Staining - Principles, Preparations of reagents, techniques: a. Papanicolaou's stain, b. May - Grunwald Giemsa stain

UNIT-II

FNAC and non gynae cytology: Normal and malignant cytology in Gastrointestinal tract, Respiratory tract, Effusions, CSF and Urinary tract. FNAC of Breast, Lymph node, Thyroid and Salivary glands, liver, pancreas and biliary system.

UNIT-III

Gynae cytology: Normal cervix, Cervical neoplasia, Pathogenesis of cervical cancer, Cervical screening, Cervical cytopathology. Collecting cellular samples from the cervix: Conventional Pap smear, Liquid based cytology.

UNIT-IV

Flow cytometry: Principles, equipments, procedure and evaluation. Image analysis.

UNIT-V

Immuno-cytochemistry: Introduction, Basic concepts of immunocytochemistry, HLA B27, CD4, CD8, Monoclonal antibodies and their preparations, Fluorescence reactions.

TEXT BOOKS :

1. *Mukherjee, KL* 2010. **Medical Laboratory Technology-A procedure manual for routine diagnostic Tests - Volume 1, 2 and 3**, Tata McGraw Hill Publishing Company Ltd, New Delhi.
2. *Sood R,* 1994 **Medical Laboratory Technology**, Jaypee Brothers, New Delhi.

REFERENCE BOOKS :

1. *Gupta, S* 1998. *A Short Text Book of Medical Laboratory for Technicians.* Jaypee Brothers Medical Publishers (P) Ltd., New Delhi
2. *Bain B J, Bates I, Laffan M A and Lewis M* 2011. *Dacie and Lewis Practical Haematology*, 11th edition, Churchill Livingstone, China.

17UCL63P	CORE PRACTICAL - VII: MICROBIOLOGY-II	SEMESTER - VI
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Total credits: 3
Hours/week: 6

CONTENTS

1. Identification of Bacteria- *Staphylococci sp.*, *Streptococci, sp.*, *Cornibacterium diptheriae*, *E.Coli*, *Klebsiella sp.*, *Salmonella typhi*, *Shigella, sp.*, *Pseudomonas sp.*,
2. Antibiotic susceptibility tests
3. Culture characteristics of *Aspergillus*, *Mucor*, *Rhizopus*, *Pencillium*, *Candida*
4. Slide culture technique for identification of fungi
5. KOH preparation and LPCB staining for fungal identification.
6. Serological tests- Widal and Blood Grouping
7. Latex Agglutination Tests -RF, ASO & CRP tests; ELISA test for HIV
8. Demonstration of bacteriological analysis of water-MPN Test
9. Demonstration of bacteriological analysis of milk-MBRT
10. Demonstration of bacteriological analysis of air.

REFERENCE BOOKS :

1. *SundaraRajan S*, 2001. **Practical Manual of Microbiology**, Anmol Publications Pvt.Ltd, New Delhi.
2. *Kannan N*, 2002. **Laboratory Manual in General Microbiology**, 1stEdition, Published by Panima Book Distributors, New Delhi.

17UCL6EA	ELECTIVE - II: QUALITY CONTROL AND BIOSTATISTICS	SEMESTER- VI
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Total credits: 4
Hours/week: 4

PREAMBLE

- Enable the students to know lab safety and quality management.
- Possesses knowledge and skills in the use of basic statistical and research methodology

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the basic concepts of Laboratory Management and Safety	K₁,K₂
CO 2	Identify the Hazards in the laboratory and the measures to manage them	K₁,K₂, K₃
CO 3	Understand the basic principles of Quality management in the laboratory	K₁,K₂,
CO 4	Understand the basic concepts of Biostatistics	K₁,K₂, K₃
CO 5	Understand the advanced concepts of Biostatistics	K₂,K₃

MAPPING WITH PROGRAMME OUTCOMES:

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	M	M	S	S	S
CO 2	S	M	S	S	S
CO 3	S	M	S	S	S
CO 4	S	M	S	S	S
CO 5	S	M	S	S	S

S- Strong, M - Medium, L - Low

17UCL6EA	ELECTIVE - II: QUALITY CONTROL AND BIOSTATISTICS	SEMESTER- VI
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Total credits: 4**Hours/week: 4****CONTENTS****UNIT-I**

Laboratory Management and Safety: Health care delivery and financial strategies for managed care, financial management, human resource management and space and facility management.

UNIT-II

Lab safety program, safety equipments, chemical hygiene plan. Hazards in the laboratory- identification of hazards, chemical hazards, clinical hazards, electrical hazards, biological hazards. Prevention of hazards.

UNIT-III

Quality management: Fundamentals, total quality management, total testing process, control of preanalytical and analytical variables, control of analytical quality using stable control materials, external quality assessment, documentation of reports, proficiency testing new quality initiatives.

UNIT-IV

Biostatistics: Frequency distribution: diagrams, characteristics of a frequency distribution Basic distribution statistics: measures of central tendencies. Measures of accuracy and precision, Statistical sampling methods, Basic for statistical inference Sampling distribution.

UNIT-V

The null hypothesis and statistical significance, Comparison of means test including paired test, One way analysis of variance (Anova), Non Parametric distribution statistics, (Chi Square) test, Linear regression and correlation.

TEXT BOOKS :

1. *Gupta S.P.*, Statistical Methods 2006, 6th edition, Sultan Chand & Sons, New Delhi.
2. *Rohatgi V K and Md.Ehsanes saleh A K*, An Introduction to Probability & Statistics, 2009, Wiley India.

REFERENCE BOOKS :

1. *Machin D, Campbell M J, Fayers P M and Pinol A P Y*. Sample Size Tables for Clinical Studies, 2nd edition, 1997, Blackwell science ltd.
2. *Chow S C, Shao J and Wang H*. Sample size calculations in clinical research, 2008, Chapman & Hall, CRC press

17UCL6EB	ELECTIVE- II: NANOMATERIALS AND NANOMEDICINE	SEMESTER- VI
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Total credits: 4
Hours/week: 4

PREAMBLE

To understand the significance of advantages and disadvantages of nanomaterials used in medicine, their types and applications.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Appreciate the Structure property relationship of Biological materials	K₁,K₂
CO 2	Understand the role of nanomaterials in cardiovascular implants	K₁,K₂, K₃
CO 3	Understand the applications of polymeric implant materials	K₁,K₂,
CO 4	Know the characteristics and applications of metallic and ceramic implant materials	K₁,K₂, K₃
CO 5	Appreciate the nanoparticles in drug delivery	K₂,K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	M	M	S	S	S
CO 2	S	M	S	S	S
CO 3	S	M	S	S	S
CO 4	S	M	S	S	S
CO 5	S	M	S	S	S

S- Strong, M - Medium, L - Low

17UCL6EB	ELECTIVE- II: NANOMATERIALS AND NANOMEDICINE	SEMESTER- VI
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Structure property relationship of Biological materials: tissues, bones and teeth, collagen rich tissues, elastic tissues, nanostructured collagen mimics in tissue Engineering. Biopolymers: Preparation of nanobiomaterials - Polymeric scaffolds collagen, Elastins: Mucopolysaccharides, proteoglycans, cellulose and derivatives; Dextrans; Alginates; Pectins; Chitin.

UNIT-II

Cardiovascular implants: Role of nanoparticles and nanodevices in blood clotting; Blood rheology; Blood vessels; Geometry of blood circulation; Vascular implants; Cardiac pacemakers; blood substitutes; Biomembranes.

UNIT-III

Polymeric implant materials: Polyolefin; polyamides (nylon); Acrylic polymers (bone cement) and hydrogels; Fluorocarbon polymers; Natural and synthetic rubbers, silicone rubbers; High strength thermoplastics; deterioration of polymers. Biomaterials for Ophthalmology: Contact lenses; Optical implants for glaucoma; adhesives; artificial tears; Protection gears.

UNIT-IV

Metallic and ceramic implant materials: Bone regeneration, Nano crystalline structures of Bone and Calcium phosphate cements. Cobalt-based alloys;

Titanium and its alloys, Nanoparticles relating to Aluminium oxides: Hydroxyapatite; Glass ceramics; ceramic implants; carbon implants. Nano dental materials.

UNIT-V

Synthesis of nanodrugs - metal nanoparticles and drug delivery vehicles - Nanoshells - Tectodentrimers Nanoparticle drug systems - Diagnostic applications of nanotechnology.

REFERENCE BOOKS :

1. SV Bhat, Biomaterials (2nd Edition), Narosa Publishing House, New Delhi - 2005.
2. JB Park, Biomaterials Science and Engineering, Plenum Press, New York, 1984 Challa S.S.R.Kumar, Joseph Hormes, Carola Leuschmal.
3. Nanofabrication towards biomedical applications Willey - VCHVerlag GmbH & Co, KGaA

17UCL6EC	ELECTIVE -II: GENETIC ENGINEERING AND BIOPROCESS TECHNOLOGY	SEMESTER- VI
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Total credits: 4
Hours/week: 4

PREAMBLE:

To understand the significance of gene technology and fermentation technology.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the basics of vectors and methods of gene cloning	K ₁ ,K ₂
CO 2	Understand the gene transfer and identification of recombinant gene.	K ₁ ,K ₂ , K ₃
CO 3	Understand the applications of sequencing methods	K ₁ ,K ₂ ,
CO 4	Appreciate the production and significance of recombinant proteins	K ₁ ,K ₂ , K ₃
CO 5	Understand the basic concepts and applications of fermentation	K ₂ ,K ₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	S
CO 5	S	S	S	S	S

S- Strong, M - Medium, L - Low

17UCL6EC	ELECTIVE -II: GENETIC ENGINEERING AND BIOPROCESS TECHNOLOGY	SEMESTER- VI
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Basis of gene cloning; Restriction endonucleases - Types and Features; Ligations; Linkers and Adaptors. Vectors of gene cloning: - Plasmid Vectors - Basic feature, pBR332. Bacteriophage vectors; Cosmids. Cloning hosts. Preparation of Plasmid DNA from bacteria.

UNIT-II

Introduction of DNA into bacterial cells: Transformation of E. coli, selection of transformed cells, Identification of recombinants. Introduction of phage DNA into bacterial cell, Identification of recombinant phage. Genomic library and cDNA library. Hybridization probes; Southern, Northern and Western blotting techniques.

UNIT-III

DNA sequencing: Outline of Sanger's method - Applications. Genetic Finger Printing - Oligonucleotide directed mutagenesis; Protein engineering. PCR - Technique and Applications.

UNIT-IV

Expression vectors for E.Coli:- Constituents; Examples of promoters - Expression cassettes - Problems caused in expression of eukaryotic genes: Fusion proteins: - Applications of gene technology: Recombinant insulin;

Recombinant growth hormones. Cloning HBV surface antigen in yeast. Insect cells as host system. Safety aspects and hazards of genetic engineering.

UNIT-V

Bioprocess technology: Fermentation: Design of a commercial fermenter; Solid substrate fermentation: Media for industrial fermentations; Batch culture and fed - batch culture. Down - stream processing. Production of amino acids; SCP; Penicillin and alcohol.

TEXT BOOKS:

1. *T.A. Brown, Gene cloning- An introduction, Chapman and Hall, 1995.*
2. *Balasubramaniam, D, C.F.A., Bryce, K. Dharmalingam, J. Green, Kunthala Jayaraman concepts in Biotechnology, COSTED - IBN university press, 1996.*
3. *R.W. Old & S.B. Primrose, Principles of Gene manipulation, Black well scientific publications, 1994.*

REFERENCE BOOKS :

1. *Glick.R, Bernard and Pasternak.J, Jack, Molecular Biotechnology, Asm press, Washington D.C, 1994.*
2. *Glazier. N. Alexander, Hiroshnikaido, Microbial Biotechnology, W.H. Freeman & co., New york, 1995.*

17UCL6ED	ELECTIVE- III: TUMOUR MARKERS AND IMMUNOHISTOCHEMISTRY	SEMESTER- VI
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Total credits: 4

Hours/week: 4

PREAMBLE :

To know about various tumour markers and immune techniques for diagnosis of cancer.

COURSE OUTCOMES

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand and define carcinogens, oncogenes. Distinguish between the general, morphological and biochemical characteristics of normal and tumor cells	K₁,K₂
CO 2	Understand the concept of tumour markers. Know the significance of different enzymes as tumour markers.	K₁,K₂, K₃
CO 3	Know the significance of different hormones and carbohydrates as tumour markers in screening and diagnosis	K₁,K₂, K₃
CO 4	Know the significance of different proteins as tumour markers	K₁,K₂, K₃
CO 5	Understand the principles of immunological techniques.	K₁,K₂

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	M
CO 2	S	S	S	S	M
CO 3	S	S	S	S	M
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL6ED	ELECTIVE- III: TUMOUR MARKERS AND IMMUNOHISTOCHEMISTRY	SEMESTER- VI
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Total credits: 4

Hours/week: 4

CONTENTS

UNIT-I

Introduction, Carcinogens - definition. Oncogene - definition - Mechanism of action of Oncogenes (outline). Characteristics of growing tumor cells- general and morphological changes, biochemical changes.

UNIT-II

Tumor Markers- Introduction and definition, Clinical applications of tumor markers. Enzymes as tumor markers, Alkaline Phosphatase (ALP), Creatine kinase (CK), Lactate dehydrogenase (LDH), Prostate specific antigens (PSA).

UNIT-III

Hormones as tumor markers (introduction of each type in brief). Oncofetal antigens. Alpha feto protein (AFP), Beta Human Chorionic Antigen (β HCG), Carcino embryonic antigen (CEA) Squamous cell carcinoma (SCC) antigen. Carbohydrate markers (brief introduction of each type) CA 15-3, CA 125.

UNIT-IV

Blood group antigen (brief introduction of each type) CA 19-9, CA 50, CA 72-4, CA 242. Bladder cancer markers (introduction in brief) - Bladder tumor

antigen (BTA) Fibrin, Fibrinogen degradation product (FDP). Nuclear matrix protein (NMP22). TRAP assay, hyaluronic acid and Hyaluronidase.

UNIT-V

Immunological techniques - immunofixation, Antigen retrieval, immunochemistry, turbimetry

Immunohistochemistry - Polyclonal and monoclonal antibodies, Direct and Indirect immunohistochemistry, labels, detection, tissue preparation, antigen retrieval, blocking, rinsing, controls.

Tumour markers - AFP, B2M, Beta hCG

REFERENCE BOOKS:

1. *Eleftherios P. Diamandis*, 2002, *Tumor Markers: Physiology, Pathobiology, Technology, and Clinical Applications*, Amer. Assoc. for Clinical Chemistry.
2. *Hebermann & Mercer*, *Immunodiagnosis of Cancer*, Second , illustrated, revised , CRC Press, 1990

15UCL6EE	ELECTIVE- III: NANOBIOTECHNOLOGY	SEMESTER -VI
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Total credits: 4
Hours/week: 4

PREAMBLE:

Understand the basic concepts of developing nanomaterials and to appreciate the applications of nanoparticles.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Understand the basic principles of cell biology and apply the knowledge for nanomaterial development	K₁,K₂, K₃
CO 2	Know the technology for developing devices for medical implants	K₁,K₂, K₃
CO 3	Understand and apply protein based nanostructures	K₁,K₂, K₃
CO 4	Understand and apply DNA based nanostructures	K₁,K₂, K₃
CO 5	Appreciate the applications of bionanomaterials for diagnostic purposes and gene transfer	K₁,K₂

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	M	M	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

15UCL6EE	ELECTIVE- III: NANOBIOTECHNOLOGY	SEMESTER -VI
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Interdisciplinary areas of Biotech and Nanoscience. It is a field that concerns the utilization of biological systems. Cells, Cellular components. Nucleic acids and proteins refinement and application of instruments - to generate and manipulate nanostructured materials to basic and applied studies.

UNIT-II

Interphase systems pertaining to biocompatible inorganic devices for medical implants - microfluidic systems - microelectronic silicon substrates.

UNIT-III

Protein based nanostructures building blocks and templates - Proteins as transducers and amplifiers of biomolecular recognition events - nanibioelectronic devices and polymer nanocontainers - microbial production of inorganic nanoparticles - magnetosomes.

UNIT-IV

DNA based nanostructures - Topographic and Electrostatic properties of DNA and proteins - Hybrid conjugates of gold nanoparticles - DNA oligomers - use of DNA molecules in nanomechanics and computing.

UNIT-V

Semiconductor (metal) nanoparticles and nucleic acid and protein based recognition groups - application in optical detection methods - Nanoparticles as carrier for genetic material.

REFERENCE BOOKS:

1. Nanobiotechnology - Concepts, Applications and Perspectives - 2004.
Edited by CM, Niemeyer, C.A. Mirkin. Wiley - VCH.
2. Nano: The essentials: T. Pradeep. McGraw - Hill education - 2007.
3. Nanofabrication Towards Biomedical Applications, Techniques, Tools,
Applications and Impact. 2005 - By Challa, S.S.R. Kumar, Josef Hormes,
Carola Leuschaer. Wiley - VCH.
5. Nanoparticle Assemblies and Superstructures. By Nicholas A. Kotov.
2006 - CRC.

17UCL6EF	ELECTIVE- III: PLANT THERAPEUTICS	SEMESTER- VI
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Total credits: 4
Hours/week: 4

PREAMBLE :

To understand plant metabolism and role of secondary metabolites as therapeutics.

COURSE OUTCOMES:

On successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO 1	Recall the concept of photosynthesis	K₁,K₂,
CO 2	Understand the cycles of elements and plant nutrition	K₁,K₂, K₃
CO 3	Describe the plant growth regulators	K₁,K₂
CO 4	Understand the significance of senescence in plants	K₁,K₂, K₃
CO 5	Know the roles of plant secondary metabolites and their role.	K₁,K₂, K₃

MAPPING WITH PROGRAMME OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	S	S	S	S	S
CO 2	S	S	S	S	S
CO 3	S	S	S	S	S
CO 4	S	S	S	S	M
CO 5	S	S	S	M	M

S- Strong, M - Medium, L - Low

17UCL6EF	ELECTIVE- III: PLANT THERAPEUTICS	SEMESTER- VI
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Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Plant cell: - Structure and functions. Photo synthesis: - Photo synthetic pigments - chlorophyll, carotenoids and phycobillin. Light reactions - two kinds of chemical system - photo system I and II -evidences in support of light reaction - Hill's reaction, Arnon's work and Emerson effect. Dark reaction - Calvin's cycle (C3 plants) Hatch - Slack cycle (C4 cycle) and CAM plants. Photo respiration.

UNIT-II

Cycles of elements: Nitrogen cycle: - Ammonification, nitrification, nitrate reduction and denitrification, nitrogen fixation- symbiotic and non-symbiotic nitrogen fixation. Sulphur cycle, phosphorus cycle and carbon cycle. Plant nutrition: Specific roles of essential elements and their deficiency symptoms in plants. Macro nutrients: - Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur, Phosphorus, Calcium, Potassium, Magnesium and Iron. Micro nutrients: - Manganese, Boron, Copper, Zinc, Molybdenum and Chlorine.

UNIT-III

Plant growth regulators: Chemistry, biosynthesis, mode of action and Practical applications of auxins, gibberellins, cytokinins, abscisic acid and Ethylene. Plant growth inhibitors and retardants.

UNIT-IV

Photo morphogenesis: Photo periodism. Phytochrome - Function in growth and development of plant. Biochemistry of seed germination. Senescence: Biochemical changes during senescence. Senescence process in life cycle of plants.

UNIT-V

Secondary metabolites: Nature, distribution and biological functions of alkaloids, terpenes, flavonoids, polyphenols, tannins and steroids. Role of secondary metabolites in pathogens, insects, animals and mankind.

TEXT BOOKS:

1. Plant Biochemistry and Molecular Biology - Lea and Lea wood, John Wiley and sons, 1997.
2. Plant Physiology -Devlin N. Robert and Francis H. Witham, CBS Publications.
3. Plant Biochemistry and Molecular Biology - Hans Walter Heldt, Oxford University Press, New York, 1997.

REFERENCE BOOKS :

1. Introduction to Plant Physiology - William G.Hopkins, John Wiley and sons.
2. Tissue culture of economic plants - C.K. John, Rajani, S. Nadyanda AF. Mascarenhas, Niscom, New Delhi, 1997

17UNM34D	NMEC- I : ANATOMY, PHYSIOLOGY AND LABORATORY SCIENCE	SEMESTER - III
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Total Credits: 2

Hours /week: 2

PREAMBLE:

To understand the various systems, parts and organs of our body and their physiological functions.

CONTENTS

UNIT-I

Definition of the terms Anatomy and Physiology- The body as a whole- organization of the body: Cells, Tissue, Organs, Membranes and glands. Musculo - Skeletal System: Bone types, structure and function. Nervous System: Structure and function of neuron

UNIT-II

Cardio Vascular System : Heart- Conduction System, Functions and Cardiac Cycle - Blood- Composition, Clotting and groups, **Respiratory System**: Structure and function of lungs.

UNIT-III

Structure and functions of the organs of digestive system (outline), Urinary System- Structure and functions of kidney, nephron and endocrine glands- Pituitary gland- functions and pathophysiology in brief). **Sense Organs**: - Structure and functions of Eye, Ear, Nose, skin and tongue

UNIT-IV

Reproductive System: Female reproductive system - Structure and functions of female reproductive organs - Menstrual cycle, menopause and process of reproduction - Male reproductive system -Structure and functions of organs.

UNIT-V

Laboratory Science: Clinical Laboratory set up, biological samples for diagnosis- serum, blood, urine and sputum. Laboratory safety practices.

TEXT BOOKS :

1. *Chatterjee, C C*, 2005. **Human Physiology**, 10th Edition, Medical Allied Agency, Kolkata.
2. *Khurana I and Khurana A* 2014. **Textbook of Anatomy and Physiology for Nurses and Allied Health Sciences**, 1st Edition, CBS Publishers and Distributors, New Delhi

REFERENCE BOOKS :

1. *Sembulingam K and Sembulingam P*, 2010, **Essentials of Medical Physiology**, 5th Edition, Jaypee Medical Pub, New Delhi
2. *Arnould-Taylor W E* 2001, **A Textbook of Anatomy and Physiology**, 3rd Edition, Stanley Thomas publishers, UK.

17UNM44D	NMEC -II: CONCEPTS OF HEALTH	SEMESTER - IV
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Total Credits: 2
Hours/week: 2

PREAMBLE:

1. To enable students to have an awareness on health.
2. To make them aware of the health oriented diseases, their prevention and management.

CONTENTS

UNIT- I

Health- definition, Concept of health, quality of life, Hygiene. Food factors for human beings and their requirements. Calorific value of food. Obesity: Definition and classification, Genetic and environmental factors leading to obesity, Obesity related diseases.

UNIT-II

Diabetes: Normal level of Blood sugar. Insulin and Glucagons. Types of Diabetes, etiology and pathogenicity.

UNIT-III

Cardiovascular diseases: Normal level of Cholesterol, Lipoproteins, Cardiac arrest, Myocardial infarction , Signs and Symptoms, Risk factors.

UNIT-IV

Kidney Stones - Mechanism of formation of kidney stones, Diet and Prevention, Cancer - Types, Food habits and its preventive measures.

UNIT-V

Health Insurance: Individual medi claim policy, domiciliary hospitalization, Cancer Insurance, Group Mediclaim Policy.

TEXT BOOKS :

1. *Burtis CA, Ashwood ER and Bruns DE (eds), (2005) Tietz Textbook of Clinical Chemistry and Molecular Diagnosis (5th edition). William Heinmann, Medical Books Ltd. New Zealand.*
2. *Varley, H. (1985), Practical clinical Biochemistry, 4th Edition, Heinemann Medical publishers, New Zealand.*

REFERENCE BOOK :

1. *Henry RJ, 1966, Clinical Chemistry - Principles and techniques, Harper and Row, New Yor. Gradwohl R B H, Sonnenwirth A C and Jarett L, 1980, Clinical Laboratory Methods and Diagnosis, University of Michigan, Michigan*

17UCLSS1	SELF STUDY PAPER - I: DISASTER MANAGEMENT	SEMESTER: III
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Total Credits: 1

PREAMBLE :

- To understand the meaning and concepts of disaster, causes and effects of disaster
- To identify the methods of disaster management and role of various organization and community in disaster management.

CONTENTS

UNIT-I

Natural Disasters - Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, Volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

UNIT-II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT-III

Disaster Preparedness: Concept & Nature, Disaster Preparedness Plan, Disaster Preparedness for People and Infrastructure

UNIT-IV

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements;

UNIT-V

Role of various organizations in disaster management- Role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

REFERENCES BOOKS :

1. Together Towards a Safer India Part III, Central Board of Secondary Education, 2006
2. Natural Hazards and Disaster Management, Central Board of Secondary Education, 2006
3. *Sharma, R.K. & Sharma, G. (2005) (ed) Natural Disaster, APH Publishing*

17UCLSS2	SELF STUDY PAPER - II: HEALTH AND HYGEINE	SEMESTER : III
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Total credits: 1**PREAMBLE :**

To enable the students to know the basic needs of health and hygiene and awareness on health care programmes

CONTENTS**UNIT-I**

Health: WHO definition of health; Determinants of health; Health and quality of life, hygiene. Healthy diet. Health and diseases- diabetes, cardiovascular diseases.

UNIT-II

Deficiency disease: Sources of nutrients-protein, carbohydrate, fat. Malnutrition, poverty and malnutrition. Effects of malnutrition. Programmes to eradicate malnutrition.

UNIT-III

Maternal and child Health:- Mother and child- Intranatal care, Post natal child care - care of the mother, complications of post portal period, restoration of mother to optimum health, Breast feeding; Family planning methods - Family planning definition, Natural family planning methods and artificial family planning methods.

UNIT-IV

Mental Health - Types and causes of mental illness - Preventive aspects; Alcoholism and drug dependence - Definition, agent factors, Host factors,

