Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur 440033

Scheme and Syllabus

Bachelor of Science (Biochemistry)

Submitted by

Board of Studies,

Bachelor of Science (Biochemistry)

FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(Biochemistry - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Biomolecules & Nutritional Biochemistry	BBC1T01	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Biomolecules & Nutritional Biochemistry	BBC1P01	-		2	1	-	-	-	-	25	25	25
3	DSC	Microbial Biochemistry	BBC1T02	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Microbial Biochemistry	BBC1P02	-		2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Refer VSC Basket	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
9	AEC	English Compulsory	BAE1T01	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Vedic Mathematics	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
12	CC	Refer CC Basket	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**125**	**275**	

B.Sc. Sem-II (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Human Physiology & Clinical Biochemistry	BBC2T03	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Human Physiology & Clinical Biochemistry	BBC2P03			2	1	-	-	-	-	25	25	25
3	DSC	Techniques in Biochemistry	BBC2T04	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Techniques in Biochemistry	BBC2P04			2	1	-	-	-	-	-	50	25
5	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
6	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
7	VSC	Microbial Culture Media	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
8	SEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
9	AEC	Second Language	BAE2T02	2	-	-	2	3	50	50	40	-	-	-
10	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
11	IKS	Indian Astronomy	BIK2T02	2	-	-	2	3	-	-	-	50	50	50
12	CC	Refer CC Basket	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**530**	**170**		**125**	**275**	

Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-III (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Agriculture Biochemistry	BBC3T05	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Agriculture Biochemistry	BBC3P05	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Enzymes and Enzyme Technology	BBC3T06	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Enzymes and Enzyme Technology	BBC3P06	-	-	2	1	-	-	-	-	-	50	25
5	Minor	Minor 1 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
6	Minor	Minor 1 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
7	Minor	Minor 2 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
8	Minor	Minor 2 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
9	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
10	VSC	Food Processing Techniques	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
11	AEC	Second Language	BAE3T03	2	-	-	2	3	50	50	40	-	-	-
12	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**150**	**350**	

B.Sc. Sem-IV (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology-Prokaryotes	BBC4T07	2	-	-	2	3	80	20	40	-	--	
2	DSC	Molecular Biology-Prokaryotes	BBC4P07	-	-	2	1					25	25	25
3	DSC	Metabolism	BBC4T08	2	-	-	2	3	80	20	40	-	--	
4	DSC	Metabolism	BBC4P08	-	-	2	1					-	50	25
5	Minor	Minor 3 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	--	
6	Minor	Minor 3 (Refer Minor Basket)		-	-	2	1					25	25	25
7	Minor	Minor 4 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	--	
8	Minor	Minor 4 (Refer Minor Basket)		-	-	2	1					-	50	25
9	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
10	SEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
11	AEC	English Compulsory	BAE4T03	2	-	-	2	3	50	50	40	-	-	-
12	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
13	CC	Refer CC Basket	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**450**	**150**		**150**	**350**	

Exit option; Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credits core NSQF course/ Internship ORContinue with Major and Minor

B.Sc. Sem-V (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology-Eukaryotes	BBC5T09	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Molecular Biology-Eukaryotes	BBC5P09	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Advanced Biophysical Techniques	BBC5T10	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Advanced Biophysical Techniques	BBC5P10	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Cell Communication and Signalling	BBC5T11	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Cell Communication and Signalling	BBC5P11	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Molecular Genetics or Forensic Biochemistry	BBC5T12	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Molecular Genetics or Forensic Biochemistry	BBC5P12	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 5 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 5 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	Minor	Minor 6 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
12	Minor	Minor 6 (Refer Minor Basket)		-	-	2	1	-	-	-	-	-	50	25
13	VSC	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
14	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**--**	**150**	**300**	**-**

B.Sc. Sem-VI (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genetic Engineering	BBC6T13	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Genetic Engineering	BBC6P13	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Biochemistry of Diseases	BBC6T14	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Biochemistry of Diseases	BBC6P14	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Immunology	BBC6T15	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Immunology	BBC6P15	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Immunodiagnostics or Molecular sequencing Techniques	BBC6T16	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Immunodiagnostics or Molecular sequencing Techniques	BBC6P16	-	-	2	1	-	-	-	-	-	50	25
9	Minor	Minor 7 (Refer Minor Basket)		2	-	-	2	3	80	20	40	-	-	-
10	Minor	Minor 7 (Refer Minor Basket)		-	-	2	1	-	-	-	-	25	25	25
11	VSC	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
12	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**225**	**325**	

Exit option: Award of UG Degree in Major with 120-132 credits OR Continue with Major and Minor

B.Sc. Sem-VII (Honors) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Bioinformatics	BBC7T17	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Bioinformatics	BBC7P17			2	1	-	-	-	-	25	25	25
3	DSC	Protein Biochemistry	BBC7T18	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Biochemistry	BBC7P18			2	1	-	-	-	-	-	50	25
5	DSC	Applied Biochemistry	BBC7T19	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Applied Biochemistry	BBC7P19			2	1	-	-	-	-	25	25	25
7	DSC	Neurobiochemistry	BBC7T20	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Neurobiochemistry	BBC7P20			2	1	-	-	-	-	-	50	25
9	DSE	Scientific communications and Data representations OR Obesity &Endocrine Disorders	BBC7T21	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Scientific communications and Data representations OR Obesity &Endocrine Disorders	BBC7P21	-	-	2	1	-	-	-	-	25	25	25
11	RM	Research Methodology	BBC7T22	2	-	-	2	3	80	20	40			
12	RM	Research Methodology	BBC7P22	-	-	4	2	-	-	-	-	50	50	50
Total				13	-	14	**20**		**520**	**130**		**125**	**225**	

B.Sc. Sem-VIII (Honors) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Toxicology and clinical research	BBC8T23	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Toxicology and clinical research	BBC8P23	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Protein Engineering and Drug delivery	BBC8T24	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Engineering and Drug delivery	BBC8P24	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Environmental Biochemistry	BBC8T25	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Environmental Biochemistry	BBC8P25	-	-	2	1	-	-	-	-	25	25	25
7	DSC	Secondary Metabolites and Its Applications	BBC8T26	2	-	-	2	3	80	20	40	-	-	-
8	DSC	Secondary Metabolites and Its Applications	BBC8P26	-	-	2	1	-	-	-	-	-	50	25
9	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8T27	3	-	-	3	3	120	30	60	-	-	-
10	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8P27	-	-	2	1					25	25	25
11	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**175**	**275**	

Four Year UG Honours Degree in Major and Minor with 160-176 credits

B.Sc. Sem-VII (Research) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Bioinformatics & Protein Biochemistry	BBC7T17R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Bioinformatics & Protein Biochemistry	BBC7P17R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Neurobiochemistry	BBC7T18R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Neurobiochemistry	BBC7P18R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Applied Biochemistry	BBC7T19R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Applied Biochemistry	BBC7P19R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Scientific communications and Data representations OR Model Systems for Research	BBC7T20R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Scientific communications and Data representations OR Model Systems for Research	BBC7P20R	-	-	2	1	-	-	-	-	-	50	25
9	RM	Research Methodology	BBC7T21R	2	-	-	2	3	80	20	40	-	-	-
10	RM	Research Methodology	BBC7P21R	-	-	4	2	-	-	-	-	50	50	50
11	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	75
Total				11	-	18	**20**		**440**	**110**		**175**	**275**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Biochemistry - Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Toxicology, &Clinical Research and + Environmental Biochemistry	BBC8T22 R	2	-	-	2	3	80	20	40	-	-	-
2	DSC	Toxicology, &Clinical Research and + Environmental Biochemistry	BBC8P22 R	-	-	2	1	-	-	-	-	25	25	25
3	DSC	Protein Engineering and Drug delivery	BBC8T23 R	2	-	-	2	3	80	20	40	-	-	-
4	DSC	Protein Engineering and Drug delivery	BBC8P23 R	-	-	2	1	-	-	-	-	-	50	25
5	DSC	Secondary Metabolites and Its Applications	BBC8T24 R	2	-	-	2	3	80	20	40	-	-	-
6	DSC	Secondary Metabolites and Its Applications	BBC8P24 R	-	-	2	1	-	-	-	-	25	25	25
7	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8T25 R	3	-	-	3	3	120	30	60	-	-	-
8	DSE	Reproductive Biochemistry OR Cancer Biology	BBC8P25 R	-	-	2	1	-	-	-	-	-	50	25
9	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**225**	**325**	

'R' in the subject code indicates 'Research'.

Four Year UG Honours with Research Degree in Major and Minor with 160-176 credits

Total Credits: 1. Three Year UG Degree Program: 132

2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

VSC Basket (Biochemistry)

Semester	Course Category	Name of Course	BoS	Course Code
I	**VSC**	Microbial Culture media	Biochemistry	**BVS1P01**
II	**VSC**	Food Processing Techniques	Biochemistry	**BVS2P03**
III	**VSC**	Protein Purification	Biochemistry	**BVS3P05**
V	**VSC**	Methods of DNA Analysis	Biochemistry	**BVS5P07**
VI	**VSC**	Data Retrieval & Analysis	Biochemistry	**BVS6P08**

Basket for ELECTIVE (DSE) Category Courses (Biochemistry)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	A. Molecular Genetics B. Forensic Biochemistry	BBC5T12
VI	Elective 2	A. Immunodiagnostics B. Molecular sequencing Techniques	BBC6T16
VII (Honors)	Elective 3	A. Scientific communications and Data representations B. Obesity & Endocrine Disorders	BBC7T21
VIII (Honors)	Elective 4	A. Reproductive Biochemistry B. Cancer Biology	BBC8T27
VII (Research)	Elective 3	A. Scientific communications and Data representations B. Model Systems for Research	BBC7T20R
VIII (Research)	Elective 4	A. Reproductive Biochemistry B. Cancer Biology	BBC7T25R

B. Sc. Part I
SEMESTER: I, PAPER: I

(Biomolecules and Nutritional Biochemistry)

UNIT-I

Carbohydrates: Classification and Biological Functions of monosaccharides(glucose, fructose, Manose, galactose), disaccharides, oligosaccharides, polysaccharides : starch, cellulose, chitin, food sources, digestion and storage in body. Nutritional aspects of carbohydrates, types of dietary carbohydrates, role of non starch carbohydrates.

Lipids: Nomenclature, classification, saturated and unsaturated lipids, Triglycerides, Conjugated lipids, Saponification value, Iodine Number, Acid value and RM number, Nutritional aspects of lipids, dietary types of lipids, essential lipids, classification, food sources, function of fats.

UNIT-II

Amino acids, classification, peptide bond, polypeptides. Proteins, functions, structure: primary Secondary, Tertiary, quaternary, Forces stabilizing protein structure, denaturation.

Nutritional aspects of proteins, Proteins - composition, sources, essential & non-essential amino acids, quality of proteins, digestibility coefficient, net protein utilization, biological value, amino acid score, Protein deficiency. Protein Energy malnutrition

Nucleic acids: Bases, Nucleoside, Nucleotide, DNA, Watson-Crick Model, A,B and Z forms of DNA, RNA, types and functions of RNA

UNIT-III

Vitamins (water & fat soluble) - definition, classification & functions. Minerals - macro & micronutrients. - functions, sources. Bioavailability, and deficiency of Calcium, Iron, Iodine, Sodium & Potassium (in very brief).

Modern methods of improvement or nutritional quality of food, food fortification, enrichment and nutrient supplementations

UNIT-IV

Direct and indirect calorimetry, energy value of foods, Basal Metabolic Rate, Measurement of BMR, Factors affecting BMR, energy requirements of human being Malnutrition- meaning. factors contributing to malnutrition, over nutrition.

Effect of cooking & heat processing on the nutritive value of foods. Role of fibers in human nutrition, Water - as a nutrient, function, sources, requirement, water balance & effect of deficiency.

B. Sc. Part I
SEMESTER: I, PAPER: II
(MICROBIAL BIOCHEMISTRY)

UNIT I

A) **History of Microbiology**: Contribution of Louis Pasteur, Robert Koch and Edward Jenner

B) **Microscopy:** Principle, Ray diagram and Applications of Compound Microscope, Phase contrast.

C) **Structure of Bacteria**: i) General morphology of bacteria, shapes & sizes ii) Biomolecular composition of Slime layer & capsule iii) Cell wall structure and composition of Gm + ve & Gm -ve cells iv) General account of Flagella, Pili & Fimbriae v) Endospore: Detailed study of endospore structure & its formation.

UNIT II

A) **Bacterial Nutrition**: i) Basic nutritional requirements (nutrients as water, carbon, nitrogen, sulfur and vitamins etc.). ii) natural and synthetic media, nutritional classification of bacteria. Selective and Differential media.
B) **Bacterial Growth:** Growth rate and generation time, growth curve ii) Physical conditions required for growth: Temperature (classification of microorganisms on the basis of temperature requirements), Ph etc.
C) **Isolation and Maintenance of Bacteria:** Pure cultures and cultural characteristics. I)Maintenance of pure culture. ii) Measurement of growth: - Total cell count and viable cell count method. ii)Biochemical characterization of bacteria

Unit III

A) **Terminologies:** Terminology Sterilization, disisinfectant, Antiseptic, Antimetabolite, Antibiotics, Microbiostatic, Microbicidal, Pasteurization and Sanitization.
B) **Biochemical basis of microbial control**: Factors influencing antimicrobial activity. Mechanism of cell injury
C) **Microbial control Methods**: Physical control methods and Chemical control methods.

Unit IV

A) Staining: Principle and technique of simple & differential staining, Gram staining, Endospore staining, Capsule staining, Negative staining.

B) **Introductory Medical Parasitology:** i) Classes of Pathogens (Bacteria, fungi, Protozoans, Helminths etc.), ii) Methods for diagnosis for parasitic infections iii) Pathogen induced disease: Malaria –(pathogen, lifecycle and stages of infection), Widal test

C) **Viruses:** General characteristics of viruses. Virus Structure. General characteristics of RNA and DNA Viruses. Bacteriophages, Lytic cycle & Lysogeny.

B. Sc. Part I Semester I PRACTICALS

[A] Biomolecules & Nutritional Biochemistry

1) Qualitative analysis of Carbohydrates.
2) Qualitative analysis of Proteins and Lipids.
3) Determination Saponification value of fats.
4) Determination of Acid value of fats.
5) Titrimetric estimation of calcium in food sample
6) Estimation of Vitamin C by DCPIP method.
7) Calculation Body Mass Index (BMI)
8) Determination of food adulterants.

[B] Microbial Biochemistry

1) Demonstration compound microscope, uses, & care of microbiological equipments.
2) Preparation of culture media: Nutrient agar slants and nutrient broth.
3) Sterilization of media and glassware by autoclaving.
4) Sterilization of heat labile compounds by filter sterilization.
5) Isolation of pure culture by streak plate and pour plate method.
6) Isolation of Bacteria on nutrient agar plate from water, air, skin, teeth samples etc.
7) Simple staining of Bacteria.
8) Differential staining: Gram staining and Endospore staining
9) Anaerobic culture of bacteria
10) Isolation of bacteriophage from sewage / other sources.

Note: - Mandatory to perform atleast 3 practical from each section

LIST OF BOOKS B.Sc. Semester I

1) Biochemistry – U. Satyanarayana, 6th Edition
2) Food Science, Chemistry and Experimental Foods: Dr.M.Swaminathan, The Bangalore Printing and Publishing Co. Ltd.
3) Fundamentals of Foods, Nutrition and Diet Therapy :S.R Mudambi and M.V. Rajgopal. New Age International Ltd
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Biochemistry – Lehninger – CBS Publishers.
6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
8) General Microbiology, Vol. I & II – Powar, Daginawala – Himalaya Publishing House.
9) General Microbiology – Stanier, Adelberg, Ingraham – The Macmillan Press – London.
10) Fundamental Principals of Bacteriology – Salle – TMH Pub. Co. Ltd. – New Delhi.
11) Microbiology – Davis, Dulbacco, Eisen, Ginsberg – Harper International Edition.
12) Microbiology – Pelczar, Chan, Kreig –McGraw Hill Int. Edition.
13) Microbiology-An Introduction – Tortora, Funke, Case, Benjamin – Cummings Publ. Co.
14) Fundamental Virology (1995) – B. N. Fields, D. M. Knipe, P. M. Howley, R. M. Chanock, J. L. Meenick, T. P. Monath, Strans, Lippin Cott Raven.

VSC Basket Biochemistry (2 credit, 4 hour Practical) Semester 1

MICROBIAL CULTURE MEDIA (BVS1P01)

Course Objective: This course is designed to offer enhanced practical skills to students. After completion of this course student will have understand, learn and perform skills needed in a microbial laboratory/pathology laboratory.

1. Basic instrumentations in microbial culture.
2. Preparation and use of nutrient broth for microbial cultivation.
3. Preparation and use of nutrient agar for microbial cultivation.
4. Preparation of enriched media and cultivation of micro-organisms from water and soil.
5. Preparation and uses of alkaline peptone water enrichment media for cultivation of *Vibrio cholerae*.
6. Preparation and uses of Selenite F broth enrichment media for isolation of Salmonella from feces, urine, water, foods and other materials.
7. Preparation and use of differential media (Mac Conkey agar, Blood agar etc.) in microbial culture.
8. Preparation and use of transport media.
9. Preparation and use of storage media for microbial culture (Egg saline medium, chalk cooked meat broth etc.).
10. Isolation of salt sensitive E Coli using LB lennox broth.
11. Cultivation of aerobic and facultative anaerobic bacteria using Mueller Hinton Broth.

References:

1. American Society for Microbiology Commi. Manual of Methods for Pure Culture Study. 2nd edition. Sagwan Press publication.
2. Stuart Isaacs and Prof David Jennings. **Microbial Culture (Introduction to Biotechniques). Taylor and Francis.**

B.Sc. SEMESTER – I

BVE1T01: ENVIRONMENTAL SCIENCE

COURSE OUTCOMES:

At the end of the course, students shall be able to:

- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

Unit-I: Basics of Environmental Science (7.5 Hrs)

A. Introduction of Environmental Science: Definition, Types, Classification, Characteristics, Components and principles of environment. Scope and need for environmental science, Multidisciplinary nature of environmental science, Environmental ethics.
B. Environmental Education: Goals, Objectives and principles of environmental education, formal and non-formal environmental education, environmental programme, importance of environmental education, environmental awareness.
C. Components of Environment: Atmosphere (Structure and composition),hydrosphere – distribution of water, hydrological cycle, global water balance, lithosphere – Internal structure of Earth, types of rocks, Biosphere- Boundaries of biosphere.

Unit-II: Basics of Atmospheric Science (7.5 Hrs)

A. Atmospheric Chemistry: Structure of atmosphere based on temperature, photochemical reaction in the atmosphere, temperature inversion and lapse rate, smog formation, types of smog (sulphur and photochemical smog), adverse effect of smog on human being, aerosol.
B. Green House Effect: Greenhouse gases, relative contribution and effects of greenhouse effect, control of greenhouse gases. Ozone depletion: chemistry of ozone depletion, Dobson Unit, ozone depleting substances (ODS), ozone hole, consequences of ozone depletion, mitigation measures and international protocols.
C. Acid Rain: Chemistry of Acid Rain, effect of acid rain on ecosystem, control measures. Precipitation – Forms of precipitation (rain, drizzle, snow, sleet, and hail), types of precipitation (conventional, orographic, and cyclonic).

Unit-III: Basics of Ecology (7.5 Hrs)

A. Ecology: Definition, subdivision and modern branches of ecology, ecology spectrum, scope of ecology. Application and significance of ecology to human beings.
B. Abiotic Factors: Temperature: effect of temperature on plants and animals, Adaptation to meet extreme temperature. Light: Zonation in marine habitat, effects of light on plants and animals, Microclimate and fire, Shelford law of tolerance, Leibigs law of minimum.
C. Biotic Factor: Inter specific relationship Positive: Mutualism (symbiosis), commensalism, proto- cooperation Negative: Parasitism, predation, competition, Antibiosis, Neutralism.

Unit-IV: Ecosystems and food chain (7.5 Hrs)

A. Ecosystem: Definition, structure and function of ecosystem, types of ecosystem: Terrestrial (forest, grassland, desert, cropland), Aquatic (Marine and freshwater)
B. Food chain: Definition & types: Grazing food chain, detritus food chain, and parasitic food chain, food web in forest and grassland ecosystem. Ecological pyramids (number biomass and energy), energy flow in ecosystem (Y- shaped). Energy flow and the law of thermodynamics.
C. Biogeochemical Cycles: Definition, classification, gaseous cycle (oxygen, carbon and nitrogen) Sedimentary cycle (phosphorus and sulphur).

Reference Books:

1. Text Book of Environment: K M Agrawal, P.K. Sikdar, and S.C. Deb, Mc'Millan Publication, Mumbai.
2. Man and Environment: M.C. Dash and P.C. Mishra, Mc'Millan Publication, Mumbai.
3. Environmental Science: S.C. Santra, New Central Book Pvt.Ltd, Kolkatta.
4. Environmental Problems and Solution: D.K. Asthana, S.Chand Publication, New Delhi.
5. Environmental Chemistry: S.S. Dara, S.Chand Publication ,New Delhi.
6. Environmental Chemistry: A.K. Dey, New Age International Publishers,2001.
7. A Textbook of Environmental Studies: Dr S.Satyanarayan, Dr S.Zade, Dr S Sitre and Dr **P.U. Meshram, Allied Publishers, New Delhi.**
8. Environmental Biology: Biswarup Mukherjee, Tata McGraw-Hill Publishing Company Ltd, New Delhi,1996.
9. Animal Ecology and Distribution of Animals: Veer Bala Rastogi , Rastogi Publication, Meerut (U.P).
10. Ecology and Environment: P.D.Sharma, Rastogi Publication ,Meerut (U.P).
11. Fundamentals of Environmental Biology: S. Arora, Kalyani Publishers.
12. Environmental Biology: P.K.G. Nair, Himalaya Publication.
13. Environmental Biology: K.C. Agrawal, Agro Botanical Publisher ,Bikaner,1994

Indian Knowledge System (IKS)

SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes: This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. gain test taking skills & creativity of calculations

UNITS	TOPICS	HOURS
Unit 1	(i)Addition - Subtraction - Combined operations - Beejank (ii) Multiplication methods: Urdhwatiryagbhayam, Nikhilam, Ekanyunen, Ekadhiken, Antyayordashakepi. (iii) Vinculum - Operations. (iv) Awareness of 1 to 5 Vedic sutras as per Shankaracharya Bharthikrishan Teerthji Swamiji's book.	**8**
Unit 2	(i) Division methods : Nikhilam, Paravartya Yojayet, Dhwajank(ii) GCD and LCM (iii) Expression of GCD in terms of two numbers.	**8**
Unit 3	(i) Divisibility tests, Osculation & Reverse osculation. (ii) Division Algorithm, Quotient & Remainder. (iii) Duplex method.	**7**
Unit 4	i) Squares & Square-roots for 6 digit number. (ii) Cubes & Cube-roots for 6 digit number, Contribution of Indian Mathematicians in Arithmetic.	**7**
	TOTAL	**30 HRS**

Reference Books:

1. Tirthaji B.K. (1965) Vedic Mathematics, MotilalBanarsidass
2. Bidder G.P. (1856) On Mental Calculation. Minutes of Proceedings, Institution ofCivil Engineers (1855-56), 15, 251-280
3. Scripture E.W. (1891) American Journal of Psychology. Vol. IV 1-59
4. Mitchell F.D. (1907) American Journal of Psychology. Vol. XVIII 61-143
5. Aitken A.C. (1954) The Art of Mental Calculation: With Demonstrations. Transactions of the Society of Engineers. 45, 295-309
6. Dow A. (1991) A Unified Approach to Developing Intuition in Mathematics, Scientific Research on the Transcendental Meditation and TM-Sidhi Program Vol 5,3386-3398
7. Williams K.R. (1984) Discover Vedic Mathematics. Vedic Mathematics Research Group
8. Nicholas, Williams, Pickles (1984) Vertically and Crosswise. Inspiration Books

B. Sc. Part I
SEMESTER: II, PAPER: I
(Human Physiology & Clinical Biochemistry)

UNIT I

A) Acid base balance concepts: i). Concepts of Acid Base reaction and hydrogen ion concentration. pH meter & pH buffer. Ii)Disorders: Acidosis, Alkalosis

B) Blood: Composition, Hemoglobin, plasma proteins, Mechanism of blood coagulation, Anemia (Sickle cell anemia)

C) Muscles and Neurons: Structure of striated muscle fiber. Sliding mechanism of muscle contraction, Structure of Neuron, conduction of impulse, Neuromuscular Junction

UNIT-II

A) Cardiac Profile: Blood pressure (BP), BP disorders: Hypotension and Hypertension, Angina, Myocardial Infarction, Pattern of Cardiac Enzymes in heart diseases.

B) Kidney: Structure of Nephron, Urine formation, GFR, analysis of urine, Renal Function Tests,

C) Liver Function Tests, Jaundice, Importance of alkaline phosphatase, SGOT,SGPT and bilirubin

UNIT-III

A) Endocrine glands & their hormones, Classification of hormones. Role of Hypothalamus & Pituitary in hormone secretion

B) Function of hormones: Thyroxine, parathormone, adrenaline, noradrenaline, cortisol, Basic mechanism of action of Peptide and Steroid hormones.

UNIT-IV

A) Examination of body fluids:Semen analysis, CSF (Cerebrospinal Fluid) and Stool Examination.

B) Diabetic Profile 1. Regulation of Blood Glucose, 2. Glucose tolerance test, 3. Glycosylated Hemoglobin, 4. Microalbuminuria etc. Role of insulin, glucagon in diabetes

B. Sc. Part I

SEMESTER: II, PAPER: II

(Techniques in Biochemistry)

UNIT – I:

Spectrophotometry:-Concepts of electromagnetic radiation, Spectrum, Absorption of electromagnetic radiation, Concept of chromophores.
Beer's law – derivation & deviations, Extinction coefficient.
Instrumentation & applications of UV & Visible spectrophotometry.

UNIT-II

Chromatography:-Partition principle, partition coefficient, Paper Chromatography and thin layer chromatography,
Gel filtration: - Concept of distribution coefficient, Types of gels & glass beads, Applications Ion-Exchange chromatography: - Principle, Types of resins, Choice of buffers, Applications. Affinity chromatography: - Principle, Selection of ligand, Applications.

UNIT – III:

Electrophoresis: Migration of ions in electric field, Factors affecting electrophoretic mobility.
Paper electrophoresis: - Electrophoretic run, Detection techniques, Cellulose acetate electrophoresis
Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications.

UNIT-IV:

Radioactive & stable isotopes: Pattern and rate of radioactive decay. Units of radioactivity. Isotopes commonly used in biochemical studies – 32P, 35S, 14C, 3H. Applications of isotopes in RIA, PET Scan etc.)

Centrifugation: Basic principles, RCF, Sedimentation coefficient, Svedberg constant, Types of centrifuge:- Desk top, High speed & Ultracentrifuges. Preparative centrifugation: - Differential & density gradient centrifugation, Isolation of cell components. Analytical centrifugation: - sedimentation velocity & sedimentation equilibrium methods.

B. Sc. Part I Semester II PRACTICALS

[A] Human Physiology & Clinical Biochemistry

1) Calculation of Normality, Molarity and preparation of Phosphate buffer.
2) Determination creatinine in urine by Jeff's method.
3) Determination serum bilirubin by Malloy and Evllyn method.
4) Estimation of blood urea by Nesslerization method.
5) Estimation of SGOT and SGPT activity.
6) Routine urine analysis.
7) Determination of alkaline phosphatase activity.
8)Determination of clotting time of blood by capillary tube method.
9) Estimation of glucose by Benedict quantitative method.
10)Measurement of blood pressure and blood group determination.

[B] Techniques in Biochemistry

1) Determination of absorption maxima of hemoglobin.
2) The validity of Beer's law for colorimetric estimation of creatinine.
3) Estimation of DNA by diphenylamine reaction.
4) Subcellular fractionation by centrifugation
5) Separation of amino acids by TLC.
6) Separation of amino acids by descending\ascending paper chromatography..
7) Determination of isoelectric pH of casein.
8) Estimation of proteins by Folin-Lowry's method.
9) Demonstration of Salting-Out of proteins by ammonium sulphate precipitation.
10) Agarose Gel electrophoresis of DNA

Note: - Mandatory to perform atleast 3 practical from each section

LIST OF BOOKS FOR SEMESTER II

1) Human Physiology, Vol. I & II, - C. C. Chatterjee – Medical Allied Agency – Calcutta.
2) Concise Medical Physiology – Choudhary – New Central Book Agency – Calcutta.
3) TextBook of Medical Physiology – Guyton – Prism Books Pvt. Ltd. – Bangalore.
4) Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
5) Biochemistry – Lehninger – CBS Publishers.
6) Biochemistry – Stryer – W. H. Freeman & Co. – New York.
7) Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.
8) Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.
9) 2) A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Ernold Publ. 11
10) The Tools of Biochemistry – T. G. Cooper.
11) Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
12) Physical Biochemistry – H. B. Bull – John Wiley & Sons.
13) Enzyme Kinetics – Irwin H. Segal – Wiley Intersci. Publ.
14) Biologist's Physical Chemistry – T. G. Morris.
15) Chromatography – G. Abbott.
16) Methods in Experimental Biology – R. Ralph.
17) Physical biochemistry – vanHolde – Prentice Hall Inc.

VSC Basket Biochemistry (2 credit, 4-hour Practical) Semester 2

FOOD PROCESSING TECHNIQUES (BVS2P03)

Course Objectives: After completion of this course, the student should be able to:

- Understand methods of processing and analysis of important parameters related to food science.
- Perform proximate analysis to know components of food,
- Demonstrate various principle applied to food processing.
- Understand the importance of processing techniques.

SYLLABUS

1. Introduction to food laboratory practices,
2. Proximate analysis (protein, carbohydrate, fat) of food
3. Estimate the moisture content of food.
4. Determination of ash content in food.
5. Determination of fiber content.
6. Precipitation of casein protein from milk with vinegar and to test the effectiveness of casein as a bonding agent to make casein glue.
7. To demonstrate how changes in air pressure can affect food products and the principle behind applying a vacuum in meat processing.
8. Jelly preparation and effect of sugar content on the quality of Jelly.
9. Effect of Temperature on Taste
10. Estimation of microbial load in food materials by aerobic plate count
11. Estimation of protein by lowry's method
12. To study the osmotic dehydration of foods
13. Determination of rehydration ratio of dehydrated food
14. To detect the adulterants, present in the food.
15. Food preservation Techniques.

REFERENCES

1.Food – The Chemistry of Its Components by T P Coultate, Royal Society of Chemistry, 2016 6^{TH} , edition ,

2.Food Processing and Preservation by B. Sivasanker, Prentic Hall of India, 2014

3.Food Microbiology by W C Frazier and D C Westhoff, McGraw-Hill Book Company

4. Modern Food Microbiology by J M Jay, Springer US, Language:English, Author:James M. Jay, Martin J. Loessner, David A. Golden2005,

5.Food Processing: Principles and Applications by J Scott Smith and Y H Hui

6.Principles of Food Processing by Sathya Prakash Sinha

SEM 2 : CONSTITUION OF INDIA (BVE2T02)

Syllabus

UNIT – I:

- Historical Background to the Framing of the Indian Constitution: General Idea about the Constituent Assembly of India.

UNIT – II

- Preamble – Nature and key concepts/Constitutional values, Socialism, Secularism, Democracy, Justice, Liberty, Equality and Fraternity

- Salient Features of the Constitution of India

UNIT – III

- General study about the kinds, nature and importance of; Fundamental Rights, Directive Principles of State Policy and Fundamental Duties.

UNIT –IV

Introduction of the Constitutional Institutions and Authorities;

- Central Legislature and Executive (Parliament of India, President of India and Council of Ministers)
- State Legislature and Executive (State legislative Assemblies, Governors and Council of Ministers)
- Higher Judiciary (Supreme Court of India and High Courts)

Indian Knowledge System (IKS)

SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes: This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture usingastronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phasetransitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the pastdramatic transitions.

UNITS	TOPICS	HOURS
Unit 1	Astronomy in Prehistoric Era, Astronomy in Vedic Era, Vedang Jyotish, Astronomical References In Religious Scriptures, Astronomies of the West	**8**
Unit 2	Arya Bhatta, Panch Siddhantika of Varahamihira, Surya Siddhanta Varahamihira to Bhaskar Acharya-II, Siddhant Shiromani of Bhaskar Acharya-II, Bhaskar Acharya-II to Jai Singh, Jai Singh and his Observatories.	**8**
Unit 3	After Jai Singh, Interaction with the Astronomies of the World, Modern Era Astronomy , Our Universe, Cosmology	**7**
Unit 4	Panchang Horoscope and Astrology , Siddhantas, Karnas and Koshtakas, Observational Instruments of Indian Astronomy	**7**
	TOTAL	**30 HRS**

Reference Books:

1. The Story Of Astronomy In India, Chander Mohan, Pothi.com
2. Indian Astronomy: An Introduction. Front Cover · S. Balachandra Rao.Universities Press, 2000
3. Astronomy in India: A Historical Perspective, Thanu Padmanabhan,Springer Science & Business Media
4. Hindu Astronomy, W. Brennand, Alpha Editions
5. Origin and Growth of Astronomy in India, https://www.tifr.res.in/~archaeo/FOP/FOP%20pdf%20of%20ppt/Vahia%20Origin% 20of%20Astronomy.pdf