BACHELOR OF SCIENCE - CLINICAL LAB TECHNOLOGY REGULATIONS

ELIGIBILITY :

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

OBJECTIVES OF THE COURSE :

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

1. Provide students with comprehensive theoretical knowledge of clinical laboratory sciences and practical experience.
2. Develop students' career entry-level competencies in clinical laboratory testing, quality assurance, and professional ethical practices.
3. Provide students with the adequate background knowledge to follow graduate studies or specialization in an area of clinical laboratory sciences.

SCHEME OF EXAMINATIONS

Subject Code	Subject	Hrs of Instruc-tion	Exam Duration (Hrs)	Max Marks			Credit Points
				CA	CE	Total	
First Semester							
Part – I							
16UTL11T 15UHL11H 15UML11M 15UFL11F	Tamil - I Hindi - I Malayalam - I French - I	6	3	25	75	100	4
Part – II							
16UEG12E	English-I	6	3	25	75	100	4
Part – III							
16UCL13A	Core – I: Human Anatomy & Physiology	4	3	20	55	75	3
16UCL13B	Core - II: Fundamentals of Biochemistry	4	3	20	55	75	3
16UCL13P	Core Practical – I: Biochemistry- I	2	3	30	45	75	3
15UIT1AA	Allied – I: Fundamentals of Information Technology	4	3	20	55	75	3
	Allied Practical – I: Office Automation	2	-	-	-	-	-
Part – IV							
15UFC1FA	Environmental Studies	2	3	-	50	50	2
		30				**550**	**22**
Second Semester							
Part – I							
16UTL21T 15UHL21H 15UML21M 15UFL21F	Tamil –II Hindi - II Malayalam - II French - II	6	3	25	75	100	4
Part – II							
16UEG22E	English-II	6	3	25	75	100	4
Part – III							
16UCL23A	Core – III: Analytical Techniques	4	3	20	55	75	3

24/6/2016.
BoS Chairman/HoD
Department of Clinical Laboratory Technology
Dr N. G. P. Arts and Science College
Coimbatore – 641 048

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Dr. NGP Arts and Science College
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16UCL23P	Core Practical - II: Biochemistry-II	6	3	30	45	75	3
15UIT2AA	Allied – II: Office Automation	4	3	20	55	75	3
16UIT2AP	Allied Practical - I: Office Automation	2	3	20	30	50	2
Part – IV							
15UFC2FA	Value Education – Human Rights	2	3	-	50	50	2
		30				**525**	**21**
Third Semester							
Part – III							
15UCL33A	Core - IV: Microbiology- I	4	3	25	75	100	4
16UCL33B	Core – V: Clinical Pathology	4	3	20	55	75	3
15UCL33C	Core – VI: Histopathology	4	3	20	55	75	3
16UCL33P	Core Practical – III: Pathology	4	3	30	45	75	3
16UCY3AA	Allied – III: Chemistry- I	4	3	20	55	75	3
	Allied Practical – II: Chemistry	4	-	-	-	-	-
Part – IV							
	NMEC I	2	3	-	50	50	2
15UCL3SA	Skill based Subject - I: Bio-safety & Bio-waste management	2	3	20	55	75	3
15UFC3FA 15UFC3FB 15UFC3FC 15UFC3FD 15UFC3FE	Tamil/ Advanced Tamil (OR) Non-major elective-I (Yoga for Human Excellence) / Women's Rights/Constitution of India	2	3	-	50	50	2
		30				**575**	**23**

Fourth Semester							
Part – III							
15UCL43A	Core – VII: Microbiology- II	4	3	25	75	100	4
16UCL43B	Core – VIII: Clinical Biochemistry-I: Metabolic disorders	4	3	20	55	75	3
16UCL43C	Core – IX: Clinical Biochemistry-II: Functional tests	4	3	20	55	75	3
16UCL43P	Core Practical – IV: Clinical Biochemistry	4	3	30	45	75	3
16UCY4AA	Allied – IV: Chemistry -II	4	3	20	55	75	3
16UCY4AP	Allied Practical – II: Chemistry	4	3	20	30	50	2
Part-IV							
	NMEC –II:	2	3	-	50	50	2
15UCL4SA	Skill based Subject – II: Epidemiology	2	3	20	55	75	3
15UFC4FA 15UFC4FB 15UFC4FC	Tamil Advanced Tamil (OR) (General Awareness)	2	3	-	50	50	2
		30				**625**	**25**
Fifth Semester							
Part – III							
15UCL53A	Core – X: Microbiology- III	4	3	25	75	100	4
15UCL53B	Core - XI: Hematology	4	3	25	75	100	4
16UCL53C	Core – XII: Blood Banking	4	3	25	75	100	4
16UCL53P	Core Practical – V: Heamatology	4	3	30	45	75	3
16UCL53Q	Core Practical – VI: Microbiology	6	9	30	45	75	3
	Elective – I :	4	3	25	75	100	4

Part-IV							
15UCL5SA	Skill based Subject - III: Basics of Molecular Biology	4	3	20	55	75	3
16UCL53T	Industrial Training	Grade A to C					
		30				**625**	**25**
Sixth Semester							
Part – III							
15UCL63A	Core – XIII: Immunology	4	3	25	75	100	4
15UCL63B	Core – XIV: Cytology	4	3	25	75	100	4
16UCL63P	Core Practical – VII: Microbiology	6	9	30	45	75	3
	Elective – II:	4	3	25	75	100	4
	Elective – III:	4	3	25	75	100	4
Part -IV							
16UCL6SV	Skill based Subject – IV: Mini Project	8	3	30	45	75	3
Part V							
16UEX65A	Extension Activity	-	-	50	-	50	2
		30				**600**	**24**
Grand Total						**3500**	**140**

ELECTIVE – I

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

S.No	Subject Code	Name of the Subject
1	15UCL5EA	Organisation of Clinical Laboratory
2	15UCL5EB	Introduction to Biomaterials
3	15UCL5EC	Plant & Animal Biotechnology

ELECTIVE - II

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

S.No	Subject Code	Name of the Subject
1	15UCL6EA	Quality Control and Biostatistics
2	15UCL6EB	Nanomaterials and Nanomedicine
3	15UCL6EC	Genetic Engineering and Bioprocess Technology

ELECTIVE - III

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

S.No	Subject Code	Name of the Subject
1.	15UCL6ED	Tumor markers and Immunohistochemistry
2.	15UCL6EE	Nanobiotechnology
3.	15UCL6EF	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 subject as Non Major Elective Courses during their III and IV semester

S. No.	Semester	Subject Code	Course Title
1.	III	15UED34D	Anatomy, Physiology & Laboratory Science
2.	IV	15UED44D	Concepts of Health

Total Credit Distribution

Subjects	Credit	Total Marks		Credits	Cumula-tive Total
Part I: Tamil	4	2 X 100 =	200	08	16
Part II: English	4	2 X 100 =	200	08	
Part III:					
Core Theory	3	7 X 75 = 100 =	525	21	98
Core Theory	4	7 X 100 =	700	28	
Core Practical	3	7 X 75 =	525	21	
Allied theory	3	4 X 75 =	300	12	
Allied practical	2	2 X 50 =	100	04	
Electives	4	3 X 100 =	300	12	
Part IV:					
NMEC	2	2 X 50 =	100	04	24
Skill based subjects	3	4 X 75 =	300	12	
Value Education : 1. EVS	2	1 X 50 =	50	02	
2. Human rights	2	1 X 50 =	50	02	
3. Women's rights/ Yoga/ Basic Tamil	2	1 X 50 =	50	02	
4. Tamil Advanced Tamil (OR) General Awareness	2	1 X 50 =	50	02	
Part V:					
Extension Activity	2	1 X 50 =	50	02	2
Total			**3500**	**140**	**140**

FOR COURSE COMPLETION

Students shall complete:

1. Language papers (Tamil/Malayalam/French/Hindi, English) in I, II, III and IV semester.
2. Environmental Studies in I semester
3. Value Education in II and III semesters respectively
4. General awareness in IV semester
5. Allied papers in I, II, III and IV semesters.
6. Students must undergo industrial training for 15 – 30 days during IV semester summer vacation. Evaluation of the report done by the internal and external examiner in the V semester. Based on their performance grade will be awarded as A to C.

   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 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 course completion
Extra credits

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

Rules:

The students can earn extra credits only if they complete the above during the course 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 Course 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 course 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.	I sem. to V sem.	16UCLSS1	Disaster Management
2.		16UCLSS2	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 course 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 course period to obtain certificate through **Tamil Nadu Board of Technical Education**
4. Student can opt for Diploma/certificate/CPT/ACS Inter/ NPTEL Course to earn one extra credit. Student who opt for Diploma/ Certificate course have to enroll any diploma/certificate course offered by Bharathiar University through our Institution. Student who opt for CPT/ ACS/CMA have to enroll and complete the foundation level during the course period. Students who opt for NPTEL course should complete the course certificate through NPTEL.
5. Award Winners in Academic/ Representation in Sports /Social Activities/ Extra Curricular/ Co-Curricular Activities at University/ District/ State/ National/ International level can earn one extra credit.

16UCL13A	CORE – I: HUMAN ANATOMY AND PHYSIOLOGY	SEMESTER – I

Total Credits: 3
Hours /week: 4

OBJECTIVE :

1. To understand the various organs of the human body and their functions.

CONTENTS

UNIT-I

General Anatomy: Introduction to anatomical terms and organization of the human body. Tissues –Definitions, Types, characteristics, classification, location, functions and formation. Blood – morphology, composition, functions.
Central Nervous system: Spinal cord, Anatomy, Functions. Structure of neuron, nerve impulse, myelinated and non-myelinated nerve. Brief account of resting membrane potential, action potential and conduction of nerve impulse.

UNIT–II

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

UNIT–III

Respiratory System: Parts, Nasal cavity and Paranasal air sinuses, trachea, Gross and microscopic structure of lungs, Diaphragm and Pleura. Principles of respiration, respiratory muscles, lung volumes and capacities, collection and composition of inspired alveolar and expired airs. Transport of oxygen and carbondioxide.
Digestive System: Parts, Structure of Tongue, Salivary glands, stomach, Intestines, Liver, Pancreas. functions of G.I secretions, principles of secretion and movements of GIT.

UNIT–IV

Excretory system: Parts, structure of Kidney, Ureters, Urinary Bladder and Urethra, Structure of Nephron, measurement and regulation of GFR, mechanism of urine formation. Clearance tests & values of insulin, PAH and urea clearance.
Reproductive System: Parts of the system. Gross structure of both male and female reproductive organs.

UNIT–V

Lymphatic System: Gross and microscopic structure of lymphatic tissue.
Special Senses: Structure of Skin, Eye, Nose, Tongue (Auditory and Olfactory apparatus).
Anatomical Techniques: Embalming of human cadaver, Museum Techniques, Basic principles of Karyotyping.

TEXT BOOKS :

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

REFERENCE BOOKS :

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

16UCL13B	CORE – II: FUNDAMENTALS OF BIOCHEMISTRY	SEMESTER - I

Total Credits: 3
Hours /week: 4

OBJECTIVE :

1. To understand the fundamentals of biomolecules such as carbohydrates, proteins, lipids, nucleic acids, enzymes and hormones.

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.
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.
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, Brief account of endocrine disorders

TEXT BOOKS :

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

REFERENCE BOOKS :

1. *Deb, AC*, 1989, **Fundamentals of Biochemistry**, 3rd 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.

16UCL13P	CORE PRACTICAL – I: BIOCHEMISTRY- I	SEMESTER - I

Total Credits: 3
Hours /week: 2

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.

15UIT1AA	ALLIED - I : FUNDAMENTALS OF INFORMATION TECHNOLOGY	SEMESTER - I

Total Credits: 3
Hours /week: 4

OBJECTIVES :

1. On successful completion of the course the students should Understood the Fundamentals of Information Technology

CONTENTS

UNIT- I **[10 Hours]**

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

UNIT–II **[10 Hours]**

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

UNIT–III **[10 Hours]**

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 **[10 Hours]**

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 **[8 Hours]**

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.

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**.

16UCL23A	CORE - III: ANALYTICAL TECHNIQUES	SEMESTER - II

Total Credits: 3
Hours /week: 4

OBJECTIVES :

1. To understand the principle, working and applications of the instruments commonly used in the clinical laboratories.
2. To enable the students to learn about the functional component of various instruments.

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; ELISA (Principles Only).

UNIT-IV

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

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOKS :

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

16UCL23P	CORE PRACTICAL - II: BIOCHEMISTRY -II	SEMESTER - II

Total Credits: 3
Hours /week: 6

CONTENTS

I BASIC TECHNIQUES

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

II QUALITATIVE ANALYSIS IN URINE

1. Urea
2. Uric acid
3. Creatinine
4. Phosphorus
5. Protein

III SEPARATION TECHNIQUES [DEMONSTRATION]

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

REFERENCE BOOKS :

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

15UIT2AA	ALLIED – II: OFFICE AUTOMATION	SEMESTER - II

Total Credits: 3
Hours /week: 4

OBJECTIVE :

1. On successful completion of the course the students should Understood the use of Microsoft Office.

CONTENTS

UNIT- I **[10 Hours]**

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 **[10 Hours]**

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 **[10 Hours]**

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 **[10 Hours]**

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 **[8 Hours]**

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

REFERENCE BOOKS :

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

16UIT2AP	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**.**

15UCL33A	CORE – IV: MICROBIOLOGY- I	SEMESTER - III

Total Credits: 4
Hours /week: 4

OBJECTIVES :

On completion of the course the student should have understood:

1. The general characters of bacteria and methods of their identification
2. The general methods of sterilization and disinfection in microbiology
3. General culture media used in microbiology

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOKS :

1. *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

16UCL33B	CORE - V: CLINICAL PATHOLOGY	SEMESTER - III

Total Credits: 3
Hours /week: 4

OBJECTIVES :

1. After completion of this course the student would have understood the techniques in Clinical pathology, complete analysis of body fluids, Urine and semen.

CONTENTS

UNIT-I

Laboratory organization, Reception of specimen, despatch of reports, records keeping, coding and indexing, Quality control – Internal and external quality assurance systems

UNIT-II

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

UNIT-III

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

UNIT–IV

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

UNIT-V

Semen analysis - method of collection examination of semen for time for liquefaction, volume, colour, reaction pH, motility of sperm, sperm count and other findings. Staining and morphological study 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.

15UCL33C	CORE - VI: HISTOPATHOLOGY	SEMESTER - III

Total Credits: 3
Hours /week: 4

OBJECTIVES :

On successful completion of this course the students would understand,

1. Instruments used in Histopathology techniques.
2. Microphotography, Museum preservation.

CONTENTS

UNIT-I

Introduction to histopathology: Receiving specimen in laboratory – Grossing, Various fixatives – Mode of action, Indications, preparation, decalcification of calcified tissue before sectioning, Processing of tissues for routine paraffin sections and other methods of embedding.

UNIT-II

Instrumentation:
a) Tissue Processor b) Knife sharpener c) Automatic slide stainer d) Microtome, knives e) Freezing microtome; Cryostat f) Instruments for grossing.

UNIT-III

Use of microscope, polarisers. Introduction to Electron Microscopy and technique of preparing slides.

UNIT-IV

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

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOKS :

1. *Todd J C, Davidson I and Henry J B* 1974. **Clinical diagnosis by laboratory methods**. 15th Edition, Saunders Publications Pvt.Ltd, Pennsylvania
2. *Culling C F A,* 1963**. Histopatholgy Techniques.** Butterworth-Heinemann Publication, London.

16UCL33P	CORE PRACTICALS - III: PATHOLOGY	SEMESTER - III

Total Credits: 3
Hours /week: 4

CONTENTS

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

REFERENCE BOOKS :

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

16UCY3AA	ALLIED –III: CHEMISTRY - I	SEMESTER III

Total Credits: 3
Hours/Week: 4

OBJECTIVE :

1. On successful completion of this course the students shall gain knowledge in the basics of chemistry which helps bioscience students to understand chemical bonding in the biomolecules and the techniques involved in the biochemistry.

CONTENTS

UNIT–I

Chemical bonding

1. Molecular Orbital Theory - bonding, antibonding and nonbonding 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–II

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–III

Basic Organic Chemistry

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

1. **Surface Chemistry**
   Adsorption – adsorbent and adsorbate, adsorption and absorption - chemisorption - physisorption - Difference between chemisorption and physisorption - applications of adsorption - Factors influencing adsorption, adsorption isobar, adsorption isostere.
2. Chromatography - Principles and applications of column, paper and thin layer Chromatography.

UNIT–V

Dyes

1. Terms used – chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift. Classification of dyes based on chemical structure and application- Preparation of azo (Methyl orange) and triphenyl methane (Malachite green) dyes.

TEXT BOOKS :

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

15UED34D	NMEC- I : ANATOMY, PHYSIOLOGY AND LABORATORY SCIENCE	SEMESTER - III

Total Credits: 2
Hours /week: 2

OBJECTIVES :

On successful completion of the course the students should have:

1. Understood clearly on various alimentary parts of human body.
2. Learn more specific on the endocrinal activities.
3. Learnt the mechanisms and actions of vital organs.

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, function – Joints, Structure and function – Ligaments. **Nervous System:** Structure and function of neuron - Central and peripheral nervous system -Autonomous nervous system

UNIT-II

Cardio Vascular System : Heart- Conduction System, Functions and Cardiac Cycle - Blood- Composition, Clotting and groups, Blood Vessels - Circulation of blood; Blood pressure and pulse. **Respiratory System:** Structure and function of respiratory organs

UNIT-III

Structure and functions of the organs of digestive system, Urinary System and endocrine glands- (Pituitary Pancreas, Thyroid, Parathyroid, Thymus, Supra renal) **Sense Organs:** - Structure and functions of Eye, Ear, Nose 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 & Pharmacology: Introduction to Clinical Pathology - Definition and Classification of diseases Bacteria: Definition, broad classification - Virus: Definition, Introduction to Pharmacology - Names of common drugs used in treatment Common abbreviations used in prescriptions.

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.

15UCL3SA	SKILL BASED SUBJECT- I: BIO-SAFETY & BIO-WASTE MANAGMENT	SEMESTER - III

Total Credits: 3
Hours /week:2

OBJECTIVE :

1. On successful completion of the course the students should have an understanding of safety, ethics and waste management in biomedical laboratories.

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. 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: Categories of biomedical waste as per WHO, Gazette notification of India. Sources of biomedical waste; Types of health care waste: Infectious and non-infectious waste, hazardous waste, solid and liquid waste, biodegradable and non-biodegradable waste.

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOKS :

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

15UCL43A	CORE – VII: MICROBIOLOGY- II	SEMESTER - IV

Total Credits:4
Hours /week: 4

OBJECTIVE :

1. On successful completion of the course the students could understand the basic concepts of immunology classification.

CONTENTS

UNIT-I

Introduction to Immunology; classification and mechanisms of immunity - Innate Immunity.Acquired immunity, Antigens, Structure and functions of immunoglobulins.

UNIT–II

Structure and functions of immune system. Biology of immune response; Mechanisms of antigen-antibody reactions including, agglutination, precipitation, neutralization and enzyme immunoassays. Complement system.

UNIT-III

Classification and mechanisms of hypersensitivity reactions; Autoimmunity and autoimmune diseases; Transplantation immunology.

UNIT-IV

Cancer immunology; Immunodeficiency diseases; Vaccines.

UNIT-V

Serological techniques in diagnostic microbiology including Widal test, Brucella agglutination test; VDRL test; Cold agglutination; Immunoflourescence test (Direct and Indirect), Immunoelectrophoresis, Counter Immunoelectrophoresis, Rocket electrophoresis, ELISA tests.

TEXT BOOKS :

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

REFERENCE BOOKS :

1. *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 J H and Klein D A*1993. **Microbiology,** 2nd edition, Brown Publishers, Iowa, USA

16UCL43B	CORE – VIII: CLINICAL BIOCHEMISTRY -I : METABOLIC DISORDERS	SEMESTER – IV

Total Credits: 3
Hours /week: 4

OBJECTIVE :

1. This course could make the students understand the significance of metabolic disorders.

CONTENTS

UNIT-I

Disorders of carbohydrate metabolism: Normal sugar 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 sugar and GTT. Glycosuria, differential diagnosis of glycosuria, complication of diabetes mellitus- Diabetic ketoacidosis, Diabetic coma, Fructosuria, pentosuria, Galactosemia, and Glycogen storage diseases.

UNIT-II

Disorders of Lipid Metabolism: Plasma lipids and lipoproteins - Introduction. Hyperlipoproteinemia - Type I, II, III, IV, V and alpha-lipoproteinemia. Hypolipoproteinemia - A - beta 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, Alkalptonuria, Albinism, and Hartnup disease.

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOKS :

1. *Swaminathan R*, 2004. **Handbook of Clinical Biochemistry**, 1st Edition, Oxford University Press, London.

2. *Devlin T M,* 1997. **Textbook of Biochemistry with Clinical Correlations**. 1st Edition, John Wiley & Sons, New York

16UCL43C	CORE – IX: CLINICAL BIOCHEMISTRY- II: FUNCTIONAL TESTS	SEMESTER - IV

Total Credits: 3
Hours /week: 4

OBJECTIVE :

1. This course would make the students understand the significance of organ function tests in diagnosis.

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

Intestinal function: Introduction, Test used in the diagnosis of malabsorption, determination of total faecal fat (fat balance test), test of monosaccharide absorption (Xylose excretion test) and determination of total protein (Lowry's method).

UNIT-IV

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

UNIT-V

Kidney Function: Introduction, physical examination of urine, elimination tests, Clearance tests - Inulin clearance, Creatinine clearance and Urea clearance tests, Renal blood flow and filtration fraction.

TEXT BOOKS :

1. *Burtis CA, Ashwood ER and Bruns DE (eds),* (2005) **Tietz** Textbook of Clinical Chemistry and Molecular Diagnosis (5th edition). William Heinmann, Medical Books Ltd. New Zealand.
2. *Mayne PD* 1998. **Clinical Chemistry in Diagnosis and**
3. **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

16UCL43P	CORE PRACTICAL - IV: CLINICAL BIOCHEMISTRY	SEMESTER - IV

Total Credits: 3
Hours /week: 4

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. SGOT
5. SGPT
6. Gamma GT
7. 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.

16UCY4AA	ALLIED- IV: CHEMISTRY- II	SEMESTER IV

Total Credits: 3
Hours/Week: 4

OBJECTIVE :

1. On successful completion of this course the students shall gain knowledge in the basics of chemistry which helps bioscience students to understand the periodic table, IUPAC nomenclature of organic compounds, enzyme kinetics and water technology.

CONTENTS

UNIT-I

Periodic Table

1. 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 electron affinity, ionization energy, electronegativity, atomic radii and ionic radii.

UNIT-II

1. Carbohydrates - Classification, preparation, properties and structure of glucose, fructose, inter conversion of glucose to fructose and fructose to glucose, mutarotation.

2. Vitamins - Sources of vitamins, diseases caused by the deficiency of vitamins.

UNIT-III

1. IUPAC Nomenclature of organic compounds – alkanes, alkenes, alcohols, aldehydes, ketones, carboxylic acids (mono and dicarboxylic), benzene and naphthalene derivatives.

2. Heterocyclic Compounds – Preparation and properties (physical, chemical and electrophilic substitution reactions) of furan, pyrrole, pyridine and thiophene.

UNIT–IV

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.

UNIT -V

Water Technology:

1. Introduction- dissolved impurities in water – hard water – disadvantages of hard water, hardness, estimation of hardness by EDTA titration.

2. Softening methods – zeolite ,demineralization process, reverse osmosis – purification of drinking water, biological oxygen demand (BOD) and chemical oxygen demand (COD).

TEXT BOOKS :

1. *R. D. Madan. 2001.***Modern Inorganic Chemistry**. S. Chand & Company, New Delhi,.
2. *Puri , Sharma, Pathania. 2004.***Principles of Physical Chemistry**, Vishal Publishing Company, Jalandhar.
3. *M. K. Jain, S. C. Sharma. 2001*. **Organic Chemistry**, Shoban Lal Nayin Chand, Jalandhar.
4. *Gopalan R. 1991.***Elements of Analytical Chemistry**, Sultan Chand & Sons, New Delhi.
5. *N Krishnamurthy, K Jeyasubramanian, P Vallinayagam.*2000. **Applied chemistry**, Tata McGraw-Hill Publishing Company limited, New Delhi.

16UCY4AP	ALLIED PRACTICAL- II: CHEMISTRY	SEMESTER IV

Total Credits: 2
Hours/Week: 4

CONTENTS

I VOLUMETRIC ANALYSIS

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

II ORGANIC ANALYSIS

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

TEXT BOOKS :

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

15UED44D	NMEC –II: CONCEPTS OF HEALTH	SEMESTER - IV

Total Credits:2
Hours /week: 2

OBJECTIVES :

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

CONTENTS

UNIT- I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOK :

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

15UCL4SA	SKILL BASED SUBJECT- II: EPIDEMIOLOGY	SEMESTER - IV

Total Credits: 3
Hours /week: 2

OBJECTIVE :

1. This course would make the students understand concepts of epidemiology in health and disease.

CONTENTS

UNIT–I: Concepts of health

WHO definition of health; Positive health; Determinants of health; Responsibility for health. Health service philosophies: - Health case; Health system; Levels of health case. Concepts of disease and concept of causation – germ theory of disease; Epidemiological triad; Multifactorial causation.

UNIT–II: Nutrition and Health

Food defined; Nutrition defined; Classification of foods; Nutrients – Sources and functions of Proteins, fats, carbohydrates; souces and functions of vitamins and minerals. Nutritional Profiles of principle foods; cereals, Millets, Vegetables, Fruits, Milk, and Milk products, Fish and meat, alcoholic beverages, egg, soft drink. Balanced Diet – PEM Malnutrition and its effects – Kwashiorkor and Marasmus.

UNIT–III: Environment and Health

Basic health requirements in the environment; Water: Sources and uses of water, Water pollution; Air: Composition and cause of discomfort; Air pollution: Source, Air pollutants, need for proper ventilation. Housing: Social goals of housing and criteria for healthful housing.

UNIT–IV: Microbiology of the environment

Microbiology of air, water and soil; Air, water, food and soil borne diseases. Bacteriological examination of air, water, milk and other food stuff; Surveillance cultures in the ICU's and other high risk areas; Zoonotic diseases, their epidemiology and diagnosis; Ornithosis;

UNIT–V: Epidemiology in health and disease

Definition of epidemics, endemics and pandemics; Study of an epidemic; Factors related to environment and host; Host – parasite interactions; Virulence factors of microbes; Epidemiology and molecular biology of antibiotic resistance.

TEXT BOOKS :

1. *Park. K.,* 2011 - Social and preventive medicine, 18th edition, Bhanot publishers,
2. *Patil R.S.,* 1995 Practical Community Health, Vora medical publishers.

REFERENCE BOOKS :

1. *Ashtekar. S.,* 2001Health and Healing – A Manual of Primary health care, Orient Longmans publishers.

2. *Dash. B.N.,* 2003, Health and physical, Neelkamal, 2nd Edition.

15UCL53A	CORE – X: MICROBIOLOGY- III	SEMESTER – V

Total Credits: 4
Hours /week: 4

OBJECTIVES :

1. On successful completion of the course students should have understood the basic concepts of bacteria, fungi, viruses and parasites in disease.

CONTENTS

UNIT–I

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

UNIT–II

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

UNIT–III

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

UNIT–IV

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

UNIT-V

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

TEXT BOOKS:

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

REFERENCE BOOKS :

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

15UCL53B	CORE - XI: HAEMATOLOGY	SEMESTER - V

Total Credits: 4
Hours /week: 4

OBJECTIVES :

On successful completion of the course the students should have understood:

1. Composition of blood.
2. Methods for the determination of blood cells and staining techniques.
3. Techniques of bone marrow aspiration and various diseases related to it.

CONTENTS

UNIT-I

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

UNIT-II

1. Laboratory methods used in the investigation of anemia: a. B 12 and folate assay b. Schilling test c. Serum iron and iron bonding capacity
2. Laboratory methods used in the investigation of haemolytic anaemias: a. Osmotic fragility b. Investigation of G-6 PD deficiency c. Test for sickling d. Estimation on of Hb-F,Hb-A2 e. Haptoglobin, demonstration of haemosiderin in urine f. Haemoglobin eleotrophoresis g. Test for auto immune hemolytic anaemias h. Measurements of abnormal Hb pigments.

UNIT- III

Investigation of Haemorrhagic disorders: a. Mechanism of coagulation b. Collection and anticoagulants used in coagulation studies c. Bleeding time and clotting time d. Other coagulation studies PT, KPTT, TGT, etc., e. Assay of clotting factors.

UN1T-IV

Test for blood fibrinolytic activity and detection of FDP. Platelet function tests Demonstration of LE cells

UNIT-V

Automation in haematology, Organization and quality control in haematology laboratory.

TEXT BOOKS :

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

REFERENCE BOOKS:

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

16UCL53C	CORE - XII: BLOOD BANKING	SEMESTER - V

Total Credits: 4
Hours /week: 4

OBJECTIVES :

On successful completion of the course the students should have understood:

1. Blood group systems.
2. Investigation of transfusion reactions.
3. Care and selection of blood donors

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, Coomb's cross matching, Blood grouping

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UN1T-III

Donor selection – donor eligibility criteria, Blood collection, screening test on donor blood sample.

UNIT-IV

Storage of whole blood, Preparation of blood components and storage. Hemolytic disease of newborn, blood transfusion reaction, 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.

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.

16UCL53P	CORE PRACTICAL -V: HEAMATOLOGY	SEMESTER – V

Total Credits: 3
Hours /week: 4

CONTENTS

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

TEXT BOOKS:

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

REFERENCE BOOKS:

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

16UCL53Q	CORE PRACTICAL - VI: MICROBIOLOGY	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, 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

15UCL5EA	ELECTIVE- I: ORGANISATION OF CLINICAL LABORATORY	SEMESTER- V

Total Credits: 4
Hours /week: 4

OBJECTIVES :

1. On successful completion of the course the students should have understood about the basic procedures in the organization and automation of Clinical Laboratory.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Disinfection- Ideal characteristic of ideal disinfectant, Mode of action, Selection of antimicrobial chemical agent, Evaluation of antimicrobial potency, Tube- dilution technique, Phenol-coefficient technique, Agar plate technique.

UNIT-V

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

TEXT BOOKS :

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

REFERENCE BOOKS :

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

15UCL5EB	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 / REFERENCE BOOKS :

1. Nano: The essentials: Pradeep .T, 2007, Tata McGraw-Hill Publishing Company Ltd. *B.Sc. Bio-Chemistry (Colleges-revised) 2008-09 Annexure No. 26 A Page 30 of 37 SCAA Dt. 21.05.2009*
2. Nanoparticles assemblies and Superstructures: Nicholas A.Kotov, 2006, CRC Press.
3. Nanoscale Technology in Biological Systems: Editors: Ralph et al, 2005, CRC Press.
4. Micromachines as Tools for Nanotechnology: H.Fujitha, 2003, Springer Verlag.
5. Nanobiotechnology: Concepts, Applications and Perspectives, C.M.Niemeyer & C.A. Mirkin, 2004, Willey VCH Verlag GMBH &co.
6. Biomaterials: An introduction. 1992. By Park JB, Lakes RS.
7. Advances in Biomaterials, Drug delivery – AICHE. J 2003, 49(12): 2990 – 3006.

15UCL5EC	ELECTIVE-I: PLANT & ANIMAL BIOTECHNOLOGY	SEMESTER -V

Total credits: 4
Hours/week: 4

OBJECTIVES :

On successful completion of the course the students should have:

1. Understood the components of culture media and various tissue culture techniques.
2. Learnt about the technique of genetic engineering in plants and animals.
3. Learnt about the synthesis and applications of recombinant proteins from cell cultures.

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

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

15UCL5SA	SKILL BASED SUBJECT – III: BASICS OF MOLECULAR BIOLOGY	SEMESTER- V

Total credits:3
Hours/week: 4

OBJECTIVES :

1. On successful completion of the course the students should have understood the techniques used in molecular biology.

CONTENTS

UNIT-I - Nucleic acid structure and functions

Structure and properties of DNA and RNA; Plasmids; Transposons; Isolation & identification of DNA; DNA replication; DNA repair; Operon concept; Protein synthesis; Reverse transcription; Mutations; Types of mutations; Mutagens; Gene transfer in bacteria; Transformation, Transduction & Conjugation, their mechanisms and significance

UNIT-II: Genetic engineering

Molecular tools; Nucleic acid purification and analysis; Cloning vectors; cDNA synthesis and cloning; Alternate strategies; Site-directed mutagenesis and Protein engineering; Gene therapy; Basics of whole genome analysis.

UNIT-III - Bioprocess Engineering and Environmental Biotechnology

a) Bioprocess Engineering: Fermentation process; Bioreactors; Dimensional analysis and Mass transfer; Media design; Industrial production of chemicals and biomolecules; Mineral beneficiation and oil reparation; Food technology.

b) Environmental biotechnology: Environment and environmental pollution; Air pollution control through biotechnology; Microbiology waste water treatment; Treatment of waste water from dairy, distillery, tannery, sugar and antibiotic industry.

UNIT-IV: Molecular diagnostics:

Principles and theory of nucleic acid amplification tests; Qualitative PCR; Quantitative PCR; Reverse transcriptase PCR; Multiplex PCR; 16s rRNA based PCR; Loop-mediated isothermal amplification; High resolution melt analysis; Immunoblot tests including Western blot and Southern blot tests

UNIT-V: Bioinformatics, Intellectual property rights and Biomedical ethics

a) Bioinformatics: Biological database; Sequence comparison; Multiple sequence alignment; Phylogeny; Bioinformatics in genomics; Open source softwares and their applications.
b) IPR in Biotechnology: Intellectual property rights and their types; Patent laws; Patent sand their types in biotechnology.
c) Biomedical ethics: Internal codes and declarations; Ethical principles; Codes and guidelines in India; Special ethical issues.

TEXT BOOKS :

1. *H.K.Das* (2010); Text book of Biotechnology: 4th Edition Wiley India Pvt Ltd;
2. *Robert Schleif* (1993),Genetics and Molecular Biology:; 2nd Edition The Johns Hopkins University Press ltd; London.

REFERENCE BOOKS :

1. *Harvey Lodish et al (*2013) - (7th edition) - Molecular Cell Biology,.
2. *Brown T.A.*, 2010, Gene Cloning and DNA Analysis: An Introduction, 6th Wiley, 336 pages.

15UCL63A	CORE – XIII: IMMUNOLOGY	SEMESTER - VI

Total credits: 4
Hours/week: 4

OBJECTIVES :

1. On successful completion of the course the students should have understood the concepts in microbiology and immunology of diseases.

CONTENTS

UNIT–I

Historical development of the science of the immunology. Innate and acquired immunity, Antibody mediated and cell mediated response tolerance. Primary and secondary lymphoid organs. Structure of 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. Antigen-antibody interaction – Precipitation and agglutination – Definition and mechanism of formation. Complement component. Cytokines and their junctions.

UNIT–III

Precipitation in gel. Oudin procedure, oahley – Fulthope procedure, immune diffusion, Ouchterlony procedure, Immuno electrophoresis and electro immuno diffusion. Agglutination: Slide agglutination, Table agglutination, Widal test. Principle and application: RIA, ELISA, Flouresent antibody technique, 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: Allograft rejection: Graft Vs Host Diseases: Immuno suppressors: mechanism of graft rejection. Resistant to tumors: NK Cells: Tumor immuno therapy: Lymphoid tumors. Vaccination: Passive and active immunization: Recombinant vaccines: DNA vaccines. Benefits and adverse effects of vaccination. CD4 Cell count in HIV infection.

TEXT BOOKS :

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

REFERENCE BOOKS :

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

15UCL63B	CORE - XIV: CYTOLOGY	SEMESTER- VI

Total credits: 4
Hours/week: 4

OBJECTIVES :

1. On successful completion of the course the students should have understood the basic concepts of cytology.

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

Immuno-cytochemistry: Introduction, Basic concepts of immunocytochemistry, 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.

16UCL63P	CORE PRACTICAL – VII: MICROBIOLOGY	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.

15ULC6EA	ELECTIVE - II: QUALITY CONTROL AND BIOSTATISTICS	SEMESTER- VI

Total credits: 4
Hours/week: 4

OBJECTIVES :

1. Understands statistical terms.
2. Possesses knowledge and skills in the use of basic statistical and research methodology.

CONTENTS

UNIT- I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

The null hypothesis and statistical significance, Comparison of means test including paired test, One way analysis of variance (Anova), Non Parametric distribution statistics, (Chi Square) test, Linear regression and correlation, Scatter diagram, Correlation coefficient, Regression coefficient, t Multiple regression Sensitivity, specificity and predictive values Receiver – operating characteristics curve.

TEXT BOOKS :

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

REFERENCE BOOKS :

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

15UCL6EB	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.

REFERENCE BOOKS :

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

15UCL6EC	ELECTIVE -II: GENETIC ENGINEERING AND BIOPROCESS TECHNOLOGY	SEMESTER- VI

Total credits: 4
Hours/week: 4

OBJECTIVES :

On successful completion of the course the student should have

1. Understood the basics, vectors, methods of gene cloning.
2. Techniques and application of gene technology
3. Bioprocess technology – fermentation methods and production of important compounds by using fermentation technology.

CONTENTS

UNIT–I

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

UNIT–II

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

UNIT–III

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

UNIT–IV

Expression vectors for E.Coli:- Constituents; Examples of promoters – Expression cassettes – Problems caused in expression of eukaryotic genes: Fusion proteins: - Applications of gene technology: Recombinant insulin; Recombinant growth hormones. Cloning HBV surface antigen in yeast. Insect cells as host system. Safety aspects and hazards of genetic engineering.

UNIT–V

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

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

15UCL6ED	ELECTIVE- III: TUMOUR MARKERS AND IMMUNOHISTOCHEMISTRY	SEMESTER- VI

Total credits: 4
Hours/week: 4

OBJECTIVE :

1. On successful completion of the course the students should have understood about carcinogens, oncogenes and their characteristics,tumor markers, various immunological techniques used in histochemistry.

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), Prostatic acid phosphatase (PAP), Prostate specific antigens (PSA).

UNIT-III

Hormones as tumor markers (introduction of each type in brief). Oncofetal antigens. Alpha feto protein (AFP) 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). Biomarkers still in research (introduction in brief) - Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase.

UNIT-V

Immunological techniques - immunofixation, immunochemistry, turbimetry, and immunohistochemistry.

REFERENCE BOOKS:

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

15UCL6EE	ELECTIVE- III: NANOBIOTECHNOLOGY	SEMESTER -VI

Total credits: 4
Hours/week: 4

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

REFERENCE BOOKS:

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

15UCL6EF	ELECTIVE- III: PLANT THERAPEUTICS	SEMESTER- VI

Total credits: 4
Hours/week: 4

OBJECTIVES :

On successful completion of the course the students should have:

1. Understood the components of culture media and various tissue culture techniques.
2. Learnt about the technique of genetic engineering in plants and animals.
3. Learnt about the synthesis and applications of recombinant proteins from cell cultures.

CONTENTS

UNIT–I

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

UNIT–II

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

UNIT–III

Plant growth regulators: Chemistry, biosynthesis, mode of action and Practical applications of auxins, gibberellins, cytokinins, 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.

REFERENCE BOOKS :

1. Molecular activities of plant cell – An Introduction to Plant Biochemistry. John. W. Anderson and John Brardall, Black well Scientific Publications, 1994.
2. Plant Biochemistry and Molecular Biology – Lea and Lea wood, John Wiley and sons, 1997.
3. Plant Physiology –Devlin N. Robert and Francis H. Witham, CBS Publications.
4. Plant Biochemistry and Molecular Biology – Hans Walter Heldt, Oxford University Press, New York, 1997.
5. Introduction to Plant Physiology – William G.Hopkins, John Wiley and sons.
6. Tissue culture of economic plants – C.K. John, Rajani, S. Nadyanda AF. Mascarenhas, Niscom, New Delhi, 1997

16UCLSS1	SELF STUDY PAPER – I: DISASTER MANAGEMENT	SEMESTER: I - V

Total Credits: 1

OBJECTIVES :

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

CONTENTS

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

REFERENCES BOOKS :

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

16UCLSS2	SELF STUDY PAPER – II: GOOD CLINICAL LABORATORY PRACTICES	SEMESTER : I – V

Total credits: 1

OBJECTIVES :

1. On completion of the course the student will understand the GCLP principles, concept and practices.

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, speciment rejection record, data management

UNIT-IV

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

UNIT-V

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

REFERENCE BOOKS :

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

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