Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Structure and Curriculum of Four Year Multidisciplinary Degree (Honors) Programme with Multiple Entry and Exit option

Undergraduate Programme of Science and Technology

B.Sc. (Honors) in Biotechnology

Board of Studies

in

Biotechnology

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

w.e.f. June, 2023

(In Accordance with NEP-2020)

Review Statement

The NEP Cell reviewed the Curriculum of **B.Sc. (Honors) in Biotechnology** Programme to be effective from the **Academic Year 2023-24.** It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 09/08/2023

Place: Latur

NEP Cell
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors) in Biotechnology** Programme to be effective from the **Academic Year 2023-24.**

Date: 14/07/2023

Place: Latur

(Dr.Sachin Kulkarni)
Chairperson
Board of Studies in Biotechnology
Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)

Rajarshi Shahu Mahavidyalaya, Latur
(Autonomous)
Members of Board of Studies in the Subject Biotechnology
Under the Faculty of Science and Technology

Sr. No.	Name	Designation	In position
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4	**Dr. Rajesh M. Jorgewad** Asst. Professor, Department of Biotechnology and Bioengineering, KIT college, Kolhapur (Autonomous)	Member	Academic Council Nominee
5	**Dr. Gunderao. H. Kathwate** Asst. Professor, Dept. of Biotech. S. P. P. U. Pune	Member	Expert from outside for Special Course
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10	**Dr. Ravindra. B. Ade**	Member	Faculty Member
11	**Dr. Sanghapal. S. Kshirsagar**	Member	Faculty Member
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14	**Miss. Swati G. Swami**	Member	Faculty Member
15	**Mr. Sanket M. Bansode**	Member	Faculty Member
16	**Miss. Karuna S. Komatwar**	Member	Faculty Member
17	**Dr. Kakasaheb S. Raut**	Member	Member from same Faculty

From the Desk of the Chairperson…

Biotechnology as a subject is a highly interdisciplinary that combines biological sciences with engineering technologies to manipulate living organisms and biological systems to produce products that advances healthcare, medicine, agriculture, food, pharmaceuticals and environment. At its simplest, biotechnology is technology based on biology - which harnesses cellular and bimolecular processes to develop technologies and products that help to improve our lives and health of our planet.

Taking into consideration of the importance of Biotechnology, Rajarshi Shahu Mahavidyalaya, Latur (Autonomous), have taken an initiative to introduce a new emerging field as an undergraduate Programme in biotechnology under the faculty of science. B. Sc. Biotechnology is a Three-year graduate degree program which is started in the academic year 2004-05 followed by the postgraduate program started in academic year 2006-07.

National Education Policy (NEP) 2020 recognizes the relevance of biotechnology in the education system due to its interdisciplinary nature, potential for research and innovation, and its alignment with the development of 21st-century skills. By integrating biotechnology into the curriculum, the policy aims to prepare students for the challenges and opportunities of a rapidly advancing biotechnology driven world.

NEP-2020 has conceptualized the idea to develop well rounded competent individuals for making the nation a self-reliant and global leader. In the same spirit, we at Department of Biotechnology, have developed a curriculum framework to encompass the goals of NEP 2020. In the overall curriculum we have incorporated choice of courses of study, creating academic pathways having constructive combinations with multiple entry and exit points as well as focus on experiential learning for students by introducing multidisciplinary, skill enhancement, vocational courses along generic elective(s) and course based on Indian knowledge system and actual Hand's on training in the recent and trending areas of Biotechnology.

With reference to global changes occurring in higher education in various national and foreign universities, the newly designed syllabi of B.Sc. Biotechnology as per NEP 2020 guidelines are effectively implemented from June, 2023. The committee members of Board of Studies in Biotechnology also took the local need and employability of graduate students into consideration while framing the given curriculum, keeping in view of the guidelines given in the University Grants Commission, New Delhi.

By aligning curriculum development, pedagogy, interdisciplinary connections, research opportunities, industry collaborations, teacher training, and available infrastructure with the institute, the department of biotechnology plans to integrate students with a comprehensive understanding of biotechnology, foster critical thinking and research skills, and prepare them for future careers in the field.

(Dr. Sachin Kulkarni)
Chairperson
Board of Studies in Biotechnology

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Index

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Faculty of Science and Technology

Structure for Four Year Multidisciplinary Undergraduate Degree Programme in Biotechnology Multiple Entry and Exit (In accordance with NEP-2020)

Year & Level	Sem	Major		Minor	GE/OE	VSC/ SEC (VSEC)	AEC/ VEC	OJT,FP,CEP, RP	Credit per Sem.	Cum./Cr. per exit
		DSC	DSE							
1	**2**	**3**		**4**	**5**	**6**	**7**	**8**	**9**	**10**
I 4.5	I	DSC I: 04 Cr. DSC II: 04 Cr.	NA	NA	GE-I: 04 Cr.	VSC-I: 02 Cr. SEC-I: 02 Cr.	AEC-I MIL: 02 Cr. VEC-I: 02 Cr.	CC-I: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-I: 02 Cr. (SES-I)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	44 Cr. UG Certificate
	II	DSCIII: 04 Cr. DSC IV: 04 Cr.	NA	NA	GE-II: 04 Cr.	VSC-II: 02 Cr. SEC-II: 02 Cr.	AEC-II MIL: 02 Cr. VEC-II: 02 Cr.	Generic IKS: 02 Cr.	22	
	Cum. Cr.	16	-	-	08	04+04 = 08	04+02 +02=08	04	44	
Exit Option: Award of UG Certificate in Major with 44 Credits and Additional 04 Credits Core NSQF Course/Internship or continue with Major and Minor										

Abbreviations:

1. DSC : Discipline Specific Core (Major)
2. DSE : Discipline Specific Elective (Major)
3. DSM : Discipline Specific Minor
4. GE/OE : Generic/Open Elective
5. VSEC : Vocational Skill and Skill Enhancement Course
6. VSC : Vocational Skill Courses
7. SEC : Skill Enhancement Course
8. AEC : Ability Enhancement Course
9. MIL : Modern Indian Languages
10. IKS : Indian Knowledge System
11. FSRCE : Fostering Social Responsibility & Community Engagement
12. VEC : Value Education Courses
13. OJT : On Job Training
14. FP : Field Projects
15. CEP : Community Engagement and Service
16. CC : Co-Curricular Courses
17. RP : Research Project/Dissertation
18. SES : Shahu Extension Services

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Biotechnology

B.Sc. (Honors) in Biotechnology

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.
I 4.5	I	101BIO1101 (DSC-I)	Cell Biology	03	45
		101BIO1103	Lab Course-I	01	30
		101BIO1102 (DSC-II)	Introductory Microbiology	03	45
		101BIO1104	Lab Course-II	01	30
		GE-I	From Basket	04	60
		101BIO1501 (VSC-I)	Bioinstrumentation-I	02	45
		(SEC-I)	From Basket	02	30
		(AEC-I)	From Basket	02	30
		(VEC-I)	Constitution of India	02	30
		AIPC/OJT-I	Mini project/ Field Project	02	60
	Total Credits			**22**	
	II	101BIO2105 (DSC-III)	Biochemistry	03	45
		101BIO2107	Lab Course-III	01	30
		101BIO2106 (DSC-IV)	Genetics	03	45
		101BIO2108	Lab Course-IV	01	30
		GE-II	From Basket	04	60
		101BIO2502 (VSC-II)	Bioinstrumentation -II	02	45
		(SEC-II)	From Basket	02	30
		(AEC-II)	From Basket	02	30
		(VEC-II)	FSRCE (CBPR)	02	30
		Generic IKS	Introduction to Indian Knowledge System	02	60
	Total Credits			**22**	
Total Credits (Semester I & II)				**44**	

Programme Outcomes (POs) for B.Sc. Programme	
PO 1	
PO 2	
PO 3	
PO 4	
PO 5	
PO 6	
PO 7	

Programme Specific Outcomes (PSOs) for B.Sc. Biotechnology (Honors)	
PSO No.	Upon completion of this programme, the students will be able to -
PSO 1	Prepare the students with the skills, ethics, aptitude and human values of practicing the science in day-to-day life
PSO 2	Promote the interdisciplinary research in biotechnology for tackling the future problems threatening the society
PSO 3	Equip the students with the abilities required to attain self-sufficiency and life sustainability by imparting entrepreneurial skills
PSO 4	Design process equipment, plants, biosensors and recombinant molecules for biotechnological and allied processes
PSO 5	Identify measures for energy, environment, health, safety and society following ethical principles and apply the knowledge of basic science and engineering to solve complex biotechnological problems
PSO 6	Isolate, purify and characterize biological samples using sophisticated analytical experimental techniques
PSO 7	Apply modern software tools including prediction and modeling methods on biological databases to identify issues in biomedical problems
PSO 8	Assess personal, product and environmental safety, intellectual property and social responsibilities related to modern biotechnological research and development

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Biotechnology

Course Type: DSC-I
Course Title: Cell Biology
Course Code: 101BIO1101
Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To understand basic of cell biology and its applications.
LO 2. To study Cell organelles and its Function
LO 3. To understand transport mechanism in and out of cell
LO 4. To understand cell cycle and its regulation events
LO 5. To understand the concept of types of cells.
LO 6. To study the concept of cytoskeleton.
LO 7. To acquire the knowledge about cell signaling.
LO 8. To acquire the knowledge about active transport.

Course Outcomes:

After completion of the course, the student will be able to-

CO 1. Discuss origin and evolution of cells
CO 2. Describe physico-chemical composition of organelles and their functional organization.
CO 3. Explain transport mechanism of cells
CO 4. Elucidate significance of cell-cell communication
CO 5. Explain the knowledge about origin of mitochondria.
CO 6. Elucidate the concept of extracellular matrix.
CO 7. Understand the role of high energy compounds.
CO 8. Understand the basic concept of stem cell.

Unit No.	Title of Unit & Contents	Hrs.
I	**Introduction to Cell biology**	**07**
	1. Cell – Shapes, morphology, Cell theory. 2. Origin of life –Stanley miller Experiment. 3. Origin of Mitochondria, Chloroplast (Endosymbiotic theory). 4. Introduction to prokaryotic and eukaryotic cells. 5. Microscopic techniques in cell biology.	
	Unit Outcomes: UO 1. Discuss origin and evolution of cells. UO 2. Explain difference between prokaryotic and eukaryotic cell.	
II	**Cell organelles and Cytoskeleton**	**15**
	1. Cell wall and cell membrane. 2. Endoplasmic reticulum and Golgi body. 3. Mitochondria and Chloroplast. 4. Nucleus. 5. Microbodies: Glyoxysome, Peroxisome, Melanosome, lysosomes, vacuoles.	

Unit No.	Title of Unit & Contents	Hrs.
	6. Cytoskeleton. 7. Extracellular matrix. 8. Cell junctions.	
	Unit Outcome: UO 1. Describe physico-chemical composition of organelles and their functional organization. UO 2. Explain cytoskeleton and cell junction.	
III	**Membrane Transport**	**13**
	1. Transport across cell membrane, simple diffusion, passive transport, active transport, Na/K ion channel, vesicular transport. 2. concept of ETC Membrane. 3. Role of high energy compound. 4. Membrane potential, Depolarization, hyperpolarization of membrane (neuronal). 5. Generation of action potential. 6. Types of biopotentials. Biopotential measurement instrument.	
	Unit Outcomes: UO 1. Explain transport mechanism of cells UO 2. Student will be able to study action potential in cell	
IV	**Cell cycle and Cell-cell communication**	**10**
	1. The mechanism of cell division 2. Cell cycle and its regulation, 3. Cell Signaling: G-Protein coupled receptor, Nitrous oxide, Calcium as secondary messenger and its role in plant and animals. 4. Cell differentiation 5. Neoplasia& Cell death **6.** Brief introduction to stem cells	
	Unit Outcomes: UO 1. Elucidate significance of cell-cell communication UO 2. Describe mechanism of cell division and cell death.	

Learning Resources:

1. Molecular Cell Biology, Lodish et al, Scientific American Book, 2004.
2. Manual of Laboratory Expts. in Cell Biol, Edward Gasque, W. C. Wilson Pub, 2005.
3. The Biology of the Cell, Alberts et al 5th Edition, 2002.
4. A Molecular Approach the Cell, Cooper &Hausmann –4th Edition , 2004.
5. Cell and Molecular Biology, Gerald Karp - 4th Edition, 2007.
6. Medical Physiology, Guyton & Hall, Eleventh Edition-Elsevier,2009.
7. Cell Biology A Short Course, Stephen R. Bolsover Wiley Liss A JOHN WILEY & SONS, INC., PUBLICATION, 2004.
8. Cell biology, Veer Bala Publication Rastogi, MedTech Science Press 2021.
9. Trends in Cell Biology (Magazine), IlariaCarnevale, Editor-in-chief ,2020.
10. Nature cell biology, ISSN: 1465-7392, 2010.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Biotechnology

Course Type: Lab Course
Course Title: Lab Course –I (Based on DSC-I)
Course Code: 101BIO1103
Credits: 01 **Max. Marks: 50** **Hours: 30**

Learning Objectives

LO 1. To study cell diversity.
LO 2. To design experiments on karyotyping
LO 3. To study different stages of cell cycle
LO 4. To provide hands-on Cell separation techniques
LO 5. To study the staining technique of lipids.
LO 6. To design experiments on cell lysis- methodology.

Course outcomes

After completion of the course, the student will be able to-

CO 1. Perform separation of subcellular components of cells.
CO 2. Identify and describe the cellular structure of organs and tissues from prepared slides, and outline the principles of histochemical staining.
CO 3. Interpret the chromosome structure, cell division events in cells.
CO 4. Explain membrane transport practically.

Practical No.	Unit
1	To Study Cell Diversity
2	To study Permeability Change in erythrocyte using Osmosis
3	Separation of cells using sedimentation and velocity Centrifugation
4	Staining of mitochondria
5	Staining of Vacuoles
6	Staining of Glycogen bodies
7	Staining of Lipids
8	Study of Karyotyping
9	Study of Mitosis using Onion Root
10	Study of Meiosis Using Onion Flower
11	Cell harvesting and cell lysis- methodology
12	Study of Tissue by Microtomy
13	Isolation of Chloroplast

N.B.: Any Ten Practical from above.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Biotechnology

Course Type: DSC-II

Course Title: Introduction to Microbiology

Course Code: 101BIO1102

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To learn and understand the contributions of various scientists in microbiology
LO 2. To learn structure and function of bacterial cell
LO 3. To understand and apply pure culture technique for isolation of microorganisms
LO 4. To understand different methods of sterilization of culture media
LO 5. To observe, understand and measure microbial growth
LO 6. To understand the mechanism and function of staining used in microbiology
LO 7. To understand the different types of culture media, direct and indirect methods of quantification of microorganisms
LO 8. To understand the mechanism of external environmental factors on growth of microorganism

Course Outcomes:

After completion of the course, the student will be able to-

CO 1. Interpret the structural similarities and differences among microorganisms and the unique structure/function relationships of prokaryotic cells
CO 2. Explain the diversity of microorganism in special reference to bacteria
CO 3. Demonstrate the proper use of a microscope to observe microorganisms and report observed characteristics
CO 4. Describe aseptic technique and be able to perform routine culture handling tasks, safely and effectively
CO 5. Perform preparation of culture media for microbial growth.
CO 6. Describe effect of different environmental factors on microbial growth.

Unit No.	Title of Unit & Contents	Hrs.
I	**History and Overview of Microbiology**	**11**
	1. Biogenesis and abiogenesis, Contributions of Redi, Spallanzani, Needham, Tyndall, Joseph Lister, Pasteur, Koch [Germ Theory]. 2. Scope of Microbiology. 3. General classification of microorganisms as Bacteria, Fungi, Algae, Protozoa. 4. Structure and organization of bacteria: Capsule, cell wall, cytoplasmic membrane, nucleoid, Ribosome, endospores, cytoplasmic inclusions, flagellum, Pilli, protoplast and spheroplast.	
	Unit Outcomes:	

Unit No.	Title of Unit & Contents	Hrs.
	UO 3. Interpret the structural similarities and differences among microorganisms and the unique structure/function relationships of prokaryotic cells. UO 4. Understand the types of micro-organisms.	
II	**Microbial Media and Sterilization Techniques**	**12**
	1. Major and minor media components. 2. Types of media Viz. Basal, Selective, Differential and Enrichment media. Mode of nutrition. 3. Definition of sterilization, dry and moist heat, pasteurization, Tyndallization, radiation, ultrasonication, filtration. 4. Physical and Chemical methods of sterilization; disinfection sanitization, antisepsis sterilant and fumigation. 5. Determination of phenol coefficient of disinfectant.	
	Unit Outcome: UO 3. Explain the diversity of microorganism in special reference to bacteria. UO 4. Explain the methods of sterilizations.	
III	**Isolation and Identification Techniques**	**13**
	1. Isolation, cultivation and identification techniques for microorganisms, aerobic and anaerobic cultivation. 2. Biochemical methods for identification, pure culture techniques and preservation of pure cultures. 3. Definition of auxochrome, chromophores. 4. Classification of stains, Theories of staining. 5. Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining, endospore staining.	
	Unit Outcomes: UO 3. Demonstrate the proper use of a microscope to observe microorganisms and report observed characteristics. UO 4. Elaborate their concepts about isolation of microbes from different forms.	
IV	**Bacterial Growth**	**09**
	1. Different types of bacterial culture (Batch, Synchronous, Diauxic, Axenic). 2. Definition and brief description. Growth Curve, Calculation of duration of Phases and generation time, Growth yields. 3. Methods of growth determination. 4. Environmental factors affecting growth - temperature, pH, osmotic pressure and nutrient concentration per cell.	
	Unit Outcomes: UO 3. Master aseptic technique and be able to perform routine culture handling tasks safely and effectively. UO 4. Understand the concepts of bacterial culture.	

Learning Resources:

1. Elementary Microbiology, H. A. Modi, NadiadAktaPrakashan, Volume I and II, 2002.
2. General Microbiology- Powar and Daginawala- Himalya Publication, 2019.
3. Fundamental Principles of Bacteriology- A.J.Salle- TATA-McGraw Hill publication, 1984.
4. General Microbiology-Pelczar- Tata McGraw Hill publication Vth Edition, 2001.
5. Text-book of Microbiology- Anantnarayan, C.K. Jayram, Panikar, Orient Longman, Universities Press (India) Pvt. Ltd.; Xth edition, 2017.
6. General Microbiology- Stanier R.-. Macmillan Press Ltd Vth Edition, 1986.
7. Text Book of Microbiology- R.C. Dubey- S. Chand Publications; Fourth edition, 2013.
8. Microbiology: A Laboratory Manual, Cappucino J and Sherman N., 9th edition. Pearson Education limited 2010.
9. Microbiology Paperback, by P. D. Sharma, Rastogi Publication, 4th Edition 2010.
10. Textbooks of Microbiology and Immunology by Subhash Chandra Parija, ELSEVIER, 2nd Edition, 2012

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Biotechnology

Course Type: Lab Course
Course Title: Lab Course –II (Based on DSC-II)
Course Code: 101BIO1104
Credits: 01 **Max. Marks: 50** **Hours: 30**

Learning Objectives

LO 1. To educate students in a variety of important microbiological disciplines
LO 2. To promote and develop skills in the use of tools, technologies and methods common to microbiology.
LO 3. To understand use of different staining methods in differentiation of Bacteria.
LO 4. To understand pure culture techniques and media required for microbial growth.
LO 5. To educate the student in various sterilization techniques used in laboratory and media preparation.
LO 6. To study and understand the microbial world and its diversity.

Course outcomes

After completion of the course, the student will be able to-

CO 1. Isolate and enumerate bacteria.
CO 2. Identify microbes using microscopic and biochemical tests.
CO 3. Determine, interpret and discuss the growth kinetics of microbes growing in batch culture.
CO 4. Act in accordance with safe laboratory practice in terms of conduct, attire, risk minimization and appropriate waste disposal.

Practical No.	Unit
1	Introduction of Microbiology laboratory
2	Study of Microscope
3	Sterilization techniques
4	Preparation of culture media
5	Isolation of bacteria by Streak plate method
6	Isolation of bacteria by spread plate method
7	Isolation of bacteria by pour plate method
8	Isolation of bacteria by serial dilution method
9	Identification of microorganisms from the habitats by simple staining method
10	Identification of microorganisms from the habitats by differential staining method
11	Identification of microorganisms from the habitats by acid fast staining method
12	Identification of microorganisms from the habitats by capsule staining method

13	Identification of microorganisms from the habitats by spore staining and motility
14	Observation of morphology - shape and arrangement of cells
15	Methods of inoculation of different microbes in selective media
16	Microscopic measurements, micrometer (ocular and stage), hemocytometer
17	Sampling and quantification of microorganisms from air
18	Sampling and quantification of microorganisms from soil
19	Sampling and quantification of microorganisms from water

N.B.: Any Ten practical from above.

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Department of Biotechnology

Course Type: DSC-III

Course Title: Biochemistry

Course Code: 101BIO2105

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1 To understand the different forms of DNA
LO 2 To understand the basic concepts in formation and function of nucleic acids.
LO 3 To deliberate the role of carbohydrates.
LO 4 To describe the structures of saturated and unsaturated fatty acids.
LO 5 To acquaint the knowledge of amino acids
LO 6 To comprehend the significance of domains in protein function and how they have arisen.
LO 7 To explain classification of vitamins.
LO 8 To explain the role of minerals.

Course Outcomes:

After completion of course, the student will be able to-

CO 1 Understand the properties of nucleotides, how they contribute to secondary and tertiary structures of nucleic acids at the molecular level.
CO 2 Understand the role of denaturation and renaturation of DNA.
CO 3 Acquaint the knowledge of carbohydrates.
CO 4 Familiarize with physical and biological properties of lipids.
CO 5 Understand that structure and classification of amino acids.
CO 6 Comprehend the classification of proteins
CO 7 Identify the deficiency and toxicity symptoms of each micronutrient.
CO 8 Learn the role of minerals.

Unit No.	Title of Unit & Contents	Hrs.
I	**Nucleic acids**	**07**
	1. Nucleic acids: Discovery and historical aspects 2. Nucleosides, nucleotides, Polynucleotides. 3. DNA and its different forms [A, B, C, D, E and Z]. 4. RNA and its types, mRNA, tRNA, SiRNA, microRNA with function 5. Forces stabilizing nucleic acid structure, Denaturation and renaturation of DNA.	
	Unit Outcomes: UO 1 Understand the basic concepts in formation and function of nucleic acids. UO 2 Understand the structure and stabilizing stabilization forces of nucleic acid	
II	**Carbohydrates and Lipids**	**15**
	1. Carbohydrates: Introduction, biological importance.	

Unit No.	Title of Unit & Contents	Hrs.
	2. Definition, stereochemistry of carbohydrates. 3. Classification, Monosaccharides other than glucose, glycosidic bond, disaccharides, polysaccharides: homopolysaccharides and heteropolysaccharides. [starch, glycogen]. 4. Lipids: Introduction, Classes, Fatty acids. 5. Physical properties, Chemical properties, Saponification value, acid value, iodine number, rancidity. Phospholipids, Sphingolipids, Glycolipids.	
	Unit Outcomes: UO 5. Distinguish between monosaccharides, disaccharides, and polysaccharides. UO 6. Gain the knowledge about classification, properties and role of lipids.	
III	**Amino acids and Proteins**	**13**
	1. Amino acids: structure and classification. 2. Properties and functions of amino acids, Acid base behavior, color reactions, Zwitterions. 3. Isoelectric point of amino acids. 4. Protein structure and Classification, Conformation of proteins. 5. Biological functions of protein. 6. Peptide bond. 7. Secondary structure – α-helix, β-sheet, triple helical structure. 8. Tertiary Structure: Myoglobin. 9. Quaternary structure – Hemoglobin.	
	Unit Outcomes: UO 5. Comprehendhow amino acids are linked via peptide bonds to make polypeptides and proteins. UO 6. Explain the structure and functions of proteins.	
IV	**Vitamins and Minerals**	**10**
	1. Introduction of vitamins 2. Water soluble vitamins (Vit-B1, B2, B3, B5, B6, B7, B9, B12 & Vit-C). 3. Fat soluble vitamins (Vit-A, D, E & K). 4. Minerals: Introduction of Macro (Na, K, Ca, Mg, P) minerals, micro minerals (Fe, I, F, Zn, Cu, Co, Se, Cr. Mn, Mo, Ni, Sn, Si, V), 5. Trace elements (Pb, Hg, B, Bo, Al). **6.** Functions of micro, macro & trace elements.	
	Unit Outcomes: UO 5. Develop the ability to understand both deficiency and toxicity symptoms of each micronutrient. UO 6. Understand classification of vitamins.	

Learning Resources:

1. Outlines of Biochemistry Conn and Stumpf, 5th Edition, Wiley Publication, 2006.
2. Principles of Biochemistry, JefforyZubey, WCB Publishers, 1995.
3. Biochemistry, L. Stryer, WH Freeman Publication, 2015.
4. Principles of biochemistry, Lehninger , Nelson, Cox. , CBS Publishers,7th ed. 2017.
5. Principles of Biochemistry, Geoffrey Zubay, McGraw Hill Publishers, 1995.
6. Fundamentals of Biochemistry, 5th Edition Voet et al., Wiley Publication, 2016.
7. Biochemistry, Donald J. Voet and Judith G. Voet 3rd Edition, John Wiley and Sons publication, 2004.
8. Biomolecules And Cell Biology, P.K. Gupta, Rastogi Publication first edition, 2018.
9. Chemistry Of Biomolecules, S.P. Bhutani, ANE Books, 2009.
10. Textbook of Medical Biochemistry, Dr (Brig) MN Chatterjee and Rana Shinde, Eighth Edition, Jaypee Brothers Medical Publishers, 2012.

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Department of Biotechnology

Course Type: Lab Course
Course Title: Lab Course –III (Based on DSC-III)
Course Code:101BIO2107
Credits: 01 **Max. Marks: 50** **Hours: 30**

Leaning Objectives

LO 1 To develop skill and proficiency in preparation of laboratory reagents, normal and molar solutions.
LO 2 To study the preparation of buffer
LO 3 To understand quality and purity of lipids.
LO 4 To understand the various methods of qualitative estimation of different biomolecules.
LO 5 To understand the various methods of quantitative estimation of different biomolecules.

Course outcomes

After completion of course, the student will be able to-

CO 1 Develop skills to estimate concentration of proteins, lipids, nucleic acids, and carbohydrates
CO 2 Determine presence of biomolecules like carbohydrates, proteins, lipids, etc. in known and unknown samples.
CO 3 Acquire training to determine saponification value and iodine value of oil and different types of fats.
CO 4 Prepare different standard solutions, buffer etc.

Practical No.	Unit
1	Preparation of solutions, buffer sensitivity, specificity accuracy, Molarities, molality, normality.
2	Preparation of acetate buffer.
3	Preparation of phosphate buffer.
4	Preparation of citrate buffer.
5	Titration of Oxalic acid and amino acid
6	Qualitative test for carbohydrates and lipids.
7	Determination of Acid value of fat
8	Determination of Saponification of Fat
9	Determination of iodine number of oil.
10	Estimation of Amino acids by Ninhydrin method

11	Estimation of Protein by Biuret and Lowry Method
12	Estimation of total sugar by anthrone method.
13	Estimation of Total Reducing Sugar by DNSA method
14	Estimation of DNA by DPA method
15	Estimation of RNA by Orcinol Method
16	Estimation of Ascorbic Acid by volumetric method.
17	Mohr's salt Titration with Potassium Dichromate.

N.B.: Any Ten Practicals from above.

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Department of Biotechnology

Course Type: DSC-IV
Course Title: Genetics
Course Code: 101BIO2106
Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1 To understand the basics of genetics behind heredity and variations amongst living organisms.
LO 2 To know recent trends in genetics and present applications.
LO 3 To understanding the physical basis of cytogenetics.
LO 4 To explain types and mechanism of mutations.
LO 5 To understand the mechanism of microbial recombination.
LO 6 To know the recent trends and applications of genetics for human welfare.
LO 7 To understand genetics in population and evolution of living organisms.
LO 8 To develop logical thinking in solving genetics problems.

Course outcomes

After completion of course, the student will be able to-

CO 1. Acquaint the basic concepts and applications of classical genetics.
CO 2. Understand the mechanism of gene interaction and sex determination.
CO 3. Familiarize with structural and functional aspects of chromosome.
CO 4. Explain the perception of extra-chromosomal inheritance and chromosomal mapping.
CO 5. Understand the role of mutations and mutagens.
CO 6. Gain the knowledge of microbial genetic recombination.
CO 7. Understand Hardy -Weinberg principle and its relevance to population genetics.
CO 8. Apply quantitative genetics approaches in agriculture.

Unit No.	Title of Unit & Contents	Hrs.
I	**Classical Genetics**	**14**
	1. History of Genetics 2. Heredity and Environment: Phenotype, Genotype, Heredity, variation, Pure lines and Inbred lines. 3. Biography of Mendel and his experiments on pea plants. 4. Principles of Mendel: Monohybrid cross, Dihybrid cross, back cross and Test cross. 5. Multiple Alleles: ABO blood groups and Rh factor in Human, Gene Interactions. 6. Intra-allelic interactions: Incomplete inheritance and	

Unit No.	Title of Unit & Contents	Hrs.
	Codominance 7. Inter allelic interactions: Complementary gene Supplementary gene, Epistasis, Duplicate gene . 8. Sex influenced and sex-limited inheritance. 9. Sex determination in animals and plants.	
	Unit Outcomes: UO 1 Understanding fundamental concepts of classical genetics. UO 2 Comprehend sex determination and gene interactions	
II	**Cytogenetics**	**13**
	1. Chromatin structure and Chromosome theory of inheritance. 2. Structure of Eukaryotic Chromosome. 3. Nucleosome model, Karyotype and Ideogram. 4. Linkages: Types of linkages, Factors affecting linkages and Significance of linkages. 5. Crossing over: Types and Mechanism of crossing over, interference and coincidence. 6. Chromosomal Mapping. 7. Sex linkages: Examples Drosophila and Man. 8. Extra-chromosomal Inheritance: Characteristic features, Mitochondrial, Chloroplast, Kappa articles in Paramecium, Shell coiling in snail. 9. Pedigree analysis in human.	
	Unit Outcomes: UO 1 Understanding physical basis of Cytogenetics UO 2 Understand mechanism of extra-chromosomal inheritance.	
III	**Mutation and Microbial Genetics**	**10**
	1. Fine structure of the Gene- Cistron, muton and recon. 2. Mutation: Physical and chemical mutagen, Types of Mutation. 3. Chromosomal Mutation: Structural and Numerical. 4. Microbial genetics: Conjugation and conjugation mapping, Transformation and Transformation mapping, Transduction and Transduction mapping.	
	Unit Outcomes: UO 1 Explain types and mechanism of Mutations. UO 2 Understand mechanism of microbial recombination.	
IV	**Population genetics and quantitative genetics**	**08**
	1. Gene and genotype frequency, Hardy-Weinberg law and equation and its application in the study of population genetics. 2. Quantitative genetics, application of quantitative genetics in agriculture.	

Unit No.	Title of Unit & Contents	Hrs.
	Unit Outcomes: UO 1 Know the recent trends and applications of genetics for human welfare. UO 2 Understand genetics in population and evolution of living organisms.	

Learning Resources:

1. Principles of Genetics, Robert H. Tamarin. Tata-McGraw Hill, Seventh Edition 2002.
2. Genetics, Principles and Analysis, Daniel Hartl & E.W. Jones, Jones & Bartlett Publication. Fourth Edition, 1998.
3. The Science of Genetics, Atherly, A. G. Girton, J. R & MC Donald, J. F., Saunders College Publications / Harcourt Brace, Revised edition, 1999.
4. Genetics,M.W. Strick Berger,Macmillan Publications New York,Second edition 1976.
5. Principles of Genetics, Snustad D P, M J Simmons and J P Jenkins, John Wiley and Sons, INC.Seventh edition,2015.
6. An introduction to genetic analysis,Griffiths A J F, H. J. Muller, D. T. Suzuki, R. C. Lewontin and W. M. Gelbart,W. H. Greeman. New York, Twelth edition, 2020.
7. i Genetics A molecular approach, Peter J Russell. Pearson publication, Third edition,2016.
8. Concepts of Genetics, Klug ,Cummings and Spencer,Pearson Publication,Tenth edition,2016.
9. Genetics: A conceptual approach, Benjamin Pierce,W.H.Freeman publication,Sixth edition,2016.
10. Genetics,Veer BalaRastogi,Medtech Publication,Fourth edition,2019.
11. Principles of Genetics,Gardner,Simmons,Snutad,Wiley Publication, Eighth edition,2006.
12. Genetics,P K Gupta, Rastogi Publication,Fifth edition,2018.

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Department of Biotechnology

Course Type: Lab Course
Course Title: Lab Course –IV (Based on DSC-IV)
Course Code: 101BIO2108
Credits: 01 **Max. Marks: 50** **Hours: 30**

Learning Objectives

LO 1 To understand basics of Mendelian inheritance of one and more than one characters through solving the problems.
LO 2 To understand phenomenon of modifications in Mendelian inheritance and non-Mendelian inheritance.
LO 3 To apply statistics in solving genetics problems.
LO 4 To understand genetics phenomenon in human, population and evolution.
LO 5 To learn the role of physical and chemical mutagens.

Course Outcomes

After completion of the course, the student will be able to-

CO 1 Understand and apply Mendel's principles in solving problems
CO 2 Recognize and analyze different types of gene interaction.
CO 3 Interpret and draw conclusions based on the results obtained from statistical analyses in genetics.
CO 4 Understand the principles of pedigree analysis and interpret pedigrees.
CO 5 Solve problems related to the calculation of allele and genotype frequencies in populations.
CO 6 Apply blood group inheritance principles to study and interpret human blood types.
CO 7 Explore and analyze the diversity of human, animal, and plant traits.

Practical No.	Unit
1	Problems based on monohybrid cross.
2	Problems based on dihybrid cross.
3	Problems based on trihybrid cross
4	Problems based on interaction of genes
5	Problems based on application of probability, Student's T test and Chi square test in genetics.
6	Problems based on pedigree analysis.
7	Problems based on Chromosome mapping.
8	Problems based on Hardy-Weinberg equilibrium.
9	To study the human blood group by using a given blood sample.

10	Analysis and interpretation karyotype and ideogram by using charts / diagrams.
11	Study of Human traits, Animal traits and plant traits for its diversity in phenotype.
12	Study of effect of physical mutagens
13	Study of effect of chemical mutagens

N.B.: Any Ten Practicals from above.

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Department of Biotechnology

Course Type: VSC-I
Course Title: Bioinstrumentation-I
Course Code: 101BIO1501
Credits: 02 (01+01) **Max. Marks: 50** **Lectures: 45 Hrs. (15 Th +30 P)**

Learning Objectives:

LO 1. To understand the analytical techniques and equipment used in biological science.
LO 2. To understand the basic principle and applications of microscopy and centrifugation.
LO 3. To acquire knowledge on the Chromatographic methods for the separation of biological molecules.
LO 4. To learn care and safety during handling of laboratory equipment's.
LO 5. To learn scientific calculations related with measurements, microscopy, centrifugation and chromatography.
LO 6. To understand good laboratory practices in practical related with biological studies.
LO 7. To learn different applications of bioinstrumentation in biological research and industries.

Course Outcomes:

After completion of the course, the student will be able to-

CO 1. Handle successfully all measurement tools in solution preparation.
CO 2. Explain the use and applications of microscopy.
CO 3. Explain the use and applications of centrifugation.
CO 4. Perform paper chromatography and TLC for the separation of biomolecules.
CO 5. Prepare Different Solutions
CO 6. Understand calibrations of tools and instruments.
CO 7. Expertise in handling above biological techniques in their research.

Unit No.	Title of Unit & Contents	Hrs.
I	**Fundamental Instrumentation used in Biological research**	**04**
	1. Tools and Instruments for measurements: Pipette, measuring cylinders, Micropipette, Weighing balance etc. 2. Principles and working of pH meter and Colorimeter 3. Other tools/instruments: Hot water bath, Hot plate, heating mantle, distillation unit, vortex mixer, homogenizer etc.	

	Unit Outcomes: UO 1. Understand the princinciple of basic instrumentation UO 2. Understand functions and working of laboratory tools and techniq UO 3. Understand calibration and maintenance of basic instrumentation.	
II	**Microscopy**	**05**
	1. Light microscopy: Simple microscope, compound microscope, Dark field microscope, Inverted light microscope. 2. Fluorescence microscope 3. Electron microscopy: TEM, SEM	
	Unit Outcomes: UO 1. Acquaint knowledge of Microscopy. UO 2. Understand the principle and working of Microscopy. UO 3. Understand applications of advanced microscopy in life sciences.	
III	**Centrifugation**	**03**
	1. Centrifuge – principle, working and applications. 2. Care and safety aspects of centrifuges 3. Analytical ultracentrifugation **4.** Differential and Density gradient centrifugation	
	Unit Outcome: UO 1.Augment the knowledge of different Centrifugation techniques UO 2.Understand applications of Centrifugation. UO 3.Aware about care and handling of different centrifuge machines.	
IV`	**Chromatography**	**03**
	1. Principle of Chromatography **2.** Principle and applications of paper and TLC chromatography **3.** Ion exchange chromatography	
	Unit Outcomes: UO 1. Understand basic principles of chromatography. UO 2. Acquaint significance of chromatography in biological studies. UO 3. Understand applications of different chromatography types in their biological studies.	
V	**Practicals (Included in above 04 units)**	**30**
	1. Calibration and handling of measurement tools and weighing balance. 2. Calibration and working applications of PH meter. 3. Calibration and practical handling and applications of colorimeter and spectrophotometer. 4. Calibration and Working of Hot water bath, Hot plate, heating mantle, vortex mixer, homogenizer etc.	

	5. To learn the process of distillation of water by using distillation unit. 6. A study of components and their functions of simple and compound microscope. 7. Prepare the specimen by using temporary mounting methods for compound microscope. 8. Prepare the specimen by using dehydration, staining and clearing by using permanent mounting of plant specimens. 9. Problems on Microscopy. 10. Demonstration of different types of centrifugation techniques. 11. Separation of Biomolecules by Centrifugation 12. Problems on Centrifugation. 13. To separate the plant leaf homogenate pigments by using paper chromatography technique. 14. To separate the amino acids by using thin layer chromatography technique. 15. To purify the enzyme from crude preparation by using ion exchange chromatography.	

Learning Resources:

1. Biophysical Chemistry by Upadhyay, Upadhyay and Nath, Himalaya Pub. House, Delhi, 2016.
2. Practical Biochemistry- principles and techniques; (5th edition), Keith Wilson and John Walker. Cambridge University press, London, UK, 2000.
3. Principles and Techniques of Biochemistry and Molecular Biology (6th edition), Keith Wilson and John Walker. Cambridge University press, London, UK, 2005.
4. Essentials of Biophysics (2nd edition) - P.Narayanan, New Age International Publications, 2007.
5. Biophysics by G.R. Chatwal, Himalaya Publishing House, 2011.
6. Biophysics by Mohan P Arora, Himalaya Publishing House, 2020.
7. Physical Biochemistry: Applications to Biochemistry and Molecular Biology by Freilder, D. Freeman, San. Francisco, 1976.
8. Biochemical Techniques: Theory and Practice by Robyt, John F.; White, Bernard J. Waveland Press, Inc., U.S.A. Published: 1990.
9. Bioinstrumentation by Webster, Wiley, 2007.
10. Bioinstrumentation by l. Veerakumari, MJP Publisher, 2019.

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Department of Biotechnology

Course Type: VSC-II
Course Title: Bioinstrumentation-II
Course Code: 101BIO2502
Credits: 02 (01+01) **Max. Marks: 50** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1 To explain the fundamental principles underlying each technique.
LO 2 To understand the principle and working of electrophoresis techniques in separation of biomolecules.
LO 3 To understand application of spectroscopy in the study of biomolecules.
LO 4 To understand significance of advanced chromatography in biological studies.
LO 5 To understand basics of Radioactivity and radioactivity techniques in biological studies.
LO 6 To compare and contrast the various techniques in terms of their applications, advantages, limitations, and suitability for different biomolecular analyses.
LO 7 To explore the mechanisms and applications of electrophoresis and chromatography in separating and analyzing biomolecules
LO 8 To discuss the quantitative aspects of these techniques, including calibration methods, standard curves, and the interpretation of spectra or chromatograms for biomolecule quantification.

Course Outcomes:

After completion of course, the student will be able to-

CO 1 Able to prepare buffers and supporting media for electrophoresis
CO 2 Understand the separation of nucleic acids and proteins by electrophoresis.
CO 3 Explain the working and applications of affinity, gel, gas chromatography.
CO 4 Understand the uses and applications of radioactivity in biological sciences.
CO 5 Ability to interpret and critically analyze data generated from various bioinstrumentation techniques, and effectively communicate findings through reports and presentations.
CO 6 Develop problem-solving skills by applying theoretical knowledge to troubleshoot and optimize bioinstrumentation protocols.
CO 7 Integrate multiple bioinstrumentation techniques to solve complex biochemical problems.

Unit No.	Title of Unit & Contents	Hrs.
I	**Electrophoresis**	**04**
	1. General Principles 2. Support media and Buffers 3. Electrophoresis of Nucleic acid – Agarose gel electrophoresis of nucleic acid 4. Electrophoresis of Proteins- PAGE **5.** Capillary electrophoresis.	
	Unit Outcomes: UO 4. Prepare buffers and other accessory requirements in electrophoresis. UO 5. Understand principles and working of different electrophoresis in biological studies.	
II	**Spectroscopy**	**05**
	4. Introduction: Basic principles and applications 5. Ultraviolet and Visible light spectroscopy 6. Infrared and Raman Spectroscopy 7. Fluorescence spectroscopy	
	Unit Outcomes: UO 1. Understand basic principles of spectroscopic Studies. UO 2. Distinguish the application of spectroscopy in biology.	
III	**Advanced Chromatography Techniques**	**03**
	5. Affinity chromatography 6. Gel filtration chromatography **7.** Gas chromatography	
	Unit Outcome: UO 1. Understand advanced chromatographic techniques in biological studies. UO 2. Understand future applications of chromatography in biological research.	
IV`	**Radioisotope Techniques**	**03**
	4. Detection and measurement of radioactivity 5. Other practical aspects of counting radioactivity and Analysis of Data **6.** Safety aspects.	
	Unit Outcomes: UO 1. Understand radioisotopes and its applications in biology. UO 2. Acquaint the practical aspects of radioactivity and data analysis.	
V	**Practicals (Included in above 04 units)**	**30**
	1. A study of Good laboratory practices in Biochemistry and molecular biology laboratories. 2. To resolve the given DNA sample by using agarose gel electrophoresis. 3. To resolve the given mixture of proteins by means of SDS PAGE. 4. To Study Lamberts Beers Law 5. Demonstration of IR spectroscopy for the study of plant secondary	

	metabolites. 6. Problems on Spectroscopy 7. To carry out desalting of the given protein by using column chromatography technique. 8. A virtual study of affinity and Gel Permeation chromatography by using animations and other study materials. 9. A virtual study of Gas chromatography by using animations and other study materials. 10. To solve the problems based on Radioactivity techniques 11. Demonstration of Geiger Muller Counter	

Learning Resources:

1. Biophysical Chemistry by Upadhyay, Upadhyay and Nath, Himalaya Pub. House, Delhi,2016.
2. Practical Biochemistry- principles and techniques; (5th edition), Keith Wilson and John Walker. Cambridge University press, London, UK,2000.
3. Principles and Techniques of Biochemistry and Molecular Biology (6th edition), Keith Wilson and John Walker. Cambridge University press, London, UK,2005.
4. Essentials of Biophysics (2nd edition)-P.Narayanan,New Age International Publications,2007.
5. Biophysics by G.R.Chatwal ,Himalaya Publishing House,2011.
6. Biophysics by Mohan P Arora, Himalaya Publishing House,2020.
7. Physical Biochemistry: Applications to Biochemistry and Molecular Biology by Freilder, D. Freeman, San. Francisco, 1976.
8. Biochemical Techniques: Theory and Practice by Robyt, John F.; White, Bernard J. Waveland Press, Inc., U.S.A. Published: 1990.
9. Bioinstrumentation by Webster, Wiley,2007.
10. Bioinstrumentation by l. Veerakumari , MJP Publisher,2019.

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UG First Year

Basket I: Generic/Open Elective (GE/OE)

(GEs offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing GE/OE	Code	Course Title	Credits	Hrs.
1	Physics	101PHY1401	Energy Sources	04	60
2	English	101ENG1403	Developing Interpersonal Skills	04	60
3	Chemistry	101CHE1401	Medicines for Daily Life	04	60
4	Commerce	101MAE1401	Fundamentals of Statistics	04	60
5	Commerce	101BAI1401	Personal Financial Management	04	60
6	Political Science	101POL1401	Human Rights	04	60
7	Music	101MUS1401	Indian Vocal Classical & Light Music	04	60
8	NCC Studies	101NCC1401	Introduction to NCC	04	60
9	Sports	101SPO1401	Counseling and Psychotherapy	04	60
10	Mathematics	101MAT1401	Fundamentals of Mathematics	04	60

Note: Student can choose any one GE from the basket.

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(Autonomous)

UG First Year

Basket II: Skill Enhancement Courses (SEC)

(SEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing SEC	Code	Course Title	Credits	Hrs.
1	Computer Science	101COS1602	Cyber Security	02	30-45
2	Computer Science	101COS1601	Data Analysis and Computer Application	02	30-45
3	Information Technology	101COM1601	Basics of Python Programming	02	30-45
4	Commerce	101BAI1601	Investment Management	02	30
5	Geography	101GEO1601	Tourism & Travel Management	02	30
6	NCC Studies	101NCC1601	Leadership and Personality Development	02	30-45
7	Chemistry	101CHE1601	Pesticides and Green Chemistry	02	30-45
8	Botany	101BOT1601	Mushroom Cultivation Technology	02	30-45
9	English	101ENG1601	Proof Reading and Editing	02	30

Note: Student can choose any one SEC from the basket.

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UG First Year

Basket III: Ability Enhancement Courses (AEC)

(AEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	English	101ENG7101	English for Professionals	02	30

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UG First Year

Extra Credit Activities

Sr. No.	Course Title	Credits	Hours T/P
1	MOOCs	Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses	Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken English Courses	Min. of 02 credits	Min. of 30 Hrs.

Guidelines:

Extra -academic activities

1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.

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Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
1	2	3				4		5	6	5 + 6
		Att.	CAT I	Mid Term	CAT II	Att.	CAT			
DSC/DSE/ GE/OE/Minor	100	10	10	20	10	-	-	40	60	100
DSC	75	05	10	15	10	-	-	30	45	75
Lab Course/AIPC/ OJT/FP	50	-	-	-	-	05	20	-	25	50
VSC/SEC/ AEC/VEC/CC	50	05	05	10	05	-	-	20	30	50

Note:

1. All Internal Exams are compulsory
2. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks.