Syllabus of 4 + 1 Year Integrated UG and PG Programme

w. e. f 2024-25 Academic Year

GRADUATE SCHOOL

Mahatma Gandhi University

P. D. Hills P O

Kottayam, Kerala

www.gs.mgu.ac.in

www.mgu.ac.in

Schools offering Majors

SL.No	School/Centre
1	School of Bio Sciences
2	School of Chemical Sciences
3	School of Computer Sciences
4	School of Environmental Sciences
5	School of Gandhian Thought and Development Studies
6	School of International Relations and Politics
7	School of Pure and Applied Physics
8	School of Social Sciences

Sl. No.	Major	Intake
SCIENCE		
1	Bio Sciences	6**
2	Chemistry	6
3	Computer Science	6
4	Environmental Science	6
5	Physics	6
SOCIAL SCIENCES		
1	Development Studies	5
2	Gandhian Studies	5
3	History	10
4	International Relations and Politics	10

Majors offered and Intake *1 seat shall be sanctioned over and above the intake in each major in the 3rd semester for students who opt for a change of major after two semesters.

**Progression to PG Shall be based on the specialization selected by students as Biochemistry (2 seats) Biotechnology (2 seats) and Microbiology (2 seats) based on merit.

Schools offering Minors/MDCs/AECs/VACs/SECs

SL.No	School/Centre
1	School of Artificial Intelligence And Robotics
2	School of Behavioural Sciences
3	School of Biosciences
4	School of Chemical Sciences
5	School of Computer Sciences
6	School of Data Analytics
7	School of Energy Materials
8	School of Environmental Sciences
9	School of Food Science And Technology
10	School of Gandhian Thought And Development Studies
11	School of Gender Studies
12	School of Indian Legal Thought
13	School of International Relations And Politics
14	School of Letters
15	School of Mathematics And Statistics
16	School of Nanoscience And Nano Technology
17	School of Pedagogical Sciences
18	School of Polymer Science And Technology
19	School of Pure And Applied Physics
20	School of Social Sciences
21	School of Tourism Studies
22	International and Inter University Centre for Nanoscience and Nanotechnology
23	K N Raj School of Economics

Scheme for 4 + 1 Integrated UG and PG Programme
Graduate School
Mahatma Gandhi University
School of Bio Sciences

Course Code	Title	Credits	Hours per Week		Level	Type
			Theory	Practicals		
SEMESTER I						
MG1DSC UBS101	Cell and its constituents	4	3	1	Foundation (100-199)	Major
MG1DSC USB121	Science of inheritance	4			"	Minor-A
MG1DSC USB141	Pandemics and infectious diseases	4			"	Minor-B
MG1MDC USB101	Biosciences in everyday life	3			"	MDC
	AEC (Eng)	3			"	AEC
	AEC (Mal)	3			"	AEC
SEMESTER II						
MG2DSC UBS101	Ecology and Evolution	4			"	Major
MG2DSC USB121	Molecules of life	4			"	Minor A
MG2DSC USB141	Functional Biology	4			"	Minor B
MG2MDC USB101	Philosophy of science	3			"	MDC
	AEC (Eng)	3			"	AEC
	AEC (Mal)	3			"	AEC
SEMESTER III						

MG3DSC UBS201	Principles of Genetics	4	3	1	Intermediate (200-299)	Major
MG3DSC UBS202	Animal Diversity	4			"	Major
MG3DSC UBS203	Plant Diversity	4			"	Major
MG3DSC USB221	Economic importance of microorganisms	4			"	Minor
MG3MDC USB201	DNA Forensics	3			"	MDC
MG3VAC USB201	Healthy gut and happy life	3			"	VAC
SEMESTER IV						
MG4DSC UBS201	Human Physiology	4	3	1	"	Major
MG4DSC UBS202	Plant Physiology	4			"	Major
MG4DSC UBS203	Immunology	4	3	1	"	Major
MG4DSC USB221	Microbial Biotechnology	4			"	Minor
MG4SEC USB201	Basic Microbiology Techniques	3			"	SEC
MG4VAC USB201	Vitamins and hormones	3			"	VAC
MG4INT	Internship/Fieldwork	2				

USB200						
SEMESTER V						
MG5DSC UBS301	Biomolecules	4	3	1	Higher (300-399)	Major
MG5DSC UBS302	Fundamentals of Microbiology	4	3	1	"	Major
MG5DSC UBS303	Molecular Biology	4	3	1	"	Major
MG5DSC UBS304	Biophysics and Biostatistics	4	3	1	"	Major
MG5SEC USB301	Animal cell culture	3			"	SEC
MG5VAC USB301	IPR	3			"	VAC
SEMESTER VI						
MG6DSC UBS301	rDNA Technology	4	3	1	"	Major
MG6DSC UBS302	Metabolism and Bioenergetics	4	3	1	"	Major
MG6DSC UBS303	Food microbiology	4	3	1	"	Major
MG6DSE UBS304 **MG6DSE UBS305** **MG6DSE UBS306**	1.Bioinformatics 2.Molecular Microbiology 3.Toxicology	4			"	Major (E)

MG6DSE UBS307 **MG6DSE UBS308** **MG6DSE UBS309**	1.Health and nutrition 2.Microbes and Environment 3.Forensic Medicine	4			"	Major (E)
MG6SEC USB301	Plant tissue culture	3			"	SEC
Total Credits		**133**				

SEMESTER VII						
MG7DSC UBS401	Bioinstrumentation	4	3	1	Advanced (400-499)	Major
MG7DSE UBS402 **MG7DSE UBS403**	1.Environmental Biotechnology 2.Techniques in diagnostic microbiology	4	3	1	"	Major (E)
MG7DSE UBS404 **MG7DSE UBS405**	1.Advances in cellular processes 2.Molecular Endocrinology	4	3	1	"	Major (E)
MG7DSC USB421	Life style diseases	4			"	Minor A/B

MG7DSC USB422	Probiotics	4			"	Minor A/B (E)
MG7DSC USB423	Plant-Microbe interactions	4			"	Minor A/B (E)
SEMESTER VIII						
MG8DSC UBS401	Enzymology	4	3	1	"	Major
MG7DSE UBS402 **MG7DSE UBS403** **MG7DSE UBS404**	1.Pharmaceutical Biochemistry 2.Human Virology 3.Animal Biotechnology	4	3	1	"	Major (E)
MG8RPH UBS400	Research Project	12			"	Research Project
MG8DSC UBS405	1.Medical Biochemistry	4	3	1	"	Major*
MG8DSC UBS406	2.Industrial Biotechnology	4	3	1	"	Major*
MG8DSC UBS407	3.Industrial Microbiology	4	3	1	"	Major*
Total Credits		**44**				
SEMESTER IX						
MG9DSC UBS501	Biological Techniques	4			PG Level (500-599)	Major
MG9DSC	Research Methodology	4			"	Major

UBS502						
MG9DSC UBS503	Research Ethics	4			"	Major
	Specialization -Biochemistry					
MG9DSC UBS504	a) Clinical Biochemistry b) Plant Biochemistry	4	3	1		
MG9DSC UBS505		4	3	1		Major-1 & 2
	Specialization -Microbiology					
	a) Medical Microbiology b) Agricultural Microbiology					
MG9DSC UBS506		4	3	1		
	Specialization – Biotechnology					
MG9DSC UBS507	a) Bioprocess technology b) Plant Biotechnology	4	3	1		
MG9DSC UBS508		4	3	1		
MG9DSC UBS509		4	3	1		
SEMESTER X						
MG10RPH UBS500	Research Project	20			"	Research Project
		4			"	Major**
		4			"	Major**

		4			“	Major**
		4			“	Major**
		4			“	Major**
Total Credits		**40**				

*Only for 4-Years Honours Students
**Only for students who opt for theory courses instead of Research Project

Note: General foundations courses shall be offered by different schools. Students can flexibly choose the courses across disciplines.

Level	Foundation (100-199	Intermediate (200-299)	Higher (300-399)	Advanced (400-499)	PG Level (500-599)

Type	Major	Minor	MDC	SEC	VAC	AEC

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Cell and its Constituents**		
Course Type	**Major**		
Course Level	100-199		
Course Code	*MG1DSCUBS101*		
Course Overview	Cell and its constituents: The major course for Bioscience Graduate & Honours comprises the study of Basic unit of life, different types of cells & cellular constituents. The course contents deal with the structure and functions of cell and cellular components as well as the event of cell division and multiplication. By understanding the structure of cell and its components students should able to acquire a basic knowledge regarding the functioning of each components of cell and their coordination for the growth, development & multiplication a cell.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	50	10	
Pre-requisite			

	Basics of Cell Biology in the 11th and 12th standard

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome *Upon completion of this course, students will be able to;*	Learning Domains	PSO No.
1	Explain the scope of cell biology, explain principles of cell theory & Understand different types of cells	Remember, Understand	
2	Deep understanding of structure and functions of cell and its organelles. Explain different models of cell membrane and different mode of cell permeability	Understand, Apply	
3	Understand the structure and function of Nucleus, types of chromatin and levels of chromatin organization. Analyse the processes of cell cycle & cell division,	Understand, Analyse	
4	Develop skill in use of microscope, evaluate and understand different stages of cell cycle and cell division	Skill, Evaluate, Understand	
5	Communicate effectively about a relevant topic in Cell & its constituents both verbally and in writing	Analyse, Create	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1-Introduction to Cell Biology	Hours	CO No
History and scope of Cell Biology, Cell as basic unit of life, Cell theory, Board classification of Types of cells: Prokaryotes, Eukaryotes (animal cell & plant cell), Actinomycetes, Mycoplasma, Virus, Virion, Viroid and Prion	**10**	
Module 2 -Structure and Function of Cell & Cell Organelles		
Structure & Function of Cell wall &Cell membrane, Molecular models of cell membrane - Sandwich model, Unit membrane model, Fluid mosaic model. Cell permeability - Diffusion, Osmosis, Passive transport, Active transport. Cell Organelles-Structure and Functions: Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysosomes, Peroxisomes, Proteosomes,	**20**	

Mitochondria, Plastids, Chloroplast, Centrioles and Basal bodies. Cytoskeleton - Microtubules, microfilaments, intermediate filaments		
Module 3 -Nucleus, Cell Cycle & Cell Division		
Nucleus: Structure of nucleus, nuclear membrane, pore complex, Nucleolus -Structure and functions, Chromatin - euchromatin and heterochromatin, different levels of chromatin organization, Chromosome - structure of 23 a typical metaphase chromosome; giant chromosomes, polytene chromosomes, lamp brush chromosomes; endomitosis Cell Cycle & its check points: G1, S, G2 and M phases. Cell Division: Mitosis – Stages. Meiosis – Stages	**20**	
Module 4- Practicum		
1. Study of microscope - parts of a compound microscope, use and maintenance of a microscope. 2. Study of prokaryotic cells - (Staining and Microscopic Observation) 3. Eukaryotic cells - Plant and Animal cell (Staining and Microscopic Observation) 3. Laboratory Record	**10**	

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative **Field activities:** **Lab based activities:** Demonstration, hands on training and recording
Mode of Assessment	A. Continuous Internal Assessment (CIA) 1. Internal Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings and literature search – 10 marks B. Semester End examination – 60 mark

Learning Resources

1. De- Roberti's E.D. and De Roberti's Jr.E.M.F 2002. Cell and Molecular Biology (Lea & Febiger/Info-Med)
2. Cell and Molecular Biology by Gerald Karp,7th Edition,
3. Cell and Molecular Biology by De Roberti's E.D.P, 8th Edition
4. Karp. G., 1996. Cell and Molecular Biology, Concepts and Experiments
5. Powar C.B. 1983. Cell Biology (Himalaya Pub. Company) 5. Rastogi S. C. 1998. Cell Biology. Tata McGraw Hill Publishing Co., New Delhi
6. The Cell-A Molecular approach, Fifth edition, Geoffrey M Cooper and Robert E. Hausman ASM Press, Washington DC

Relevance of Learning the Course/ Employability of the Course
The course will facilitate the student to understand Cell as the basic unit of life and how cellular components coordinate the function of a cell as well as process of cell cycle and mechanism of cell division.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Science of inheritance**		
Course Type	**Minor**		
Course Level	**100-199**		
Course Code	*MG1DSCUSB121*		
Course Overview	This course on Genetics deals with the frontier areas of basic biology The objective of the course content is to create a preliminary understanding about how genes behave in individuals and populations.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	60	0	
Pre-requisite	Basics of genetics in the 11th and 12th standard.		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand how heredity and variation is transmitted	R	

	through generations and the practical applications of principles of genetics		
2	Understand how genes behave in populations	R,U	
3	Understand how gene exchange happens in microbes	U	
4	Analyze the different stages of mitosis and meiosis	An	
5	Communicate effectively about a relevant topic in ecology/ evolution both verbally and in writing	An, C	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	**Hours**	**CO No**
Classical Genetics: Genetics, the evolution of the subject through pre mendelian, Mendelian and post Mendelian Peroids. Mendelism – the basic principles of inheritance, gene interactions – allelic and no allelic. Environment and gene expression, penetrance and expressivity. Multiple alleles and polygenic inheritance, Heritability and genetic advance	**15**	
Module 2		
Deviation to Independent assortment, Organelle Genetics: Linkage and linked genes with special reference to inheritance, Concept of Chromosome mapping with three - point test crosses. Organelle Genetics and cytoplasmic inheritance.	**15**	
Module 3 Populaion genetics and Medical genetics Population Genetics – types of gene variations, Measuring genetic variations, Hardy Weinberg principle and its deviations-an introduction . Medical genetics - an introduction	**15**	
Module 4		
Genetic System in Microbes, Yeast and Neurospora: Plasmids & bacterial sex. Types of plasmids. Plasmids copy number and incompatibility, Replication of plasmid. Plasmid as a cloning vector. Episomes. Transposable element-IS element and transposon, Integrons and Antibiotic resistance cassettes, Multiple antibiotic resistant bacteria, 2µm plasmids. Gene mapping in Bacteria. Bacteriophage genetics-Plaque formation & phage mutants, genetic recombination in lytic cycle. Genetic system in Yeast & Neurospora.	**15**	

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative **Field activities:**

	Lab based activities
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings **Semester End examination – 60 marks**

Learning Resources

1. Strickberger M W (2015) Genetics 3rd Edition, Pearson
2. Genetics a conceptual approach. 6th edition. Benjamin Pierce, Macmillan Learning, New York
3. Principles of Genetics, Snustad, Simmons and Jenkins, John Wiley And Sons Inc

Relevance of Learning the Course/ Employability of the Course
The course will facilitate the student to understand how genes behave in populations and individuals for transmitting heredity and variation.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	School of Biosciences		
Programme	**4 + 1 Integrated UG and PG Programme**		
Course Title	**Pandemics and Infectious Diseases**		
Course Type	Minor		
Course Level	100-199		
Course Code	*MG1DSC USB141*		
Course Overview	This course on pandemics and infectious diseases deals with an overview on the scientific and social impact of diseases. As the society has already been experienced the severity of Covid-19 pandemic, a basic understanding on related topic is of much academic, scientific and social relevance. The objective of this course is to generate awareness among students to motivate them to contribute in this area which is highly essential for the existence of human.		
Semester	1	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	

	60	0
Pre-requisite	Basics of Biology in 11th and 12th standard	

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Understand the basics of diseases, causative agents and mode of transmission	U	
2	Understand the history of pandemic and will enable them to think about its impact and future challenges	U/An	
3	Get an overview on treatment methods in pandemic by considering Covid-19 as an example	U/A	
4	Get an insight into the relevance of course with respect to India and Kerala and which will motivate them to think innovatively for the management of emerging infectious diseases	U/An/E	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Infectious Diseases: Different types- endemic, epidemic, pandemic and prosodemic, An over view on common etiological agents- Bacteria, fungi, viruses, prions, and parasites. Mode of transmission. Methods for control	**15**	

Module 2 **Pandemic** : History of pandemics, Pandemic and public health, Major pandemics- plague, cholera, Spanish flu, SARS, MERS and COVID-19, COVID-19 : Origin and spread, transmission, diagnostic methods and treatment, role of quarantine and isolation protocols for COVID management, Health education and promotion in containment , Future challenges with pandemics	**15**	
Module 3 **Covid-19 Management:** Drugs used for the treatment of Covid-19, Immunoprophylaxis, Vaccines developed for Covid-19, types and mode of action, Covid-19 vaccines used in India, Challenges with Covid-19 vaccine, Covid-19 impact on society	**15**	
Module 4 **Emerging and Re-emerging Diseases**: Factors responsible for the Emerging and Re-emerging Diseases, Risk factors, Disease transmission from animals to humans, public health emergency infections, Indian and Kerala scenario of infections, Communicable disease programmes under the national health mission	**15**	

Mode of Transaction	**Classroom activities:** Lectures, teaching, learning through online resources, interactive discussion, assignments, seminars, discussion and interaction with experts from community medicine and infectious disease units of hospitals **Field activities:** Hospital visit, data collection **Lab based activities:**
Mode of Assessment	Continuous Internal Assessment (CIA) 1. Internal Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings Semester End examination – 60 marks

Learning Resources

1. **C. K Joseph**, G Madhukumar, Jacob Thomas, Chronicles of internationally acclaimed Covid 19 preventive measures of Kerala government, Holding Hands in Peril (Kerala Model), 2022 .Don Books,Kottayam.

2. **Harrison's** Infectious Diseases, Third Edition (Indian Edition) Paperback, 2016

3. **Andrej Spec** & Gerome V. Escota & Courtney Chrisler & Bethany Davies Comprehensive Review of Infectious Diseases, 1st Edition, 2019

Relevance of Learning the Course/ Employability of the Course
This is a fundamental course meant to give awareness on the scope and opportunities of this area both in research and biopharma industry. This is also meant to make the students to think and contribute for the benefit of society for a better and healthy life

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Biosciences in everyday life**		
Course Type	**MDC**		
Course Level	**100-199**		
Course Code	*MG1MDCUSB101*		
Course Overview	This course gives the student an overview of major areas of Biosciences and how our life is intertwined with the influence of biosciences. The course provides a preliminary idea of how diseases are caused and managed, how foods are preserved and are produced, and a general idea about the importance of DNA analyses. This would help the student to comprehend the matters concerned with the abovementioned areas in their daily life.		
Semester	1	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	Basic 10th standard level biology knowledge		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		
1	Explain the major fields in biosciences	U	
2	Understand the basics of human health and fitness and analyse the different dietary and other options available for better nutrition and fitness	U, A	
3	Comprehend the deviations from normal health, its causes and laboratory results connected with common life style diseases and infections	U, A	
4	Understand the science behind food preservation and agricultural practices and can apply the knowledge when they indulge in such day-to-day activities	U, A	
5	Understand the basics of DNA analyses and its importance in diseases as well as forensics	U	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Introduction to Biosciences: Different areas in Biosciences- Biochemistry, Microbiology, Biotechnology, Biophysics, Animal and Plant Sciences, Pharmacology, Toxicology.	**5**	
Module 2		
Human nutrition, health and fitness: Food groups and balanced diet, nutritional requirements for different age groups. Digestion of food, calorie values of different food, body mass index, Dietary supplements. Understanding dietary planning and management in health, fitness and disease. **Disease prevention, management and diagnosis** - Life style diseases- Causes, types and symptoms. Monitoring blood sugar and blood pressure, Control of bacterial and viral diseases- antibiotics and vaccines	**20**	
Module 3		

Food preservation and agricultural practices: Science behind food preservation, Fermentation of food, microorganisms involved in fermentation, wine production and beer manufacturing, beneficial microorganisms, yeast and probiotics, improved nutritional and functional quality of foods- genetically modified foods, food waste management and water purification. Organic farming, pesticide-free vegetables. **DNA analysis and forensics:** Introduction to DNA fundamentals, DNA evidence collection from biological samples to identify individuals involved in cybercrimes, Extraction of DNA from biological samples and analysis, DNA finger printing, DNA testing services including paternity testing.	**20**	

Mode of Transaction	**Classroom activities:** Direct Instruction: Lectures and classroom teaching, E-learning, interactive and active co-operative learning, Seminar, Group Assignments, Library work and Group discussion, Presentation by individual student **Field activities:** Small projects involving surveys and interviews **Lab based activities:** Demonstration /observation of key elements related to the subjects
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** - Tests of maximum 20 marks 2. Seminar Presentation – a related topic is to be discussed and presented as seminar - Maximum marks 5 3. Assignment - Write a detailed report on a given topic based on available literature - Maximum marks 5 **Semester End examination –45 marks**

Learning Resources

1. Nutritional Biochemistry (2017) Sharma D. C ISBN-13- 978-8123925271
2. Introduction to Bioscience by Dr. O.N. Pandey (2013) ISBN-13- 978-9350143247
3. Food Facts & Principles" by Shakuntala Manay (2001) New Age International, ISBN 8122413250, 9788122413250
4. Text Book on Food Microbiology. (2020) Rajeswari Anburaj ISBN: 978-81-947191-6-8, 978-81-947191-7-5
5. Food Science" by Norman Potter: fifth edition (2007) ISBN-13- 978-8123904726
6. Text book of nutritional in health and diseases by kaveri chakrabarty and chakrabarty (2020)- ISBN-13- 978-9811509612
7. DNA science by David A Micklos. Second edition (2003) ISBN-13978-1936113170

Relevance of Learning the Course/ Employability of the Course
The course will help the student to comprehend bioscience-related problems or matters in their daily life and equip them to act accordingly in a meaningful way.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Ecology and evolution**		
Course Type	**Major**		
Course Level	**100-199**		
Course Code	*MG2DSCUBS101*		
Course Overview	This is an interdisciplinary course that involves studying biological processes that range from single cells to bigger ecosystems, also studies focus on factors that are key to understand the evolution of organisms, how biodiversity is generated and maintained, how organisms work, and how organisms interact with their environment		
Semester	2	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	60	0	
Pre-requisite	Basics of ecology and evolution in the 11th and 12th standard.		

COURSE OUTCOMES (CO)

CO	Expected Course Outcome	Learning	PSO No.

No.		Domains	
	Upon completion of this course, students will be able to;		
1	Explain the processes, laws, and theories related to inheritance and evolution	R	
2	Students will be able to understand and communicate the sustenance of natural biological systems on the earth effectively	R, U	
3	Acquire skills in explaining all kinds of interrelationships in natural biological systems	U	
4	Students will be able to understand the significance of biodiversity and its conservation in the sustenance of natural ecosystems	U	
5	Communicate effectively about a relevant topic in ecology/ evolution both verbally and in writing	An, C	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Introduction to Ecology and different ecological objects: Basic concept of the environment – components of the environment, the definition of ecology, ecological things. Autecological and Synecological concepts: **A. Population Ecology (Autecological concepts)**: **(a)** Characteristics of populations **(b)** Genecology - ecads, ecotypes, ecospecies, coenospecies; k-selection and r-selection populations **B. Synecological concepts(a)** Ecological processes of community formation, ecotone, edge effect. Classification of communities - criteria of classification, dynamic system of classification by Clement **(b)** Special plant communities - quantitative, qualitative, and synthetic characteristics of plant communities**, (c)** Dynamic community characteristics - cyclic replacement changes and cyclic no-replacement changes	**15**	
Module 2		
Ecological succession -(a) The concept – autogenic and allogenic succession, primary and secondary, autotrophic and heterotrophic **(b)** Retrogressive changes or the concept of degradation, concept of climax or stable communities, resilience of communities, ecological balance and survival thresholds **Biosphere and Ecosystem** - **(a)** Significance of habitat, biodiversity, ecological niche, trophic level, primary and secondary productivity, food chains, food webs, ecological pyramids, energy flow and nutrient cycles **(b**) Comparative study of the significant world ecosystems: Different aquatic and terrestrial ecosystems concerning their productivity, 0.5 57 biodiversity, energy flow, food chains and trophic levels	**15**	
Module 3		

Natural Resources: Soil, water and air Resources – soils and parent materials – ecology of soil fertility; Fresh water and marine resources – global distribution of water resources – surface and groundwater resources – water conservation – prevention of marine pollution – conservation of marine resources; Atmospheric resources – the structure of atmosphere – climate and weather – climatic factors – precipitation, wind temperature, aerosols. **Conservation of natural resources**	**15**	
Module 4		
Evolution: Origin of the universe and origin of life; concept of Oparin, Miller-Urey Experiments; Evolution of Prokaryotes - origin of eukaryotic cells - Margulis Endosymbiotic theory; **Geological Timescale:** Tools and techniques in estimating evolutionary time scale; **Theories of evolution of life**: Pre-Darwinian concepts – Lamarkism, Darwinism – major concepts - variation, adaptation, struggle, fitness and natural selection, Neo-Darwinian theories – theories of speciation – allopatric and sympatric speciation - Rose Mary and Peter Grant (Molecular evolution in Darwinian finches) - Neutral Theory of Molecular Evolution.	**15**	

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, , Library work and Group discussion, Presentation by individual student/ Group representative **Field activities:** **Lab based activities:**
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings Maximum marks 10 **Semester End examination – 60 marks**

Learning Resources

1. MC Dash (1993) Fundamentals of Ecology, Tata McGraw Hills
2. Odum EP 3rd Edition (1991) Fundamentals of ecology, Saunders and Com
3. Jonathan B (2016) Principles of Evolution, Garland Science, Taylor and Francis

Relevance of Learning the Course/ Employability of the Course
The course will facilitate the student to make ecological discourses and analyse the current issues

in and global ecosystems to interfere fruitfully.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Molecules of Life**		
Course Type	**Minor**		
Course Level	**100-199**		
Course Code	*MG2DSCUSB121*		
Course Overview	This course gives the student a clear idea about the structure and functions of different molecules present in biological systems, help them to differentiate between different types of biomolecules based on their structure, and help them to appreciate the importance of these molecules in the various biochemical processes in life. The course makes the student aware of the biological importance of vitamins and hormones, daily requirement of vitamins and the natural dietary sources, and how the altered levels of hormones and vitamin causes diseases.		
Semester	2	**Credit**	4
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	15	
Pre-requisite	10^{th} standard level biology and chemistry knowledge		

COURSE OUTCOMES (CO)

CO	Expected Course Outcome	Learning	PSO No.

No.		Domains	
	Upon completion of this course, students will be able to;		
1	Identify and differentiate the structural and functional features of biomolecules such as proteins, nucleic acids, lipids and carbohydrates	U, An	
2	Understand the higher order structural organisation of proteins, nucleic acids and carbohydrates	U	
3	Explain the role of vitamins in maintaining health and related deficiency disorders	U	
4	Explain the role of hormones in health and diseases associated with their altered levels in the body	U	
5	Develop basic skill for analysing the presence of carbohydrates, proteins and lipids in biological samples	S	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	Hours	CO No
Carbohydrates: Classification of Carbohydrates with examples- monosaccharides, disaccharides and oligosaccharides; their structure and functions. Anomers, epimers and enantiomers, Reducing and nonreducing sugars. Polysaccharides - structure and functions of homoglycans- starch, glycogen, cellulose, structure and functions of heteroglycans –glycoaminoglycans (An example). Glycolipids and Glycoproteins. **Lipids:** Classification of lipids with examples; their structure and functions. Simple lipids- Triacyl glycerol, waxes, Compound lipids- phospholipids, Glycolipids and lipoproteins - structure and functions., Derived lipids- Fatty acids, cholesterol.	**15**	
Module 2		
Proteins: Amino acids- Structure and properties**,** Classification of proteins on the basis of shape. Structural organisation of proteins- Primary structure, Secondary, tertiary and quaternary structures of proteins. Forces that stabilize protein structure.	**15**	

Nucleic Acids: Components of nucleic acids**,** Watson -Crick model of DNA structure. Higher order organization of DNA. RNA Structure: Types of RNA; structure of mRNA, tRNA and rRNA.		
Module 3		
Vitamins: -water soluble -thiamine, riboflavin, niacin, pyridoxine, folic acid, ascorbic acid-source, functions, and deficiency diseases; fat soluble -vitamin A, D, E, K, -source, functions and deficiency diseases. Hormones: endocrine gland, Major hormones of hypothalamus, pituitary gland, thyroid gland, parathyroid glands, pancreas, adrenal glands, testes and the ovaries -their biological role and related disorders.	**15**	
Module 4		
Laboratory identification of carbohydrates- General reactions of fructose, lactose, and starch, Laboratory identification of protein- Albumin or Casein, Qualitative analysis of fats	**15**	

Mode of Transaction	**Classroom activities:** Direct Instruction: Lectures and classroom teaching, E-learning, interactive and active co-operative learning, Seminar, Assignments, Library work and Group discussion, Presentation by individual student **Field activities:** **Lab based activities:** Hands on laboratory training, demonstration, Case-based discussions
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** Tests -maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar- Maximum marks 10 3. Assignment- Write a detailed report on a given topic - Maximum marks 10 **4. Semester End examination – 60 marks**

Learning Resources

1. Biochemistry 10th Edition by Jeremy M.berg, Gatto Jr. Gregory, Hines Justin (2023) Publisher:W.H.Freeman & Co Ltd;Pvt.Ltd ISBN-10:1319498507 ISBN-13: 978-1319498504

2. Lehninger Principles of Biochemistry, 8th edition, (2021) Edition by David L. Nelson Michael M. Cox Publisher: W. H. Freeman; ISBN-13: 978-1319228002 ISBN-10: 1319228003
3. Fundamentals of Biochemistry, 6th Edition, Donald Voet, Stephen Woski, Judith G. Voet, Charlotte W. Pratt, Destin Heilman, (2024) Publisher: Wiley, ISBN: 978-1-119-90348-2

Relevance of Learning the Course/ Employability of the Course
The course equips the students to identify the major molecules present in the living beings. Understanding the importance of these molecules will be useful in their own life and also, will be helpful in the deeper understanding of allied subjects.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4+1 Integrated UG and PG Programme**		
Course Title	**Functional Biology**		
Course type	**Minor**		
Course Level	**100-199**		
Course code	MG2DSC USB141		
Course Overview	In Functional Biology , students will be introduced to the fascinating field of physiology, which is the study of how living body functions. This course will explore how the overall functional properties of an individual depend on the operation of its organs, and how the function of these organs is governed by cellular and molecular systems. Physiologists seek to answer two fundamental questions: What is the mechanism by which a function is accomplished? How did that mechanism evolve? To address these questions, students will learn to integrate knowledge from chemistry and physics with biological principles. This interdisciplinary approach is essential for understanding the complex processes that sustain life. Moreover, the study of physiology is critical for comprehending the health and disease of both non-human animals and humans. By the end of this course, students will have gained insights into the functioning of organs, cells, and molecules, and how these interactions contribute to maintaining health and developing treatments for diseases. This knowledge is vital for improving the well-being of all living creatures.		
Semester	2	Credit	4
Total student Learning time	Instructional hours for theory	Instructional hours for practical/ lab work/ field work	
	60	NIL	
Pre-requisite	NIL		

COURSE OUTCOMES (CO)

CO NO.	EXPECTED OUTCOME	LEARNING DOMAINS	PSO NO
	Upon completion of this course, students will be able to;		
1	Understand the Hierarchy of Structural Levels	U	
2	Master the Concepts of Homeostasis	R	

3	Recognize the Organization and Regulation of Body Systems	A	
4	Identify and Describe Organ Systems	E	
5	Integrate Knowledge from Multiple Disciplines	A	
6	Apply Physiology to Health and Disease	A	

MODULE 1	HOURS	CO
Exploring Life and Science, hierarchy of structural levels in biological organization, homeostasis, negative feedback, positive feedback, organization and regulation of body systems, histology, general features of the four major classes of tissues, Identify the organ systems, their functions, and the major organs in each system	15	
MODULE 2		
Skeletal System- general functions of the skeletal system, Cardiovascular System-functions and major components of the cardiovascular system, heart, pulmonary and systemic circuits, systole and diastole, blood, blood groups, blood pressure and heart rate, Respiratory System-Identify the main structures of the respiratory system and state their functions, Trace the flow of air from the nose to the pulmonary alveoli, mechanisms of transporting O_2 and CO_2	15	
MODULE 3		
Muscular System- structure and functions of muscles, stimulation of muscle fibre, isotonic and isometric contraction, Nervous System-function of the nervous system, anatomical and functional subdivisions of the nervous system, communication within a neuron and between neurons, reflex, mechanism of sensory perception, Endocrine System-hormones and major organs of the endocrine system, hyposecretion and hypersecretion	15	
MODULE 4		
Digestion and nutrition-structures of the digestive system and functions, basic processes underlying digestion, vitamins and minerals, Osmoregulation and mammalian kidney, Reproduction and development-fundamental biological distinction between male and female, oogenesis with spermatogenesis, fundamental processes involved in ovulation and menstruation, process of fertilization, implantation and pregnancy	15	

COURSE CONTENT

Mode of transaction	Class room activities- Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction:, Active co-operative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative
Mode of assessment	A. Continuous Internal Assessment (CIA) 1. Internal Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar Maximum marks 10 3. Write a detailed report on a given topic based on research findings and literature search – 10 marks B. Semester End examination – 60 marks

Learning Resources

1. Vander's Human Physiology- The mechanism of body function. Widmaier, Raff & Strang
2. Textbook of Medical Physiology. Arthur.C. Guyton& John.E. Hall
3. Physiological basis of Medical Practice. John.B. West
4. Endocrinology- Mac E Hadley

Relevance of Learning the Course/ Employability of the Course
Learning Functional Biology is crucial for grasping the complexities of living organisms and their systems. This course equips students with essential knowledge and skills, enhancing their employability across various fields. By understanding how animal bodies function and how physiological mechanisms have evolved, students gain a comprehensive foundation that prepares them for diverse and impactful careers in healthcare, research, education, and beyond. This solid grounding in physiology not only opens up opportunities in medicine and veterinary sciences but also paves the way for roles in environmental conservation, biotechnology, agriculture, and science communication.

	MAHATMA GANDHI UNIVERSITY **Graduate School**
	4 + 1 Integrated UG and PG Programme

School	**School of Biosciences**		
Programme	**4 +1 integrated UG and PG programme**		
Course Title	**Philosophy of Science**		
Course Type	**MDC**		
Course Level	**100-199**		
Course Code	*MG2MDCUSB101*		
Course Overview	This course on Philosophy of science deals with the history of science and its philosophical interpretation. The objective of the course content is to create an understanding about the important milestones in the structure of scientific revolutions		
Semester	2	**Credit**	3
Total Student Learning Time	**Instructional hours for theory**	**Instructional hours for practical/lab work/field work**	
	45	0	
Pre-requisite	Basic exposure to science and social science		

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PSO No.
	Upon completion of this course, students will be able to;		

1	Understand how science got evolved into the present form	R	
2	Evaluate important milestones in the scientific developments	R, U	
3	Understand the significance of ethics in scientific research	U	
4	Analyze the progressive impact of science on society	A	
5	Communicate effectively about important milestones in scientific development and its social significance	A, C	

*(Learning Domains: Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E) , Create (C), Skill (S))

COURSE CONTENT

Module 1	**Hours**	**CO No**
Module I: The History of Science Ancient civilization in India, china, Babylon, Egypt, Greece, Rome, Origin of science, Socrates, Plato, Aristotelian views, Archimedes, The Copernican revolution, Contributions of Galileo, Keppler, Louis Pasteur, Newton, Einstein, Linus Pauling, Development of science, Science in the 21 st century	**15**	
Module 2		
Module II : Philosophical Perspective Ancient Philosophy, Philosophers of science- Immanuel Kant, Karl Popper, Will Durant, Thomas Kuhn , Imre Lakotte., Argumentation analysis, Types- Rhetorical and Dialogue, Positivism, Relativism, Realism. Factors affecting scientific interaction, Positivist perspective, Proximate ultimate causation, Pseudoscience. Improving reasoning, Critical thinking, Affective strategies, Cognitive strategies,	**15**	
Module 3	**15**	
Module III: Science and society Scientific outlook, Verifiability and reproducibility, Plagiarism, IPR, Cyberlaws, Internet security, Media role, Science and knowledge, Beliefs, Justification ,Need of Environmental Education, Social perspective, Ethical dilemmas ,Ethics in science, Kantian ethics ,Literature and science		

Module 4		
Module IV: Current Trends in Science Latest developments in various branches of science and technology, Importance of Nobel Prizes, Science education, Scientific research, Science literacy, how science is changing the world, Artificial Intelligence in science, Science in future, Challenges and prospects	**15**	

Mode of Transaction	**Classroom activities:** Direct Instruction: Brain storming lecture, Explicit Teaching, E-learning, interactive Instruction: Active co-operative learning, Seminar, Group Assignments Authentic learning, Library work and Group discussion, Presentation by individual student/ Group representative **Field activities:** **Lab based activities**
Mode of Assessment	**Continuous Internal Assessment (CIA)** **1. Internal** Tests of maximum 20 marks 2. Seminar Presentation – a theme is to be discussed and identified to prepare a paper and present in the seminar - Maximum marks 5 3. Write a detailed report on a given topic based on research findings - Maximum marks 5 **Semester End examination –45 marks**

Learning Resources

1. Science in history, 1-4 Volumes ,J D Bernal, MIT Press,Cambridge,1971.
2. The Story of Civilization, Will Durant, Simon and Schuster Publishers, United States, 1975
3. The Scientific Outlook, Bertrand Russell, Routledge Classics
4. Science and Society, John Scales Avery, World scientific
5. The New Physics, C.V. Raman, Literary Licensing LLC, Wisconsin
6. Evolution of the Philosophy of Science-Literary Perspectives, K. Sujatha, and S. Kurien, Ane Books Pvt. Ltd, 2011.
7. One, two, three…infinity ,George Gammow, Dover Publications, INC, NewYork,1974
8. Science and society: Scientific thought and education for 21 st centaury, Peter S .Daempfle,

Jones &Bartlett Learning, Burlington

Relevance of Learning the Course/ Employability of the Course
The course will facilitate the student to understand the structure of scientific revolutions