A.D.M. COLLEGE FOR WOMEN (AUTONOMOUS), NAGAPATTINAM

Nationally Accredited with "A" Grade by NAAC - 3rd Cycle
(Affiliated to Bharathidasan University, Thiruchirappalli)

DEPARTMENT OF BIOCHEMISTRY

(for the candidates admitted from the academic year 2021-2022)

B.Sc. BIOCHEMISTRY

SYLLABUS

2021-2024

A.D.M COLLEGE FOR WOMEN (AUTONOMOUS), Nagapattinam

UG Programme - B.Sc Biochemistry
(For the candidates admitted from 2020 – 2021 onwards)

Bloom's Taxonomy Based Assessment Pattern

Knowledge Level

K1 – Acquire/Remember	K2 – Understanding	K3 – Apply	K4 – Analyze	K5 – Evaluate	K6 – Create

Part I, II and III

Theory (External + Internal = 75 + 25 = 100 marks)

External/Internal					
Knowledge Level	**Section**	**Marks**	**Hrs.**	**Total**	**Passing Mark**
K1-K3	A (Answer all)	10 ×2 = 20	3	75	38
K3-K6	B (Either or pattern)	5 × 5 = 25			
K3-K6	C (Answer 3 out of 5)	3 × 10 = 30			

DEPARTMENT OF BIOCHEMISTRY

(for the candidates admitted from the academic year 2021-2022)

Programme Educational Objectives (PEO)

PEO 1:	To build a strong foundation in bio molecules, cell biology and biotechnology.
PEO 2:	To prepare students for career options in hospital, clinical laboratory and related fields.
PEO 3:	To equip students with practical skill, interpersonal skill and analytical skill.
PEO 4:	To prepare students to enter Masters Programme M.Sc and pursue professional programmes like nutrition and dietics, Bioinformatics etc...
PEO 5:	To develop Laboratory skills in students.

Programme Outcomes (POs)

On completion of the course the learner will be able to

PO 1:	Students acquired necessary knowledge and skills to undertake a career in research either industry.
PO 2:	Integrate and apply the techniques Analytical Biochemistry, Clinical Biochemistry, Molecular Biology and Basics in Bioinformatics
PO 3:	Handling microbial, cellular and biochemical systems.
PO 4:	Facilitate placement in various clinical laboratories and biological research.
PO 5:	Contribution to the betterment of the society by inculcating expertise in health sector.

Programme Specific Outcomes(PSO)

On completion of the course the learner will be able

PSO 1:	An ability to acquire in-depth theoretical and practical knowledge of Biochemistry and the ability to apply the acquired knowledge to provide cost efficient solutions in Biochemistry.
PSO 2:	An ability to properly understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by human kind.
PSO 3:	To apply contextual knowledge and modern tools of biochemical research for solving problems.
PSO 4:	To make them able to express ideas persuasively in written and oral form to develop their leadership qualities.
PSO 5:	To demonstrate professional and ethical attitude with enormous responsibility to serve the society.

DEPARTMENT OF BIOCHEMISTRY

COURSE STRUCTURE OF THE UG PROGRAMME - B.Sc. BIOCHEMISTRY

Part	Title of the part	No. of Courses	Hours	Credit
I	LC- Language Course	4	24	12
II	ELC – English Language Course	4	24	12
III	CC- Core Course	13	72	65
	AC –Allied Course	6	28	18
	MBE - Major Based Elective	3	15	15
IV	NME - Non- Major Elective	2	4	4
	SBE - Skill Based Elective	3	6	6
	SSD – Soft Skill Development	1	2	2
	ES - Environmental Studies	1	2	2
	VE - Value Education	1	2	2
V	EA - Extension Activities	0	0	1
	GS - Gender Studies	1	1	1
	Total	**39**	**180**	**140**

* Extra Credit Courses:

- Semester I - First Aid Management I
- Semester II- Nutrition and Dietetics

A.D.M. COLLEGE FOR WOMEN (AUTONOMOUS), NAGAPATTINAM
DEPARTMENT OF BIOCHEMISTRY
B.Sc., BIOCHEMISTRY

Course Structure under CBCS
(for the candidates admitted from the academic year 2021-2022 onwards)

Sem.	Part	Course Code	Course	Ins. Hrs	Credit	Exam Hours	Marks		Total Marks
							CIA	SE	
I	I	LCTA	LC- Language Course Tamil-I	6	3	3	25	75	100
	II	LCEA	ELC – English Language Course English-I	6	3	3	25	75	100
	III	BUA	CC- Core Course I Biomolecules	6	6	3	25	75	100
		BUBY	CC- Core Course II Major Practical-I	3	-	-	-	-	-
		QUA1	AC-Allied Course I Inorganic, Organic and Physical Chemistry-I	4	3	3	25	75	100
		QUA2Y	AC-Allied Practical I Inorganic, Organic and Physical Chemistry-II(Practical)	3	-	-	-	-	-
	IV	VE	Value Education	2	2	3	25	75	100
			Total	**30**	**17**	*	*	*	**500**
II	I	LCTB	LC- Language Course Tamil-II	6	3	3	25	75	100
	II	LCEB	ELC – English Language Course English-II	6	3	3	25	75	100
	III	BUBY	CC- Core Course II Major Practical-I	3	3	3	40	60	100
		BUC	CC - Core Course III Analytical Techniques	6	6	3	25	75	100
		QUA2Y	AC-Allied Practical I Inorganic, Organic and Physical Chemistry-II(Practical)	3	3	3	40	60	100
		QUA3	AC -Allied Course II Inorganic, Organic and physical chemistry	4	3	3	25	75	100
	IV	ES	Environmental Studies	2	2	3	25	75	100
			Total	**30**	**23**	*	*	*	**700**

Sem.	Part	Course Code	Course	Ins. Hrs	Credit	Exam Hours	Marks		Total Marks
							CIA	SE	
III	I	LCTC	LC- Language Course Tamil III	6	3	3	25	75	100
	II	LCEC	ELC – English Language Course English III	6	3	3	25	75	100
	III	BUD	CC - Core Course IV Human Physiology and Anatomy	6	6	3	25	75	100
		BUFY	CC - Core Course V Major Practical II	3	-	-	-	-	-
		BUA1	AC - Allied Course III Biology I	4	4	3	25	75	100
		BUA3Y	AC -Allied Practical II Microbial and Biological Techniques	3	-	-	-	-	-
	IV	BUE1	NME -Non Major Elective I Women and Health / Health and Disease	2	2	3	25	75	100
			Total	**30**	**18**	*	*	*	**500**
IV	I	LCTD	LC- Language Course Tamil IV	6	3	3	25	75	100
	II	LCED	ELC – English Language Course English IV	6	3	3	25	75	100
	III	BUFY	CC - Core Course V Major Practical II	3	3	3	40	60	100
		BUE	CC – Core Course VI Cell and Molecular Biology	6	5	3	25	75	100
		BUA2	AC - Allied Course IV Biology II	4	2	3	25	75	100
		BUA3Y	AC -Allied Practical II Microbial and Biological Techniques	3	3	3	40	60	100
	IV	BUE2	NME - Non Major Elective II Cosmetology / Hospital Management	2	2	3	25	75	100
		BUS1	SBE – Skill- Based Elective I Herbal Medicine	2	2	3	25	75	100
			Total	**32**	**23**	*	*	*	**800**

Sem.	Part	Course Code	Course	Ins. Hrs	Credit	Exam Hours	Marks		Total Marks
							CIA	SE	
V	III	BUG	CC – Core Course VII Introduction to Enzymology	5	5	3	25	75	100
		BUH	CC- Core Course VIII Bioenergetics and Metabolism	5	7	3	25	75	100
		BUI	CC – Core Course IX Pharmaceutical Biochemistry	6	5	3	25	75	100
		BUJY	CC- Core Course X Major Practical III	3	3	3	40	60	100
		BUE3	MBE –Major Based Elective I Medical Lab Techniques / Endocrinology	5	5	3	25	75	100
	IV	BUS2Y	SBE –Skill Based Elective II Herbal Medicine Practical	2	2	3	40	60	100
		BUS3	SBE – Skill Based Elective III Food and Nutrition	2	2	3	25	75	100
	V	SSD	Soft Skills Development	2	2	3	25	75	100
			Total	**30**	**31**	*	*	*	**800**
VI	III	BUK	CC- Core Course– XI Advanced Clinical Biochemistry	6	6	3	25	75	100
		BUL	CC- Core Course– XII Immunology	6	6	3	25	75	100
		BUMY	CC – Core Course– XIII Major Practical IV	5	4	3	40	60	100
		BUE4	MBE – Major Based Elective II Biotechnology /General Microbiology	5	4	3	25	75	100
		BUE5	MBE – Major Based Elective III Bioinformatics / Genetic Engineering	5	6	3	25	75	100
	V		EA - Extension Activities	-	1	-	-	-	-
		GS	Gender Studies	1	1	3	25	75	100
			Total	**28**	**28**	*	*	*	**600**
			Grand Total	**180**	**140**				**3900**

Semester-I / Core Course-I	**BIOMOLECULES**	**Course Code: BUA**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• To enable the students can get knowledge about structure, classification of carbohydrate, amino acids, lipids &vitamins. • Learn the elements present in biomolecules and difference monomers • Identify their chemical elements of nucleotides. • Learn about saturated and unsaturated fatty acids. • Learn about types and nutritional requirements of Macro minerals and Micro minerals.	
UNIT	**CONTENT**	**HOURS**
I	CARBOHYDRATES:Carbohydrates: Occurrence, Chemical properties, Classification and elucidation. Configuration of Glucose, Fructose. Inter Concersion of sugars, Structure and biological functions of Mono (Triose to xedose), Di, Oligo (Tri,tetra,penta) andpolysaccharides.Homo and Heteroglycans. Reaction based on functional groups: Aldehyde&Ketone.	15
II	**AMINOACIDS&PROTEINS :**Amino acids - Structure. Classification essential and non essential aminoacids & physical, chemical, biological properties Zwitter ions isoelectricpoint.Proteins- Classification, Primary, Secondary, tertiary and Quaternary structure (Haemoglobin and Myoglobin only).Protein in biological properties Denaturation & Renaturation with agents.	15
III	**FATTY ACIDS & LIPIDS** Fattyacids: Definition, classification (saturated & unsaturated & PUFA). Essential and non essential fattyacids- general properties. Lipids: Definition, classification, structure, properties- physical, chemical,	15

	biological properties of lipids. Example (cholesterol & lecithin structure)	
IV	**NUCLEIC ACIDS** Purine and pyrimidine bases, nucleosides, nucleotides. Classification, Structure and Functions of nucleic acids. Types of DNA and RNA (Watson & crick model of DNA), RNA(t RNA, r RNA, mRNA).	15
V	**VITAMINS & MINERALS** Vitamins – Definition, occurrence, Classification, Structure, Nutritional Requirements & deficiency Diseases of fat soluble (A,D,E,K) and water soluble (Vitamin C & Folic acids, cyanocobalamine). Minerals and its biological importance, sources, types and nutritional requirements of Macro minerals and Micro minerals (sodium, potassium, calcium, phosphorous, magnesium, zinc, iron, cobalt)	15
VI	**Biophysical Concepts** Water as biological solvent, Buffers, measurement ofpH, electrodes, Biological relevance of pH, pKa value, analysis of drinking water and pond water, Total dissolved salts (TDS), BOD, COD, soil analysis (texture, organic matter, elements), Electrical conductivity.	-

Text Book

1. Fundamentals of Biochemistry for Medical students – Ambika Shanmugam
2. U.Satyanarayana, "Biochemistry", 4 th edition, 2014.

Reference Books

1. David L nelson Michael M. cox, "Prinicipals of Biochemistry ",Leninger, Nelson cox worth Publishers, 7th edition2013.
2. Neale Ridgway, Roger Mcload, "Biochemistry of lipids ,lipoproteins membrane", Amsterdam Elsevier, 6th edition,2015
3. J.L. Jain, "Fundamentals of Biochemistry", 7th edition,2015.
4. Robert K, "Introductory Experiments on Biomolecules and theirInteractions",2015.
5. WoltersKluwer," Lippincott illustrated reviews biochemistry", 7th edition,2017.

6. Principles of Biochemistry – 7th edition Lehninger, Nelson Cox Macmillan worth Publishers, 2013.

Web-Resources:

https://www.macmillanlearning.com/college/us/product/Lehninger-Principles-of Biochemistry/p/1319228003.

https://topfreebook.com

Course Outcomes

On completion of the Course, Students should be able to

CO 1: This paper trains students to appreciate the salient features of biomolecules the organization of life.

CO 2: It spans over the significance and methodology involved in characterizing major biomolecules.

CO 3: It helps the students in understanding the classification functions and application aspects of biomolecules.

CO 4 : Have knowledge of the structure/conformational freedom of bimolecular, e.g proteins, DNA/RNA, carbohydrates and key metabolites/co-factors, e.g. be able to draw and recognize key structures such as the 20 amino acids 5 and major metabolites.

CO 5: Understand and demonstrate haw the structure of biomolecules determines their chemical properties and reactivity.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	M	M	M	M	S
CO5	S	S	S	S	S	M	M	M	M	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-I & II / Core Course-II	**MAJOR PRACTICAL – I**	**Course Code: BUBY**
Instruction Hours: 3	**Credits: 3**	**Exam Hours: 3**
Internal Marks :40	**External Marks:60**	**Total Marks: 100**

Cognitive Level	**K1 -Recalling** **K2 -Understanding** **K3 -Applying** **K4 - Analyzing** **K5 - Evaluating** **K6 - Creating**	
Course Objectives	• To understand principle and theory. • To understand the calculations of experiment. • To gain hands on preparation of all the solutions • To standardize solutions individually. • To enable the students can get practical knowledge about the qualitative analysis of biomolecule	
UNIT	**CONTENT**	
	I. QUALITATIVE ANALYSIS: **a) Carbohydrates** Glucose Fructose Lactose Sucrose Starch **b) Aminoacids** TryptophanProline Histidine Arginine **c) Lipids** Libermann-Burchard's test, Aromatic Aliphatic test.	
	II. QUANTITATIVE ANALYSIS 1. Estimation of reducing sugar Benedict 's quantitative method	

	2. Estimation of Amino acids by Formal titration. 3. Estimation of amino protein by calorimetric method 4. Estimation of Ascorbic acid by titrametric method using 2,6 dichlorophenol indophenols dye 5. Acid Number 6. Iodine number 7. Saponification number of lipids 8. Estimation of calcium by titrimetric method	

Text Book:

1. Dr. J. Jayaraman, "Manuals in biochemistry" New Age International Publishers, Bangalore,2011.

2. DM Vasudevan, Subir Kumar Das "Practical Textbook Of Biochemistry For Medical Students" 3rd Edition Jaypee Brothers Publisher, 2019.

Reference Books:

1. Practical Biochemistry – Plummer, New Delhi: Tata Mcgraw Hill Publishing Company, 2000.
2. Biochemical methods – S.Sadasivam, V.A Manickam 2 ed New Age International Publishers, 2006.
3. Biochemical Tests – Principles and Protocols.Anil Kumar, Sarika Garg and Neha Garg. Vinod Vasishtha Viva Books Pvt Ltd, 2012.

Web-Resources:

https://www.topfreebooks.org.

https://bookboon.com.

https://www.e-booksdirectory.com

https://ttk.elte.hu/dstore/document/871/book.pdf

Course Outcomes

On completion of the Course, Students should be able to

CO 1: This paper introduces people to chemical reasoning and thinking, encouraging application of chemical rules and logic to problems.

CO 2: Draw molecules and reaction mechanisms; understand experiments aimed at elucidating mechanism.

CO 3: Students understand various identification tests for carbohydrates and amino acids.

CO 4 : Students acquire the skill to distinguish reducing and reducing sugars.

CO 5: Students acquire skill to perform the experiment in the real lab.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	M	M	M	M	S
CO5	S	S	S	S	S	M	M	M	M	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-II / Core Course-III	**ANALYTICAL TECHNIQUES**	**Course Code: BUC**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Create	
Course Objectives	• To enable the Students to have a deep knowledge on the principles and applications of chromatography. • To understand the Students to get on Instrumentation and applications of electrophoresis. • To enable the students understand the Homogenization and cellular fractionation. • To learn about the UV – Vis spectrophotometer. • To understand the measurement of radioactivity GM counter, Scintillation counter and autoradiography	
UNIT	**CONTENT**	**HOURS**
I	**Chromatography:** Definition, Principles, Instrumentation & applications of paper chromatography, Thin layer chromatography, Column chromatography, Gas liquid chromatography, Ion exchange chromatography, High performance liquid chromatography, molecular sieve chromatography and affinity chromatography	18
II	**Electrophoresis:** Definition, Principles, Instrumentation & Applications of paper electrophoresis, agarose gel electrophoresis, PAGE, SDS – PAGE, Immuno electrophoresis, Isoelectro focusing. Factors affecting electrophoretic techniques.	18
III	**Centrifugation:** Homogenization and cellular fractionation.Centrifugation:	18

	Definition Principles RCF, sedimentation velocity and gravitational force and its units. instrumentation and application of analytical – preparatory and ultra Centrifugation. Molecular weight determination of proteins.	
IV	**Spectroscopy:** Colorimetry: Beer Lambert's Law, Light absorption and its transmittance, Absorption Spectroscopy - Principle, instrumentation and applications of colorimetry and UV-Vis spectrophotometer. Emission Spectroscopy–Spectrofluorimeter - Principle, instrumentation and applications. Flame photometry - principle and applications.	18
V	**Radio isotopes:** Definition Radioactive decay: Measurement of radio activity – GM counter, Scintillation counter and autoradiography. Trace and techniques, biological applications of isotopes.	18
VI	**General principles of Biochemical investigation:** *In vivo* and *in vitro* studies - organ and tissue slice techniques, tissue homogenization. Methods of cell disruption, basic principles of cell sorting and counting. Maintenance and preservation of cells.	-

Text Book:

1. Handbook of Analytical Techniques edited by Helmut Gunzler and Alex Williams2001.
2. Chatwal / Anand ,"Instrumental method of chemical analysis",2005

Reference Books:

1. Keith Wilson & John Walker, "Principles and techniques of practical biochemistry", Cambridge University Press, India2005.
2. Shourie and Shilpa S Chapadagaonkar, "Bioanalytical techniques", Abhilasha the energy and resources institute, TERI, India 2015.
3. Ghosal Sabari and Srivastava, "Fundamentals of bio analytical techniques and instrumentation", A.K. PHI Learning Pvt.Ltd.
4. Paviaetal, "Introduction to Spectrosocopy" Brooks/ ColePublishers Co., NewDelhi, India3rd edition.,2000.
5. K.K. Machve, "Basic Instrumentation", Neha Publishers & Distributors, India2010.

Web-Resources:

http://web.uniplovdiv.bg/plamenpenchev/mag/books/anchem/Handbook%20of%20Analytical%20Techniques,%202%20Volume%20Set.pdf

https://www.worldcat.org/title/research-methodology-methods-techniques/oclc/395725716

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Students acquired the various analytical techniques.

CO 2: On completion of this paper, the learner will be able to perform beers law calculations and calorimetry.

CO 3: Describe the principles of thin layer chromatography (TLC) and high performance liquid chromatography (HPLC) Draw a schematic diagram of the instrumentation.

CO 4: Employ the knowledge for the separation of proteins/ polypeptides by selecting appropriate separation techniques, characterize certain functionalities of biomolecules by using spectroscopic techniques.

CO 5: Significantly enhanced Knowledge of methodologist in various laboratory techniques.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	M	S	S	M	M	M

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W-Weakly Correlated

N – No Correlation

Semester-III / Core Course-IV	**HUMAN PHYSIOLOGY AND ANATOMY**	**Course Code: BUD**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students can get knowledge about variousphysiological system and their function in human anatomy. • To learn the function of bodyfluid. • To study the concepts of digestivesystem. • To learn the structure if circulatorysystem. • To acquire knowledge about excretory, Nervous system and reproductivesystem.	
UNIT	**CONTENT**	**HOURS**
I	**BODY FLUIDS:** Extra cellular fluid - plasma - Interstitial and transcellular fluid. Intracellular fluid: Lymph and Blood - composition, functions, osmolarity of the body fluids, ionic composition, electrolytes, body buffers. Blood cells, hemoglobin, haemopoiesis, blood coagulation & bloodgroups.	18
II	**DIGESTIVE SYSTEM:** Introduction to physiology. Anatomy of digestive system salivary, Gastric and bile secretions - composition and functions. Intestinal hormones, movements in Gastro intestinal tract, Secretion, digestion and absorption in the small intestine. Large intestine; Digestion and absorption of carbohydrates, lipids and proteins.	18

III	**CIRCULATION:** Structure of Heart and blood vessels, cardiac cycles, blood pressure, factors affecting Blood pressure electrocardiogram. Respiration: Anatomy and physiology of respiration exchange of gases between lungs and blood, blood and tissues. Role of lungs in acid - base balance.	18
IV	**EXCRETORY AND NERVOUS SYSTEM:** Structure of Kidney, Nephron composition and formation of urine, Renal regulation of acid - base balance. **Muscles :** types of muscles structure, mechanism of muscle contraction. **Nervous system :** structure of brain, neuron, nerve impulse, synapse, cerebrospinal fluid and blood brain barrier.	18
V	**REPRODUCTIVESYSTEM:** General anatomy of the male and female reproductive organs. Testis,ovary, uterus, menstrual cycle, physiological changes. Spermato genesis, ovulation, physiology of pregnancy- metabolic changes duringpregnancy.	18
VI	**BONE**: Bone - Role of calcium, phosphorus, vitamin D and hormones in bone metabolism. Collagen in boneformation.	-

Text Book:

1. Human Physiology,Arumugam,2007.
2. Textbook Of Medical Physiology-3rd Updated Edition Paperback – 29 August2019

Reference Books:

1. Human physiology ,Vol. I & II - C.V. Chatterjee,2000
2. Function of Human body , Guyton A.C., 1996
3. The living body ,Best C.H. TaylorN.B.,2000
4. Human Physiology ,Systemic & applied,Sahalya,2007
5. Book of Basic HumanPhysiology,Dr.H.Singh,2008

6. Animal Physiology, Mohan.P.Arora,2008

Web-Resources:

https://library.palmer.edu/physioweb.

https://openstax.org/details/books/anatomy-and-physiology.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Ensure the students to acquire knowledge on composition and function of body fluid.
CO 2: To understand apply the various concepts of digestivesystem.
CO 3: To understand the anatomy and physiology and cardiovascular and respiratorysystem.
CO 4: To classify different type of muscle and anatomy of excretory and nervous system.
CO 5: To understand the general anatomy and function of the male and female reproductive organs.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	M	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	M	S	M	S	S	S	S	M
CO4	S	S	M	S	M	S	S	S	S	M
CO5	S	S	S	S	M	S	S	M	M	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-III / Allied Course-III	BIOLOGY I	Course Code: BUA1
Instruction Hours: 4	Credits: 4	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the student understand the microscopic techniques. • To determine gram staining identifying bacteria. • To separate the chloroplast pigment by chromatography. • To demonstrate significant cell biological principles, quantitative and analytical approaches. • To enable the student to translate the theoretical foundation in cell biology to be translated into practical understanding.	
UNIT	**CONTENT**	**HOURS**
I	Molecular Biology - Structure of atoms, molecules and chemical bonds. Composition, structure and functions of biomolecules: carbohydrates, proteins, lipids and nucleic acids. Stabilizing interactions: Vanderwaals, electrostatic, hydrogen bonding and hydrophobic interactions.	12
II	Cell Biology – Membrane: structure of membrane, lipid bilayer, osmosis, ion channels, and membrane pumps, active transport, electrical properties ofmembranes.	12
III	Cell Biology – Structure and function of cellular organelles – cell wall, nucleus, mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, chromosomes, chromatin, mitosis and meiosis and cell cycle.	12
IV	Developmental Biology – Animal: Production of gametes, zygote formation, blastula, gastrula and formation of germ layers in animals,	12

	embryogenesis. Programmed cell death, ageing and senescence.	
V	Developmental Biology – Plants: Double fertilization in plants, seed formation, germination, organization of shoot and root apical meristem, shoot and root development, flowering.	12

Text Book

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, P.S.Verma& V.K. Agarwal, S. Chand& Company Ltd, New Delhi, 2004.
2. Essentials of Modern Bology, R.C. Sobti, V.L. Sharma, Ane Books India, 2009.

Reference Books

1. General, organic and Biochemistry, 2nd edition, Ira blei& George Odian, W.H. Freeman Company, New York 2006.
2. Plant Physiology 4th ed, SN Pandey, BK Sinha, Vikas Publishing House, New Delhi, 2009.
3. Essentials of Modern Bology, R.C. Sobti, V.L. Sharma, Ane Books India, 2009.
4. Cell Biology, C.B. Powar, Himalaya Publshing House, 2010.
5. Plant Biochemistry, 4th ed, Hans-walter Heldt, Academic press, Elsevier Publications, 2010.
6. Text Book of Plant Physiology, V. Verma, Ane Books Pvt. Ltd, New Delhi, 2011.
7. Environmental Biology (Principles of Ecology) P.S. Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2012.

Web Resources:

http://www.freebookcentre.net/Biology/Biology-Books-Online.html.

https://brill.com/view/serial/BIOEB.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: To learn the energy and information flow living system.

CO 2: Gain the knowledge in the membrane and properties of membrane.

CO 3: Form and function of cells organelles.

CO 4 : To understand then animal biology.

CO 5: To understand the development of plant biology.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	M	M	S	S	S	S	M
CO5	S	S	S	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-III / Non Major Elective-I	**WOMEN AND HEALTH**	**Course Code: BUE1**
Instruction Hours: 2	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Create	
Course Objectives	• To learn the female reproductive system and diseases. • To understand the vaccines for during pregnancy. • To study of different types of parturition. • To learn the health problem in women. • To enable the students can get knowledge about balanced diet for women.	
UNIT	**CONTENT**	**HOURS**
I	Study of the female reproductive system, female hormones, menarche, menstrual cycle ,menopause, associated problems - premenstrual syndrome, amenorrhoea, dysmenorrhoea, polycystic ovarian diseases (PCOD) and fallopian tube obstruction, nutrition during adolescence.	6
II	Pregnancy, vaccines and diagnosis test during pregnancy, fetal testing – amniocentesis and other tests for genetic abnormalities, genetic counselling complications associated with pregnancy –gestational diabetes, ectopic pregnancy ,miscarriage ,nutrition during pregnancy.	6
III	Parturition –different types, significance of breast feeding, nutrition during lactation, vaccination for infants, contraceptive methods, sexually transmitted diseases.	6
IV	Health problems in women, cancer –breast cancer, cervical cancer ovarian	6

	cancer, diagnosis and treatment. Menopause associated problems-osteoporosis. Hormones replacement therapy.	
V	Balanced diet for women –carbohydrate, lipids, proteins vitamins and minerals - sources and deficiency disorders . Physicals activity – calorie expenditure for various activities, aerobics and yoga**.**	6

Text Book

1. Text Book of Womens, Health Lila A.Wallis,1997
2. Nutrition Science, B.SriLakshmi,2008

Reference Books

1. Essential of food and nutrition,Vol.I andII,Swaminathan.M,2006
2. Foodchemistry,L.G.Meyor
3. FoodScience,Polter
4. Nutrition Science,B.SriLakshmi,2008
5. A text book of Health Worker (ANM),Vol I and II ,A.M.Chacklay.

Web Resources:

https://www.elsevier.com/books/women-and-health/goldman/978-0-12- 288145-9.

https://www.ebooks.com/en-us/subjects/health-fitness-women-s-health- ebooks/401/.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Ensure the students to acquire knowledge on anatomy of female reproductive system and related diseases.

CO 2: To understand the concepts of vaccines and genetic complication during the pregnancy.

CO 3: To understand acquire knowledge on different types of parturition and vaccination for infants.

CO 4 : Ensure the students to understand acquire knowledge on diagnosis and treatment in health problem for women

CO 5: Ensure the students to understand acquire knowledge on balanced diet and physical activity for women

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	S	S
CO2	S	S	S	M	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	M	M	S	S	S	S	S	M
CO5	S	S	S	S	S	S	S	M	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-III / on Major Elective-I	**HEALTH AND DISEASE**	**Course Code:BUE1**
Instruction Hours: 2	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Create	
Course Objectives	• To learn the specimen collection • To understand the concepts of anticoagulants and preservatives during the specimen collection • To understand the biochemistry and disorder of various diseases commonly affecting human being. • To learn about the disorder of kidney, liver and heart. • To learn about the disease of hyper and hypothyroidism.	
UNIT	**CONTENT**	**HOURS**
I	Specimen collection and processing (blood, urine and faces). Anti coagulants and preservatives for blood and urine. A brief review of units and abbreviations used in expressing concentrations, standard solutions and clinical values. Electrolytes and acid base balance. Maintenance of acid base balance by respiratory and renal mechanism. Acidosis and alkalosis.	6
II	Disorders of Carbohydrate metabolism: Diabetes mellitus, glucose tolerance test, sugar levels in blood, renal threshold for glucose, factors influencing blood glucoselevel.	6
III	Disorders of Lipids and Proteins: Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and diseases. Hyperlipidemia, hyperlipoproteinemia, abetalipoproteinemia. Abnormalities in nitrogen	6

	metabolism uremia, hyperuricemia, coma.	
IV	Disorders of liver, kidney and heart: Jaundice, fatty liver, functions of liver and kidney. Diagnostic enzymes – enzymes in health and diseases. Renal calculi, Cardiac arrest and management, atherosclerosis.	6
V	Cancer – properties of cancer cells, etiology of cancer, carcinogenic agents, biochemistry of metastasis, tumor markers. Gall stones, Prenatal diagnosis and postnatal diagnosis, duodenal ulcer, diseases of hyper and hypothyroidism.	6

Text Book:

1. TextbookofMedicalBiochemistry,Chatterjea,MNandRanaShinde.JaypeeBrothers, New Delhi, 7th edition, 2007.
2. Biochemistry with clinical Correlation, T.M. Devlin, 7th edition, Wiley Publications 2010.

Reference Book:

1. Textbook of Medical Biochemistry, Chatterjea, MN and Rana Shinde. Jaypee Brothers, New Delhi, 7th edition,2007.
2. The Biochemistry of Clinical Medicine, William S. Hoffman, Year Book Medical publishers, 1964.
3. Clinical Medicine (A Textbook of Clinical Methods and Laboratory Investigations), KV Krishna Das (Editor in Chief), 2013, Jaypee Brothers Meical publishers, New Delhi.
4. Clinical Chemistry Interpretation and techniques, 4th edition, A.Kaplan, R. Jack, K.E. Opheim, B. Toivola, A.W. Lyon, Williams and Wilkins, USA,1995.
5. Clinical Chemistry in Diagnosis and treatment, J.F. Zilva and P.R. Pannall the d., G Publishing pvt limited,1984.
6. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, Carl A. Burtis , Edward. Ashwood and David E. Bruns, Elsevier2012.
7. Biochemistry with clinical Correlation, T.M. Devlin, 7th edition, Wiley Publications2010.

Web Resources:

https://www.saraspublication.com/books/public-health-and-hygiene/.

https://www.mlanet.org/page/top-health-websites.

Course Outcomes

CO1: Explain at an introductory level, biological processes essential for the maintenance of health and the mechanisms underlying the cause, consequence and treatment of a range of human diseases.

CO2: Evaluate and interpret case study information to understand clinical signs and symptoms.

CO3: Discuss gaps in our knowledge of health and disease and gain insight into the contemporary process of medical science research.

CO4: Locate relevant information using on-line search tools and databases.

CO5: Evaluate the quality and rigor of evidence presented to support an idea.

On completion of the Course, Students should be able to

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	M
CO5	S	S	S	S	S	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-IV / Core Course-VI	**CELL AND MOLECULAR BIOLOGY**	**Course Code: BUE**
Instruction Hours: 6	**Credits: 5**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Create	
Course Objectives	• To learn the female reproductive system and diseases. • To understand the vaccines for during pregnancy. • To study of different types of parturition. • To learn the health problem in women. • To enable the students can get knowledge about balanced diet for women.	
UNIT	**CONTENT**	**HOURS**
I	**STRUCTURE OF THE CELL:** An Overview of cells: Origin and evolution of cells. Cell theory, Classification of cells – Prokaryotic and Eukaryotic cells. Comparison of prokaryotic and eukaryotic cells. Cell Membrane – Fluid mosaic model of membrane structure and its composition. signal transduction system-types of transport across membrane receptor GPCR, Second messenger – CAMP,IP3,Ca+.cell division and Cell cycle.	12
II	**CELL ORGANELLES:** Structure and functions of plant and animal cell organelles-Endoplasmic recticulam, Golgi apparatus Lysosomes, Mitochondria, Ribosomes, Chloroplast, centrosomes, Vacuoles, Nucleus and nucleoli. Chromatin structure and function.	12
III	**REPLICATION**	12

	Evidences of DNA as genetic material. Types of replication-Mechanism of replication-Enzymes and accessory proteins involved in replication, DNA repair mechanism.	
IV	**TRANSCRIPTION** Prokaryotic and Eukaryotic transcription- Mechanism of initiation, elongation and termination of transcription. Post transcriptional modification. Inhibitors of transcription - Jacob and Monad concept- Regulation of transcription.	12
V	**TRANSLATION** Protein synthesis in prokaryotic and eukaryotes- activation, initiation, elongation and termination of translation, post translational modification. Genetic code and its characteristic features.	12
VI	**TOOL OF CELL BIOLOGY:** Sample preparation and staining techniques for different kinds of microscopy. Basic principles of identification of sub cellular organelles.	-

Text Book:

1. Cell and Molecular biology ,Prakash.s.Lohar,2009
2. Freifelder's Essentials of Molecular biology ,George,2008

Reference Books:

1. Molecular Biology, Freifelder,2000
2. Essentials of Molecular biology, Freifelder,2006
3. Molecular Biology-A.V.S.S.SAMBAMUTY,2008
4. Cell Biology,Dr.V.K.chhazllani-2008
5. Cell and Molecular biology ,Prakash.s.Lohar,2009
6. Freifelder's Essentials of Molecular biology,George,2008.

Web Resources:

https://www.pdfdrive.com/cell-biology-books.html.
https://books.google.co.in/books/about/Cell_And_Molecular_Biology.html?id=iXeQ1Bi9P7cC.

Course Outcomes

On completion of the Course, Students should be able to

CO1: To understand the cell and types of signal transduction system.

CO2: Ensure the students to understand structure and function of plant and animal cell organelles.

CO3: To study the basic types of replication and replication mechanism.

CO4: To understand the different stage of mechanism if transcription.

CO5: Ensure the students to understand acquire knowledge on prokaryotic and eukaryotic translation.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	M	M	S	S	S	S	S
CO3	S	S	S	M	M	S	S	S	S	M
CO4	S	S	S	M	M	S	S	S	S	M
CO5	S	S	S	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-III & IV / Core Course-V	**MAJOR PRACTICAL II**	**Course Code: BUFY**
Instruction Hours: 3	**Credits: 3**	**Exam Hours: 3**
Internal Marks :40	**External Marks:60**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To understand preparation of buffer. • To estimate the DNA and RNA. • To learn about the separation procedure. • Isolation of DNA methods. • Demonstrate of electrophoresis	
UNIT	**CONTENT**	**HOURS**
	1. Preparation of phosphate, citrate buffers, and measurement of Ph 2. Estimation of DNA by Diphenylamine methods 3. Estimation of RNA by Orcinol method 4. Separation of amino acid by paper chromatography 5. Separation of sugar by paper chromatography 6. Separation of amino acid by thin layer chromatography 7. Mitosis (onion root tip) 8. Isolation of DNA from Animal tissue 9. Demonstration of Agarose gel electrophoresis 10. Titration curve of an amino acid.	

Text Book

1. Dr. J. Jayaraman, "Manuals in biochemistry" New Age International Publishers, Bangalore, 2011.
2. DM Vasudevan, Subir Kumar Das "Practical Textbook Of Biochemistry For Medical Students" 3rd Edition Jaypee Brothers Publisher, 2019.

Reference Books

1. Manuals in Biochemistry ,Dr. J.Jayaraman , 1996
2. Manuals in Biochemistry ,Dr.S.Ramakrishnan,1996
3. Practical Biochemistry, Plummer ,2007
4. Introductory practical biochemistry , S.K. Sawhney,2001
5. Practical biochemistry, Varley,2008.

Web Resources:

1. https://iubmb.onlinelibrary.wiley.com/doi/pdf/10.1016/0307-4412%2875%2990076-X.
2. https://ttk.elte.hu/dstore/document/871/book.pdf.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: The student gets knowledge about the principles in various analytical techniques.
CO 2: To understand the different types of buffer preparation and measurement of pH.
CO 3: To estimate the RNA and DNA used in specific methods.
CO 4 : To learn the different types chromatography in separation of amino acid and sugar.
CO 5: To understand the isolating the DNA from animal tissue.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	M	S	M	S	S	S	S	M
CO5	S	S	S	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-IV / Allied Course-IV	**BIOLOGY II**	**Course Code: BUA2**
Instruction Hours: 3	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Create	
Course Objectives	• To understand the taxonomy. • To learn about the inheritance biology. • To introduce the importance of plant physiology. • To acquire knowledge about environmental biology. • To learn about the evolutionary biology.	
UNIT	**CONTENT**	**HOURS**
I	Taxonomy – Concepts of species of hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy, classification of plants, animals and microorganisms.	9
II	Inheritance Biology – Mendelian principle, allele, multiple allele, pseudo allele, co dominance, incomplete dominance, pleiotropy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.	9
III	Plant Physiology – Photosynthesis, C3, C4 pathway, photorespiration, nitrate and ammonia assimilation, plant hormones, Phytochemicals; alkaloids, flavonoids, saponins, quinones, terpenes , phenols, nitrogenous compounds - functions.	9
IV	Environmental Biology – Physical environment, biotic and abiotic,	9

	Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement energy flow and mineral cycling in ecosystem.Terrestrial and aquaticecosystem.	
V	Evolutionary Biology – Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Spontaneity of mutations; the evolutionary synthesis. The evolutionary time scale; Eras, periods and epoch; Origins of unicellular and multi cellular organisms; Hardy – Weinberglaw.	9

Text Book:

1. Plant Biochemistry, 4th ed, Hans-walterHeldt, Academic press, Elsevier Publications, 2010.
2. CellBiology,Genetics,MolecularBiology,EvolutionandEcology,P.S.Verma&V.K. Agarwal, S. Chand& Company Ltd, New Delhi, 2004

Reference Books:

1. Molecular Biology of the cell- 4rd ed. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter.New York: Garland Science; 2002
2. General, organic and Biochemistry, 2nd edition, Ira blei& George Odian, W.H.Freeman Company, NewYork 2006.
3. Plant Physiology 4th ed, SN Pandey, BK Sinha, Vikas Publishing House, New Delhi, 2009.
4. Essentials of Modern Bology, R.C. Sobti, V.L. Sharma, Ane Books India,2009.
5. Cell Biology, C.B. Powar, Himalaya Publshing House,2010.
6. Environmental Biology (Principles of Ecology) P.S. Verma& V.K. Agarwal, S. Chand& Company Ltd, New Delhi,2012.
7. Text Book of Plant Physiology, V. Verma, Ane Books Pvt Ltd, New Delhi,2011.

Web Resources:

https://open.umn.edu/opentextbooks/textbooks/167.

https://courses.lumenlearning.com/suny-osbiology2e/.

Course Outcomes

On completion of the Course, Students should be able to

CO1: To ensure the students basic concepts and methods of taxonomy.
CO2: To understand the principle of mandolin and inheritance of mitochondrial genes.
CO3: To study about the pathway of plant physiology and photochemical of plants.
CO4: To ensure the students understand the physical environmental of biology.
CO5: To study about the basic concepts of evolutionary biology.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	M	S	S	S	S	M
CO2	S	S	S	M	S	S	S	S	M	S
CO3	S	S	S	M	M	S	S	S	S	M
CO4	S	S	S	M	M	S	S	S	M	M
CO5	S	S	S	S	S	S	S	M	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-III & IV / Allied Practical-II	**MICROBIAL AND BIOLOGICAL TECHNIQUES**	**Course Code: BUA3Y**
Instruction Hours: 3	**Credits: 3**	**Exam Hours: 3**
Internal Marks :40	**External Marks:60**	**Total Marks: 100**

Course Objectives

- To enable the student understand the microscopic techniques.
- To determine gram staining identifying bacteria.
- To separate the chloroplast pigment by chromatography.
- To demonstrate significant cell biological principles, quantitative and analytical approaches.
- To enable the student to translate the theoretical foundation in cell biology to be translated into practical understanding

LIST OF PRACTICALS

1. To learn use of microscope, principle of fixation and staining.
2. Study of various plant cell types.
3. To carryout gram staining for identifying bacteria.
4. To prepare squash mounts of onion root tips to study mitosis.
5. To study meiosis through permanent slides.
6. Separation of chloroplast pigments by paper chromatography.
7. To study the cytochemical distribution of nucleic acids and mucopoly saccharides within cells/tissues from permanent slides.
8. To raise the culture of E.coli and estimate the culture density by turbidity method. Draw a growth curve from the data.
9. Observation of various stages of chick embryo.
10. Measurement of Physico – Chemical parameters in aquatic environment.

A. Dissolved Oxygen

B. Salinity

C. pH (Using pH paper (or) pH meter or Lovid bond Comparator). Free Carbon-di -oxide, carbonates and bicarbonates

Text Book:

1. Practical Biology 5th Edition For Advanced Level, Medical and Intermediate Students Author: C. J. Wallis eBook ISBN: 9781483222356 Imprint: Butterworth-Heinemann Published Date: 1st January 1966.

Reference Books:

1. Biology, 8th edition, Campbell, N.A. and Reece, J. B. Pearson Benjamin Cummings, San Francisco (2008).
2. Biology 7th edition, Raven, P.H et al Tata McGraw Hill Publications, New Delhi (2006).
3. Introduction to Genetic Analysis, 9th edition, Griffiths, A.J.F, W.H. Freeman & Co. NY (2008).
4. Introductory Microbiology (Bell and Howell Co, London), Ross, F.C. (1986).
5. Practical Cytology, Taylor, R.G.W, Academic Press, London (2005).

Web Resources:

https://www.researchgate.net/publication/334107842_Practical_lab_manual_for_microbiology_and_plant_pathology.

http://www.scientificpub.com/upload/pdf/465.pdf

Course Outcomes

On completion of the Course, Students should be able to

CO1: To determine the various type of techniques microscopic and gram staining.

CO2: To estimate the various plant cell type and onion root mitosis.

CO3: To improve the culture medium identification.

CO4: Students will be able to observe and correctly identify different cell types, cellular structure using different microscopic techniques

CO5: Students will able to differentiae the cells of various living organisms and get awareness of physiological processes of cell e.g. cell divisions

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	M	S	S	S	S	S	S	M
CO5	S	S	S	S	S	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-IV / Skill Based Elective -I	**HERBAL MEDICINE**	**Course Code: BUS1**
Instruction Hours: 2	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To learn the history of herbal medicine. • To understand the source of herbal materials. • To learn the drug yielding. • To understand the physical and chemical constants. • To learn the plant morphology.	
UNIT	**CONTENT**	**HOURS**
I	Definition, Brief history, scope and application of herbal medicine. Study of various systems of drugs of plant origin in Allopathy, Ayurveda, Unani, Siddha, Homeopathy and Aromapathy.	6
II	Source of herbal raw materials, identification, collection and processing of herbal drugs and authentication.	6
III	Study of selected drug yielding microbial and groups (With reference to drug only). Actinomycetes, Fungi- Actinomycetes, gymnosperms, algae, Lichens and Bryophytes.	6
IV	Determination of physical and chemical constants such as extractive values, moisture content, volatile oil content, ash values and bitterness value.	6
V	Plant morphology –Botanical description of various plants parts used as drugs such as root, Rhizome, stolon, bulb, bark, leaf, flower, fruits, and seed.biological importance of phytochemicals.	6

Text Book:

1. V. Kumaresan, "Herbal Biotechnology and Pharmacognosy" Saraspublications.
2. Joseph E. Pizzorno and Michael T. Murray "Textbook of Natural Medicine"Fifth Edition 2020

Reference Books:

1. India medical plants by orientLongman-1996
2. Ayuruvedic materials media for domestic use by ThohomasJ.Graham-2006
3. Herbal medicines by Dr.M.D .ZulfeequarAlam-2008.
4. Medicinal Plants,A.K.shrivastava,2010.
5. Pharmacognosy,C.KKokate, A.P.Purohit andS.B.Gokhale-2007

Web Resources:

1. https://www.kobo.com/us/en/ebook/fundamentals-of-herbal-medicine-3.
2. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine- natural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu.

Course Outcomes

On completion of the course the learner will be able

CO1: To ensure the students scope and application of herbal medicine.
CO2: To understand the raw materials of herbal medicine.
CO3: To study about the drug yielding in fungi and algae.
CO4: To understand the determination of physical and chemical constants.
CO5: To study about the botanical description of various plants.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-IV / Non Major Elective-II	**COSMETOLOGY**	**Course Code: BUE2**
Instruction Hours: 2	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To learn the scope of beauty culture and healthcare. • To understand the able to perform skills. • To introduce the hair analysis. • To acquire knowledge about cosmetic allergy. • To learn about the health care.	
UNIT	**CONTENT**	**HOURS**
I	Scope of beauty culture and health care. Career opportunity in beauty culture, Hotels and cosmetics industry.	6
II	Manicure, pedicure and basic facials, electrology. Professional ethics and Communication skills. Home care recipes for skin and hair.	6
III	Factors influencing hair loss, hair analysis and treatments, haircuts, coloring and dyeing, hair rebonding, transplantation, body and facial hair removals.	6
IV	Definition of Cosmetology, Cosmetics allergy, skin analysis and care of various types of skin, body and nail art.	6
V	Definition of physical and mental health. Social health and beauty with respect to care. Balanced diet for better beauty and health care. Sources and role of natural Antioxidant.	6

Text Book:

1. Martin.M.Rieger "Harry'scosmeticology",2009
2. Sonia Tekchandani "Study of Clinical Cosmetology– 2", 2017

Reference Books:

1. Mythil's beautycare.
2. Harry'scosmotelogy
3. Anatomy, physiology and health education by Dr.Murugesh (Sathyapublisher)
4. Meesa's beauty careseries Beauty Culture-H.EllenBrowing (KessingerPublications)
5. Beauty Culture-A Practical Handbook on the Care of the Person- William.A.Woodbury.

Web Resources:

https://www.pdfdrive.com/cosmetology-books.html.

https://www.pdfdrive.com/cosmetology-e57742835.html.

Course Outcomes

On completion of the Course, Students should be able to

CO1: To ensure the students basic concepts of beauty culture and health care.
CO2: To understand the skill in the areas of skin, make up, manicuring.
CO3: To study about the hair analysis such as hair cutting, coloring, styling.
CO4: To understand the cosmetic allergy for skin ,hair and nail
CO5: To ensure the student understand the physical, mental and health care

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	M	S	M	S	S	S	S	M
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-IV / Non Major Elective-II	**HOSPITAL MANAGEMENT**	**Course Code:BUE2**
Instruction Hours: 2	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• Identify the main components and issues of the organization, financing and delivery of health services and public health systems. • Describe the legal and ethical bases for public health and health services. • Methods of ensuring community health safety and preparedness. • Discuss the policy process for improving the health status of populations. • Apply the principles of program planning, development, budgeting, management and Evaluation in organizational and community initiatives	
UNIT	**CONTENT**	**HOURS**
I	**Introduction to Hospital management**: Eligibility and personal skills required for Hospital management. Job opportunities in Hospital management. Important hospital management Institutes in India and around the World.	6
II	**Hospital management system:** Benefits and Modules of Hospital management systems. Interfacing of analyzer. Pathology lab management. Radiology, Blood Bank, Pharmacology, management software's.	6
III	**Health Care Services:** Health and Hospitals Services, Classification and Characteristics of Service Organizations, Healthcare Revolution, Dimensions of Health, Indicators of Health- Composition of Health Sector, Types of Care, Pyramidal Structure of Health Services, Hospitals, Types of Hospitals and Role of Hospital in Healthcare.	6
IV	**Health care Facilities:** Functioning of modern hospitals &	6

	changing need of patients Hospitality in Hospital Care, Invasive and non-invasive diagnostic facilities in modern hospital Care offered in Specialty and Super specialty Hospitals.	
V	**Health and Management:** Current Issues in Healthcare Accreditation- Tele medicine-Health Tourism-Health Insurance and Managed Care- Disaster Management-Hospital Wastes Management.	6

Text Book:

1. William A. Reinke - Health Planning For Effective Management -, Oxford University Press - 1988.
2. Peter Berman - Health Sector Reform in Developing Countries - Harvard University Press,1995.

Reference Books:

1. Grant's Method of Anatomy: A Clinical Problem-solving Approach (BI Waverly Pvt. Ltd., New Delhi) John V. Basmajian and Charles E. Slonecker, ISBN 81- 7431-033- 9, 1989.
2. Anatomy and Physiology for Nurses by, Watson, Roger, ISBN 9780702043581, 2013.
3. Textbook of Preventive and Social Medicine (M/S Banarsidas Bhanot Elaine La Monica, J.E. Park and K. Park, Management in Health Care (Macmillan Press Ltd, London)2011.
4. Principles of Hospital Administration and Planning (Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi), B.M. Sakharkar,2009.
5. HospitalAdministration(JaypeeBrothersMedicalPublishersPvt.Ltd.,NewDelhi),C.M. Francis and et al., 2004.
6. Management Process in Health Care (Voluntary Health Association of India, S. Srinivasan (ed.), New Delhi),1992.

Web Resources:

https://www.academia.edu/38166165/Healthcare_and_Hospital_Management_Edited_book_Excel
https://www.ebooks.com/en-us/book/1908583/textbook-of-hospital- administration/sonu-dr-goel/.

Course Outcomes

On completion of the Course, Students should be able to

CO1: Understanding about reinsurance and its types

CO2: To know about the basic principles of underwriting knowledge about disaster and its types.

CO3: To familiarize the students in disaster preparedness, planning, drill, committee in hospitals.

CO4: Triage area behind emergency department.

CO5: Understanding about health and management

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	M	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	S	M	S	S	S	S	M
CO5	S	S	M	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Core Course-VII	INTRODUCTION TO ENZYMOLOGY	Course Code: BUG
Instruction Hours: 5	Credits: 5	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students can get knowledge about the classification of enzymes • To study the Isolation and purification of enzymes • To understand the enzymes in lock and key hypothesis • To know about the concept of enzymes involved in pharmaceutical of medicine • To learn about the application of enzyme in food.	
UNIT	**CONTENT**	**HOURS**
I	**CLASSIFICATION, PROPERTIES OF ENZYME:** Definition, Nomenclature and classification of enzymes, properties and enzymes as biological catalyst. Specificity of enzymes, assay of enzymes. Structure and functions of coenzymes. Units of enzyme activity turn over number.	15
II	**SEPARATION METHODS:** Isolation and purification of enzymes. Classical Methods of purification and crystallization. Separation procedures based on molecular size, solubility difference and electric charge and selection adsorption. Criteria of purity.	15
III	**ENZYME ACTION:** Mechanism of enzyme action - active site definition, lock and key hypothesis, induced fit hypothesis, mechanism of enzyme catalysis, enzyme substrate complex formation, mechanism of bisubstrate reactions, allosteric enzymes, feed back inhibition.	15
IV	**ENZYME KINETICS:**	15

	Factors influencing enzyme activity, derivation of Michalis - Menton equation. Line weaver - Burk plot, activators, inhibitor kinetics (competitive, un and non - competitive)	
V	**APPLICATIONS OF ENZYMES:** Enzymes of clinical importance, application of enzyme in food, pharmaceuticals and medicine. Immobilized enzymes-principals and application industrial application of enzymes.	15
VI	**USES OF ENZYMES IN ANALYSIS**: Enzymes as Biosensors – Calorimetric biosensors, Potentiometeric biosensors, Amperometric biosensors, Optical biosensors and immunosensors. It's Principle, technique, and examples.	-

Text Book:

1. Harper's review of Biochemistry, David W.Martin,2002.
2. Principle of bio - chemistry, Lehniger,2004

Reference Books:

1. Harper's review of Biochemistry, David W.Martin,2002.
2. Principle of bio - chemistry, Lehniger,2004
3. Biochemistry, Stryer,2000.
4. Biochemistry, Voet & Voet,19980.
5. Fundamentals of Enzymology, Nicholas C. Prince,2002.
6. Enzymes, Palmer,2004.

Web Resources:

https://www.sciencedirect.com/bookseries/methods-in-enzymology/volumes

Course Outcomes

On completion of the Course, Students should be able to

CO1: Plan and execute an enzyme assay
CO2: Analyze enzyme kinetic data
CO3: Analyze kinetic inhibition data and to determine the mechanism of inhibition
CO4: Perform library research on a specific enzyme topic
CO5: To study about application of enzyme in different industries.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Core Course-VIII	BIOENERGETICS AND METABOLISM	Course Code: BUH
Instruction Hours: 5	Credits: 7	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the differences between anabolic and catabolic processes in metabolism • Use knowledge mechanism to follow metabolic pathways. • Understand the fundamentals of cellular metabolism of carbohydrates, protein, lipids, porphyrins, amino acids and nucleic acids and their association with various metabolic diseases. • Be able to describe how anabolic and catabolic processes are coupled to energetic from ATP hydrolysis. • Understand redox and electron transfer reactions in biological systems	
UNIT	**CONTENT**	**HOURS**
I	Bioenergetics: Free energy and entropy changes in biological system, coupling of endergonic and exergonic processes. High energy phosphate compounds – Structure and importance of ATP. Biological oxidation – Enzymes involved in oxidation and reduction – oxidases, dehydrogenases, hydroperoxidase and oxygenases. Cytochrome P450 monooxygenae system.	15
II	Mechanism of oxidative phosphorylation – chemiosmotic theory, ATPases. Oxidative Phosphorylation – uncouplers, inhibitors, ionophores. Inhibitors of ETC. Malate and glycerophosphates shuttles.	15
III	Carbohydrate metabolism: Glycolysis and its energetics. Gluconeogenesis, oxidation of pyruvate to acetyl coA, TCA cycle and its energetic – anaplerotic reations: Hexose monophosphate pathway, glycogenesis and glycogenolysis, glucuronic acid cycle: glyoxalate cycle:	15

	metabolism of galactose and fructose.	
IV	Lipid metabolism: Biosynthesis of fatty acids – biosynthesis and catabolism of triglycerides, phospholipids and glycolipids. Oxidation of fatty acids – albha, beta and gamma oxidation: Cholesterol - synthesis and degradation. ketogenesis: Plasma Lipoproteins.	15
V	Protein, Nucleic acid and Porphyrins metabolism: catabolism of amino acids – Deamination, decarboxylation, transamination – Glycogenic and ketogenic amino acids, urea – biosynthesis. Metabolism of purine and pyrimidine nucleotides. Biosynthesis and degradation of porphyrins,Heme.	15
VI	Components of Electron Transport chain and the sequence of electron transport. Mechanism of ATP synthesis; Oxidative phosphorylation – the chemiosmotic theory. Mitochondrial transport systems, ATP/ADP exchange, malate/glycerol phosphate shuttle.	-

Text Book:

1. Principles of Biochemistry – 7th edition, Lehninger, Nelson & CoX, Macmillanworth Publishers,2013
2. Biochemistry 29th edition Robert Harper's. Mcgraw, Hill,2012

Reference Books:

1. Principles of Biochemistry – 7th edition, Lehninger, Nelson & CoX, Macmillan worth Publishers,2013
2. Biochemistry 29th edition Robert Harper's. Mcgraw,Hill,2012
3. Biochemistry,5th edition, Stryer W. H. Freeman. Donald Voet, J.G. Voet, John Wiley, JOHNWIVP & Publisher Kayepace,2005
4. General Biochemistry - Weil (WileyEastern,India)
5. Essentials of Biochemistry – A.L. jain. 2nd edition. S. ChandPublications,2004.
6. Primer for the Exercise and Nutrition Sciences: Thermodynamics, Bioenergetics, metabolism, Christopher B.Scott.2010
7. Bioenergetics (Biochemistry Research Trends), Jeffrey W.Berkin2011

8. Bioenergetics: Energy Conservation and conversion (Results and Problems in cell Differebtation), GunterSchafer,2008.

Web Resources:

https://www.pdfdrive.com/bioenergetics-and-metabolism-d38219817.html

https://library.um.edu.mo/ebooks/b28050757.pdf

Course Outcomes

On completion of the Course, Students should be able to

CO1: Analyse the structure of amino acids, proteins, enzymes, chemical messengers, carbohydrates, lipids and nucleic acids.

CO2: Analyse the function of the above listed biomolecules

CO3: Analyze biochemical energy is generated in the cells using principles of thermodynamics (free energy, enthalpy). Write coupled reactions to show how an endergonic reaction can occur by coupling it with a very exergonic reaction.

CO4: Perform library research on a specific enzyme topic

CO5: To study about application of enzyme in different industries.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Core Course-IX	**PHARMACEUTICAL BIOCHEMISTRY**	**Course Code: BUI**
Instruction Hours: 6	**Credits: 5**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students understanding the classification, metabolism, Chemotherapeutic effect, Toxic effect of various drugs. • To understands drug distribution, absorption, elimination of drug. • To understand the chemical pathway of phase I and phase II reaction. • To enable the students understanding antibiotics. • To know about anesthetics.	
UNIT	**CONTENT**	**HOURS**
I	**CLASSIFICATION AND DISTRIBUTION OF DRUGS:** Classification of drugs Based on sources, mode of administration, site of action absorption of drugs. Drugs distribution and elimination role of kidney in elimination.	18
II	**DRUG METABOLISM:** Chemical pathway of drug metabolism-phase I and phase II reactions, role of cytochrome, non microsomal reactions of drug metabolism, drug metabolicenzymes.	18
III	**CHEMOTHERAPY:** Biochemical mode of action of antibiotics- penicillin and chloramphenacol, action of alkaloids, antiviral and antimalerial substances, biochemical mechanism of drug resistance.	18

IV	**TOXICOLOGY:** Adverse responses, side effects of drugs; allergy, drug intolerance, drug addiction, drug abuses and their biological effects.	18
V	**ANAESTHETICS AND ORGANIC PHARMACEUTICAL AIDS:** Anaesthetics: General, local and gaseous anaethetics- ether, vinyl ether, halogenated hydrocarbon like chloroform, cocaine, cyclopropane and nitrous oxide; intravenous anaesthetics- thiopental sodium, ketamine; antiseptic and disinfectants- phenols and related compounds	18
VI	**DRUG ACTION AND SIDE EFFECTS:** Significance of drug metabolism and biochemical mode of action of antibiotics and site of action of absorption of drug, adverse response and side effect of the drugs.	-

Text Book:

1. Pharmacology,N.Murugesh,1995.
2. Biochemical basis ofNeuroPharmacology,Cooper2002

Reference Books:

1. Pharmacology,N.Murugesh,1995.
2. Biochemical basis of NeuroPharmacology,Cooper2002.
3. Pharmaceuticalchemistry,chatwal,1950.
4. Drug action in central nervous system,Carvey,2002.
5. Toxicology, M.A.Subramanian,2000.

Web Resources:

https://content.kopykitab.com/eReader.html

https://www.schandpublishing.com/books/higher-education/medical/pharmaceutical-biochemistry/9788121942485/#.X-mTxtIzaM8

https://pharmamedinfo.blogspot.com/2018/05/textbook-of-medical-biochemistry-by.html

Course Outcomes

On completion of the Course, Students should be able to

CO1: The history of pharmacy, development of pharmacy profession and industry in India.

CO2: Various routes of drug administration, concept of dosage forms, unit operations involved in preparation of these dosage forms.

CO3: Alternative system of medicines

CO4: The factors which influence the design of pharmaceutical dosage forms.

CO5: Summarize the factors influencing formulation of various dosage form like solution.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Core Course-X	**MAJOR PRACTICAL III**	**Course Code: BUJY**
Instruction Hours: 3	**Credits: 3**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Course Objectives

- To enable the students can get the practical knowledge about the moisture content, ash. Content, analysis of micro nutrient and enzymes in food sample by specific method.
- To understand the experiments of Carbohydrate, Protein, Fat content in food materials.
- To enable the iron, phosphorous experiments.
- To study to calcium in milk.
- To determine the pH, salivary amylase.

LIST OF PRACTICALS

1. Moisture content of food materials
2. Ash content of food materials
3. Estimation of carbohydrate by Anthrone method
4. Estimation of protein by Lowry's Method
5. Estimation of Fat content in food materials
6. Estimation of iron – Dipyridyl Method.
7. Estimation of phosphorous- Sub marrow Method.
8. Estimation of calcium in Milk
9. Determination of specific activity, effect of temperature and pH of alkaline phosphates activity.

10.Determination of specific activity, effect of temperature and pH of Salivary amylase activity.

Text Book:

1. Manual in Biochemistry, Dr. Ramakrishnan,1996
2. Practical Biochemistry, Plummer,2000

Reference Books:

1. Manual in Biochemistry, Dr. Ramakrishnan,1996
2. Introductory practical biochemistry, S.K. Sawhney,2001
3. Text books of clinical chemistry, Tietz,1975.

Web Resources:

https://play.google.com/store/books/details/Soundravally_Rajendiran_Biochemistry_Practical_Man?id=MpWDDwAAQBAJ.

https://www.barnesandnoble.com/w/biochemistry-practical-manual-e-book- soundravally-rajendiran/1130203513.

https://ttk.elte.hu/dstore/document/871/book.pdf**.**

Course Outcomes

On completion of the Course, Students should be able to

CO1: Determination of ash and moisture content of food materials.
CO2: Determine carbohydrate, protein and fat content analysis
CO3: Estimation of iron and phosphorous in standard procedure.
CO4: Estimation of calcium in milk.
CO5: Doing estimation of specific activity pH of salivary amylase and alkaline phosphates.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Major Based Elective-I	**MEDICAL LAB TECHNIQUES**	**Course Code: BUE3**
Instruction Hours: 5	**Credits: 5**	**Exam Hours: 3**
Internal Marks:25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students understanding the various diagnostics method for identifying the disease. • The role of medical laboratory technology in the healthcare industry. • Communication in the Laboratory setting. • Accuracy, attention to detail, organization and quality control. • Safe and accurate performance of laboratory procedures. • How to collect the specimen and preservation fortest.	
UNIT	**CONTENT**	**HOURS**
I	Introduction to medical laboratory science, safety in the laboratory, General Laboratory instruments and equipments.	15
II	Collection of specimen and preservation, composition of weight, Measuring liquids and solids. Culture media and inoculation. Biochemical reaction, Antibiotic sensitivitytest.	15
III	Development of blood cells. Methods of estimation of hemoglobin. Blood sugar level. Blood urea level. Bleeding time, clotting time.	15
IV	Cholesterol test, HDL cholesterol, Bilirubin test, Pregnancy test, Albumin and globulin ratio-Total cholesterol, lipoproteins-HDL,LDL,VLDL.	15
V	VDRL test, Widal test, clinically diagnostics Enzymes-liver- AST, ALT, GT. Heart-AST, LDH, CK, Bone- Alkaline Phosphatase, Muscle-CPK.CRP test, HIV test, A.S.O test.	15

Text Books:

1. Text Book of Medical Laboratory Techniques, Muhargee Vol I, II &III.

Reference Books:

1. A Text Book of Microbiology ,C.K.J. PanikarandAnanthanarayanan.
2. Text Book of Medical Laboratory Techniques ,MuhargeeVol I, II,III.
3. Text book ofBiochemistry, S.Nagini.

Web-Resources:

https://www.ebooks.com/en-us/book/1602488/manual-of-medical- laboratory-techniques/s-ramakrishnan/.

https://www.pdfdrive.com/bensons-microbiological-applications-laboratory-manual-in-general-microbiology-short-version- e185416575.html

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Recognize the role of medical laboratory technology in the context of providing quality patient healthcare.
CO 2: Perform basic clinical laboratory procedures using appropriate laboratory techniques and instrumentation in accordance with current laboratory safety protocol.
CO 3: Calculate and properly report laboratory data.
CO4: Interpret laboratory results in accordance to laboratory protocol.
CO 5: Use effective written and verbal communication that represents competence and professionalism in the clinical laboratory setting.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	M	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	S	M	S	S	S	S	M
CO5	S	S	M	S	M	S	S	M	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Major Based Elective-I	**ENDOCRINOLOGY**	**Course Code- BUE3**
Instruction Hours: 5	**Credits: 5**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students understanding the various diagnostics method for identifying the disease. • The role of medical laboratory technology in the healthcare industry. • Communication in the Laboratory setting. • Accuracy, attention to detail, organization and quality control. • Safe and accurate performance of laboratory procedures. • How to collect the specimen and preservation fortest.	
UNIT	**CONTENT**	**HOURS**
I	Thyroid hormones- definition, classification, biosynthesis and circulation in blood. Mechanism of hormone action. Plasma membrane receptors. Adenylate cyclase, Role of G-proteins. Protein kinases, tyrosine, kinase, Inositol phosphate. Calcium, calmodulin. Mechanism of steroid hormone receptors- Mechanism of action of steroid hormone.	15
II	Hormones of the thyroid Biosynthesis and biological actions of thyroid hormones. Antithyroid agents.Thyroid disease- thyrotoxicosis, Goiter, Grave's disease, Hashimoto's thyroiditis. Parathyroid hormone- Biological actions regulation of calcium and phosphorous metabolism. Calcitonin. Calcitriol-Biosynthesis and functions. Hyper and hypocalcemia. Hyperparathyroidism, hypoparathyroidism, Paget's disease. Ricket's and osteomalacia.	15
III	Hypothalamus and pituitary hormones: Vasopressin and oxytocin-synthesis and biological effects. Hypothalamic releasing factors. Anterior pituitary hormone sactions. Growth promoting and lactogenic hormones.	15

	Glycoprotein hormones the POMC family. Endorphins, MSH. Gigantism, Acromegaly, Dwarfism and Diabetesinsipidus.	
IV	Pancreatic hormones- Insulin- Biosynthesis, regulation of secretion and biological actions. Mechanism of action of insulin. Glucagon, somatostatin and pancreatic polypeptide. Insulin like growth factors.	15
V	Adrenal hormones - Glucocorticoids, Mineralocorticoids - synthesis and biological effects. Catecholamines: biosynthesis and biological effects. Gonadal hormones- Androgens and estrogens. Ovarian cycle. Abnormal secretion of adrenal hormones- Addison's disease. Cushing's syndrome, congenital adrenal hyperplasia, phaeochromocytoma.	15

Text Book:

1. Textbook of Endocrinology- Williams et al, 2015.

Reference Books:

1. Textbook of Endocrinology –8th edn. Wilson andFoster,1998.
2. Principles of Biochemistry – Mammalian Biochemistry – Smith et al, Mc Graw Hill, 1982.
3. Mechanisms of Hormone Action, Estelle Jones, Hardcover -2015
4. Harper's Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.Principles of Biochemistry – Mammalian Biochemistry – Smith et al. McGraw Hill 7thed.

Web Resources:

https://www.elsevier.com/books/williams-textbook-of-endocrinology/melmed/978-1- 4377-0324-5.
https://www.elsevier.com/books/williams-textbook-of-endocrinology/melmed/978-0- 323-55596-8.

Course Outcomes

On completion of the Course, Students should be able to

CO1: Students should know the chemical nature of hormones, the relationship between structure and function of hormones.

CO2: Quantitative aspects of hormonal action in relation to endocrine disorder, the role of hormones as a regulatory factor of a living system.

CO3: The neurotransmitters and their relation with some diseases and drug addiction.

CO4: To discuss the definition of a hormone in terms of its general properties.

CO5: Students will be identify the glands, organs, tissues and cells that synthesizes and secrete hormones, hormone precursors and associated compounds

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	M	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	M	S	S	S	S	M
CO4	S	S	S	S	M	S	S	S	S	M
CO5	S	S	S	S	M	S	S	S	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Skill Based Elective-II	HERBAL MEDICINE PRACTICAL	Course Code: BUS2Y
Instruction Hours: 2	Credits: 2	Exam Hours: 3
Internal Marks :25	External Marks:75	Total Marks: 100

Course Objectives

- To enable the students can get the practical knowledge about the analysis of various phyto constituents present in materials.
- Students to understand the soxhlet apparatus how to collect solvent extracts.
- Preparing TLC fingerprints of various plants extracts.
- To understand the column chromatography.
- To understand the separation of plant pigments using column chromatography.

LIST OF PRACTICALS

1. Phytochemical Screening of medicinal plants using chemicaltests for various groups of Phytoconstituents.
2. Preparation of alcoholic and other organic solvents extracts of medicinal plants bysoxlet.
3. Preparing TLC fingerprint profile of various plants extracts.
4. Demonstration of columnchromatography
5. Estimation ofAscorbic acid
6. Estimation of Alkaloids
7. Separation of plant pigment by column chromatography

Text Book:

1. Phytochemical methods, Harbone J.B and MabryT.J,1984.
2. Text book of pharmacogenosy - Handa S and KapoorV.K,2003

Reference Books:

1. Quality control methods for medicinal plant materials, world health organization,2000
2. Plant drug analysis-WagnerH.andBladt,1996.
3. Text book of pharmacogenosy-Handa S and KapoorV.K,2003
4. Phytochemical methods , Harbone J.B and MabryT.J,1984.

Web Resources:

1. https://www.amazon.in/Practical-Herbal-Medicine-Handbook- Reference-ebook/dp/B00QR9QLRY.

Course Outcomes

On completion of the Course, Students should be able to

CO1: Demonstrating initiative by beginning work in a timely manner without being reminded
CO2: Exhibiting professional appearance by adhering to laboratory dress code
CO3: Organizing work flow and determining priorities
CO4: Producing accurate work within the allotted time
CO5: Demonstrating awareness of own limitations, and seeking help when needed.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	M
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	M
CO4	S	S	S	S	S	S	S	S	S	M
CO5	S	S	S	S	S	S	S	S	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-V / Skill Based Elective -II	**FOOD AND NUTRITION**	**Course Code: BUS3**
Instruction Hours: 2	**Credits: 2**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students can get knowledge about dietary intake for diseases like, returns diabetes, arthrosclerosis, Ulcerative etc. • To provide students with the knowledge of basic terminology and several aspects of nutrition and the functions of food in healthy life sustenance; • To ensure that students are familiar with the food classification, nutrition during special conditions and role of special functional food; • To equip students with knowledge and understanding of modern aspects of nutritional science and novel food usage	
UNIT	**CONTENT**	**HOURS**
I	Source food composition, properties and storage of common foods, functions of food in relation to health – classification of food based on nutrients, food preservation–food addictives. Types of food - body building foods and protective foods – Bomb colorimeter.	6
II	Essential nutrients: fats, carbohydrates and proteins, Energy needs. Definition of unit of energy – Kcal, RQ, SDA, NPU, Basal metabolism – BMR – factors influencing BMR. Role of fiber in diet.	6
III	Micro and macro mineral nutrients: Distribution, sources, metabolic functions and deficiency manifestion vitamins – classification, source functions and Deficiency disorder – hyper and hypo vitaminosis. Water and electrolyte balance.	6

IV	Nutrition in different stages – Infants, children, adolescents, pregnant, lactating women and old persons.	6
V	Principles of diet therapy. Diet during stressed conditions, labourer and patients, therapeutic diets for anemia, malnutrition, obesity, diabetes mellitus and allergy.	6

Text Book:

1. Food Chemistry, L.GMeyers, CBS, 2004, Puiblishers & Distributors.
2. Food science, Polter 2001, CBSpublishers & Distributers

`Reference Books:

1. Food Chemistry, L.GMeyers, CBS, 2004, Puiblishers & Distributors.
2. Food science, Polter 2001, CB Spublishers & Distributers
3. Essential of food nutritions, Vol I&II ,Swaminathan. M.S, Bangalorepринting
4. A Test book of food and nutrition, Annie Fredrick 2006 lotus press.

Web-Resources:

http://www.fao.org/publications/e-book-collection/nutrition/en/.

https://www.pdfdrive.com/nutrition-and-dietetics-text-books-online-e6071568.html

https://rushu.libguides.com/nutrition/ebooks.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Locate and interpret government regulations regarding the manufacture and sale of food products.

CO 2: Discuss the major chemical reactions that occur during food preparation and storage.

CO 3: Discuss the important pathogens and spoilage microorganisms in foods.

CO 4: Explain the effects of common food preparation methods and food storage conditions on survival and growth of microbial contaminants. Obtain food protection manager certification

CO 5: Discuss basic principles of common food preservation methods.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	S	S	S	M	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-VI / Core Course-XI	**ADVANCED CLINICAL BIOCHEMSITRY**	**Course Code: BUK**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• Remember the historical background for Clinical Biochemistry and understand the basic elements of core biochemistry and specialized test in biochemistry. • Analyze the basic differences between carbohydrate, lipid, protein and nucleic acid Metabolism abnormalities. • Understand and identify the main characteristics of diagnosis, screening, and prognosis of disease. • Apply the processes of scientific research to use in emergency services in clinical biochemistry. • Evaluate the scientific explanations that show the hormonal disorders during disease and analyze the functioning of the various organs and tissue through tissue function tests and also evaluate the role of biomarkers in disease diagnosis.	
UNIT	**CONTENT**	**HOURS**
I	**DISORDERS OF FLUIDS:** Disorder of fluids - electrolyte balance & disorders involving changes in H+ concentration-water toxicity, Dehydration. Renal function tests: normal and abnormal constituents of urine. Disturbances in blood clotting mechanism, haemophilia, anemia, porphyrias& anticoagulants.	18
II	**DISORDERS OF CARBOHYDRATE METABOLISM:** Sugar level in normal blood - maintenance of blood sugar concentration - endocrine influence on carbohydrate metabolism, hypoglycemia,	18

	hyperglycemia, glycosuria, renal threshold value, diabetes mellitus - classification, complications, glucose tolerance test, diabetic coma, diabetic ketoacidosis, glycogen storage disease, fructosuria, galactosemia & hypoglycemic agent.	
III	**DISORDERS OF LIPID METABOLISM:** Lipid metabolism in liver and adipose tissue, plasma lipoproteins, cholesterol in health and diseases, fatty liver, atherosclerosis, lipid storage disease, hypolipoproteinemia and hyperlipoproteinemia.	18
IV	**DISORDERS OF PROTEIN & NUCLEICACID METABOLISM:** Plasma proteins, their origin significance & variation in diseases, nitrogen balance, proteinuria, multiple myeloma, Wilson's disease. Liver function test, jaundice – Haemolytic, hepatic & obstructive jaundice. Phenyl ketonuria, alkaptanuria, tyrosinemia, albinism, gout - complications, Leschnyhan syndrome, oroticaciduria. COVID-19 - causes, Symptoms, diagnosis prevention and Treatment.	18
V	**DISORDERS OF ENDOCRINE SYSTEMS:** Disorder associated with thyroid, pituitary, adrenal medulla & sex hormones	18
VI	Disorder of carbohydrate, proteins, nucleic acids and lipids metabolism and causes for different diseases. Disorder of endocrine system of various hormones	

Text Book:

1. Biochemistry for Medical Students, AmbikaShanmugam
2. Text Book of Biochemistry, Nagini

Reference Books:

1. Text Book of Biochemistry,Nagini
2. Practical Clinical Biochemistry ,Haroldvarley ,1988.
3. Clinical Biochemistry ,chatterjee,2004.

Web Resources:

https://www.pdfdrive.com/clinical-biochemistry-books.html

https://www.pdfdrive.com/clinical-biochemistry-metabolic-and-clinical- aspects-e164553523.html

Course Outcomes

On completion of the Course, Students should be able to

CO1: Trained the students clinically asses the laboratory indicators of physiologic condition and diseases.

CO2: Biochemical and molecular tools needed to accomplish preventive, diagnostic and therapeutic intervention on hereditary and acquired disorders

CO3: Assessment of the diagnostic performance of laboratory tests.

CO4: It trains the students to gain concept of human physiology using biological fluids.

CO5: It illustrates mechanism of metabolic disorders at molecular level. It facilitates in employability in diagnostic and research institutes

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	S	S	S	M	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-VI / Core Course-XII	**IMMUNOLOGY**	**Course Code: BUL**
Instruction Hours: 6	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the students can get knowledge about the, immune system, immune response and allergic reaction.. • The students will be able to identify the cellular and molecular basis of immune responsiveness. • The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease. • The students will be able to describe immunological response and how it is triggered and regulated. • The students will be able to demonstrate a capacity for problem-solving about immune responsiveness.	
UNIT	**CONTENT**	**HOURS**
I	**IMMUNE SYSTEM :** Introduction, lymphocytes, their origin and differentiation. Types of immunity, primary & secondary lymphoid organs, Humoral-Non specific body defences, surface membrane barrier, chemical defences, inflammation, cell mediated immunity, Antigen presenting cells - macrophages, dendritic cells, langerhans cell their origin and functional mechanism of phagocytosis, identification of cell types of immune system antigens - structure classification complements and their biological functions - types of immune responses, immunetolerance.	18
II	**IMMUNOGLOBULINS :** Structure of immunoglobulins antibody specificity, biological function of immunoglobulins, monoclonal antibodies- preparation and applications.	18

	Antigen - Antibody interaction, antitoxins, opsonin, agglutination, bacteriolysin and precipitation.	
III	**IMMUNOTECHNIQUES:** Production of antisera, precipitation reaction, immune diffusion, immune electrophoresis, radio immunoassay, immune fluorescence, complement fixation and ELISA.	18
IV	**IMMUNO HAEMATOLOGY:** Blood group antigens, Rhesus incompatibility. Maternal response to other fetal antigens, other blood group system.Major histocompatibility complex, HLA-immune response gene and diseases, pathogenesis of autoimmune diseases.	18
V	**IMMUNITY TO INFECTION:** Hypersensitivity reactions: Types of hypersensitivity, mechanism of T-Cell activation, macrophage activation and granuloma formation. Transplantation - Immunologic response, graft rejection mechanism and prevention of graft rejection. Immuno suppressive drugs.	18
VI	Recent studies on Auto-immune disorders, Hypersensitivity. Dynamics of the immune response. The immune response in health and disease.	-

Text Book:

1. Immunology, Wan Roitt-2004
2. Essential Immunology,IvanRoitt,2004.

Reference Books:

1. Immunolog, Wan Roitt-2004
2. Essential Immunology,IvanRoitt,2004
3. Immunology, Joshi,2004,2005
4. Immunology,Tizard,2003

Web Resources:

https://www.pdfdrive.com/basic-immunology-functions-and-disorders-of-the-immune-system-e185969491.html

https://www.pdfdrive.com/kuby-immunology-7th-edition-2013- e44842271.html

Course Outcomes

On completion of the Course, Students should be able to

CO1: Locate and access immunological information relevant to area of study.

CO2: Think critically about issues that involve immunology.

CO3: Collaborate with peers and work effectively in a group.

CO4: Articulate scientific processes related to immunology in written and/or oral format.

CO5: Present conclusions and explain logic to immunological issues.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	M	S	S	S	S	M	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	M	S	S	S	S	M	S	S
CO5	S	S	M	S	S	S	S	M	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-VI / Core Course-XIII	**MAJOR PRACTICAL IV**	**Course Code: BUMY**
Instruction Hours: 5	**Credits: 4**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Course Objectives

- To enable the students can get the practical knowledge about the urine analysis and estimation of abnormal constituent present in blood &blood grouping.
- To understand the student can get knowledge about the quantitative estimation in blood
- The students will be able to identify the blood group, RH typing, TC/DC and ESR count

LIST OF PRACTICALS

1. Qualitative tests of Urine, Normal, Abnormal constituents , sugar, protein (albumin) ketone bodies, bile pigments and bilesalts
2. Microscopic Examinations of urine – cast cells, crystals, pus cells.
3. Quantitative estimations of sugar in urine –Benedict'smethod.
4. Quantitative estimations in Blood.
   - **a.** Glucose – Orthotoluidinemethod.
   - **b.** Cholesterol – Zak'smethod.
   - **c.** Creatinine – Jaffe's method.
   - **d.** Urea - DAM method.
   - **e.** Protein - Lowry's method.
   - **f.** Uricacid - Phosphotungstate method.
   - **g.** Bilirubin - Malloyevelyn method.
5. TC/DC count, haemoglobin Estimation method, Sahli's method, ESR count.

Blood grouping, Rh typing and PCV.

Text Book

1. Manuals in Biochemistry Dr. J.Jeyaraman1996
2. Practical Biochemistry, Plummer,2000

Reference Books

1. Manuals in Biochemistry Dr. J.Jeyaraman,1996
2. Practical Biochemistry ,Plummer,2000
3. Practical Clinical Biochemistry, Harold Varley,1988
4. Introductory practical Biochemistry,S.K. Sawhney, Randhir Singh,2001

Web Resources:

https://www.amazon.in/Practical-Clinical-Biochemistry-Method.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Discuss the fundamental biochemistry knowledge related to health

CO 2: Explain the clinical significance of the laboratory tests

CO 3: Diagnosis of clinical disorders by estimating biomarkers

CO 4: Determine various substances including substrates, enzymes, hormones, etc and their use in diagnosis and monitoring of disease are applied

CO 5: Evaluate the abnormalities which commonly occur in the clinical field

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-VI / Major Based Elective-II	**BIOTECHNOLOGY**	**Course Code: BUE4**
Instruction Hours: 5	**Credits: 4**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To understand the technological aspect applied to molecular and microbial biology. • To understand principles of animal culture, media preparation. • To explain Invitro fertilization and embryo transfer technology. • To describe meristem culture and colonel propagation of plants on a commercial scale. • To get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.	
UNIT	**CONTENT**	**HOURS**
I	Fermentation biotechnology-biotechnology-scope and importance, basic principles of microbial growth, Bioreactor- batch and continuous bioreactor, fermentation culture medium, downstream processing, fermentation production of penicillin and vitamin $B_{12.}$	15
II	Food and industrial biotechnology- Fermentation production of yoghurt and cheese. Production of single cell protein; spirulina; cultivation and uses. Biofertilizers- blue green algae; cultivation and uses. Production of amylase and protease	15
III	Molecular biotechnology- basic principles of cloning, introduction of foreign DNAin tohostbyparticlebombardmentgun,electrophorationandmicroinjection.Basicpolymerasechain reaction(PCR), applications. Microarrays, the human genome project.	15
IV	Animal and plant biotechnology- elementary details of animal cell and tissue culture, medium, transfection, targeted gene transfer, transgenic animals, plant cell and tissue culture, medium, totipotent, pluripotent cells, protoplat culture, artificial seeds and transgenic plants.	15

V	Environment biotechnology - biological fuel generation - ethanol and methane from biomas. Sewage treatment. Bioremediation: oil spill cleanup, bioleaching, IPR, Bio safety and hazards of environmental engineering	15

Text Book:

1. Text book biotechnology by R.K.Santhyanarayana, 2010 , Books & Applied (p) ltd.

Reference Books:

1. Molecular Biotechnology: Principles and Applications of Recombinant DNA- B.R.Glick & J.J. Pasterak, ASM Press, Washington, D.C., 2010.
2. Gene cloning and DNA analysis: an introduction / T.A. Brown.—6th ed. Brown, T.A. (Terence A.) Wiley-Blackwell. 2010.
3. Elements of Biotechnology- P.K.Gupta, Rastogi Publications, 2nd edition 3rd reprint, 2015-2016.
4. A text book of Biotechnology- R.C.Dubey, S.Chand Publications, 2014
5. Industrial Microbology- A.H.Patel,Macmillan , India Ltd, 2012
6. Animal Cell Culture and Technology, Michael Butler Garland Science/BIOS Scientific Publishers, Second Edition, London and New York. 2004.

Web-Resources:

https://www.pdfdrive.com/molecular-biotechnology-principles-and-applications-of-recombinant-dna-d33452385.html

https://www.pdfdrive.com/plant-biology-and-biotechnology-volume-ii-plant-genomics-and-biotechnology-e176062706.html.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Biotechnology in an historical perspective

CO 2: Scope and Importance of Biotechnology.

CO 3: Familiarization of the terms associated with plant tissue culture.

CO 4: Felt applications in the different domains of biotechnology.

CO 5: The concept of recombinant DNA technology.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	M

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-VI / Major Based Elective-II	**GENERAL MICROBIOLOGY**	**Course Code:BUE4**
Instruction Hours: 5	**Credits: 4**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To enable the Students can get knowledge about the various diseases, morphology, classification and application of various microorganisms. • To understand the students isolation and maintenance of pure culture • To study the probiotics in health and disease. • To learn the classification of algae and fungi • To production of antibiotics and vaccines.	
UNIT	**CONTENT**	**HOURS**
I	**INTRODUCTION TO MICROBIOLOGY** Introduction & scope of microbiology, characterization, classification and identification of microorganisms, sterilization technique, Disinfectant and antiseptic agents.	15
II	**BACTERIA** Introduction, major features of bacteria, size and shape of bacterial cells, modes of reproduction. Cultivation of bacteria, Bergey's classification, nutritional requirements, types of media, factors affecting growth, choice of media and conditions of incubation, isolation and maintenance of pure culture. Probiotics –types of probiotics, mechansim of action .,importance of probiotics in health and diseases.	15
III	**AIGAE AND FUNGI**: Introduction, occurrence, general characteristics, classification and biological importance. Fungi classification, cultivation and morphology of	15

	yeast and moulds, control of fungal growth. economical importance of algae and fungi	
IV	**VIRUSES:** Viruses: Classification – plant and animal viruses, general characteristics and structure. Bacteriophages characteristics, lifecycle, - lytic and Iysogenic cycle. oncogenic virus.	15
V	**INDUSTRIAL MICROBIOLOGY**: Fermentation and fermental microbes, Bioreactors-basic fuction and types. Industrial production of pharmaceuticals-Antibiotics, Vaccines.	15

Text Book

1. Microbiology –Essential and application Mc Kane and KendelMcGraw Hill.
2. Text Book of Microbiology-Ananthanarayanan and Paniker. Orient Longman.

Reference Books

1. Review of Medical Microbiology, Jawetz et al, Large medical
2. Text Book of Microbiology-prescot
3. General Microbiology,S.B.Sullia and S.Shantharam, Second edition
4. Microbiology,R.MShukla
5. Microbiology,P.D. Sharma
6. Immunology and Microbiology,Dulsy Fatima, Dr.L.M.Narayanan.

Web Resources:

https://www.freebookcentre.net/medical_text_books_journals/microbiology_ebooks_online_texts_download.html

http://www.grsmu.by/files/file/university/cafedry/microbiologii-virysologii-immynologii/files/essential_microbiology.pdf

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology.

CO 2: Identify ways microorganisms play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention.

CO 3: Explain why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats.

CO 4: Cite examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human well being.

CO 5: Demonstrate that microorganisms have an indispensable role in the environment, including elemental cycles, biodegradation, etc.

Mapping with Cos With PO & PSOs

CO/PO	PO					PSO				
	1	2	3	4	5	1	2	3	4	5
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	M
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	M

S – Strongly correlating

M- Moderately correlating

W- Weakly correlating

N-No correlation

Semester-VI / Major Based Elective-III	**BIOINFORMATICS**	**Course Code: BUE5**
Instruction Hours: 5	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• To understand the students can get knowledge about sequence alignment phylogenenetic studies. • To set up a collaborative development environment to avoid redundancy and to facilitate future bioinformatics developments across organizations. • To provide training in bioinformatics and support for bioinformatics projects hosted on the ARCAD platform. • To collaborate (share software, workshop, mailing lists, and good practices) with other national as well as international bioinformatics platforms. • To ensure quality control in bioinformatics research though a scientific user committee, documentation, data traceability and reliability, CECILL licenses, in dicat or measurement.	
UNIT	**CONTENT**	**HOURS**
I	Introduction to bioinformatics: History and scope – computer operating system- Internet- Bioinformatics sites on World Wide Web.	15
II	Data bases: Importance and architecture of data bases-Types of databases – Biological Nucleic acid and protein structure-a-Application of data bases.	15
III	Sequence alignment: Algorithm- Goals and type of alignment – Similarly studies –scoring – Deletion –Substitution- Para wise alignment-Multiple sequence Alignment-Identification of Domains- Sequence search.	15
IV	Phylogenetic studies: phylogeny- homology and similarities- phylogenetic	15

	Tree-Tree Building methods- phylogenetic analysis Databases.	
V	Applications of bioinformatics- Industry- education-pharmacology-drug designing –Drug discovery-Target and optimization.	15

Text Book:

1. Bioinformatics – sequence and genome analysis- david W.Mount.

Reference Books:

1. Bioinformatics- method and application, S.CRastogi
2. Basic Bioinformatics,Ignacimuthu
3. Inroduction to bioinformatics, T.K.Attwood.

Web Resources:

https://www.pdfdrive.com/basics-of-bioinformatics-lecture-notes-of-the- graduate-summer-school-on-bioinformatics-of-china-e165983343.html

https://www.pdfdrive.com/bioinformatics-algorithms-techniques-and- applications-wiley-series-in-bioinformatics-e185077187.html

Course Outcomes

On completion of the Course, Students should be able to

CO1: To get introduced to the basic concepts of Bioinformatics and its significance in Biological data analysis.

CO2: Describe the history, scope and importance of Bioinformatics and role of internet in Bioinformatics.

CO3: Explain about the methods to characterize and manage the different types of Biological data.

CO4: Classify different types of Biological Databases.

CO5: Introduction to the basics of sequence alignment and analysis.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	PO					PSO				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation

Semester-VI / Major Based Elective-III	**GENETIC ENGINEERING**	**Course Code: BUE5**
Instruction Hours: 5	**Credits: 6**	**Exam Hours: 3**
Internal Marks :25	**External Marks:75**	**Total Marks: 100**

Cognitive Level	K1 -Recalling K2 -Understanding K3 -Applying K4 - Analyzing K5 - Evaluating K6 - Creating	
Course Objectives	• Understand the importance of plasmids and viruses to genetic engineering. • Understand the principles of the techniques of selection and screening of clones. • Analyze the methods of screening for clones that contain a desired gene fragment. • Evaluate the various techniques used to characterize DNA. • Analyze and evaluate the different applications of gene technology.	
UNIT	**CONTENT**	**HOURS**
I	**TOOLS OF GENETIC ENGINEERING** Restriction enzymes: discovery, nomenclature, types and uses. Linking of DNA- ligases, linkers, adaptors and Homopolymer tails. Gene libraries: Genomic and cDNA libraries. Cloning vectors: Plasmids (pBR322),Bacteriophage (λ, M13) and Cosmids. Ti plasmid, Retrovirus, phagemid, YACs.	15
II	**GENE TRANSFER TECHNIQUES** Gene transfer techniques – calcium phosphate coprecipitation, transduction, protoplast fusion, electroporation, Microinjection and lipofection. Selection and Screening: Insertional inactivation Immunological screening, DNA Hybridization. Northern, Southern, Western Blotting and PCR- Principle, technique and applications.	15

III	**PLANT TISSUE CULTURE** Biotechnology: Definition, Scope, Biotechnology as an interdisciplinary pursuit.Plant tissue culture methods-callus culture, micropropagation, protoplast culture. Cloning of disease resistant plants, cloning of Bacillus thuringiensis, Application of plant tissue culture. SCP and its applications.	15
IV	**ANIMAL CELL CULTURE** Animal cell culture – culture media, primary and continuous culture, cell lines and its applications. Stem cells and its applications. Fish Biotechnology: Transgenic fish, IVF. Transgenic live stock production and application, Knockout mice. Rules in Biotechnology – Patent (IPR), copyright safety, bioethics and hazards.	15
V	**APPLICATIONS OF BIOTECHNOLOGY** Recombinant hormones: concept, applications (Insulin and GrowthHormone)Vaccines: Subunit vaccines, Recombinant vaccines, edible vaccines. Monoclonal Antibodies: Methods of production (Hybridoma, vectors) and its application.	15

Text Book:

1. Dubey, P.C. (2007) Text Book of Biotechnology, Chand and Co New Delhi.

Reference Books:

1. Kumar, H.D. (1994) Mol. Bio., and Biotech. Vikas publishing House (P) Ltd., New Delhi.
2. Smith John, E. (1988) Biotech Edward Arnold London.
3. Trehan, K. (1990) Biotechnology, Wiley Eastern Ltd., New Delhi.
4. Old R.W and primrose, S.B (1989). Principles of Gene manipulation. Blackwell Scientific publications, Newyo

Web Resources:

http://freebookcentre.net/medical_text_books_journals/genetics_ebooks_online_texts_download.html.

https://www.genengnews.com/category/resources/ebooks/.

Course Outcomes

On completion of the Course, Students should be able to

CO 1: Provide examples of current applications of biotechnology and advances in the different areas like medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic.

CO 2: Understand the concept of recombinant DNA technology or genetic engineering

CO 3: Describe DNA fingerprinting, and restriction fragment length polymorphism (RFLP) analysis and their applications

CO 4:Explain the concept and applications of monoclonal antibody technology

CO 5: Explain the general principles of generating transgenic plants, animals and microbes.

Mapping of Course outcomes with Programme outcomes/ Programmes Specific outcomes

CO/PO	**PO**					**PSO**				
	1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S - Strongly Correlated

M - Moderately Correlated

W-Weakly Correlated

N – No Correlation