BACHELOR OF CLINICAL LAB TECHNOLOGY

SYLLABUS 2018-19

(Outcome Based Education)

Dr. N.G.P. ARTS AND SCIENCE COLLEGE
(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu and Accredited by NAAC with 'A' Grade (2nd Cycle)
Dr. N.G.P.- Kalapatti Road, Coimbatore-641048, Tamil Nadu, India
Web: www.drngpasc.ac.in | Email: info@drngpasc.ac.in | Phone: +91-422-2369100

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 Instruc-tion	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
Part – I							
17UTL11T 17UHL11H 17UML11M 17UFL11F	Tamil - I Hindi - I Malayalam - I French - I	5	3	25	75	100	3
Part – II							
17UEG12F	English-I	5	3	25	75	100	3
Part – III							
18UCL13A	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: Office Automation	2	-	-	-	-	-
Part – IV							
17UFC1FA	Environmental Studies	2*	2	-	50	50	2
		30				**550**	**21**
Second Semester							
Part – I							
17UTL21T 17UHL21H 17UML21M 17UFL21F	Tamil –II Hindi - II Malayalam - II French - II	5	3	25	75	100	3
Part – II							
17UEG22F	English-II	5	3	25	75	100	3
Part – III							
18UCL23A	Core – III: Analytical Techniques	4	3	20	55	75	4

20/12/2018.

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

Academic Council
Dr.V. Rajendran
CHAIRMAN
Dr.N.G.P. Arts and Science College

18UCL23B	Core-IV: Intermediary Metabolism	4	3	20	55	75	4
18UCL23P	Core Practical - II: Biochemistry-II	4	4	30	45	75	2
18UIT2AA	Allied – II: Office Automation	4	3	20	55	75	3
18UIT2AP	Allied Practical - I: Office Automation	2	3	20	30	50	2
Part – IV							
17UFC2FA	Value Education – Human Rights	2*	2	-	50	50	2
		30				**600**	**23**
Third Semester							
Part – III							
18UCL33A	Core – V: Clinical Pathology	4	3	20	55	75	4
18UCL33B	Core – VI: Histopathology	4	3	20	55	75	4
18UCL33C	Core – VII: Human Genetics and Foetal Medicine	4	3	20	55	75	4
18UCL33P	Core Practical – III: Pathology	4	4	30	45	75	2
17UCY3AB	Allied – III: Chemistry for Biologists	4	3	20	55	75	3
17UCY3AP	Allied Practical – II: Chemistry	3	3	20	30	50	2
18UCL3SA	Skill based Course - I: Laboratory Automation and Quality Control	3	3	20	55	75	3
Part – IV							
	NMEC I	2	2	-	50	50	2
17UFC3FA 17UFC3FB 17UFC3FC 17UFC3FD 17UFC3FE	Basic Tamil/ Advanced Tamil/ Yoga for Human Excellence/ Women'sRights/ Constitution of India	2	2	-	50	50	2
		30				**600**	**26**

Fourth Semester							
Part – III							
18UCL43A	Core – VIII: Microbiology- I	4	3	25	75	100	4
18UCL43B	Core – IX: Clinical Biochemistry-I: Metabolic disorders	4	3	20	55	75	3
18UCL43C	Core – X: Clinical Biochemistry-II: Functional tests	4	3	20	55	75	3
18UCL43P	Core Practical – IV: Clinical Biochemistry	6	6	30	45	75	3
18UCL4AA	Allied – IV: Bio-safety and Biowaste Management	4	3	20	55	75	4
18UCL4SA	Skill based Course – II: Molecular Biology	4	3	20	55	75	3
Part-IV							
	NMEC –II:	2	2	-	50	50	2
17UFC4FA 17UFC4FB 17UFC4FC	Basic Tamil/ Advanced Tamil (OR) General Awareness	2	2	-	50	50	2
		30				**575**	**24**
Fifth Semester							
Part – III							
18UCL53A	Core – XI: Microbiology- II	4	3	25	75	100	4
18UCL53B	Core - XII: Hematology	4	3	20	55	75	3
18UCL53C	Core – XIII: Blood Banking	3	3	20	55	75	3
18UCL53P	Core Practical – V: Hematology	6	6	30	45	75	3
18UCL53Q	Core Practical – VI: Microbiology-I	6	9	30	45	75	3
	Elective – I :	4	3	25	75	100	4
18UCL5SA	Skill based Course - III: Drug Biochemistry	3	3	20	55	75	3
Part-IV							

17UCL53T	Industrial Training	Grade A to C					
		30				**575**	**23**
Sixth Semester							
Part – III							
18UCL63A	Core – XIV: Immunology	4	3	25	75	100	4
18UCL63B	Core – XV: Cytology	4	3	25	75	100	4
18UCL63P	Core Practical – VII: Microbiology- II	6	9	30	45	75	3
	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	1
		30				**600**	**23**
Grand Total						**3500**	**140**

- *** Instructions hours (2 hours) given to placement training**

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	18UCL5EA	Biostatistics
2	18UCL5EB	Introduction to Biomaterials
3	18UCL5EC	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	18UCL6EA	Research Methodology & Intellectual Property Rights
2	18UCL6EB	Nanomaterials and Nanomedicine
3	18UCL6EC	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.	18UCL6ED	Tumor markers and Immunohistochemistry
2.	18UCL6EE	Nanobiotechnology
3.	18UCL6EF	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 and 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	1 X 75 =	75	03	114
Core Theory	4	6 X 75=	450	24	
Core Theory	4	7X 100 =	700	28	
Core Practical	2	3 X 75=	225	06	
Core Practical	3	4 X 75 =	300	12	

Allied theory	3	3 X 75 =	225	09	
Allied theory	4	1 X 75 =	75	04	
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 and II 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.

   A – 75 marks and above

B – 60 – 74 marks

C – 40 – 59 marks

Below 40 marks Reappear (RA)

7. One Non Major Elective Course (NMEC) each in the third and fourth semesters
8. Skill based papers in III, IV, V and VI semesters
9. Elective papers in the fifth and sixth semesters.
10. An in-house project at the end of VI semester.
11. Extension activity in VI semester.

Earning Extra credits is not mandatory for programme 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	1	**1**
Representation – Academic/Sports /Social Activities/ Extra Curricular / Co-Curricular activities at University/ District/ State/ National/ International	1	**1**
		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.		18UCLSS2	Good Clinical Laboratory Practices

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 Foundation 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 programme period.
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 lifelong 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.

17UEG12F	English – I	SEMESTER - I

Total Credits: 3
Hours per week: 5

PREAMBLE:

To expose students to language competency through literary works and to obtain development in various genres of English Literature and the skills of the language

COURSE OUTCOMES:

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

CO Number	CO Statement	Knowledge Level
CO1	Analyze the genre of prose through the works of Martin Luther King, M. K. Gandhi and Jesse Owens	K 4
CO2	Interpret Poetry through the poems of Tagore, George Herbert and John Milton	K 2
CO3	Analyze the techniques of Short Story writing through the works of R. K. Narayan, Guy De Manupassant and Bonnie Chamberlain.	K 4
CO4	Interpret the techniques of One Act Play through the play by Ramu Ramanathan	K 2
CO5	Explain the fundamentals of basic Grammar through Functional English	K 2

MAPPING WITH PROGRAMME OUTCOME

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

S – Strong, M – Medium, L – Low

17UEG12F	English – I	SEMESTER - I

Total Credits: 3
Hours per week: 5

CONTENTS

UNIT I – PROSE

I Have a Dream – Martin Luther King Jr.

At School – M.K. Gandhi

My Greatest Olympic Prize – Jesse Owens

UNIT II – POETRY

Where the Mind is without Fear – Rabindranath Tagore

Pulley – George Herbert

On His Blindness – John Milton

UNIT III – SHORT STORY

The Gateman's Gift – R.K. Narayan

The Necklace – Guy De Maupassant

The Face of Judas Iscariot – Bonnie Chamberlain

UNIT IV – ONE ACT PLAY

The Boy Who Stopped Smiling – Ramu Ramanthan

UNIT V – FUNCTIONAL GRAMMAR AND COMPOSITION

Sentences , Verbs – Tenses and Voice

Concord, Letter – Writing

Dialogue Writing

TEXT BOOK:

1. Board of Editors. 2016. *Stream – A Course book to enhance Language and Life Skills*. Chennai: New Century Book House.

REFRENCE BOOK:

1. Wren and Martin, *High School English Grammar and Composition* S. Chand Publishing 2006, New Delhi.

18UCL13A	CORE – I: HUMAN ANATOMY AND PHYSIOLOGY	SEMESTER – I

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

18UCL13A	CORE – I: HUMAN ANATOMY AND PHYSIOLOGY	SEMESTER – I

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- urea & creatinine.
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.

TEXT BOOKS :

1. *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.
3. Elaine.N. Marieb, 'Essentials of Human Anatomy and Physiology', 8th edition, Pearson Education, New Delhi ,2007.
4. .William F.Ganong, 'Review of Medical Physiology', 22nd edition, McGraw Hill, New Delhi, 2005.
5. A.K. Jain, 'Text book of Physiology', volume I and II, Third edition, Avichal Publishing company, New Delhi, 2005.

17UCL13B	CORE – II: FUNDAMENTALS OF BIOCHEMISTRY	SEMESTER - I

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	K_1, K_2
CO 2	Understand the types, properties and significance of major biomolecules.	K_1, K_2, K_3
CO 3	Understand the structure and functions of nucleic acids and to recall the types, sources and functions of vitamins and minerals	K_1, K_2
CO 4	Understand the classification, structure, mechanism of action and diagnostic importance of enzymes.	K_2, K_3
CO 5	Understand the types and functions of various endocrine hormones and their disorders	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**	**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

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. *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.
3. *Voet, D and Voet J G,* 2011, Biochemistry, 4th Edition, John Wiley and Sons, USA .
4. Devlin T M (Ed.), 2010, Textbook of Biochemistry with Clinical Correlations (7th Edition), John Wiley and Sons, USA
5. Garrett, R H and Grisham, C M, 2013, Biochemistry (5th Edition), Brooks/Cole, USA

17UCL13P	CORE PRACTICAL – I: BIOCHEMISTRY- I	SEMESTER – I

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

Total Credits: 3
Hours /week: 4

Preamble:

1.To be aware about classification and components of computer.

2. 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

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 - Complier - 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**.

17UFC1FA	PART-IV: VALUE EDUCATION-ENVIRONMENTAL STUDIES	SEMESTER - I

Total Credits: 2

Hours per week: 2

CONTENTS

UNIT- I

The Multi Disciplinary Nature of Environmental Studies**:** Definition, scope and importance-Need for public awareness-Natural resources-Natural resources and associated problems-Role of an individual in conservation of natural resources-Equitable use of resources for sustainable lifestyle…

UNIT- II

Eco System:Concept of an eco system-structure and function of eco system-Producers, consumers and decomposers-Energy flow in the eco system-Ecological succession-Food chain, food webs and ecological pyramids-Forest ecosystem-Grassland eco system-Desert eco system-Aquatic eco system…

UNIT- III

Bio Diversity and its Conservation Introduction Definition: Genetic, Species and Eco System Diversity-Bio Geographical Classification Of India: Value of bio diversity: conceptive use, productive use, social, ethical and option values-bio diversity at global, national and local levels-India as a mega diversity nation, hot spots-threats: habitat loss, poaching of wild life-man wild life conflicts-endangered and endemic species of India, conservation of bio diversity….

UNIT- IV

Environmental Pollution:Definition-causes, effects and control measures of air, water, soil, noise, thermal pollution-soil waste management: causes, effects and control measures of urban and industrial wastes-prevention of pollution-pollution case studies-disaster management: floods, earthquake, cyclone and landslides…

UNIT- V

Social Issues and the Environment**:** Sustainable development-urban problems related to energy-water conservation, rain water harvesting, watershed management-resettlement and rehabilitation of people ;its problems and concerns-environmental ethics: issues and possible solutions-climate change, global warming, ozone layer, depletion, acid rain, nuclear accidents and holo caust-consumerism and waste products-environmental protection act-air, water act-wild life protection act-forest conservation act-issues involved in enforcement of environmental legislation-public awareness-human population and the environment.

TEXT BOOK:

1. *Kumaraswamy. K, A. Alagappa Moses and M. Vasanthy. 2001,* **EnvironmentalStudies.** Thanjavur- National Offset Printers.

17UEG22F	English – II	SEMESTER - II

Total Credits: 3
Hours per week: 5

PREAMBLE:

To expose students to language competency through literary works and to obtain development in various genres of English Literature and the skills of the language

COURSE OUTCOMES:

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

CO Number	CO Statement	Knowledge Level
CO1	Develop the knowledge of prose through the works of Martin Luther King, M. K. Gandhi and Jesse Owens	**K 3**
CO2	Interpret Poetry through the poems of Tagore, George Herbert and John Milton	**K 2**
CO3	Identify the techniques of Short Story writing through the works of R. K. Narayan, Guy De Manupassant and Bonnie Chamberlain.	**K 3**
CO4	Interpret the techniques of One Act Play through the play by Ramu Ramanathan	**K 2**
CO5	Explain the fundamentals of basic Grammar through Functional English	**K 2**

MAPPING WITH PROGRAMME OUTCOME

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

S – Strong, M – Medium, L – Low

17UEG22F	ENGLISH – II	SEMESTER - II

Total Credits: 3
Hours per week: 5

CONTENTS

UNIT I – PROSE

Words of Wisdom – Chetan Bhagat

Acceptance Speech – Noble Peace Prize – Mother Teresa

My Early Days – Dr. A.P.J.Abdul Kalam

UNIT II – POETRY

In the Bazaars of Hyderabad – Sarojini Naidu

Telephonic Conversation – Wole Soyinka

Mending Wall – Robert Frost

UNIT III – SHORT STORY

The Old Man at the Bridge – Ernest Hemingway

The Model Millionaire – Oscar Wilde

White Washing the Fence – Mark Twain

UNIT IV – ONE ACT PLAY

Soul Gone Home – Langston Hughes

UNIT V – FUNCTIONAL GRAMMAR AND COMPOSITION

Relative Pronoun

Degrees of Comparison

Reported Speech

Correction of Sentences

Business Correspondence

Memo, Reports, Proposals, Resume & CV Writing

TEXT BOOK:

1. Board of Editors. 2016. *Stream – A Course book to enhance Language and Life Skills*. Chennai: New Century Book House.

REFRENCE BOOK:

1. Wren and Martin, *High School English Grammar and Composition* S. Chand Publishing 2006, New Delhi.

18UCL23A	CORE - III: ANALYTICAL TECHNIQUES	SEMESTER – II

Total Credits: 4
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	K_1, K_2, K_3
CO 2	Understand the principle, methodology and applications of various techniques applied for separation of biomolecules.	K_1, K_2, K_3
CO 3	Appreciate the applications of electrophoretic and immunological techniques in disease diagnosis.	K_2, K3
CO 4	Describe the procedures for determination of concentration of various substances by spectroscopic methods.	K_2, K_3
CO 5	Understand the techniques applied for separation, purification and determination of concentration of biological samples.	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**	**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

18UCL23A	CORE - III: ANALYTICAL TECHNIQUES	SEMESTER – II

Total Credits:4
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. *Sabari Ghosal and A.K.Srivastava,* 2010*,* **Fundamentals of Bioanalytical Techniques and instrumentation,** Eastern Economy Edition

2. *Dr. P.Asokan,* 2001, **Basics of Analytical Biochemistry**, First edition, Chinna Publications, Tamilnadu.

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.

18UCL23B	CORE – IV: INTERMEDIARY METABOLISM	SEMESTER–II

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	K_1,K_2, K_3
CO 2	Know the metabolism of carbohydrates and understand the individual pathway and its alternative pathway	K_1,K_2, K_3
CO 3	Describes the lipid metabolism and Biosynthesis of saturated and unsaturated fatty acids.	K_1,K_2, K_3
CO 4	Understands the Protein metabolism, Biosynthesis and degradation of purine and pyrimidine nucleotides	K_1,K_2, K_3
CO 5	Know the Biological oxidation and :- structure of ATPase complex and Mitochondrial shuttle system	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

18UCL23B	CORE – IV: INTERMEDIARY METABOLISM	SEMESTER–II

Total
Credits: 4
Hours /week: 4

CONTENTS

UNIT – I

Introduction to metabolism: Types of metabolic reactions. Bioenergitics - 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.

Reference Books

1. Voet, D. et al., 2012. Fundamentals of Biochemistry: Life at the Molecular level, 4 th 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.

3. Nelson,D.L. and Cox,M.M. 2013. Lehninger Principles of Biochemistry, 6 th Edition, W.H. Freeman & Co.

4. Berg,J.M. et al., 2012. Biochemistry, 7 th Edition, W. H. Freeman & Co

5. *Deb, AC*, 2001, **Fundamentals of Biochemistry**, 7th Edition New central Agency, Calcutta.

18UCL23P	CORE PRACTICAL - II: BIOCHEMISTRY -II	SEMESTER - II

Total Credits: 2
Hours /week: 4

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 ManickamA*. 2008. **Biochemical methods**. Revised second edition, New age International, New Delhi.
2. *Plummer D T,* 2002. **Practical Biochemistry**. 3rd Edition, Tata

18UIT2AA	ALLIED – II: OFFICE AUTOMATION	SEMESTER - II

3. McGraw Hill Publisher Pvt. Ltd, New Delhi

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

18UIT2AA	ALLIED – II: OFFICE AUTOMATION	SEMESTER - II

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.

TEXT BOOKS:

1. Joyce Cox, Polly Urban, 2000. **Microsoft Office,** Galgotia Publications Pvt. Ltd.

REFERENCE BOOKS:

1**.** *Nellai Kannan C. 2004* **MS Office,**Nels Publications**.**

2. Stephanie Krieger, 2007. **Advanced Microsoft Office Documents,** Prentice Hall.

3. Michael Price, 2012. **Office 2010,** Tata McGraw-Hill.

4.Taxali RK. 2000 **PC Software for windows**, Tata Mc Graw-HillPublications

18UIT2AP	ALLIED PRACTICAL- I: OFFICE AUTOMATION	SEMESTER- II

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 primarically 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**.**

17UFC2FA	PART–IV:VALUE EDUCATION-HUMAN RIGHTS	SEMESTER - II

Total Credits: 2

Hours per week: 2

CONTENTS

UNIT- I

Concept of Human Values, Value Education Towards Personal Development
Aim of education and value education; Evolution of value oriented education; Concept of Human values; types of values; Components of value education.

Personal Development: Self analysis and introspection; sensitization towards gender equality, physically challenged, intellectually challenged. Respect to - age, experience, maturity, family members, neighbours, co-workers.

Character Formation towards Positive Personality: Truthfulness, Constructivity, Sacrifice, Sincerity, Self Control, Altruism, Tolerance, Scientific Vision.

UNIT - II

Value Education towards National and Global Development National and International Values: Constitutional or national values - Democracy, socialism, secularism, equality, justice, liberty, freedom and fraternity.

Social Values - Pity and probity, self control, universal brotherhood.

Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith.

Religious Values - Tolerance, wisdom, character.

Aesthetic values - Love and appreciation of literature and fine arts and respect for the same.

National Integration and international understanding.

UNIT - III

Impact of Global Development on Ethics and Values: Conflict of cross-cultural influences, mass media, cross-border education, materialistic values, professional challenges and compromise.

Modern Challenges of Adolescent Emotions and behave or; Sex and spirituality: Comparison and competition; positive and negative thoughts.

Adolescent Emotions, arrogance, anger, sexual instability, selfishness, defiance.

UNIT – IV

Therapeutic Measures

Control of the mind through

a. Simplified physical exercise
b. Meditation – Objectives, types, effect on body, mind and soul
c. Yoga – Objectives, Types, Asanas
d. Activities:
   (i) Moralisation of Desires
   (ii) Neutralisation of Anger
   (iii) Eradication of Worries
   (iv) Benefits of Blessings

UNIT- V

Human Rights

1. Concept of Human Rights – Indian and International Perspectives
   a. Evolution of Human Rights
   b. Definitions under Indian and International documents

2. Broad classification of Human Rights and Relevant Constitutional Provisions.
   a. Right to Life, Liberty and Dignity
   b. Right to Equality
   c. Right against Exploitation
   d. Cultural and Educational Rights
   e. Economic Rights
   f. Political Rights

g. Social Rights

3. Human Rights of Women and Children
   a. Social Practice and Constitutional Safeguards
      (i) Female Foeticide and Infanticide
      (ii) Physical assault and harassment
      (iii) Domestic violence
      (iv) Conditions of Working Women

4. Institutions for Implementation
   a. Human Rights Commission
   b. Judiciary

5. Violations and Redressel
   a. Violation by State
   b. Violation by Individuals
   c. Nuclear Weapons and terrorism
   d. Safeguards.

REFERENCE BOOKS:

2. *DeyA.K*, 2002, **EnvironmentalChemistry.** NewDelhi–VileDasausLtd.

3. *Gawande. E.N*. **Value OrientedEducation.**Visionforbetterliving. NewDelhi, Saruptsons.

4. *BrainTrust Aliyar*, 2008, **ValueEducationforhealth, happinessandharmony.**Vethathiripublications, Erode.

5. *IgnacimuthuS.J.S,* 1999, **Valuesforlife.**BombayBetter Yourself.

6. *Seetharam.R. (Ed),* 1998 **,BecomingabetterTeacher**MadrasAcademicStaffCollege.

7. *Grose.D.N* , 2005, **Atext bookofValueEducation.** Dominant PublishersandDistributors, NewDelhi.

8. *ShrimaliK.L,* 1974,**ASearch forValuesinEducation**. Vikas Publishers, Delhi.

9. *YogeshKumarSingh&RuchikaNath* , 2005, **Value Education.** P.HPublishingCorporation, NewDelhi.

10. *Venkataram&Sandhiya. N,*2001, **ResearchinValue Education.** APHPublishingCorporation, NewDelhi.

11. *RuhelaS.P*. **HumanValueandEducation.**Sterlingpublishers, NewDelhi.

12. *BrainTrust Aliyar*, 2004,**ValueEducationforHealth, Happinessand Harmony.**Vethathiripublications , Erode.

13. *SwamiVivekananda*, 2008, **PersonalityDevelopment.** AdvaitaAshrama, Kolkata.

14. *SwamiJagadatmananda*, **LearntoLive.**SriRamakrishnaMath, Chennai.

18UCL33A	CORE - V: CLINICAL PATHOLOGY	SEMESTER - III

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	K_1,K_2, K_3
CO 2	Demonstrate a working understanding of the urine chemistry and its significance in the pathogenesis of a variety of common and uncommon diseases.	K_1,K_2, K_3
CO 3	Demonstrate a working understanding of the stool chemistry and its significance in the pathogenesis of a variety of common and uncommon diseases.	K_1,K_2, K_3
CO 4	Understand the various body fluids and will demonstrate the ability to interpret laboratory data to help in the clinical decision making process.	K_1,K_2, K_3
CO 5	Know the basics of semen collection and analysis. Interpret and evaluate clinical laboratory examination of Seminal fluid	K_1,K_2, K_3

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

18UCL33A	CORE - V: CLINICAL PATHOLOGY	SEMESTER - III

Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

Importance of pre-analytical measures, generation of request, Instructions for sample collection, Rejection criteria and preservation, despatch of reports, records keeping**,** coding and indexing.

UNIT-II

Urine Analysis: Formation of urine, Macroscopic Examination –Volume, Colour, transparency, pH and Sp gravity. Normal and Abnormal constituents in urine. Microscopical examination – Cells (RBC, WBC, Epith), casts, crystals, Bacteria, Detection of microalbumin & 24 hours urine protein estimation.

UNIT-III

Stool Analysis: - Faeces –Macroscopic Examination and Microscopic 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 and Amniotic fluid.

UNIT-V

Semen analysis – Macroscopic Examination and Microscopic examination of semen for time for liquefaction, volume, colour, 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 KL2010.***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.

18UCL33B	CORE - VI: HISTOPATHOLOGY	SEMESTER – III

Total Credits: 4
Hours /week: 4

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.	K_1,K_2, K_3
CO 2	Description of instruments and its applications employed in histotechniques.	K_1,K_2, K_3
CO 3	Learn about principle, working, instrumentation, types and applications of microscopes	K_1,K_2, K_3
CO 4	Understand principle, concepts, techniques of section making, staining and mounting process.	K_1,K_2, K_3
CO 5	Know about record maintanence, microphotography, museum techniques and ICDS classifications.	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**	**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

18UCL33B	CORE - VI: HISTOPATHOLOGY	SEMESTER – III

Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

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

UNIT-II

Instrumentation:

a) Tissue Processor- Manual tissue processor and Automated 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: CO_2 Freezing, Cryostat and freezing microtome. Principles and techniques of sections cutting, routine staining and special staining (any five), Mounting techniques.

UNIT-V

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

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* 2016.**Clinical diagnosis by laboratory methods**. 22nd Edition, Saunders Publications Pvt. Ltd,

Pennsylvania

2. *Culling C F A,* 1974**.Histopathology Techniques.**3rdEdition.Butterworth-Heinemann Publication, London.

3. Matthew J Lynch, 1976. Lynch's medical laboratory Technology.3nd Edition,W.B Saunders Co Publications.

Web Links:

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

18UCL33C	CORE - VII: HUMAN GENETICS AND FOETAL MEDICINE	SEMESTER - III

Total Credits: 4
Hours /week: 4

Preamble:

To understand the basics of human genetics and foetal medicine

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 Genetic Analysis	K_1,K_2, K_3
CO 2	Description of Laws of inheritance and chromosome theory	K_1,K_2, K_3
CO 3	Principle of recombination and gene mapping, and sex inheritance	K_1,K_2, K_3
CO 4	Understand principle, concepts, techniques of Embryology and Fetal development.	K_1,K_2, K_3
CO 5	Know about multiple pregnancies and Perinatal infectious diseases	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**	**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

18UCL33C	CORE - VII: HUMAN GENETICS AND FOETAL MEDICINE	SEMESTER - III

Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

Model systems in Genetic Analysis: Bacteriophage, E. coli, yeast, maize, Drosophila, Homo sapiens - General outline of life cycle, importance in Genetic analysis

UNIT-II

Laws of inheritance: Mendel's Laws, concept of dominance, segregation, independent assortment; Chromosome theory of inheritance. Allelic and non-allelic interactions: Concept of alleles, types of dominance, alleles types, test of allelism and epistasis.

UNIT-III

Linkage: Concepts, recombination, gene mapping in prokaryotes and eukaryotes, Sex-linked inheritance: Conceptual basis, sex influenced traits, mechanism of sex determination. Quantitative inheritance – Concept, Genes and Environment - heritability, penetrance and expressivity.

UNIT–IV

Embryology and Fetal development - General embryology, Ovulation to implantation, Development of amniotic sacs, placenta and membranes, development of main organ systems, basic priniciples,mechanism of teratrogenesis and effects of possible teratogens.

UNIT-V

Multiple pregancies – Twins, Triplets and more, antenatal complications – IUGR, Chrioamnionitis, premature rupture of membranes, IUF death. Perinatal infectious diseases – Toxoplasmosis, CMV, Herpes, HBV, HIV, HPV, Rubella,streptocococcal infection and syphilis.

TEXT BOOKS:

1. *Robert Schley* (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.

REFERENCE BOOKS:

1. Fetal Medicine: Basic science and Clinical practice , 2nd Edition, Charles H.Rodeck and Martin J whittle(2008)
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.

18UCL33P	CORE PRACTICAL - III: PATHOLOGY	SEMESTER – III

Total Credits: 2
Hours /week: 4

CONTENTS

1. CompleteUrine examination
2. Complete Stool examination
3. Preparation of various fixatives, routine processing and tissue embedding
4. Section cutting, staining and mounting of tissues.
5. Body Fluids - CSF, pleural, Peritoneal, synovial, semen Analysis.

REFERENCE BOOKS:

1. Mukherjee, KL2010. **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.

17UCY3AB	ALLIED-III: CHEMISTRY FOR BIOLOGISTS	SEMESTER-III

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.	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 BIOLOGISTS	SEMESTER-III

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, electro negativity.

UNIT–II

Chemical bonding

1. Molecular Orbital Theory- bonding, anti-bonding and non-bonding orbitals. MO-configuration of H_2, N_2, O_2, F_2- 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 CH_4, NH_3, H_2O, shapes of $BeCl_2$, BF_3, 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.

REFERNCE BOOKS

1.*M. K. Jain, S. C. Sharma. 2001*. **Organic Chemistry**, Shoban Lal Nayin Chand, Jalandhar.

2. *Puri, Sharma, Pathania. 2004.* **Principles of Physical Chemistry**, Vishal Publishing Company, Jalandhar.

3. *Gopalan R. 1991.***Elements of Analytical Chemistry**, Sultan Chand & Sons, New Delhi.

17UCY3AP	ALLIED PRACTICAL-II: CHEMISTRY	SEMESTER-III

Total Credits: 2

Hours / week: 3

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.

18UCL3SA	SKILL BASED COURSE – I: LABORATORY AUTOMATION AND QUALITY CONTROL	SEMESTER – III

Total Credits: 3
Hours /week: 3

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	K_1,K_2, K_3
CO 2	Know the maintenance and care of common laboratory glassware and common equipments	K_1,K_2, K_3
CO 3	Know Common terms used in Quality control, Internal and External Quality control	K_1,K_2, K_3
CO 4	Understand the Autoanalyzer and different types of analyzers and barcoding.	K_1,K_2, K_3
CO 5	Perceive the Laboratory informatics, laboratory information management system	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**	**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

18UCL3SA	SKILL BASED COURSE – I: LABORATORY AUTOMATION AND QUALITY CONTROL	SEMESTER – III

Total credits: 3
Hours/week: 3

CONTENTS

UNIT I

Functional components of clinical laboratories, cleanliness, precautions to be taken with respect to 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 use of centrifuge, colorimeter, oven, incubator, Lanimar air flow microscope, Neubaur' s chamber, Autoclaveetc .

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 Hospital information management system (HIS).

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.

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

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.

17UCLSS1	SELF STUDY PAPER – I: DISASTER MANAGEMENT	SEMESTER: III

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

Sharma, R.K. & Sharma, G. (2005) (ed) Natural Disaster, APH Publishing.

18UCLSS2	SELF STUDY PAPER –II: GOOD CLINICAL LABORATORY PRACTICES	SEMESTER III

Total Credits: 1

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 recordand 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.

18UCL43A	CORE – VIII: MICROBIOLOGY-I	SEMESTER – IV

Total Credits: 4
Hours /week: 4

PREAMBLE:

1. To understand the general characters of bacteria and methods of their identification
2. To understand he 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 introductionSummarize the importance of Microbiology in laboratory Medicine	**K_1,K_2**
CO 2	Classification of microorganisms and techniques used in their staining.Understand and compare the different types of Microscopy	**K_1,K_2**
CO 3	Define sterilisation-definition, physical agents employed with example	**K_1**
CO 4	Explain the bacterial growth and nutrition	**K_1,K_2**
CO 5	Identify the bacterial morphology, culture, biochemical reactions, antigenic character, typing of bacteria	**K_1,K_2,K_3**

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

18UCL43A	CORE – VIII: MICROBIOLOGY-I	SEMESTER – IV

Total Credits: 4
Hours /week: 4

CONTENTS

UNIT-I

Contribution of Louis Pasteur, Joseph Lister, Robert Koch, Edward Jenner and Alexander Fleming in the field of clinical microbiology. Importance of microbiology in laboratory Medicine.

UNIT-II

Classification of microorganisms; Structure of bacteria, fungus, virus and parasites. Microscopy- Light microscope, Dark-ground microscope, Fluorescent microscope, Phase contrast microscope, and Electron microscope; Observation of micro-organism - Wet preparations, Staining preparations.

UNIT-III

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

UNIT-IV

Bacterial culture - growth and nutrition; Bacterial metabolism; Bacterial genetics and variation; Different bacteriological culture media.

UNIT-V

Identification of bacteria- 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 P2005. **Medical Parasitology,** 2nd edition,New Central Book Agency Pvt. Ltd, Kolkata

REFERENCE BOOKS:

1. Pelczer *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

18UCL43B	CORE – IX: CLINICAL BIOCHEMISTRY -I : METABOLIC DISORDERS	SEMESTER – IV

Total Credits: 3
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.	**K_1,K_2, K_3**
CO 2	Understand the abnormal conditions associated with lipoproteins including those of genetically inherited diseases	**K_1,K_2, K_3**
CO 3	Understand the normal levels of lipids in blood and its components, describe the different types of diseases associated with lipid metabolism	**K_1,K_2, K_3**
CO 4	Understands the abnormalities associated with protein and nitrogen metabolism, discriminate between different amino acid diseases.	**K_1,K_2, K_3**
CO 5	Understand the significance of uric acid level in blood, know the diseases caused by abnormal metabolism of purines	**K_1,K_2**

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

18UCL43B	CORE – IX: CLINICAL BIOCHEMISTRY -I : METABOLIC DISORDERS	SEMESTER – IV

Total Credits: 3
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, HbA1C and GTT. Glycosuria, differential diagnosis of glycosuria, complication of diabetes mellitus- Diabetic ketoacidosis, Diabetic coma, Inherited metabolic disorders- 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 lipoprotenemia, 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, Alkaptonuria, 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

18UCL43C	CORE – X: CLINICAL BIOCHEMISTRY - II: FUNCTIONAL TESTS	SEMESTER – IV

Total Credits: 3
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	**K_1,K_2, K_3**
CO 2	Evaluate in detail on functions, conditions and biochemical test involving Pancreatic secretions.	**K_1,K_2, K_3**
CO 3	Analyse in detail on functions, conditions and biochemical test involving Intestinal secretions	**K_1,K_2, K_3**
CO 4	Estimate in detail on functions, conditions and biochemical detection in Liver secretions.	**K_1,K_2, K_3**
CO 5	Analyse and estimate the functions, conditions and biochemical tests in kidney secretions.	**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	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

18UCL43C	CORE – X: CLINICAL BIOCHEMISTRY- II: FUNCTIONAL TESTS	SEMESTER– IV

Total Credits: 3
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.Pancreatic function: Introduction, pancreatic function tests, serum amylase and lipase; direct stimulation test, indirect stimulation test.

UNIT-II

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-III

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-IV

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

UNIT-V

Hormone function: Endocrine function tests-TSH, FSH, LH, GH, Adrenal – cortisol, Gonadal-Testosterone and estradiol.

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

18UCL43P	CORE PRACTICAL - IV: CLINICAL BIOCHEMISTRY	SEMESTER – IV

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 phoshatase
2. Alkaline phoshatases
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.

18UCL4AA	ALLIED IV: BIO-SAFETY AND BIOWASTE MANAGEMENT	SEMESTER –IV

Total Credits: 4
Hours /week: 4

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	**K_1,K_2, K_3**
CO 2	Realize the significance of bioethics and responsibilities of clinicians in laboratory	**K_1,K_2, K_3**
CO 3	Know the Indian regulations regarding biowastes segregation and disposal.	**K_1,K_2, K_3**
CO 4	Identify the sources of biowastes, types and segregation	**K_1,K_2, K_3**
CO 5	Understand the need for biowaste management and the technologies applied for biowaste management	**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	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

18UCL4AA	ALLIED IV: BIO-SAFETY AND BIOWASTE MANAGEMENT	SEMESTER - IV

Total Credits:4
Hours /week: 4

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; Category and color coding for different biomedical wastes,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. Generation of Biogas from food 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.*

18UCL4SA	SKILL BASED COURSE –II: MOLECULAR BIOLOGY	SEMESTER – IV

Total credits: 3
Hours/week: 4

PREAMBLE:

1. 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

18UCL4SA	SKILL BASED COURSE – II: MOLECULAR BIOLOGY	SEMESTER- IV

Total credits: 3
Hours/week: 4

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.

17UNM44D	NMEC –II: CONCEPTS OF HEALTH	SEMESTER – IV

Total Credits: 2
Hours /week: 2

PREAMBLE:

1. To enable students to have an awareness on health.
2. To make them aware of the life style 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 BOOKS:

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

18UCL53A	CORE – XI: MICROBIOLOGY- II	SEMESTER – V

Total Credits: 4
Hours /week: 4

PREAMBLE:

- To understand the general characteristics of various microbes
- To appreciate laboratory diagnosis, 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	**K_1,K_2, K_3**
CO 2	Understand the characteristics of various organisms	**K_1,K_2, K_3**
CO 3	Recall the characters of important pathogenic fungi	**K_1,K_2, K_3**
CO 4	Understand the general characters of pathogenic viruses	**K_1,K_2, K_3**
CO 5	Know the general characters of various microbes	**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**	**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

18UCL53A	CORE – XI: MICROBIOLOGY- II	SEMESTER – V

Total Credits: 4
Hours /week: 4

CONTENTS

UNIT–I

Microorganisms: Brief general characters including colony morphology, pathogenicity, laboratory diagnosis and prophylaxis of the following Gram Positive Cocci : Staphylococcus aureus, Streptococcus pyogenes. Gram Positive rod- Corynibacterium diphtheriae, Bacillus anthracis, Clostridium perfringens.

UNIT–II

Microorganisms: Brief general characters including colony morphology, pathogenicity, laboratory diagnosis and prophylaxis of the following Gram Negative rods:Escherichia coli, Salmonellae typhi, Pseudomonas aeruginosa, Non-fermenting gram negative bacilli including, Mycobacterium tuberculosis, Treponema pallidum, Mycoplasmas.

UNIT–III

Mycology: Brief general characters including colony morphology, pathogenicity, laboratory diagnosis and prophylaxis of Candida albicans, Dermatophytes, Mycetoma and Dimorphic fungi.

UNIT–IV

Virology: General characters of important pathogenic viruses including morphology, methods of replication, pathogenisis and laboratory diagnosis of Poliovirus, Influenza viruses, Rabies virus, Hepatitis BVirus, Retroviruses: HIV.

UNIT-V

Parasitology: General characteristics of parasites including Morphology, Pathogenicity, life cycle and Lab diagnosis of Ascaris lumbricoids, Ancyclostoma deodenale, Enterobius vermicularis, Taenia saginata and Wuchereria bancrafti.

TEXT BOOKS:

1. *Ananthanarayan R and Panicker C K J* 2005. **Textbook of Microbiology,** 3rd edition, Orient Longman Private Limited, Hyderabad.
2. *Chakraborty P 2013.***Textbook of Microbiology**, 3rd edition, New Central Agency (P) Ltd, London

REFERENCE BOOKS:

1. *Atlas R M, 1993.* **Microbiology - Fundamentals and Applications,** 3rd edition, Macmillan Publishing Company, New York.
2. *Pelczer 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,** 3nd edition, Brown Publishers, Iowa, USA

18UCL53B	CORE - XII: HEMATOLOGY	SEMESTER - V

Total Credits: 3
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 basic tests in hematology laboratory	K_1,K_2, K_3
CO 2	Know the patho-physiologyof anemia	K_1,K_2, K_3
CO 3	Know the mechanism of coagulation and diagnosis of hemorrhagic disorders	K_1,K_2, K_3
CO 4	Understand fibrinolysis and tests used for its diagnosis	K_1,K_2
CO 5	Understand lab automation in hematology	K_1,K_2,K_3

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

18UCL53B	CORE - XII: HEMATOLOGY	SEMESTER - V

Total Credits: 3
Hours /week: 4

CONTENTS

UNIT-I

Introduction – Blood, Blood collection, Anticoagulants used in Hematology, Normal values in Hematology, Basic Hematological techniques: a. RBC Count b. Hemoglobin 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

UNIT-II

Preparation of blood films, Stains used in Hematology,Morphology of red cells, Morphology of Leukocytes and platelets, Bone marrow a. Techniques of aspiration, preparation and staining of films , Bone marrow biopsy, Preparation of buffy coat smears.

UNIT-III

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

UNIT- IV

Investigation of Hemorrhagic disorders:Mechanism of coagulation, Bleeding time and clotting time,other coagulation studies: PT, APTT, Mean Prothrombin Time (MPT), Fibrinogen.Assay of clotting factors.Test for blood fibrinolytic activity and detection of D-dimers, Platelet function tests.

UN1T-V

Automation in hematology-Automated ESR, , Automated coagulometers , Diagnosis of hemoglobinopathies by HPLC, Cell counts (Automated hematology analysers) ,Organization and quality control in hematology laboratory.

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** 4thEd. *Jaypee Brothers* Medical Publishers (P) Ltd., *New Delhi*
3. *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 Hematology**, 11th edition, Churchill Livingstone, China

18UCL53C	CORE - XIII: BLOOD BANKING	SEMESTER - V

Total Credits: 3
Hours /week: 3

PREAMBLE:

- To emphasize the basic concept of blood grouping and transfusion process.
- To 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	**K_1,K_2**
CO 2	Apply screening methods of cross matching	**K_1,K_2, K_3**
CO 3	Know the criteria for donor selection and screening tests	**K_1,K_2, K_3**
CO 4	Understand blood transfusion reactions	**K_1,K_2, K_3**
CO 5	Understand the organization of blood bank	**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	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

18UCL53C	CORE - XIII: BLOOD BANKING	SEMESTER - V

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.

UN1T-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 overloadand 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 TransfusionMedicine**, 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**.** ElsieverMosby publishers, Missouri.
2. *Rudmann **S V*** 2005. **Textbook of Blood Banking and Transfusion Medicine**.2nd Ed.Elsiever Saunders publisher**s**, Pennsylvania.

18UCL53P	CORE PRACTICAL -V: HEMATOLOGY	SEMESTER – V

Total Credits: 3
Hours /week: 6

CONTENTS

1. Hemoglobulin estimation by cyanmethemoglobin 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- Westergren methods.
12. Osmotic fragility test.
13. Sickling test
14. Bleeding time and clotting time.
15. Preparation of Buffy coat smears.

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 Hematology, 11th edition, Churchill Livingstone, China

18UCL53Q	CORE PRACTICAL - VI: MICROBIOLOGY-I	SEMESTER - V

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 and 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, H_2S 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

18UCL5EA	ELECTIVE- I: BIOSTATISTICS	SEMESTER- V

Total Credits: 4
Hours /week: 4

PREAMBLE:

- To understand the basic concepts of statistics and tools
- To understand the application of statistical methods and interpretation of results.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO 1	Understand the components of sampling method	K_1,K_2, K_3
CO 2	Understand data collection, analysisandinterpretationof results.	K_1,K_2, K_3
CO 3	Describes the various methods of data representation.	K_1,K_2, K_3
CO 4	Understands the basics of central tendency	K_1,K_2, K_3
CO 5	Appreciate the applications of statistics in researchwork	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

18UCL5EA	ELECTIVE- I: BIOSTATISTICS	SEMESTER- V

Total Credits: 4
Hours /week: 4

CONTENTS

UNIT- I

Introduction to statistics-Biostatistics - Definition, steps in statistics, Sampling Design—Principles of sampling, Census and sampling, Essential of sampling, Methods of sampling – Random sampling and Non- random sampling, Statistical laws- law of statistical regularities, law of inertia of large numbers, Statistical errors. (Theory only)

UNIT-II

DataCollection-PrimaryandSecondary data, Sources and collection of data, Framing a questionnaire, Editing the data.

UNIT-III

Classificationand Tabulations,Diagrammatic representationof data-Bar diagram, Pie diagram,Graphical presentation of data-Histogram,Frequencypolygon, Frequencycurve, Ogive, Pictograph.

UNIT-IV

MeasuresofCentralTendency- Definition, Objectives, Characteristics, Types- Mean, medianandmode, Meritsanddemerits.

UNIT-V

Measuresof dispersion- Standard deviation,standarderrorand Student's t- test. Null hypothesis and statistical significance. Analysis of variance- one way ANOVA

TEXT BOOKS:

1. GuptaS.P. (2006).Statisticalmethods.SultanChandandsons-23,Educational publishers, Daryagans, New Delhi-110002.

2. Girija M, Sasikala L and Girija Bai V (2004), Introduction to statistics, Vrinda Publication Ltd., New Delhi.

REFERENCE BOOKS:

1. Prasad.S.(2004). Elements of Biostatistics RastogiPublications, Meerut,India.

2. Pillai, R.S.N.and Bhagavathi, V. (2001). Statistics, S.Chand and Co., NewDelhi.

18UCL5EB	ELECTIVE- I: INTRODUCTION TO BIOMATERIALS	SEMESTER-V

Total credits: 4
Hours/week: 4

PREAMBLE:

- To understand various concepts and various generations of biomaterials
- 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	**K_1,K_2, K_3**
CO 2	Know the significance of second generation biomaterials	**K_1,K_2, K_3**
CO 3	Describes the synthesis and applications of third generation biomaterials	**K_1,K_2, K_3**
CO 4	Understands the principles and applications of nanotechnology	**K_1,K_2, K_3**
CO 5	Know the applications of advanced microscopic and spectroscopic techniques for analysis of sample	**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

18UCL5EB	ELECTIVE- I: INTRODUCTION TO BIOMATERIALS	SEMESTER-V

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 APage 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.

18UCL5EC	ELECTIVE-I: PLANT & ANIMAL BIOTECHNOLOGY	SEMESTER -V

Total credits: 4
Hours/week: 4

PREAMBLE:

- To understand the principle and applications of mammalian cell culture
- To know the basic applications of plant tissue 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	**K_1,K_2, K_3**
CO 2	Know the significance culture technique for gene transfer	**K_1,K_2, K_3**
CO 3	Describe the basic concepts of mammalian cell culture	**K_1,K_2, K_3**
CO 4	Understand the principles and applications of gene technology in production of therapeutic compounds	**K_1,K_2, K_3**
CO 5	Describe the production of recombinant proteins	**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**	**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

18UCL5EC	ELECTIVE-I: PLANT & ANIMAL BIOTECHNOLOGY	SEMESTER -V

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, Invitro fertilization (IVF): embryo cloning. Human embryo research, transgenic mice, Gene therapy; the Human Genome Project.

Hybridoma technology- Monoclonal antibodies- production and applications.

TEXT BOOKS:

1. Plant tissue culture; Razdan; Oxford IBH publishers, 2019.
2. *Freshney*; Animal cell culture; IRL press.

REFERENCE BOOKS:

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

18UCL5SA	SKILL BASED COURSE - III: DRUG BIOCHEMISTRY	SEMESTER–V

Total Credits: 3
Hours /week: 3

PREAMBLE:

- To understand the types of drugs, their routes of administration and their metabolism in the human body.
- 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 drugs administration and its action	**K_1,K_2**
CO 2	Know the metabolism and excretion of drugs	**K_1,K_2, K_3**
CO 3	Describe the adverse drug reactions	**K_1,K_2, K_3**
CO 4	Understand the toxicological studies and their effects	**K_1,K_2, K_3**
CO 5	Know the phytoconstituents as drugs and its separation 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

18UCL5SA	SKILL BASED COURSE - III: DRUG BIOCHEMISTRY	SEMESTER–V

Total Credits: 3
Hours /week: 3

CONTENTS

UNIT- I

Sources and classification of drugs, Routes of drugs administration – Enteral and parental. Drug absorption, Drug distribution, Biotransformation.

UNIT- II

Drug metabolism – general pathways of drug metabolism different types of reaction in phase I and phase II with examples.Factors affecting drug metabolism,Excretion of drugs - kidney.

UNIT- III

Drug interactions-Receptors, Drug Receptor interaction – Agonist, Antagonist, Partial and Reverse agonist.Drug – DrugInteraction, Tolerance, Adverse drug reactions.

UNIT- IV

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

UNIT- V

Extract preparation – Tissue and plant, Extraction techniques, Phytoconstituents – chemical nature and medicinal properties, Analysis of phytoconstituents

TEXT BOOKS

1. Mohammed Ali, 1995. **Text book of pharmaceutical chemistry**, CBS Publishers and Distributors, New Delhi.
2. R.S. Satoskar, S.D.Bhandharkar and Nirmala,NR 2009. **Pharmacology and Pharmacotherapeutics**, Volume 1; Elsevier.

REFERENCE BOOKS

1. Willam.O.Foye, B.I. Waverks, LW&W., (1995) **Principles of medicinal chemistry**, 4th edition.

2. Pharmacology , An introduction to Drugs, Prentice Hall Inc, Eaglewood Cliif, New Jersey,1994.
3. Manfred E. Wolff, 1996. **Burger's Medicinal Chemistry and Drug Discovery, Therapeutic Agents;** 5th Edition, Wiley& Sons Publications..

18UCL63A	CORE – XIV: IMMUNOLOGY	SEMESTER - VI

Total credits: 4
Hours/week: 4

PREAMBLE:

- To understand the immunological reactions and manifestation of immuno diseases
- To 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 immuno therapy 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

18UCL63A	CORE – XIV: IMMUNOLOGY	SEMESTER - VI

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 ,2016***Immunology,** 6thedition**,** W.H.Freeman and Company, New York.

REFERENCE BOOKS:

1. *Roitt I, Brastoff J and Male D*, 2012 – Immunology, Mosby – Elsiever, 8 th ed.
2. *Ananthanarayan R and Panicker C K J* 2005. **Textbook of Microbiology,**8rd edition, Orient Longman Private Limited, Hyderabad.
3. Janis Kuby, 1997. **Immunology.** W H Freeman & Co (Sd), 3rd edition.

18UCL63B	CORE - XV: CYTOLOGY	SEMESTER- VI

Total credits: 4
Hours/week: 4

PREAMBLE:

- To understand the basic cell types and thier functions, basic techniques in sampling and staining of cytology samples.
- To understand the various types of cytological samples, and morphological differences

COURSE OUTCOMES:

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

CO Number	CO Statement	Knowledge Level
CO 1	Know histology and cytology of various tissues	**K_1,K_2**
CO 2	Understand the normal and malignant cytology of FNAC and non gynae cytology	**K_1,K_2, K_3**
CO 3	Understand the cytology of cervix	**K_1,K_2, K_3**
CO 4	Understands concepts of flow cytometry	**K_1,K_2, K_3**
CO 5	Understand the production of monoclonal antibodies and immunohistochemical analysis	**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

18UCL63B	CORE - XV: CYTOLOGY	SEMESTER- VI

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, Types of Flow cytometer, equipments, procedure and evaluation and its applications in disease diagnosis. 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.
3. Svante R. Orell, Gregory F. Sterrett's, 2011. Fine Needle Aspiration Cytology. 5 th edition, Elsevier, *New Delhi*.

18UCL63P	CORE PRACTICAL – VII: MICROBIOLOGY-II	SEMESTER - VI

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.

18UCL6EA	ELECTIVE – II: RESEARCH METHODOLOGY &INTELLECTUAL PROPERTY RIGHTS	SEMESTER–VI

Total Credits: 4
Hours /week: 4

Preamble:
To understand the research methodology and intellectual property rights.

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

CO Number	CO Statement	Knowledge Level
CO 1	Understand concepts of research problem and solution	K_1,K_2, K_3
CO 2	Know the Effective literature studies Plagiarism and Research ethics.	K_1,K_2, K_3
CO 3	Describe the Guidelines for writing the research paper	K_1,K_2, K_3
CO 4	Understand the Nature of Intellectual Property	K_1,K_2, K_3
CO 5	Know the Scope of Patent Rights and licensing	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

18UCL6EA	ELECTIVE – II: RESEARCH METHODOLOGY &INTELLECTUAL PROPERTY RIGHTS	SEMESTER–VI

Total
Credits: 4
Hours /week: 4

CONTENTS

UNIT – I

Meaning of Research- definition, hypothesis, null hypothesis. Types of Research. Research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT – II

Effective literature studies approaches, analysis Plagiarism, Research ethics. Preparation of Research Papers and Dissertation, Illustrations and Tables.

UNIT - III

Guidelines for writing the research paper. Efficient technical writing and how to write areport. Developing a Research Proposal, Format of research proposal. Journals web search, Scopus and science direct.

UNIT – IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: innovation, technological research, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under Patent Cooperation Treaty (PCT).

UNIT - V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. India`s New National IP Policy Administration of Patent System. New developments in IPR; IPR of Biological Systems and Traditional knowledge.

Text Books

1. Ranjit Kumar., 2011, Research Methodology: A Step by Step Guide for beginners, 3rd Edition, SAGE Publications India Pvt Ltd.
2. Nithyananda, K V. 2019, Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

Reference Books

1. Neeraj, P., & Khusdeep, D, 2014, Intellectual Property Rights. India, IN: PHI learning Private Limited.
2. Kothari's C. R, 2014, Research Methodology, New Age International Pvt Ltd Publishers
3. T. Ramappa, 2008, Intellectual Property Rights Under WTO", Wheeler Pub.

E-resources:

1. Cell for IPR Promotion and Management (http://cipam.gov.in/)
2. World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
3. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

18UCL6EB	ELECTIVE- II: NANOMATERIALS AND NANOMEDICINE	SEMESTER- VI

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	K_1,K_2
CO 2	Understand the role of nanomaterials in cardiovascular implants	K_1,K_2, K_3
CO 3	Understand the applications of polymeric implant materials	K_1,K_2,
CO 4	Know the characteristics and applications of metallic and ceramic implant materials	K_1,K_2, K_3
CO 5	Appreciate the nanoparticles in drug delivery	K_2,K_3

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

18UCL6EB	ELECTIVE- II: NANOMATERIALS AND NANOMEDICINE	SEMESTER- VI

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 hydrigels; 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.

TEXT BOOKS:

1. SV Bhat, 2005. **Biomaterials**2nd Edition, Narosa Publishing House, New Delhi.
2. Roderic S. Lakes , Joon B. Park, 2005.**Biomaterials: An Introduction,**3rd Edition,Springer.

REFERENCE BOOKS:

1. JB Park,1984**Biomaterials Science and Engineering**, Plenum Press, New York, Challa S.S.R.Kumar, Joseph Hormes, Carola Leuschmal.

18UCL6EC	ELECTIVE -II: GENETIC ENGINEERING AND BIOPROCESS TECHNOLOGY	SEMESTER- VI

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

18UCL6EC	ELECTIVE -II: GENETIC ENGINEERING AND BIOPROCESS TECHNOLOGY	SEMESTER- VI

Total credits: 4
Hours/week: 4

CONTENTS

UNIT–I

Basics 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; Single cell protein; 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.

18UCL6ED	ELECTIVE- III: TUMOUR MARKERS AND IMMUNOHISTOCHEMISTRY	SEMESTER- VI

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 biochemical characteristics of tumor cells	K_1,K_2
CO 2	Understand the concepts of tumour markers	K_1,K_2, K_3
CO 3	Know the hormones and carbohydrates as tumour markers in screening and diagnosis	K_1,K_2, K_3
CO 4	Know the significance of different proteins as tumour markers	K_1,K_2, K_3
CO 5	Understand the principles of immunological techniques.	K_1,K_2

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

18UCL6ED	ELECTIVE- III: TUMOUR MARKERS AND IMMUNOHISTOCHEMISTRY	SEMESTER- VI

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

TEXT BOOKS:

1. Gerhard Seifert, 2012, Morphological Tumor Markers: General Aspects and Diagnostic Relevance, illustrated, Springer Science & Business Media,
2. Manjul Tiwari, 2012, Tumor Marker and Carcinogenesis, River Publishers.
3. Carl A. Burtis, David E. Bruns, 2014, Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics, 7th edition, Elsevier Health Sciences.
4. William J. Marshall, 2000, Clinical Chemistry, 4th edition, illustrated, reprint, Mosby, 2000.

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, 2nd edition , illustrated, revised , CRC Press, 1990

18UCL6EE	ELECTIVE- III: NANOBIOTECHNOLOGY	SEMESTER -VI

Total credits: 4
Hours/week: 4

PREAMBLE:

To 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 principles of nanomaterial development	**K_1,K_2, K_3**
CO 2	Know the development of devices for medical implants	**K_1,K_2, K_3**
CO 3	Understand and apply protein based nanostructures	**K_1,K_2, K_3**
CO 4	Understand and apply DNA based nanostructures	**K_1,K_2, K_3**
CO 5	Appreciate the applications of bionanomaterials for diagnostic purposes and gene transfer	**K_1,K_2**

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

18UCL6EE	ELECTIVE- III: NANOBIOTECHNOLOGY	SEMESTER -VI

Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

Definitions and Concept of Nano-biotechnology, Historical background.Fundamental sciences and broad areas of Nanobiotechnology. Various applications of Nano-biotechnology. Cell – Nanostructure interactions.

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 – nanobioelectronic 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 medicine.

UNIT-V

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

TEXT BOOKS:

1. C.A. Mirkin, 2004. **Nanobiotechnology – Concepts, Applications and Perspectives,** Edited by CM, Niemeyer,. Wiley – VCH.
2. T. Pradeep 2007.**Nano: The essentials,** McGraw – Hill education –

REFERENCE BOOKS:

1 Challa, S.S.R. Kumar, Josef Hormes, Carola Leuschaer,2005. **Nanofabrication Towards Biomedical Applications, Techniques, Tools,Applications and Impact,** Wiley Publications.
2 Nicholas A. Kotov , 2006. **Nanoparticle Assemblies and Superstructures**, CRC Publishers.

18UCL6EF	ELECTIVE- III: PLANT THERAPEUTICS	SEMESTER- VI

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	K_1,K_2
CO 2	Understand the cycles of elements and plant nutrition	K_1,K_2, K_3
CO 3	Describe the plant growth regulators	K_1,K_2
CO 4	Understand the significance of senescence in plants	K_1,K_2, K_3
CO 5	Know the roles of plant secondary metabolites and their role.	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	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

18UCL6EF	ELECTIVE- III: PLANT THERAPEUTICS	SEMESTER- VI

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.

UNIT–III

Plant growth regulators: Chemistry, biosynthesis, mode of action and Practical applications of auxins, gibberellins, cytokinins, abscicic 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. Lea and Lea wood, 1997, **Plant Biochemistry and Molecular Biology**, John Wiley and sons, 1997.
2. Devlin N. Robert and Francis H. Witham, 2017.**Plant Physiology,** 4th Edition, CBS Publications.

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