MANIPAL UNIVERSITY
JAIPUR

Department of Biosciences
School of Basic Sciences
Manipal University Jaipur

Course Handout - (2019 - 20)

B.Sc. (Hons.) Biotechnology

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BoS Coordinator

Director, SBS

Director, Academics

HoD
Dr Abhyeet Singh

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

DEPARTMENT OF BIOSCIENCES

PROGRAM OUTCOMES *AND* PROGRAMME SPECIFIC OUTCOMES

B.Sc. (Hons) Biotechnology | Academic Year: **2019-20**

PROGRAM OUTCOMES

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

[PO.7]. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyse research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

PROGRAMME ARTICULATION MATRIX

SEMESTER	COURSE CODE	PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES									
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
I	BT 1101	1	-	-	-	-	1	1	2	2	-
	BT 1102	1	1	1	1	1	1	2	1	2	3
	BT 1103	1	1	-	1	-	-	2	1	2	3
	CA 1170	1	1	-	1	1	1	1	-	1	1
	CY 1160	3	-	-	-	-	-	3	3	3	2
	CY 1003	3	2	3	2	3	3	3	1	3	2
	LN 1106	-	3	2	1	2	3	3	-	-	1
II	BT 1201	1	-	1	1	-	1	1	1	2	-
	BT 1202	1	1	1	1	1	1	2	3	2	2
	BT 1203	1	1	1	1	1	1	1	1	2	1
	BT 1204	1	1	1	1	1	1	2	3	2	2
AVERAGE		**1.4**	**1.4**	**1.4**	**1.1**	**1.4**	**1.4**	**1.9**	**1.8**	**2.1**	**1.9**

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Diversity of Lower Plants| BT 1101 | 3 Credits | 2 1 0 3

Session: Jul 2019 – Nov 2019| Faculty: Dr. Jain Rohit| Class: I Semester

A. Introduction: This course is offered by Dept. of Biosciences as a core course in B.Sc. (Hons) Biotechnology Programme targeting students who wish to pursue their career in the research field of Plant Sciences and Microbiology or higher studies in the field of Phycology, Bryology and Pteridology. The course offers in depth knowledge of the distribution, classification, general characteristics and economic importance of various groups living world such as Algae, Bryophyta and Pteridophyta and the salient features of the life cycles of model organisms of every group. Students are expected to have background knowledge of the different types of classification systems for living world.

B. Course Outcomes: At the end of the course, students will be able to:

[BT 1101.1]. Identify important Algae, Bryophytes and Pteridophytes growing in different habitats based on their morphology
[BT 1101.2]. Classify lower plants into different evolutionary groups
[BT 1101.3]. Study the life cycle of model organisms of each group to understand the process of evolution
[BT 1101.4]. Identify different types of pigments in algae and develop protocols for isolation of these pigments
[BT 1101.5]. Analyse the development of higher plants from cryptogames by studying evolution pattern of Pteridophytes
[BT 1101.6]. Designing protocols for commercial uses of economically important algae and bryophytes in agriculture and energy industry, thereby increasing the possibilities for entrepreneurship development

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.
[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.
[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.
[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1 – IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	20
End Term Exam (EX)	End Term Exam – EX 1	40
	Total	100

Note: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

Algae: Occurrence, general characteristics, classification system, thallus structure, pigments, reproduction and importance. Study of life cycle of the following genera: *Volvox, Chara, Vaucheria*. Bryophytes: Occurrence, distribution, general characteristics, alternation of generation, classification and economic importance. Study of life cycle of the *Marchantia*. Pteridophytes: Occurrence, general characteristics, classification, stele system, seed habit and heterospory, apospory and apogamy. Study of life cycle of the *Marsilea*. Comparative study of the algae, bryophytes and pteridophytes in general. Global applications of cryptogames in industry.

F. REFERENCES

R1. V. Singh, P.C. Pande and D.K. Jain. Diversity of Microbes and Cryptogams, 5th Revised Edition, Rastogi Publication, Meerut, India. 2012.

R2. N. S. Parihar. Biology and Morphology of Pteridophytes, Central Book Depot., Allahabad, 2002.

R3. S. K Bassi, Diversity of Microbes and Cryptogams. S. Chand Publicaions, New Delhi, India, 2007.

R4. B. R. Vashishta, A. K. Sinha and V. P. Singh. Botany for Degree Students: Algae, S. Chand Publications, New Delhi, India. 2014.

R5. G. M. Smith. Cryptogamic Botany: Bryophytes and Pteridophytes, Tata McGraw Hill Publishing Co., New Delhi, 2008.

R6. E. Karl. Cryptogams: Cyanobacteria, Algae, Fungi, Lichens. Cambridge University Press. 1982.

G. Lecture Plan:

LEC NO	TOPICS	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Syllabus discussion and Introduction to Plant Kingdom and differences between Cryptogames and Phenerogames	Differentiate between cryptogames and phenerogames with examples	Lecture	-	MTE I
2.	Introduction to Algae: Group of fresh water/marine photosynthetic eukaryotic organisms	Explain how viruses play as connecting link with the help of their characteristics	Lecture	BT 1101.1	Class Test MTE I End Term
3.	Tutorial	Describe characteristics of viruses and distinguishing features between crypto- and phenero-games	Discussion	BT 1101.1	Quiz/Test
4.	Affinities and dissimilarities of Algae with bacteria	Understand virus structure and classification. Identify plant and animal viruses	Lecture	BT 1101.1	Class Test MTE I End Term
5.	Affinities of algae with higher plants and comparison of the common features	List diseases caused by plant and animal viruses	Lecture	BT 1101.1	Class Test MTE I End Term
6.	Tutorial	Recall epidemiology of diseases caused by various plant and animal viruses	Discussion	BT 1101.1	Quiz
7.	Algae: General characteristics	Discuss importance of mycoplasma and enlist diseases caused by it	Lecture	BT 1101.3	Class Test MTE I End Term
8.	Algae: Classification of algae proposed by various workers	Explain different structures and importance of bacteria. Understand methods of reproduction in bacteria	Lecture	BT 1101.2 BT 1101.4	Class Test MTE I End Term
9.	Tutorial	Recall importance of bacteria and mycoplasma	Discussion	BT 1101.4 BT 1101.3	Class Test
10.	Algae in diversified habitat: Cosmopolitan	Understand the importance of bacteria in industry and agriculture. Discuss treatment and symptoms of common bacterial diseases	Lecture	BT 1101.4	Class test MTE I End Term
11.	Study of different groups of Algae, general characteristics, Algae as ancestors of higher plants	Explain general characteristics of algae and distinguish among its different groups	Lecture	BT 1101.2	Class Test MTE I End Term
12.	Tutorial	Recall importance of bacteria and classification of algae	Discussion	BT 1101.2 BT 1101.4	Quiz/Class Test
13.	Photosynthetic pigments and stored food and	Discuss importance of algae	Lecture	BT 1101.4	Class test

	economic importance of algae			BT 1101.7	MTE 2 End Term
14.	Study of Life Cycle of *Volvox*	Describe the life cycle of *Volvox*	Lecture	BT 1101.2	Class Test MTE 2 End Term
15.	Tutorial	Recall importance of algae and life cycle of *Volvox*	Discussion	BT 1101.2 BT 1101.4	Quiz
16.	Study of Life Cycle of Vaucheria	Explain the different stages in life cycle of *Polysiphonia*	Lecture	BT 1101.2	Class Test MTE 2 End Term
17.	Study of Life Cycle of Vaucheria	Explain the different stages in life cycle of *Vaucheria*	Lecture	BT 1101.2	Class test MTE 2 End Term
18.	Tutorial	Distinguish between life cycle of *Polysiphonia* and *Vausheria*	Discussion	BT 1101.2	Quiz
19.	Study of Life Cycle of Chara	Describe the life cycle of *Chara*	Lecture	BT 1101.2	Class Test MTE 2 End Term
20.	Research in India in the field of Bryology and contribution of Prof. S.R. Kashyap	Discuss the contributions of eminent scientists in Bryology	Lecture	BT 1101.6	Assignment MTE 2 End Term
21.	Tutorial	Recall the different stages in life cycle of *Chara* and evaluate research done in Bryology in India	Discussion	BT 1101.2 BT 1101.6	Quiz
22.	Bryophyta: General characteristics and modes of reproduction	Explain the general characteristics and modes of reproduction in bryophytes	Lecture	BT 1101.2	Class Test MTE 2 End Term
23.	Life Cycle of Marchantia: Vegetative Phase	Discuss the different stages in vegetative phase of life cycle of *Marchantia*	Lecture	BT 1101.2	Class Test MTE 2 End Term
24.	Tutorial	Recall the general characteristics of bryophytes and their reproduction	Discussion	BT 1101.2	Class Test
25.	Life Cycle of Marchantia: Sexual Phase and Fertilization	Explain the different stages in sexual phase of life cycle of *Marchantia*	Lecture	BT 1101.2	Class Test End Term
26.	Economic importance of Bryophyta (Mosses)	Evaluate the economic importance of different bryophytes	Lecture	BT 1101.4	Class Test End Term
27.	Tutorial	Recall the stages in life cycle of *Marchantia* and economic importance of bryophytes	Discussion	BT 1101.2 BT 1101.4	Quiz
28.	Pteridophyta: First successful land plants with seed habit, general characteristics and	Describe general characteristics and classification of first successful land	Lecture	BT 1101.2 BT 1101.6	Class Test End Term

	classification	plants with seed habit			
29.	Development of seed habit and heterospory in Pteridophyta	Explain the stages in development of seed habit and heterospory in Pteridophytes	Lecture	BT 1101.2	Class test End Term
30.	Tutorial	Recall the characteristics, classification and stages of development of pteridophytes	Discussion	BT 1101.2	Quiz
31.	Economic importance of pteridophytes and modes of asexual reproduction: Apogamy and Apospory	Evaluate the importance of pteridophytes and distinguish between methods of asexual reproduction	Lecture	BT 1101.2 BT 1101.4	Class Test End Term
32.	Life cycle of *Marsilea*: Vegetative phase	Describe the stages in vegetative phase *Marsilea*	Lecture	BT 1101.2	Class Test End Term
33.	Tutorial	Recall importance of petridophytes and their modes of asexual reproduction	Discussion	BT 1101.2 BT 1101.4	Quiz
34.	Marsilea: Sexual phase and fertilization	Explain the different stages in sexual phase of life cycle of *Marsilea*	Lecture	BT 1101.2	Class Test End Term
35.	Comparative studies between Algae, Bryophyta and Pteridophyta	Identify and classify different lower plant species into algae, bryophyta and pteridophyte based on their distinguishing characteristics	Lecture	BT 1101.5	Class Test End Term
36.	Tutorial	Recall the stages in life cycle of *Marsilea* and characteristic differences among algae, pteridophytes and bryophytes	Discussion	BT 1101.2 BT 1101.5	Class Test
Lab sessions	Study of morphology and anatomy of lower plants	Preparation of microscopic slides and observe the anatomy of lower plants	Lab sessions	BT 1101.2 BT 1101.5	Experimental results in 24 lab sessions End Term Practical Examination

2 Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[BT 1101.1].	Identify important Algae, Bryophytes and Pteridophytes growing in different habitats based on their morphology								2		
[BT 1101.2].	Classify lower plants into different evolutionary groups						1		1		
[BT 1101.3].	Study the life cycle of model organisms of each group to understand the process of evolution										
[BT 1101.4].	Identify different types of pigments in algae and develop protocols for isolation of these pigments									2	
[BT 1101.5].	Analyse the development of higher plants from cryptogames by studying evolution pattern of Pteridophytes	1									
[BT 1101.6].	Designing protocols for commercial uses of economically important algae and bryophytes in agriculture and energy industry, thereby increasing the possibilities for entrepreneurship development							1	2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Fundamentals of Biotechnology| BT 1102 | 3 Credits | 2 1 0 3

Session: Jul 2019 - Nov 2019 | Faculty: Dr. Nitesh Kumar Poddar | Class: I Semester

A. Introduction: This course is offered by Dept. of Biosciences as a core course in B.Sc. (Hons.) Biotechnology Programme targeting students who wish to pursue their career in the research field of Biotechnology or higher studies in applied field of Biology. The course offers basic understanding of different terms and applications of Biotechnology processes. Students are expected to have background knowledge of Biology

B. Course Outcomes: At the end of the course, students will be able to:

[BT 1102.1]. List the tools and techniques employed in Biotechnology
[BT 1102.2]. Understand about various branches of Biotechnology and their applications
[BT 1102.3]. Describe the steps used in recombinant DNA technology, DNA fingerprinting etc.
[BT 1102.4]. Relate the concepts of gene and genomes and Proteins and proteome and techniques related to antibody production gene
[BT 1102.5]. Select safety guidelines and risk assessment in biotechnology
[BT 1102.6]. Analyse biological research project and generally employed in pathology labs, hospital labs to study biological samples-tissues, blood, body fluids etc. hence develop hence develop employability skills.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
[PO.7]. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.
[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyse research questions through the use of the scientific method.
[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1– IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	20
End Term Exam (EX)	End Term Exam – EX 1	40
	Total	100

Note: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

Biotechnology: Introduction and history. Basic concepts, definition and descriptions of some important terminology in biotechnology. Study of various branches of Biotechnology including plant, animal, medical, industrial, environmental, marine biotechnology, bioinformatics. Introduction of Techniques: Genetic engineering, plant and animal tissue culture, fermentation technology, immobilized enzymes, monoclonal antibodies and hybridoma technology, embryo transfer technology, introduction to gene and genomes, proteins and proteome, recombinant DNA technology, DNA fingerprinting and forensic analysis. Avenues of Biotechnology: Current status of biotechnology and future of biotechnology in developing world, role of biotechnology in Indian industry, new trends in biotechnology. Practice of biotechnology: Medicine, industry, agriculture, livestock improvement and environment.

F. REFERENCES:

R1. S. C. Bhatia, Text Book of Biotechnology. Atlantic Publisher and Distributor, New Delhi. 2012.

R2. A. K. Chakravarty. Introduction to Biotechnology. Oxford University Presss, New Delhi, 2013.

R3. J. William, M. Thieman and A. Palladino. Introduction to Biotechnology. Benjamin Cummings. 2013.

R4. R.W. Old and S.B. Primrose. Principles of Gene Manipulation. Blackwell Scientific Publications, U.K. 2006.

G. Lecture Plan:

LEC NO	TOPICS	Session Outcome	Mode of Delivery	Corresponding CO	Mode of assessing the outcome
1.	Biotechnology: Introduction and history	Understanding the concept of biotechnology	Lecture	BT1102.1 BT1102.2	MTE I ETE
2.	Biotechnology: Introduction and history	Discuss the history of Biotechnology	Lecture	BT1102.1 BT1102.2	MTE I Assignment ETE
3.	Basic concepts, definition and descriptions of some important terminology in biotechnology	Understanding the concept of different terminology used in Biotechnology	Lecture	BT 1102.2	MTE I Quiz/Test
4.	Tutorial	Recall the concept and definitions of Biotechnology	Discussion	BT1102.1 BT1102.2	Test/Quiz
5.	Basic concepts, definition and descriptions of some important terminology in biotechnology	Understanding the concept of different terminology used in Biotechnology	Lecture	BT1102.1	MTE I ETE
6.	Basic concepts, definition and descriptions of some important terminology in biotechnology	Understanding the concept of different terminology used in Biotechnology	Lecture	BT1102.1 BT1102.2	MTE I Quiz/Test ETE
7.	Study of various branches of Biotechnology including plant, animal, medical, industrial, environmental, marine biotechnology, bioinformatics.	Understanding the concept of different branches of Biotechnology	Lecture	BT1102.2 BT1102.3	MTE I
8.	Study of various branches of Biotechnology including plant, animal, medical, industrial, environmental, marine biotechnology, bioinformatics.	Understanding the concept of different branches of Biotechnology	Lecture	BT1102.2 BT1102.3	MTE I
9.	Study of various branches of Biotechnology including plant, animal, medical, industrial, environmental, marine biotechnology, bioinformatics.	Understanding the concept and application of different branches of Biotechnology	Lecture	BT1102.3 BT1102.4	MTE I
10.	Tutorial	Recall the concept of differences of Biotechnology.	Discussion	BT1102.2 BT1102.3 BT1102.4	Quiz/Test
11.	Introduction of Techniques: Genetic engineering	Understanding the principle of Biotechnology technique	Lecture	BT1102.3	MTE I ETE
12.	Introduction of Techniques: Genetic	Understanding the application of	Lecture	BT1102.3	MTE I

	engineering	Biotechnology technique			ETE
13.	Plant and animal tissue culture	Understanding the principle of tissue culture	Lecture	BT1102.2	MTE 1 ETE
14.	Plant and animal tissue culture	Understanding the application of tissue culture	Lecture	BT 1102.3	MTE 1 ETE
15.	Tutorial	Recall the principle and application of Biotechnology tools	Discussion	BT1102.2 BT 1102.3	Quiz/Test
16.	Fermentation technology	Understanding the principle and application of Fermentation technology	Lecture	BT 1102.3	MTE 1 ETE
17.	Immobilized enzymes	Understanding the principle and application of Immobilized enzymes	Lecture	BT 1102.4 BT 1102.6	MTE 1 Assignment/Test ETE
18.	Immobilized enzymes	Understanding the application of Immobilized enzymes	Lecture	BT 1102.3	MTE 1 ETE
19.	Tutorial	Recall the principle and application of Biotechnology tools	Discussion	BT 1102.3 BT 1102.4 BT 1102.6	Quiz/Test
20.	Monoclonal antibodies and hybridoma technology	Discuss the principle of hybridoma technology	Lecture	BT1102.4	MTE 1 ETE
21.	Monoclonal antibodies and hybridoma technology	Explain the application of hybridoma technology	Lecture	BT1102.5	MTE 2 ETE
22.	Introduction to gene and genomes	Compare the concept of gene and genomes in biotechnology	Lecture	BT1102.3	MTE 2 ETE
23.	Proteins and proteome	Compare the concept of Protein and Proteome in biotechnology	Lecture	BT1102.4	MTE 2 ETE
24.	Tutorial	Recall the concept of biotechnology techniques with respect to antibody productions	Discussion	BT1102.3 BT1102.4	Quiz/Test
25.	Recombinant DNA technology	Discuss the principle and application of RDT	Lecture	BT 1102.3 BT 1102.6	MTE 2 ETE
26.	DNA fingerprinting and forensic analysis	Discuss the principle of DNA fingerprinting used in Biotechnology	Lecture	BT 1102.3	MTE 2 ETE
27.	DNA fingerprinting and forensic analysis	Discuss the application of DNA fingerprinting used in Biotechnology	Lecture	BT 1102.3 BT 1102.6	MTE 2 ETE
28.	Avenues of Biotechnology: Current status of biotechnology and future of biotechnology in developing world	Discuss the trends of present and future biotechnology in developing world	Lecture	BT 1102.6	Quiz/Test

29.	Tutorial	Critically evaluate different applications of biotechnology methods in the present and future world	Discussion	BT 1102.4 BT 1102.5	Quiz/Test
30.	Avenues of Biotechnology: Current status of biotechnology and future of biotechnology in developing world	Discuss the trends of present and future biotechnology in developing world	Lecture	BT 1102.3 BT 1102.6	MTE 2 ETE
31.	Role of biotechnology in Indian industry	Discuss the role of biotechnology in Indian sector	Lecture	BT 1102.3	Quiz/Test ETE
32.	New trends in biotechnology.	Discuss the upcoming trends in Biotechnology	Lecture	BT1102.5	MTE 2 ETE
33.	Practice of biotechnology: Medicine, industry, agriculture, livestock improvement and environment.	Discuss the role of Biotechnology in different sectors of industries	Lecture	BT1102.5	MTE 2 ETE
34.	Practice of biotechnology: Medicine, industry, agriculture, livestock improvement and environment.	Discuss the role of Biotechnology in different sectors of industries	Lecture	BT1102.5	ETE
35.	Practice of biotechnology: Medicine, industry, agriculture, livestock improvement and environment.	Discuss the role of Biotechnology in different sectors of industries	Lecture	BT1102.6	ETE
36.	Tutorial	Recall the role of Biotechnology in different sectors of Industries.	Discussion	BT1102.6	Quiz/Test
Lab Sessions	Laboratory: Introduction to lab and lab environment, Good Laboratory Practices (GLP), Identification of different cells, mitosis in onion root tip.	Learn about the lab good practices, handling of different instruments etc	Lab Sessions	BT1102.2 BT1102.6	Experimental results lab sessions End Term Practical Examination

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[BT1102.1]	List the tools and techniques employed in Biotechnology	1							1		
[BT1102.2]	Understand about various branches of Biotechnology and their applications		1						1		
[BT1102.3]	Describe the steps used in recombinant DNA technology, DNA fingerprinting etc.	1			1				1		
[BT1102.4]	Relate the concepts of gene and genomes and Proteins and proteome and techniques related to antibody production gene.		1							1	
[BT1102.5]	Select safety guidelines and risk assessment in biotechnology			1		1	1			2	
[BT1102.6]	Analyse biological research project and generally employed in pathology labs, hospital labs to study biological samples- tissues, blood, body fluids etc. hence develop hence develop employability skills				1	1	1	2			3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Cell Biology: Structure and function | BT 1103 | 3 Credits | 3 1 0 4

Session: Jul 2019 – Nov 2019 | Faculty: Dr. Mousumi Debnath | Class: I Semester

A. Introduction: This course is offered by Dept. of Biosciences as a core course in B.Sc. (Hons) Biotechnology targeting students who wish to pursue their career in the research field of cell biology, microbiology and molecular biology. Cell biology is an important course and is an integral part of any biological and life sciences program at undergraduate level in any university. The aim of the course is to demonstrate to the students the intricate relationship between various cellular structures and their corresponding functions. This course has been designed for undergraduate level studies and has been deliberately kept at a basic level which provides an opportunity for the learner to familiarize themselves with the fundamentals of cell biology and its applications.

B. Course Outcomes: At the end of the course, students will be able to:

[BT 1103.1] Recall structure and function of prokaryotic and eukaryotic cells (both plant and animal cells).

[BT 1103.2] Understand an overview of cell cycle comprising G1, S, G2 and M phases; division of cells in both somatic and germ cells in both plant and animal cells.

[BT 1103.3] Understand ultra- and fine-structure of difference cell organelles such as mitochondria, nucleus, golgi apparatus etc.

[BT 1103.4] Differentiate and relate the role of each cell organelle of the cell and their role in enabling cell performing necessary cellular responsibilities such as cell division, metabolism etc.

[BT 1103.5] Appraise different cell signaling pathways and how the pathways transmit signals from environmental response to gene expression to maintain cellular homeostasis.

[BT 1103.6] Investigate the mechanisms by which different cellular insults make cells become diseased which finally led to illness or death.

[BT 1103.7] Investigate recent advancements cell biology research and technologies that has enabled us understanding the structure and function of the cell with deep understanding and increase employability skills.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

[PO.7]. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life- long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1 – IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	20
End Term Exam (EX)	End Term Exam – EX 1	40
	Total	100

Note: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

History and introduction of cell, cell theory, eukaryotic and prokaryotic cells, different models of cell membrane and structure of cell wall, active & passive transport. Cell organelles: Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplasts, Ribosome, Liposome, Peroxisomes, Nucleus, lysosomes, Vacuole, Cytosol and Cytoskeleton (Microtubules, Microfilaments and Intermediate filaments). Discovery, morphology and structural organization of chromosome- chemical composition and karyotype, special types of chromosome: salivary gland and lamp brush chromosomes. Cell Division: mitosis & meiosis, cell cycle. Cell signaling: Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways. Cellular communication: cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins. Cell Senescence and Programmed Cell Death (PCD).

F. REFERENCES:

R1. Rastogi. S.C. Cell Biology, Tata Mc Graw Hill Pub. Co. New Delhi, 2010.

R2. Gupta. P. K. A Text Book of Cell and Molecular Biology, Rastogi Publications, Merrut, 2012.

R3. Alberts B., Bray D., Lewis J., Raff M. and Watson J.D.. Molecular Biology of the Cell, Garland Publishing Inc. New York, 2008.

R4. Robertis D., Cell and Molecular Biology, Waverly International, New York, 2011.

R5. Lodish H., Berk A, Zipursky S.L, Matsudiara P., Baltimore D., and Darnell J., Molecular Cell Biology, WH Freeman & Co., New York, 2013.

G. LECTURE PLAN

Lecture No.	Topics	Session outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1.	Introduction and Course Hand-out briefing	To acquaint and clear teachers expectations and understand student expectations	Lecture	NA	NA
2.	History and introduction of cell	Know the cell as a unit of life	Lecture	BT 1103.1	Mid Term I End term
3.	Cell theory	Understand Cell theory	Lecture	BT 1103.1	Mid Term I End term
4.	Eukaryotic and prokaryotic cells	Distinguish between Eukaryotic and prokaryotic cells	Lecture	BT 1103.1	Mid Term I End term
5.	Different models of cell membrane	Know the models of cell membrane	Lecture	BT 1103.1	Mid Term I End term
6.	Different models of cell membrane	Have detailed knowledge of the cell membrane	Lecture	BT 1103.1	Mid Term I End term Mid Term I End term
7.	Structure of cell wall	Know the structure of cell wall	Lecture	BT 1103.1	Mid Term I End term
8.	Active & passive transport	Understand and differentiate active & passive transport	Lecture	BT 1103.1 BT 1103.	Mid Term I End term
9.	Cell organelles: Nucleus	Understand cell organelles and Nucleus	Lecture	BT 1103.3	Class quiz Mid Term I End term
10.	Cell organelles: Mitochondria,	Know about Mitochondria its structure and function	Lecture	BT 1103.3	Mid Term I End term
11.	Cell organelles: chloroplast	Know chloroplast	Lecture	BT 1103.3	Class quiz Mid Term I End term

12.	Cell organelles: Ribosomes	Cell organelles: Ribosomes, its importance in protein synthesis and structure	Lecture	BT 1103.3	Mid Term I End term
13.	Cell organelles: Endoplasmic reticulum,	Stucture and function of ER and Golgi bodies	Lecture	BT 1103.3	Mid Term I End term
14.	Cell organelles: Golgi apparatus	How the endomembrane system and golgi help in protein sorting	Lecture	BT 1103.3	Mid Term I End term
15.	Cell organelles: Vacuoles	Understand the use of Vacuoles	Lecture	BT 1103.3	Mid Term I End term
16.	Cell organelles: Liposomes	Understand the use of Liposomes	Lecture	BT 1103.3	Mid Term I End term
17.	Cell organelles: Lysosomes	Understand the use of Lysosomes	Lecture	BT 1103.3	Class quiz Mid Term I End term
18.	Tutorial	Tutorial			
19.	Cell organelles: Peroxisomes	Understand the use of Peroxisomes	Lecture	BT 1103.3	Mid Term II End term
20.	Cell organelles: Centrosomes	Understand the use of Centrosomes	Lecture	BT 1103.3	Mid Term II End term
21.	Cytoskeleton, microtubules, microfilaments & intermediate filaments	Understand the use of Cytoskeleton, microtubules, microfilaments & intermediate filaments	Lecture	BT 1103.3	Class quiz Mid Term II End term
22.	Tutorial	Tutorial			
23.	Discovery of chromosome	Importance of chromosome	Lecture	BT 1103.3	Class quiz Mid Term II End term
24.	Morphology and structural organization of chromosome	Understand the morphology and structural organization of chromosome	Lecture	BT 1103.3	Class quiz Mid Term II End term
25.	Chemical composition and karyotype	Know the chemical composition and karyotype	Lecture	BT 1103.3	Class quiz Mid Term II

					End term
26.	Tutorial	Tutorial			
27.	Special types of chromosome: introduction	Understand salivary gland chromosomes	Lecture	BT 1103.3	Class quiz Mid Term II End term
28.	Special types of chromosome: salivary gland chromosomes, lampbrush chromosomes	Understand lampbrush chromosomes	Lecture	BT 1103.3	Class quiz Mid Term II End term
29.	Cell Division: Mitosis	Understand Mitosis	Lecture	BT 1103.2	Class quiz Mid Term II End term
30.	Tutorial	Tutorial			
31.	Cell Division: Meiosis	Understand Meiosis	Lecture	BT 1103.2	End term
32.	Cell Cycle	Understand the importance of Cell Cycle	Lecture	BT 1103.2	Class quiz End term
33.	Cell signaling: introduction	Know cell signaling	Lecture	BT 1103.5	Class quiz End term
34.	Tutorial	Tutorial			
35.	Cell signaling: hormones and their receptors, cell surface receptors	Cell signaling hormones and their receptor and their concepts.	Lecture	BT 1103.5	Class quiz End term
36.	Cell signaling: signaling through G- protein coupled receptors	Know what Cell is signaling: signaling through G-protein coupled receptors	Lecture	BT 1103.5	Class quiz End term
37.	Cell signaling: signal transduction pathways.	Importance of Cell signaling: signal transduction pathways.	Lecture	BT 1103.5	Class quiz End term
38.	Tutorial	Tutorial	Lecture		
39.	Cellular communication: introduction	Understand what is Cellular communication	Lecture	BT 1103.5	Class quiz End term
40.	Cellular communication: cell adhesion roles of	Understand what is cellular communication: cell			

	different adhesion molecules	adhesion roles of different adhesion molecules	Lecture	BT 1103.5	Class quiz End term
41.	Tutorial	Tutorial	Lecture		Class quiz End term
42.	Cellular communication: gap junctions	Understand cellular communication: gap junctions	Lecture	BT 1103.5	Class quiz End term
43.	Cellular communication: extracellular matrix	Understand Cellular communication: extracellular matrix	Lecture	BT 1103.5	Class quiz End term
44.	Cellular communication: integrins	Understand Cellular communication: integrins	Lecture	BT 1103.5	Class quiz End term
45.	Tutorial	Tutorial	Lecture		Class quiz
46.	Cell Senescence	Know what is Cell Senescence	Lecture	BT 1103.5	End term
47.	Necrosis	Understand Necrosis	Lecture		End term
48.	Apoptosis: programmed Cell Death (PCD)	Explain Apoptosis: programmed Cell Death (PCD)	Lecture	BT 1103.7 BT 1103.6	End term
49.	Conclusion and Course Summarization	Conclusion and Course Summarization	Lecture	NA	End term
50.	Lab session for hands on training on cell types	Lab session to understand what cell and its function	Lab visit and lab session	NA	End term theory End term practical

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[BT 1103.1]	Recall structure and function of a prokaryotic and eukaryotic cells (both plant and animal cells).								1		
[BT 1103.2]	Understand an overview of cell cycle comprising G1, S, G2 and M phases; division of cells in both somatic and germ cells in both plant and animal cells.		1						1	1	
[BT 1103.3]	Understand ultra- and fine-structure of difference cell organelles such as mitochondria, nucleus, golgi apparatus etc.								1	2	
[BT 1103.4]	Differentiate and relate the role of each and every cell organelle of the cell and their role in enabling cell performing necessary cellular responsibilities such as cell division, metabolism etc.	1						1		1	1
[BT 1103.5]	Appraise different cell signaling pathways and how the pathways transmit signals from environmental response to gene expression to maintain cellular homeostasis.				1			2			3
[BT 1103.6]	Investigate the mechanisms by which different cellular insults make cells become diseased which finally led to illness or death.							2		2	
[BT 1103.7]	Investigate recent advancements in cell biology research and technologies that has enabled us understanding the structure and function of the cell with deep understanding and increase employability skills	1						1			3

Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Fundamentals of Computer | CA 1170 | 3 Credits | 2103

Session: Jul 2019 – Nov 2019 | Faculty: Dr. Pradeep Kumar Tiwari | Class: I Semester

A. Introduction: Computer is an advanced electronic device that takes raw data as an input from the user and processes it under the control of a set of instructions (called program), produces a result (output), and saves it for future use. The foundational concepts of computer hardware, software, operating systems, peripherals, etc. along with how to get the most value and impact from computer technology are covered in this course.

B. Course Objectives: At the end of the course, students will be able to

[CA 1170.1]. To understand the fundamental concepts of the computer system with the contemporary skill and knowledge.

[CA 1170.2]. To analyse and understand the knowledge of computer equipment both hardware and software, which would leverage the options of employability.

[CA 1170.3]. To describe various operating systems, peripheral devices, networking, multimedia and internet.

[CA 1170.4]. Demonstrate and understand the terms and various functions associated with hardware and software program menus of computer systems, amalgamation of which would help a student in enhancing entrepreneurship skills.

C. Program Outcomes and Program Specific Outcomes

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

[PO.7]. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology.

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS:

Computer Fundamentals: Definition and Purpose, Data, Information and Knowledge, Characteristics of Computers, Classification of Computers, Generations of Computer, Basic organization of Computer, System Software and Application Software; Operating Systems and Multimedia: Types of Operating System, Windows v/s Linux, Mobile based OS, Multimedia, Definition and Types, Multimedia Software; Computer Networks: Applications of Networking, Network Topologies- Mesh, Bus, Star, Ring, Types of Network (LAN, MAN, WAN), Network Cables- Optical Fiber, Twisted, Co-axial, Network Devices- Hubs, Switch, Router, Network Interface Card, Ethernet; Internet: Introduction and Usage of Internet, Internet Connectivity Options (Wired and Wireless), IP Addressing and DNS, Website, URL, HTML, Web Browser and Search Engines; Operational Guideline of Computer Usage: Do's and Don'ts of Computer, E-mails, Email Etiquettes, Cyber Security, Internet Frauds, Secure Password Formation, Computer Security, Malware, Virus, Ransomware etc., Social Media and its Impact

F. REFERENCES:

R1. E. Balagurusamy "*Fundamentals of Computers*" Published by Tata McGraw-Hill Education Pvt. Ltd.

R2. P.K.Sinha, *"Computers Fundamentals"*, BPB Publications.

R3. I.R. Thareja, *Fundamental of Computer*, (1e) Oxford Publications, 2014.

R4. K. Atul, *Information Technology*, (3e) Tata McGraw Hill Publication, 2008.

G. Lecture Plan:

Lec. No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1-3	Definition and Purpose Data, Information and Knowledge Characteristics of a computer	To acquaint and clear teachers expectations and understand student expectations Basic understanding of computer and its resources. Explain the classification of computers.	Discussion	CA 1170.1	NA
4-6	Classification of Computers Generations of Computer Basic organization of Computer, System Software and Application Software	Describe various generations of computers. Describe various types of networks. Describe types of network cables and their design.	Lecture & Discussion	CA 1170.1	In Class Mid Term I End Term
7-9	Operating Systems and Multimedia Types of Operating System Windows v/s Linux Mobile based OS	Describe various types of operating system. Describe the basic differences between windows and linux operating systems. Explain the mobile based operating systems.	Lecture & Discussion	CA 1170.3	In Class Mid Term I End Term
10-12	Definition and Types Multimedia Software	Discuss the Multimedia types and applications Describe multimedia software's and their working	Lecture & Discussion	CA 1170.3	In Class Mid Term I End Term
13-15	Computer Networks Applications of Networking Network Topologies- Mesh, Bus, Star, Ring Types of Network (LAN, MAN, WAN) Network Cables- Optical Fiber, Twisted, Co-axial Network Devices- Hubs, Switch, Router, Network Interface Card	Explain the networking applications. Describe the features of different topologies. Describe various types of networks. Describe types of network cables and their design. Elaborate the Types of network devices. Explain NIC and ethernet.	Lecture & Discussion	CA 1170.3 CA 1170.4	In Class Mid Term I End Term

16-18	Introduction and Usage of Internet Internet Connectivity Options (Wired and Wireless) IP Addressing and DNS, Website, URL, HTML Web Browser and Search Engines	Explain the internet model and applications of internet. Explain the difference between wired and wireless connections, sbasics of Wifi.	Lecture & Case Study	CA 1170.3	Class Quiz Mid Term I End Term
19-21	Operational Guideline of Computer Usage Do's and Don'ts of Computer e-mails, email Etiquettes, System Software and Application Software	Explain IP address and DNS. Describe the Functions of Websites, HTML basics. Describe various types of web browsers and search engines. Learn to use computers in a secure and efficient manner. To compose emails and explain the email exchange process.	Lecture & Discussion	CA 1170.3 CA 1170.4	Class Quiz Mid Term I End term
22-24	Cyber Security Internet Frauds Secure Password Formation Computer Security Malware, Virus, Ransomware Social Media and its Impact	To understand cyber security, internet attacks. Learn to make strong passwords to improve security concerns. Learn and understand the malwares and types of viruses, difference between malware and virus	Lecture & Practical	CA 1170.1	Class Quiz Mid Term II End Term

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[CA 1170.1.]	To understand the fundamental concepts of the computer system with the contemporary skill and knowledge.	**1**					**1**	**1**		**1**	
[CA 1170.2.]	To analyse and understand the knowledge of computer equipment's both hardware and software, which would leverage the options of employability.		**1**		**1**					**1**	
[CA 1170.3.]	To describe various operating systems, peripheral devices, networking, multimedia and internet.		**1**								
[CA 1170.4.]	Demonstrate and understand the terms and various functions associated with hardware and software program menus of computer systems, amalgamation of which would help a student in enhancing entrepreneurship skills.	**1**				**1**	**1**				**1**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Science

Department of Biosciences

Course Hand-out

General Chemistry-I | CY 1160 | 3 Credits | 2 1 0 3

Session: July 19 – Nov19 | Faculty: Dr Meenakshi Pilania | Class: I Semester

A. Introduction: This course is offered by Department of Chemistry. This course introduces the students to basic fundamentals and topics relevant to the field of general chemistry. It help the students to become familiar with various topics like stereochemistry, structure, bonding and aromaticity. This course also offers in depth knowledge of some basic concept of inorganic chemistry.

B. Course Outcomes: At the end of the course, students will be able to

[CY 1160.1]. Understand the structure and bonding based on hybridization, resonance, hydrogen bonding of various molecule

[CY 1160.2]. Apply the skills and strategies to understand the organic reaction mechanism based on various reactive intermediates

[CY 1160.3]. Explain the reaction mechanism with stereochemistry using enantiomers, diastereomers and racemic mixture.

[CY 1160.4]. Apply the knowledge of the periodicity of the elements towards the description of covalent and ionic bonding

[CY 1160.5]. Able to demonstrate the knowledge of Miscellaneous topic like oxidation, reduction, acid /Bases concept.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	

E. SYLLABUS

Structure and Bonding: Hybridization, interactions, resonance, aromaticity, H-bonds. Mechanism: Notations, bond cleavage, electrophiles and nucleophiles, intermediates, free radicals. Stereochemistry: Isomerism, symmetry, chirality, projections, D&L- E&Z- R&S- nomenclature. Basic Concepts of Inorganic Chemistry: Structure, periodicity, ionic solids. Bonding: Covalent bonds, hybridization, VSEPRT, VBT, MOT. s-block Elements: Comparison, diagonal relationships, hybrids. Miscellaneous: Oxidation and reduction, acids and bases, noble gasses, radioactivity.

F. REFERENCES:

R1. J. D. Lee, *Concise Inorganic Chemistry*, Blackwell Science, 2008.

R2. J. E. Huheey, E. A. Keiter & R. L. Keiter, *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson India, 2008.

R3. G. W. Solomon and B. F. Craig, *Organic Chemistry*, John Wiley & Sons, Inc., 2010.

R4. P. Sykes, *A Guidebook to Mechanism in Organic Chemistry*, Pearson India, 2003.

G. Lecture Plan:

Lec No	**Topics**	**Session Outcome**	**Mode of Delivery**	**Corresponding CO**	**Mode of Assessing the Outcome**
1	Introduction and Course Hand-out briefing	Introduce the syllabus and course handout	Lecture	CY 1160.1	In Class assignment Mid Term I End Term
2,3	**Structure and Bonding:** Hybridizations	Explain hybridization and VSEPR theory with suitable examples	Lecture	CY 1160.1	Mid Term I End Term
4,5	Van-der Waals interactions	Describe various type of Van-der Waals force of interactions and their application etc.	Lecture	CY 1160.1	In Class assignment Mid Term I End Term
6-8	Resonance	Explain resonance, hybrid structure and stability of their resonating structures	Lecture	CY 1160.1	In Class assignment Mid Term I
9	Aromaticity	Introduction, huckel rule, frost cycle of various aromatic compounds	Lecture	CY 1160.1	In Class assignment Mid Term I End Term
10,11	Hydrogen bonding	Explain hydrogen bonding and its application	Lecture	CY 1160.1	Mid Term I End Term
12,13	Mechanism of Organic compounds	General Introduction	Lecture	CY 1160.2	In Class assignment Mid Term I End Term
14	Curved arrow notations	Describe the drawing electron movement with arrows, half headed and double headed arrow	Lecture	CY 1160.2	Mid Term I End Term
15,16	Homolytic and heterolysis bond breaking,	Recall and describe different Types of Reagents: Electrophiles and nucleophiles	Lecture	CY 1160.2	Mid Term I End Term
17-19	Types of organic reactions	Describe the various reactive intermediates	Lecture	CY 1160.2	Mid Term I End Term
20	Revision	Revision of structure and bonding	Lecture	N.A.	N.A.
21,22	Free radical	Recall and describe Captodative effect, bent rule, stability order	Lecture	CY 1160.2	In Class assignment Mid Term I End Term
23	**Stereochemistry**	Concept of isomerism, types of isomerism, optical isomerism	Lecture	CY 1160.3	In Class assignment Mid Term II End Term
24,25	Elements of symmetry and projection	Explain molecular chirality, Newman projection and Saw Horse formula	Lecture	CY 1160.3	Mid Term II End Term
26	Elements of symmetry and projection	Explain different Fischer and Flying wedge formula, enantiomers	Lecture	CY 1160.3	Mid Term II End Term
27	Chiral and achiral molecules	Explain stereoisomers, mesocompounds	Lecture	CY 1160.3	Mid Term II End Term

28	Relative and absolute configurations	Explain sequence rules, D&L and R&S systems	Lecture	CY 1160.3	In Class assignment Mid Term II End Term
30	Nomenclature E and Z system	Describe geometrical isomerism	Lecture	CY 1160.3	Mid Term II End Term
31	**Basic Concepts of Inorganic Chemistry**	Introduction	Lecture	CY 1160.4	Mid Term II End Term
32	Periodicity	Describe ionization potential, electron affinity and its trends in periodic table	Lecture	CY 1160.4	Mid Term II End Term
33	Revision	Revision stereochemistry	Lecture	N.A.	N.A
34	Covalent bonds	Explain ionic solids and covalent bonds	Lecture	CY 1160.4	In Class assignment Mid Term II End Term
35	VSEPR Theory	Describe VSEPR Theory, MOT and it's application	Lecture	CY 1160.4	Mid Term II End Term
36,37	S-block Elements	Introduction	Lecture	CY 1160.4	Mid Term II End Term
38, 39	Diagonal relationships	Describe diagonal relationship and hybrids	Lecture	CY 1160.4	End Term
40	**Miscellaneous topics**	Explain **Miscellaneous topics** Oxidation and reduction	Lecture	CY 1160.5	End Term
41,42	Arrhenius Acids/Bases and Bronsted Acids/ Bases	Describe the various acid base theory	Lecture	CY 1160.5	End Term
43	Noble gases	Explain various properties of Noble gases and their trend in periodic table	Lecture	CY 1160.5	End Term
44	Radioactivity	Describe Radioactivity, rate law, average life and half life	Lecture	CY 1160.5	End Term
45	Revision	Revision	Lecture	N.A.	N.A.

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[CY 1160.1]	Understand the structure and bonding based on hybridization, resonance, hydrogen bonding of various molecule	3						2	2	3	2
[CY 1160.2]	Apply the skills and strategies to understand the organic reaction mechanism based on various reactive intermediates	2						3	3	2	2
[CY 1160.3]	Explain the reaction mechanism with stereochemistry using enantiomers, diastereomers and racemic mixture.	2						2	3	1	2
[CY 1160.4]	Apply the knowledge of the periodicity of the elements towards the description of covalent and ionic bonding	3						3	2	2	2
[CY 1160.5]	Able to demonstrate the knowledge of Miscellaneous topic like oxidation, reduction, acid/Bases concept.	3						1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR
School of Basic Sciences

Department of Biosciences
Course Hand-out

Environmental Science| CY 1003 | 3 Credits | 3 0 0 3

Session: Jul 2019 – Nov 2019 | Faculty: Dr. Michel Prabhu Inbaraj | Class: I Semester

A. **Introduction:** This course is offered by Dept. of Chemistry as a Compulsory Course, in B.Sc. Biotechnology (Hons) programme targeting students who are studying in undergraduate courses of higher education of all branches including Science, Arts, Social Sciences, Design, Business and Commerce, Journalism and Mass Communication. Offers the knowledge of how natural world works, Environmental and natural processes which effects humans and how human activities and developmental processes change the environment and natural systems. Conservation of nature and natural resources, ecosytems and their services, biodiversity loss and its conservation, environmental pollution, effects and control, environmental policies and practices, human communities and the environment. Students are expected to have basic knowledge of science and social sciences for a better learning.

B. **Course Outcomes:** At the end of the course, students will be able to

[CY 1003.1] Acquire awareness and sensitivity to environmental and its allied problems.
[CY 1003.2] Acquire skills for identifying and solving environmental problems.
[CY 1003.3] Find out the environmental problems concerning with human activities and developmental processes.
[CY 1003.4] Understand the strategies for conservation of nature and natural resources and to solve the emerging problems related to environment degradation.
[CY 1003.5] Understand physical and chemical processes required for environmental sustainability.
[CY 1003.6] Understand chemical processes for waste management and environmental conservation.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

[PO1.] **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

[PO2.] **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO3.] **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO4.] **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO5.] **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO6.] **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

[PO7.] **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio technological changes.

[PSO1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.

[PSO3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I (Closed Book)	20
	Sessional Exam II (Closed Book)	20
	In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged)	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100
Attendance (Formative)	A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.	
Make up Assignments (Formative)	Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester.	
Homework/ Home Assignment/ Activity Assignment (Formative)	There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded.	

E. SYLLABUS

INTRODUCTION Multidisciplinary Nature of Environmental Studies, Scope and importance, concept of sustainability and sustainable development ECOSYSTEMS Concept, structure and function, energy flow in an ecosystem, food chain, food webs and ecological succession, examples. NATURAL RESOURCES (RENEWABLE & NON RENEWABLE RESOURCES) Land Resources and land use change, Land degradation, soil erosion and desertification; Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies BIODIVERSITY AND CONSERVATION Levels, Biogeographic zones ,Biodiversity patterns and hot spots, India as a mega-biodiversity nation; Endangered and endemic species, threats, conservation, biodiversity services ENVIRONMENTAL POLLUTION type, causes, effects, and controls of Air, Water, Soil and Noise pollution, Nuclear hazards and human health risks, ill effects of fireworks, Solid waste management, case studies ENVIRONMENTAL POLICIES & PRACTICES Climate change, global warming, ozone layer depletion, acid rain, Environment laws, International agreements, nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context HUMAN COMMUNITIES AND THE ENVIRONMENT Human population growth, human health and welfare, Resettlement and rehabilitation, case studies, Disaster management, Environmental ethics, Environmental communication and public awareness, case studies, Field work and visit.

F. REFERENCES

1. Rajagopalan, R., Environmental Studies: From Crisis to Cure, Oxford University Press, 2016.
2. De, A. K. *Environmental Studies*, New Age International Publishers, New Delhi, 2007.
3. Bharucha, E., *Text book of Environmental Studies for undergraduate courses*, Universities Press, Hyderabad, 2nd Edition, 2013.
4. Gadgil, M., & Guha, R. *This Fissured Land: An Ecological History of India*. Univ. of California, Press, 1993.
5. Carson, R. *Silent Spring*. Houghton Mifflin Harcourt, 2002.
6. Groom, Martha J., Gary, K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
7. Singh, J.S., Singh, S.P., Gupta, S.R. Ecology, Environmental Science and conservation. S. Chand Publishing, New Delhi, 2014.
8. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). *Conservation Biology: Voices from the Tropics. John Wiley & Sons,* 2013.

G. Lecture Plan:

Lec No	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to Environmental Studies: multidisciplinary nature of environmental studies	Explain about environment and its processes and to interpret as multidisciplinary subject	Lecture	CY 1003.1	In Class Quiz Mid Term I End Term
2	Scope and importance, concept of sustainability and sustainable development	Recall concept of sustainability, Explain sustainable development, Scope and importance of environmental science	Lecture	CY 1003.1	Mid Term I End Term
3,4	Ecosystem: concept, structure and function, Energy flow in an ecosystem, food chain, food webs	Explain ecosystem with structure, flow of energy, nutrients cycling in the ecosystem, food chain and food webs	Lecture	CY 1003.1	In Class Quiz Mid Term I End Term
5,6	Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem (Ponds, Streams, Lakes, River, Oceans, Estuaries)	Explain different type ecosystem with examples of terrestrial and aquatic ecosystem and their importance	Lecture	CY 1003.1	In Class Quiz Mid Term I End Term
7.8	Ecological succession, Natural Resources (Renewable & Non Renewable Resources): Land Resources and land use change, Land degradation	Recall Ecological succession and its type, Explain different Natural Resources including Land Resources and land use change	Lecture	CY 1003.1	In Class Quiz Mid Term I End Term
9	Soil erosion and desertification	Recall soil degradation by erosion and desertification	Lecture	CY 1003.2	Mid Term I End Term
10	Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations	Recall Deforestation processes and their impact on the environment and biodiversity	Lecture	CY 1003.2	Mid Term I End Term
11	Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).	Recall distribution and consumption pattern of water across the world and its related environmental issues including overexploitation and conflicts	Lecture	CY 1003.2	Mid Term I End Term
12	Energy resources: Renewable and Non- renewable energy sources	Recall different Energy resources including coal, oil, nuclear and their environmental impacts on the environment and on human health	Lecture	CY 1003.2	Mid Term I End Term
13	Use of alternate energy sources	Explain other energy resources including solar, water, wind, geothermal and hydrogen energy for sustainability.	Lecture	CY 1003.2	Mid Term I End Term
14	Growing energy needs, case studies	Recall energy demand and supply in different sector and their environmental concern	Lecture	CY 1003.2	Mid Term I End Term

15,16	Biodiversity and conservation: Levels of biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India	Recall different variety and variability of plants and animals Explain different type of biodiversity and Biogeographic zones of India	Lecture	CY 1003.3	Mid Term II End Term
17	Biodiversity patterns and global biodiversity hot spots	Compare biodiversity at national and global level and ecological hotspots for their respective biodiversity	Lecture	CY 1003.3	Mid Term II End Term
18	India as a mega-biodiversity nation; Endangered and endemic species of India	Recall different mega-diversity nation including India Describe different Endangered and endemic species of India	Lecture	CY 1003.3	Mid Term II End Term
19	Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions	Explain biodiversity loss and their reasons, Explain biological invasive species and their impact on biodiversity	Lecture	1120.3	Mid Term II End Term
20	Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value	Explain the goods and services provided by biodiversity and the ecosystem	Lecture	CY 1003.4	Mid Term II End Term
21	Conservation of biodiversity: *In-situ* and *Ex-situ*	Explain different measures of conservation of biodiversity, Description of National parks, wildlife sanctuaries etc.	Lecture	CY 1003.4	Mid Term II End Term
22	Environmental pollution: type, causes, effects, and controls of Air Pollution	Recall air pollution and their effects and explain different air pollutants and their impacts on environment and human health	Lecture	CY 1003.5	Mid Term II End Term
23	ill effects of fireworks , Controls of Air Pollution	Describe harmful impact of fireworks and control methods of air pollutants like ESP, Scrubber	Lecture	CY 1003.5	Mid Term II End Term
24	Type, causes, effects of Water Pollution	Describe water pollutants and their effects, BOD, COD, water quality parameters, DO, TSS	Lecture	CY 1003.5	Mid Term II End Term
25	Controls of Water Pollution	Describe conventional and advance methods for prevention and control of water pollution	Lecture	CY 1003.5	Mid Term II End Term
26	Causes, effects of Soil and Noise Pollution, Nuclear hazards and human health risks	Explain the Causes, effects of Soil and Noise Pollution, Nuclear hazards and human health risks	Lecture	CY 1003.5	Mid Term II End Term
27	Solid waste management: control measures of urban and industrial waste	Describe different type of solid waste and their methods of management	Lecture	CY 1003.5	Mid Term II End Term
28,29	Pollution case studies, Environmental Policies & Practices: Climate change and global warming, International agreements: Kyoto protocols and Convention on Biological Diversity (CBD)	Recall of environmental pollution with some case studies, Describe sources and effects of greenhouse gases in global warming and climate change and their environmental impact, Explain different treaties for reduction of greenhouse gases and conservation of biodiversity	Lecture	CY 1003.6	Mid Term II End Term
30,31	Ozone layer depletion, Montreal protocols, Acid rain and impacts on human communities and agriculture	Explain the importance of ozone layer and causes of its depletion, control measures, Describe the Acid Rain with its effects and control	Lecture	CY 1003.6	End Term

32,33	Environment laws; Water (Prevention and control of Pollution) Act, Air (Prevention and Control of Pollution) Act, Environmental Protection Act,	Describe the provision of Water Act, 1974, Air Act, 1981for prevention and control of water and air pollution, Explain EPA, 1986	Lecture	CY 1003.6	End Term
34,35	Wildlife Protection Act, Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context, Human communities and the Environment: Human population growth: impact on environment	Describe the provision of Wildlife Protection Act, Forest Conservation Act, Explain Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context, impact of population growth on environment	Lecture	CY 1003.6	End Term
36, 37	Human health and welfare, Resettlement and rehabilitation of project affected persons; case studies, Disaster management: flood, earthquake, cyclone and landslides	Explain human health with respect to environment, measures of disaster management, Describe natural disasters and their impact	Lecture	CY 1003.6	End Term
38	Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan,	Describe different movement in Indian continents for conserve environment and their socio-economic importance	Lecture	CY 1003.6	End Term
39, 40	Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). Revision on Ecosystem and Natural Resources	Describe role of ethics in preservation and conservation of environment, environmental awareness programme, green enrgy concept and revision	Lecture	CY 1003.6	End Term
41-42	Revision on Biodiversity & Conservation, Environment Pollution and Environmental Policies	Revision for preparation for end term exam	Lecture	CY 1003.6	Class quiz End Term

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
CY1003.1	Acquire awareness and sensitivity to environmental and its allied problems.		1	3			3	2	1	1	1
CY1003.2	Acquire skills for identifying and solving environmental problems.	2		1	1	2	3	2			2
CY1003.3	Find out the environmental problems concerning with human activities and developmental processes.		1	2	2		3				
CY1003.4	Understand the strategies for conservation of nature and natural resources and to solve the emerging problems related to environment degradation.	3				2	3	3		1	
CY1003.5	Understand physical and chemical processes required for environmental sustainability.	3	2	1	1	3	3	2		3	
CY1003.6	Understand chemical processes for waste management and environmental conservation.	2	1	2	1	3	3	2		1	

1- **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

MANIPAL UNIVERSITY JAIPUR

School of Humanities and Social Sciences

Department of Biosciences
Course Hand-out

Communicative English | LN1106 | 1 Credit | 0 0 2 1

Session: Jul 2019 – Nov 2019 | Faculty: Dr Deepa Sarabhai | Class: I Semester

A. Introduction: This course is offered by Department of Languages as a common course to the students of Semester-I of BSc Biotechnology (Hons) and BSc Microbiology (Hons). The course offers an in-depth knowledge of language as an important branch of English language studies. It covers basic concepts such as role of communication, word formation, English Grammar, comprehension, composition. It also focuses on the enhancement of the LSRW skills.

B. Course Objectives:

[LN 1106.1]. Enhance the learner's communication skills by giving adequate exposure to LSRW skills

[LN 1106.2]. Recognize and overcome learner's shortcomings in pronunciation and grammar

[LN 1106.3]. Enrich the vocabulary with advanced readings

[LN 1106.4]. Impart better writing skills by sensitizing the learners to the dynamics of effective writing

[LN 1106.5]. Build up learners' confidence in oral and interpersonal communication specially focusing on interviews

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO1.] Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO2.] Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO3.] Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO4.] Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO5.] Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO6.] Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO7.] Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Evaluation:

Criteria	Description	Maximum Marks
Internal Assessment (Summative)	Sessional Exam I	20
	Sessional Exam II	20
	Class Quizes, Assignments, Activities, etc.	20
End Term Exam (Summative)	End Term Exam (Closed Book)	40
	Total	100

E. SYLLABUS

Communication- Definition, Process, Types, Flow, Modes, Barriers; Types of Sentences; Modal Auxiliaries; Tenses and its Usage; Voice; Reported Speech; Articles; Subject-Verb Agreement; Spotting Errors; Synonyms and Antonyms; One Word Substitution; Reading Comprehension; Précis Writing; Essay Writing; Formal Letter Writing; Email Etiquettes; Résumé & Curriculum Vitae; Statement of Purpose; Presentations

F. REFERENCES:

R1. *Collins English Usage*. Harpers Collins, 2012.

R2. Hobson, Archie Ed. *The Oxford Dictionary of Difficult Words.* Oxford, 2004.

R3. Jones, Daniel. *English Pronouncing Dictionary*. ELBS, 2011.

R4. Krishnaswamy, N. *Modern English: A Book of Grammar Usage and Composition*, Macmillan India, 2015.

R5. *Longman Dictionary of Contemporary English.* Pearson, 2008.

G. Lecture Plan:

L No.	Topics	Session Outcome	Mode of Delivery	Corresponding CO	Mode of Assessing the Outcome
1	Introduction to the Course and topics	Introduction	Lecture/ Discussion	NA	NA
2	Communication- Definition, Process,	Understand the fundamental principles of effective communication and presentation skills	Lecture/ Discussion	LN 1160.1	Quiz/Mid term I/ ET
3	Types, Flow, Modes	Understand the fundamental principles of effective communication and presentation skills	Lecture/ Discussion	LN 1160.1	Quiz/Mid term I/ ET
4	Barriers	Understand the fundamental principles of effective communication and presentation skills	Lecture/ Discussion	LN 1160.1	Quiz/Mid term I/ ET
5	Types of Sentences	Develop critical and creative thinking abilities for communicative competence	Lecture/ Discussion	LN 1160.2	Quiz/Mid term I/ ET
6	Modal Auxiliaries	Develop critical and creative thinking abilities for communicative competence	Lecture/ Discussion	LN 1160.2	Quiz/Mid term I/ ET
7	Tenses and its Usage	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/Mid term I/ ET
8	Tenses and its Usage	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/Mid term I/ ET
9	Voice	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/ Mid term II/ET
10	Voice	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/ Mid Term II/ ET
11	Reported Speech	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/ Mid Term II/ ET
12	Reported speech	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/ Mid Term II/ ET

13	Articles	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.2	Quiz/ Mid Term II/ ET
14	Subject-Verb Agreement	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/ Mid Term II/ ET
15	Subject-Verb Agreement	Recognize the importance of grammar in written communication	Lecture/ Discussion	LN 1160.2	Quiz/ Mid Term II/ ET
16	Spotting Errors	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.2	Quiz/ Mid term II/ET
17	Spotting Errors	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1	Quiz/ ET
18	Synonyms and Antonyms	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.3	Quiz/ ET
19	One Word Substitution	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.3	Quiz/ ET
20	Reading Comprehension	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1	Quiz/ ET
21	Précis Writing	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.4	Quiz/ ET
22	Essay Writing	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.4	Quiz/ ET
23	Formal Letter Writing	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.4	Quiz/ ET
24	Email Etiquettes	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.4	Quiz/ ET
25	Résumé & Curriculum Vitae	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.4	Quiz/ ET
26	Statement of Purpose	Improve ideas with precision and coherence in LSRW skills	Lecture/ Discussion	LN 1160.1 LN 1160.4	Quiz/ ET
27	Presentation	Display enhanced competence in oral and written communication	Presentations	LN 1160.5	GD
28	Presentation	Display enhanced competence in oral and written communication	Presentations	LN 1160.5	GD

H. Alignment of Assessment tools to COs

CO	STATEMENT	Correlation with Program Outcomes (POs) and Program Specific Outcomes (PSOs)									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO 2	PSO 3
[LN 1106.1].	Enhance the learner's communication skills by giving adequate exposure to LSRW skills		3	2	1	1	1	3			
[LN 1106.2].	Recognize and overcome learner's shortcomings in pronunciation and grammar		2	1				1			
[LN 1106.3].	Enrich the vocabulary with advanced readings		2	1				1			
[LN 1106.4].	Impart better writing skills by sensitizing the learners to the dynamics of effective writing		2	1		1	1	2			
[LN 1106.5].	Build up learners' confidence in oral and interpersonal communication specially focusing on interviews		3	2	1	2	1	3			1

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Mycology, and Plant Pathology | BT 1201 | 3 Credits | 2 1 0 3

Session: Jan 2020 – May 2020 | Faculty: Dr. Jain Rohit| Class: II Semester

A. Introduction: This course is offered by Dept. of Biosciences as a core course in B.Sc. (Hons) Biotechnology Programme targeting students who wish to pursue their career in the research field of Mycology and Plant Pathology higher studies in the field of Plant pathology or Phytophatology. The course offers in depth knowledge of distribution, morphology, taxonomy, physiology, and ecology, of Fungi including the roles of fungi as both beneficial organisms and as causal agents in plant and animal diseases. Also, the students will learn about Mushroom cultivation and importance, identification, epidemiology and control measures of major diseases of food crops caused by Fungi. Students are expected to have background knowledge of the different types of staining techniques and identification of spores of different fungal pathogens.

B. Course Outcomes: At the end of the course, students will be able to

[BT1202.1.] Classify Kingdom Mycota on the basis of different morphological and reproductive features
[BT1202.2.] Identify the habit and habitat and economic importance of fungi
[BT1202.3.] Interpret the process of heterothallism in fungi and its utility in Mushroom cultivation for enhancing the skills related to organic farming
[BT1202.4.] Examine the symptoms and major causes of recurrence of diseases in crop plants and analyse the specific defence mechanisms executed by plant for disease resistance
[BT1202.5.] Investigate and design new methodologies for better yield with less use of pesticides hence enhance the entrepreneurship skills.
[BT1202.6.] Apply the new protocols for development of disease free high yielding crops and therefore increase the employability in agriculture sector.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.
[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.
[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1 – IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	10
End Term Exam (EX)	End Term Exam – EX 1	50
	Total	100

NOTE: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

Fungi: Occurrence, general characteristics, structure, classification (Alexopoulous and Mims, 1979), recent developments in fungal taxonomy, reproduction, parasexual cycle, heterothallism, mushroom cultivation, economic and ecological importance, Study of life cycle of the following genera: *Albugo, Puccinia*. Plant diseases and their control measures: history, classification, symptoms, defence mechanism, mechanism of host parasite interaction, transmission and dissemination of diseases. Causal organisms of disease cycle of the following: green ear disease of Bajra, rust of Crucifers, rusts and smuts of Wheat. Disease Management: prophylaxis-quarantine measures, biological control and integrated pest management.

F. REFERENCES

R1. H.C. Dube. An Introduction to Fungi, Vikas Publishing House Pvt., Ltd. Delhi, 2013.
R2. V. N. Pathak, N.K. Khatri and M. Pathak, Fundamentals of Plant Pathology, Agrobios, Jodhpur, 2012.
R3. B. R. Vashishta, A. K. Sinha and A. Kumar. Botany for Degree Students: Fungi. S. Chand & Company Pvt. Ltd, New Delhi, 2016
R4. C. J. Alexopoulous, C.W. Mims, and M. Blackwel, Introductory Mycology, John Wiley & Sons Inc, New Delhi, 2012.
R5. R.S. Singh, An Introduction to Principles of Plant Pathology, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2011.

G. Lecture Plan:

Lecture	Topic	Session Outcome	Mode of Delivery	Corresponding CO	Mode of assessing the outcome
1.	Fungi: Occurrence and distribution and General characteristics	Identification of Fungi on the basis of their characteristic features	Lecture	BT 1201.1	MTE 1 Quiz End Term
2.	Fungi: Structure and classification (Alexopolous & Mims)	Differentiation of various fungi in distinct groups	Lecture	BT 1201.1	MTE 1 Quiz End Term
3.	Tutorial	Recall the Fungal structure and Classification	Discussion	BT 1201.1	Class Test/ Quiz
4.	Reproduction (Sexual & Asexual), Parasexual cycle in Fungi and its importance, Heterothalism Homothallism in fungi,	Describe the importance of parasexual cycle and heterothallism in industry	Lecture	BT 1201.2	MTE 1 Quiz/ Class Test End Term
5.	Mushroom cultivation and importance	Learn the procedure for culture the economically important edible mushrooms	Lecture	BT 1201.3	MTE 1 Quiz/ Class Test End Term
6.	Tutorial	Recall the importance of parasexuality and heterothallism	Discussion	BT 1201.3	Class Test & Assignments
7.	Study of life cycle of *Albugo candida*: Asexual reproduction in host and disease symptoms	Recall the life cycle of *Albugo* on the oil yielding mustard crop	Lecture	BT 1201.4	MTE 1 Quiz/ Class Test End Term
8.	*Albugo candida*: Sexual reproduction	Recall the life cycle of *Albugo* on the oil yielding mustard crop	Lecture	BT 1201.4	MTE 1 Quiz/ Class Test End Term
9.	Tutorial	Discuss the role of *Albugo* in spread of disease	Discussion & Debate	BT 1201.4	Class Test & Assignments
10.	Study of life cycle of *Aspergillus flavus* : Asexual reproduction and disease symptoms	Understand the growth and development of Aspergillus on the food material	Lecture	BT 1201.4	MTE 2 Quiz/ Class Test End Term
11.	*Aspergillus flavus* : Sexual reproduction	Understand the growth and development of Aspergillus on the food material	Lecture	BT 1201.4	MTE 2 Quiz/ Class Test End Term
12.	Tutorial	Discuss various strains and common diseases caused by *Aspergillus*	Discussion, Lecture	BT 1201.4	Class Test End Term

13.	Study of life cycle of *Puccinia graminis*: Aciospores, Pycniospores and Uredospores, Basidiospores and Teleutospores	Understand the growth and development of the Rust Fungi on Wheat Plant	Lecture	BT 1201.4	MTE 2 Quiz/ Class Test End Term
14.	*Puccinia graminis: Sexual reproduction*	Understand the growth and development of the Rust Fungi on Wheat Plant	Lecture	BT 1201.4	MTE 2 Quiz/ Class Test End Term
15.	Tutorial	Discuss and understand the occurrence and recurrence of rust disease in every season of wheat	Lecture	BT 1201.4	MTE 2 Debate End Term
16.	Plant pathology: History, definition of disease and general terminology used in plant pathology	Understand the different aspects of study of Plant pathology, Common terminology used in plant diseases	Lecture	BT 1201.5	MTE 2 Quiz/ Class Test End Term
17.	Plant disease: Pathogenesis and pathogenicity, Different stages of pathogenesis	Identify different stages of diseases in plants on the basis of symptoms	Lecture	BT 1201.5	MTE 2 Quiz/ Class Test End Term
18.	Tutorial	Understand the common viral, bacterial and fungal diseases	Lecture/ discussion	BT 1201.5	Quiz/ Class Test End Term
19.	Plant defence mechanism against pathogens, Systemic acquired resistance (SAR),	Describe the defence mechanisms of plants for disease resistance	Lecture	BT 1201.4	MTE 2 Quiz/ Class Test End Term
20.	Plant disease: Host parasite interactions	Understand Physiological and molecular changes in the plants during disease cycle	Lecture	BT 1201.4	MTE 2 Quiz/ Class Test End Term
21.	Tutorial	Describe various mechanism for disease control measures according to the modern methods	Lecture & Discussion	BT 1201.4	End Term Quiz/ Class Test
22.	Green ear disease of Bajra: Causal organism, disease symptoms and occurrence, Disease cycle and control measures	Identify the causes of green ear, its impact on the food crops (Bajra)	Lecture	BT 1201.5	End Term Quiz/ Class Test
23.	Green ear disease of Bajra: Disease cycle and control measures	Recall the methods of disease control	Lecture	BT 1201.5	End Term Quiz/ Class Test
24.	Tutorial	Discuss the possibilities for development of disease resistant and high yielding varieties of Bajra	Lecture/ Discussion	BT 1201.5	Class Test

25.	White rust of Crucifers: Causal organism, occurrence, disease cycle, Dissemination and control measures	Identify the causes of white rust, its impact on the oil yielding crops (Mustard) and methods of disease control	Lecture	BT 1201.5	End Term Quiz/ Class Test
26.	Rust of wheat: Causal organism, types of rust, disease cycle,	Identify the causes of black rust, its impact on the staple food crop (Wheat)	Lecture	BT 1201.5	End Term Quiz/ Class Test
27.	Tutorial	Discuss the possibilities for development of disease resistant and high yielding varieties of Wheat	Lecture/ Discussion	BT 1201.5	Class Test
28.	Black rust, yellow rust and brown rust in wheat and control measures	Differentiation of various rust diseases on the host and methods of disease control	Lecture	BT 1201.5	End Term Quiz/ Class Test
29.	Loose smut of wheat: Causal organism, occurrence, disease cycle, control measures	Identify the causes of Loose Smut , its impact on the staple food crop (Wheat) and methods of disease control	Lecture	BT 1201.5	End Term Quiz/ Class Test
30.	Tutorial		-	-	Class Test
31.	Red rot of sugarcane: Causal organism, occurrence, disease cycle and disease control	Identify the causes of Loose Smut , its impact on the economically important food crop (Sugarcane) and methods of disease control	Lecture	BT 1201.5	End Term Quiz/ Class Test
32.	Disease Management: prophylaxis-quarantine measures, Seed certification brief account of physical, chemical and biological control	Understand treatment of seeds before sowing for disease resistance and methods of control of disease using chemical and biological agents	Lecture	BT 1201.6	End Term Quiz/ Class Test
33.	Tutorial		-	-	Class Test
34.	Lichens: General characteristics, structure, types	Understand the association of Fungi and Algae	Lecture	-	End Term Quiz/ Class Test
35.	Lichens: reproduction and ecological importance	Understand the importance of lichens in the industry	Lecture	-	End Term Quiz/ Class Test
36.	Tutorial		-	-	Class Test
Lab Sessions	Preparation of slides to identify different types of fungus based on their morphological and sexual characteristics. To conduct field study for identification of different types of disease patterns in plants.	Identify different types of disease causing fungus by studying their morphological and reproductive characteristics. Identify the type of infection in selected plant species	Lab sessions	BT 1201.1 BT 1201.4	Experimental results in 24 lab sessions End Term Practical Examination

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[BT1202.1.]	Classify Kingdom Mycota on the basis of different morphological and reproductive features								1		
[BT1202.2.]	Identify the habit and habitat and economic importance of fungi										
[BT1202.3.]	Interpret the process of heterothallism in fungi and its utility in Mushroom cultivation for enhancing the skills related to organic farming								1		
[BT1202.4.]	Examine the symptoms and major causes of recurrence of diseases in crop plants and analyse the specific defence mechanisms executed by plant for disease resistance	1			1				1		
[BT1202.5.]	Investigate and design new methodologies for better yield with less use of pesticides hence enhance the entrepreneurship skills.						1	1			
[BT1202.6.]	Apply the new protocols for development of disease free high yielding crops and therefore increase the employability in agriculture sector.			1						2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Elements of Biochemistry| BT1202 | 3 Credits | 2 1 0 3

Session Jan 2020 – May 2020 | Faculty: Dr. Nitesh Kumar Poddar | Class: II Semester

A. Introduction: This course is offered by Dept. of Biosciences as a core course in B.Sc. (Hons) Biotechnology Programme targeting students who wish to pursue their career in the research field of Biochemistryor higher studies in the field of enzymology, biochemical mechanisms, metabolism.The course offers in depth knowledge of the biochemistry and metabolism and the salient features of the metabolism in model organisms. Students are expected to have background knowledge of the biomolecules and chemical properties.

B. Course Outcomes: At the end of the course, students will be able to

[BT1202.1.] Identify the five classes of polymeric biomolecules and their monomeric building blocks.
[BT1202.2.] Understand fundamental biochemical principles, such as the structure/function of biomolecules
[BT1202.3.] Apply the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action.
[BT1202.4.] Analyse the structure of DNA, and explain how it carries genetic information in its base sequence.
[BT1202.5.] Evaluate the DNA, RNA replication and protein synthesis.
[BT1202.6.] Develop an idea of planning, production and management of bio-processing industries to increase employability skills.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
[PO.7]. **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

Programme Specific Outcomes

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.
[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.
[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1 – IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	10
End Term Exam (EX)	End Term Exam – EX 1	50
	Total	100

Note: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

Introduction to Biochemistry: Structure and properties of important biomolecules: Carbohydrates: Classification of carbohydrates, chemical structure and properties of monosaccharide, disaccharides, oligosaccharides and polysaccharides- Starch, cellulose and glycogen. Lipids: Saturated and unsaturated fatty acids. Protein: Structure and classification of amino acids. Primary, secondary and tertiary structure of protein. Ramachandran Plot. Vitamins: Structure and functions. Principles of thermodynamics: First and Second law of thermodynamics, concept of free energy. Enzymes: classification, nomenclature, mechanism of action (binding to substrate, lowering of activation energy), holoenzyme, co-enzyme and cofactors, isozymes and ribozymes. Enzyme kinetics: Michalis-Menten equation, Km value, enzyme inhibition, factors controlling enzyme activity, role of enzymes as catalysts, Purine and Pyrimidine: structure and properties, nucleotide biosynthesis, Conformation of nucleic acids [helix (A, B, Z), t-RNA, micro-RNA].

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F. REFERENCES:

R1. Srivastav, H.S. Elements of Biochemistry, Rastogi Publication, Meerut, 2005.

R2. Jain,J.L.. Fundamentals of Biochemistry. S. Chand & Co. Pvt. Ltd. New Delhi, 2008.

R3. Voet, D. and Voet, J.G. Biochemistry, John Wiley & Sons Inc., New Delhi, India, 1995.

R4. Lehninger, A., Nelson, D.L. and Cox, M.M. Principles of Biochemistry, Freeman Publishers, New York, 2000.

G. Lecture Plan:

LEC NO	TOPICS	Session Outcome	Mode of Delivery	Corresponding CO	Mode of assessing the outcome
1.	Introduction to Biochemistry: Structure and properties of important biomolecules	Learn about structure and function of biomolecules	Lecture	BT1202.1	MTE 1 Quiz End Term
2.	Introduction to Biochemistry: Structure and properties of important biomolecules	Learn about structure and function of biomolecules	Lecture	BT1202.1	MTE 1 Quiz/End Term
3.	Tutorial	Recall the structures of molecules	Discussion	BT1202.1	Class Test/ Quiz
4.	Carbohydrates: Classification of carbohydrates, chemical structure and properties of monosaccharide	Understand the structure and properties of carbohydrates	Lecture	BT1202.1	MTE 1 Quiz/End Term
5.	Carbohydrates: Classification of carbohydrates, chemical structure and properties of disaccharides, oligosaccharides	Understand their role and application	Lecture	BT1202.1	MTE 1 Quiz/End Term
6.	Tutorial	Learn and recall the previous class	Lecture	BT1202.1/ BT1202.6	MTE 1 Quiz/End Term
7.	Carbohydrates: Classification of carbohydrates, chemical structure and properties of polysaccharides- Starch, cellulose and glycogen.	Recall the techniques of carbohydrate detection etc	Discussion	BT1202.1/ BT1202.6	Class Test/ Quiz
8.	Lipids: Saturated and unsaturated fatty acids.	Understand the structure of lipids	Lecture	BT1202.1/ BT1202.6	MTE 1 Quiz/End Term
9.	Tutorial	Recall and summarize lipid classes	Lecture	BT1202.1/ BT1202.6	MTE 1 Quiz/End Term
10.	Protein: Structure and classification of amino acids.	Learn about amino acid structure and classification	Discussion	BT1202.1/ BT1202.6	Class Test/ Quiz
11.	Primary, secondary and tertiary structure of protein.	Learn the function of tertiar structure of proteins	Lecture	BT1202.1/ BT1202.6	MTE 1 Quiz/End Term
12.	Tutorial	Discuss various role of proteins in organisms	Lecture	BT1202.2	MTE 1 Quiz/End Term
13.	Primary, secondary and tertiary structure of protein.	Advanced discussion about various forms of proteins	Lecture	BT1202.2	MTE 1 Quiz/End Term
14.	Ramachandran Plot.	Discussion about Ramachandran plot	Discussion	BT1202.2	Class Test/ Quiz
15.	Tutorial	Various examples of R plot	Lecture	BT1202.2	MTE 1 Quiz/End Term

16.	Vitamins: Structure and functions.	Learn about vitamins structure and classification	Lecture	BT1202.2	MTE 1 Quiz/End Term
17.	Principles of thermodynamics: First and Second law of thermodynamics, concept of free energy.	Learn about thermodynamics rule in metabolsim	Discussion	BT1202.2	Class Test/ Quiz
18.	Tutorial	Discuss the thermodynamics calculations	Lecture	BT1202.3	MTE 1 Quiz/End Term
19.	Enzymes: classification, nomenclature, mechanism of action (binding to substrate, lowering of activation energy), holoenzyme, co-enzyme and cofactors, isozymes and ribozymes.	Lear enzyme classification	Lecture	BT1202.3	MTE 2 Quiz/End Term
20.	Enzyme kinetics: Michalis-Menten equation, Km value, enzyme inhibition, factors controlling enzyme activity, role of enzymes as catalysts, Purine and Pyrimidine: structure and properties, nucleotide biosynthesis, Conformation of nucleic acids [helix (A, B, Z), t-RNA, micro-RNA].	Learn enzyme kinetics	Discussion	BT1202.3	Class test/ Quiz
21.	Tutorial	Discussion about kinetics	Lecture	BT1202.4	MTE 2 Quiz/End Term
22.	Enzyme kinetics: Michalis-Menten equation, Km value,	Importance of Km value	Lecture	BT1202.4	MTE 2 Quiz/End Term
23.	Enzyme inhibition,	Discussion about enzyme inhibition	Lecture	BT1202.4	MTE 2 Quiz/End Term
24.	Tutorial	Calculation of enzyme inhibition	Discussion	BT1202.4	Class test/ Quiz
25.	Factors controlling enzyme activity	Learn about enzyme regulation	Lecture	BT1202.5	MTE 2 Quiz/End Term
26.	Role of enzymes as catalysts,	Application sof enzymes	Lecture	BT1202.5	MTE 2 Quiz/End Term
27.	Tutorial	Problem solving sessions	Discussion	BT1202.5	Class test/ Quiz
28.	Purine : structure and properties	Understand about nucleotides and their role	Lecture	BT1202.5	MTE 2 Quiz/End Term
29.	Pyrimidine: structure and properties,	Understand about nucleotides and their role	Lecture	BT1202.5	MTE 2 Quiz/End Term
30.	Tutorial	Discuss various pathways of nucleotide metabolism	Lecture	BT1202.5	MTE 2 Quiz/End Term
31.	Nucleotide biosynthesis	Discussion on ntdbiosnthesis	Discussion	BT1202.5	Class test/

					Quiz
32.	Conformation of nucleic acids [helix (A, B, Z)].	Learn about nucleic acid structure and forms	Lecture	BT1202.5	MTE 2 Quiz/End Term
33.	Tutorial	Discussion of A, B and Z form of DNA	Lecture	BT1202.6	MTE 2 Quiz/End Term
34.	Conformation of t-RNA.	Learn about RNA and its function	Tutorial	BT1202.6	Class test/ Quiz
35.	Conformation of nucleic acids micro-RNA.	Learn separation of biomolecules on density	Lecture	BT1207.6	MTE 2 Quiz/End Term
36.	Tutorial	Discussion on tRNA and their functional importance	Lecture	BT1202.6	MTE 2 Quiz/End Term
Lab Sessions	Study of UV absorption spectra of macromolecules (protein and nucleic acid). Determination of Lambda max of a dye solution. Determination of protein and nucleic acid concentration by spectrophotometric method. Separation and identification of amino acids using TLC. Separation and detection of various biomolecules (carbohdrates, fats, proteins)	Learn various techniques	Lab sessions	BT1202.1 BT1202.2 BT1202.6	Experimental results lab sessions End Term Practical Examination

H. Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[BT1202.1]	Identify the five classes of polymeric biomolecules and their monomeric building blocks.	1						1	3		2
[BT1202.2]	An understanding of fundamental biochemical principles, such as the structure/function of biomolecules		1					1		1	
[BT1202.3]	Apply the specificity of enzymes (biochemical catalysts), and the chemistry involved in enzyme action.			1				2	1		2
[BT1202.4]	Analyse the structure of DNA, and explain how it carries genetic information in its base sequence.						1		3	2	
[BT1202.5]	Evaluate the DNA, RNA replication and protein synthesis				1	1					1
[BT1202.6]	Develop an idea of planning, production and management of bio-processing industries to increase employability skills					1		1		2	1

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences
Course Hand-out

Gymnosperms and Palaeobotany| BT1203| 3 Credits | 2 1 0 3

Session: Jan 2020 – May 2020| Faculty: Sharma Madan Mohan | Class: II Semester

A. **Introduction:** This course is offered by Dept. of Biosciences as a core course in in B.Sc. (Hons) Biotechnology Programme targeting students who wish to pursue their career in the research field of Gymnosperms and Palaeobotany and higher studies in the field of palyntology and Palaeobotany. The course offers in depth knowledge of distribution, morphology, taxonomy, physiology and ecology of Gymnosperms. Also, the students will learn about different ornamental Gymnosperm plants used in homes. Palaeobotany is an interesting area of research as it deals with the fossils and extinct species. Student will learn to identify different types of fossils, process of fossilization and techniques of fossil preservation. The study of geological time scale will allow the students to understand the process of evolution throughout the last many billions of years. Students are expected to have background knowledge of the different classification systems of fossils and Gymnosperms.

B. **Course Outcomes:** At the end of the course, students will be able to

[BT1203.1.] Identify various Gymnosperms in the nature based on their characteristics
[BT1203.2.] Locate the sites from where Gymnosperms can be collected and classify Gymnosperms as per their varied importance
[BT1203.3.] Identify importance of Gymnosperms as ornamental plant/ source of food/medicinal plants etc.
[BT1203.4.] Distinguish significant Gymnosperm based on ethnomedicinal/ethnobotanical importance
[BT1203.5.] Critically analyse uses of Gymnosperms and Palaeobotany in modern day science
[BT1203.6.] Develop the protocol to conserve the Gymnosperms and identify their locations/identify various fossils for fossil fuel production

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

[PO.1]. **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.
[PO.2]. **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
[PO.3]. **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
[PO.4]. **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
[PO.5]. **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
[PO.6]. **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
[PO.7]. **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyse research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1 – IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	20
End Term Exam (EX)	End Term Exam – EX 1	40
	Total	100

NOTE: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

Gymnosperms: Occurrence, distribution, general characteristics, classification (Sporne, 1974; Kremer and Green, 1990), evolution of seed habit, origin and evolution of gymnosperms and economic importance, Life cycle of the following genera: *Cycas, Gnetum*. Comparative study of Pteridophytes, Gymnosperms and Angiosperms. **Palaeobotany**: Geological time scale. Types of fossils, techniques for study of fossils. **Applied aspects of fossils**: use in coal and petroleum exploration, fossil Pteridophytes and fossil Gymnosperm.

F. References:

R1. S. P. Bhatnagar and A. Moitra. Gymnosperms, New Age International Pvt. Ltd., New Delhi, 2010.

R2. Purohit and Vyas. A Text Book of Gymnosperms, Ramesh Book Depot, Jaipur, 1997.

R3. Bendre and A. Kumar. A Text Book of Practical Botany-II. Rastogi Publications, Meerut, 2011.

R4. K. R. Sporne. The Morphology of Gymnosperms, Hutchinson and Co. Ltd., London, 1994.

R5. W.N. Stewart and G.W. Rathwell. Palaeobotany and the Evolution of Plants, Cambridge University Press, Cambridge, 1993.

R6. C. J. Chamberlain. Gymnosperms: Structure and Evolution, CBS Publishers and Distributors, New Delhi, 2010.

G. Lecture Plan:

Lecture	Topic	Session Outcome	Mode of Delivery	Corresponding CO	Mode of assessing the outcome
1.	Elaboration of course plan/course outcome along with Porgramme and programme specific outcomes	Students will be able to learn about the course plan and the outcomes of the contents they will study in the consecutive classes	Discussion/lecture	All COs	In later stage they will be assessed
2.	Gymnosperms: Occurrence, distribution, general characteristics	Identification of Gymnosperms on the basis of their characteristic features	Lecture	BT 1203.1	MTE 1 Quiz End Term
3.	Gymnosperms: Classification proposed by Sporne, Kremer & Green	Distinguished characteristics which classify the gymnosperms and outline of the proposed classification system	Lecture	BT 1203.1	MTE 1 Quiz End Term
4.	Tutorial	Remembrance the general characteristic and Classification	Discussion	-	Oral test
5.	Evolution of seed habit and its significance, Origin and evolution of gymnosperms and economic importance	Describe the importance of Heterospory for evolution of seed habit and its importance	Lecture	BT 1203.2	MTE 1 Quiz/ Class Test End Term
6.	Cycas: External morphology (Root, stem, leaf)	Learn the external morphology of organs of gymnosperms	Lecture	BT 1203.3	MTE 1 Quiz/ Class Test End Term
7.	Tutorial	Recall the importance and evolution of seed habit and external features	Discussion	-	Class Test & Assignments
8.	Cycas: Internal structure of coralloid root and normal root	Recall the anatomical features of coralloid root and normal root	Lecture	BT 1203.3	MTE 1 Quiz/ Class Test End Term
9.	Cycas: Internal structure of young and mature stems	Recall the anatomical features of young and mature stems	Lecture	BT 1203.3	MTE 1 Quiz/ Class Test End Term
10.	Tutorial	Discuss the differentiating internal structures of the different organs of Cycas	Discussion	-	Class Test & Assignments
11.	Cycas: Internal structure of foliage leaf – Rachis and leaflet	Understand the role of different tissues of leaf lamina and rachis of Cycas	Lecture	BT 1203.3	MTE 2 Quiz/ Class Test End Term
12.	Cycas: Shoot apex organization and vegetative reproduction	Recognize the mode of vegetative reproduction in gymnosperms	Lecture	BT 1203.4	MTE 2 Quiz/ Class Test

					End Term
13.	Tutorial	Discussion	Discussion & debate	-	Class Test End Term
14.	Sexual reproduction in Cycas: Structure and development of male cone (microsporangium) and female reproductive structure (ovule)	Understand the development of sexual structure and mode of sexual reproduction	Lecture	BT 1203.4	MTE 2 Quiz/ Class Test End Term
15.	Embryo development in Cycas and Germination of seed	To understand the development of embryo and further change in to seed	Lecture	BT 1203.4	MTE 2 Quiz/ Class Test End Term
16.	Tutorial	Discussion of the cycas	Interaction/	-	MTE 2 Debate End Term
17.	Gnetum: External morphology of root, stem, leaf	Understand the different external features of Gnetum	Lecture	BT 1203.5	MTE 2 Quiz/ Class Test End Term
18.	Gnetum: internal structure of root and stem	Identify the plant based on the anatomical characteristics and authenticate the same.	Lecture	BT 1203.5	MTE 2 Quiz/ Class Test End Term
19.	Tutorial	Discussion/ problem solving	Lecture/ discussion	-	Quiz/ Class Test End Term
20.	Gnetum: Reproduction- Structure of Male and female reproductive organs	Understand the structure and development of reproductive organs in Gnetum	Lecture	BT 1203.4	MTE 2 Quiz/ Class Test End Term
21.	Tutorial	Problem solving/ discussion	Discussion	-	End Term Quiz/ Class Test
22.	Gnetum: Fertilization and embryo development, seed development	Able to understand the requirement of seed production and precautions	Lecture	BT 1203.5	End Term Quiz/ Class Test
23.	Comparison of Cycas and Gnetum: External morphology	Understand the external features of both Gymnosperms	Lecture	BT 1203.5	End Term Quiz/ Class Test
24.	Tutorial	Doubt clearance and provide platform to discuss the evolutionary features developed from Cycas to Gnetum	Discussion	-	Class Test
25.	Comparative study of Cycas and Gnetum: Internal structure of root, stem and leaf	Identify the specific characteristics of anatomy of root, stem and leaf.	Lecture	BT 1203.5	End Term Quiz/ Class Test
26.	Comparative study of Cycas and Gnetum: Internal structure of leaf	Understand the anatomical features of both the plants in leaf	Lecture	BT 1203.6	End Term Quiz/ Class Test

27.	Tutorial	Recall the points for comparison of structure, development of reproductive structures.	Recall/ Discussion	-	Class Test
28.	Study of advance characteristics of Gnetum	Understand the process for evolutionary mechanism for the development of higher plants	Lecture	BT 1203.5	End Term Quiz/ Class Test
29.	Palaeobotany: Introduction and scope, Geological time scale	Recognise the characteristics of fossils and their scope	Lecture	BT 1203.5	End Term Quiz/ Class Test
30.	Tutorial	Recall the special features of fossils and some of the fossils	Recall/ Discussion	-	Class Test
31.	Fossilization: types of fossils, techniques for study of fossils	Identify the fossils and understand the various steps of fossilization	Lecture	BT 1203.7	End Term Quiz/ Class Test
32.	Applied aspects of fossils: use in coal and petroleum exploration.	Review applications of fossils in petroleum industry	Lecture	BT 1203.6	End Term Quiz/ Class Test
33.	Tutorial	Recall the features of fossils and resolve the issues of students	Discussions	-	Class Test
34.	Fossil Pteridophyta: Lepidodendron	Understand the life cycle of Lepidodendron	Lecture	BT 1203.7	End Term Quiz/ Class Test
35.	Fossil Gymnosperm: Williamsonia	Understand the life cycle of Williamsonia	Lecture	BT 1203.7	End Term Quiz/ Class Test
36.	Tutorial	Doubt clearance and interaction	Discussion	-	Class Test
Lab Sessions	Preparation of slides to identify different types of Gymnosperms based on their morphological, anatomical and sexual characteristics. Field visit along with campus visit for identification of gymnosperms	Students will be acquainted with the morphological/anatomical traits to identify Gymnosperms in nature	Lab sessions	BT 1203.1 BT 1203.2 BT 1203.3 BT 1203.4	Experimental results in 12 lab sessions End Term Practical Examination

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
BT 1203.1	Identify various Gymnosperms in the nature based on their characteristics	1							1		
BT 1203.2	Locate the sites from where Gymnosperms can be collected and classify Gymnosperms as per their varied importance		1							1	
BT 1203.3	Identify importance of Gymnosperms as ornamental plant/ source of food/medicinal plants etc.			1						1	
BT 1203.4	Distinguish significant Gymnosperm based on ethnomedicinal/ethnobotanical importance			1	1					1	
BT 1203.5	Critically analyse uses of Gymnosperms and Palaeobotany in modern day science			1			1	1		2	
BT 1203.6	Develop the protocol to conserve the Gymnosperms and identify their locations/identify various fossils for fossil fuel production		1		1		1				1

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

MANIPAL UNIVERSITY JAIPUR

School of Basic Sciences

Department of Biosciences

Course Hand-out

Essentials of Microbiology | BT1204 | 3 Credits | 2 1 0 3

Session: Jan 2020 – May 2020| Faculty: Dr. Mousumi Debnath | Class: II Semester

A. Introduction: This course is offered by Dept. of Biosciences as an elective in B.Sc. (Hons) Biotechnology Programme targeting students who wish to pursue their career in the research field of Microbiology or in the multidisciplinary discipline. The course offers introduction to the world of microbes, the various scientist who worked in the field of microbiology, the different classification system and the role of microbes in chemical processes related to human health benefits. Students are expected to have some background knowledge of the microbes.

B. Course Outcomes: At the end of the course, students will be able to

[BT1204.1.] Recall the background history and contribution in the field of microbiology

[BT1204.2.] Understand the diversity among the microorganisms

[BT1204.3.] Apply the characteristics of different divisions of microbes to classify them

[BT1204.4.] Analyze the characteristics of different groups of microbes.

[BT1204.5.] Evaluate the microorganisms on the basis of their distribution and occurrence, morphology, mode of reproduction and economic importance

[BT1204.6.] Develop an idea of planning, production and management of microbes for chemical processes in different industries to increase employability skills

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

[PO.2]. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3]. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4]. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5]. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

[PO.6]. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

[PO.7]. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

[PSO.1.] To demonstrate competency in factual content and interpretation of the major biological concept areas of cell and molecular biology, genetics, organismal biology, and evolution and ecology.

[PSO.2.] To demonstrate the ability to identify significant biological research questions, develop research protocols, and properly analyze research questions through the use of the scientific method.

[PSO.3.] Enhance analytical and quantitative skills and demonstrate an understanding of basic computational and statistical techniques in the field of Biotechnology

D. Assessment Plan:

Criteria	Description	Maximum Marks
Internal Assessment (IA)	Mid Term Exam 1 – IA 1	20
	Mid Term Exam 2 - IA 2	20
	CWS Assessment IA 3 10 marks of IA 3 are awarded based on the various assignments, class tests, seminar presentation etc.	20
End Term Exam (EX)	End Term Exam – EX 1	40
	Total	100

Note: A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves.

E. SYLLABUS

History and development and scope of Microbiology: Contribution of Anton Leeuwenhoek, Joseph Lister, Edward Jenner, Paul Ehrlich, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman, Elie Metchnikoff, Norman Pace, Carl Woese, Ronald Ross and Ananda M. Chakraborty, M. S. Swaminathan. Spontaneous generation vs. biogenesis, study of various microbiological techniques. Establishment of the field of medical microbiology. Diversity of Microbial world: Introduction to archaea, bacteria and eukaryote. Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) with emphasis on distribution and occurrence, morphology, mode of reproduction and economic importance.

F. REFERENCES:

R1. R.Y. Stainer, M.J. Doudoroff and E.A. Adelberg. *The Microbial World.* Prentice Hall (India) Pvt. Ltd. 2005.

R2. J.W. Brown. *Principles of microbial diversity*, 1st edition ASM press, 2015.

R3. M.J. Pelczar, E.C.S. Chan and N.R. Krieg. *Microbiology*. 5th edition. McGraw Hill Book Company, 2005.

R4. M.T. Madigen, J.M. Martinko, K.S. Bender, D.H. Buckley, D. A. Stahl and T. Brock. *Brock Biology of Microorganisms*. 14th edition, Benjamin Cunnings-Pearson, 2014.

R5. J. Cappucino and Sherman. *Microbiology: Laboratory Manual.* 9th Edition. Pearson Education limited, 2010.

R6. R.Y. Stanier, J.L. Ingraham, M.L. Wheelis, and P.R. Painter. *General Microbiology*. 5th edition. McMillan publishers, 2005.

R7. J Willey, L. Sherwood and J Woolverton. Prescott's Microbiology. McGwaw Hill Education, USA. 2017.

A. Lecture Plan:

LEC NO	TOPICS	Session Outcome	Mode of Delivery	Corresponding CO	Mode of assessing the outcome
1.	Introduction and Course Hand-out briefing	To acquaint and clear teachers' expectations and understand student expectations	Lecture	NA	NA
2.	History and introduction to microbes	Learn about History of the study of microbes	Lecture	BT 1204.1	MTE I Quiz End Term
3.	History and introduction to microbes	Learn more about History of the study of microbes	Discussion	BT 1204.1	MTE I Quiz End Term
4.	Contribution of Anton Leeuwenhoek, Edward Jenner, Louis Pasteur,	Understand the contributions of some eminent scientists	Lecture	BT 1204.1	MTE I Quiz End Term
5.	Contribution of Robert Koch, Martinus W. Beijerinck,	Understand the contributions of some eminent scientists	Lecture	BT 1204.1	MTE I Quiz End Term
6.	Contribution of Sergei N. Winogradsky, Alexander Fleming	Understand the contributions of some eminent scientists	Lecture	BT 1204.1/ BT 1204.6	MTE I Quiz End Term
7.	Medical microbiology	Introduce the microbes causing diseases	Lecture	BT 1204.1/ BT 1204.6	MTE I Class Test/ Quiz End Term
8.	Medical microbiology	Introduce the microbes causing diseases	Discussion	BT 1204.1/ BT 1204.6	MTE I Quiz End Term
9.	Tutorial	Recall and summarize scientist contribution and medical microbiology	Discussion	BT 1204.1/ BT 1204.6	MTE I Quiz End Term

10.	Diversity of Microbes: Introduction to archaea	Learn about archaea	Lecture	BT 1204.1/ BT 1204.6	MTE 1 Class Test/ Quiz End Term
11.	Diversity of Microbes: Introduction to bacteria.	Learn about the bacteria	Lecture	BT 1204.1/ BT 1204.6	MTE 1 Quiz End Term
12.	Introduction to eukaryote	Learn about the eukaryotes	Lecture	BT 1204.2	MTE 1 Quiz End Term
13.	Binomial Nomenclature and their utility	Understand about binomial nomenclature	Lecture	BT 1204.2	MTE 1 Quiz End Term
14.	Whittaker's five kingdom and their utility	Understand the Whittaker's five kingdom	Lecture	BT 1204.2	MTE 1 Class Test/ Quiz, End Term
15.	Carl Woese's three kingdom classification systems and their utility	Understand the Carl Woese's three kingdom classification systems	Lecture	BT 1204.2	MTE 1 Quiz End Term
16.	Tutorial	Recall the classification system	Discussion	BT 1204.2	Quiz
17.	Acellular microorganisms : Viruses with emphasis on distribution and occurrence and morphology	Learn about the general characteristics acellular organisms with special emphasis on viruses	Lecture	BT 1204.2	MTE 2 Class Test/ Quiz End Term
18.	Viruses with emphasis on mode of reproduction and economic importance	Understand more about the general characteristics of viruses	Lecture	BT 1204.3	MTE 2 Quiz End Term
19.	Viroids with emphasis on distribution and occurrence and morphology	Introduce to the general characteristics of viroids	Lecture	BT 1204.3	MTE 2 Quiz End Term

20.	Viroids with emphasis on mode of reproduction and economic importance	Learn about the general characteristics of viroids	Lecture	BT 1204.3	MTE 2 Class test/ Quiz End Term
21.	Tutorial	Discussion about Acellular organisms	Discussion	BT 1204.4	Quiz
22.	Prions with emphasis on distribution, occurrence , morphology, mode of reproduction and economic importance	Introduce and understand prions	Lecture	BT 1204.4	MTE 2 Quiz End Term
23.	**C**ellular microorganisms (Bacteria, Algae, Fungi and Protozoa)	Introduce cellular organisms	Lecture	BT 1204.4	MTE 2 Quiz End Term
24.	Bacteria with emphasis on distribution, occurrence and morphology.	Analyse how bacteria are distributed in nature	Discussion	BT 1204.4	MTE 2 Class test/ Quiz End Term
25.	Bacteria with emphasis on mode of reproduction and economic importance	Learn more about bacterial mode of reproduction and economic importance	Lecture	BT 1204.5	MTE 2 Quiz End Term
26.	Algae with emphasis on distribution occurrence and morphology	Know about algal distribution	Lecture	BT 1204.5	MTE 2 Quiz End Term
27.	Algae with emphasis on mode of reproduction	Know about algal , mode of reproduction	Lecture	BT 1204.5	MTE 2 Quiz End Term
28.	Algae with emphasis on economic importance	Know about algal economic importance	Lecture	BT 1204.5	MTE 2 Quiz End Term
29.	Tutorial	Discussion on Algae	Lecture	BT 1204.5	Quiz
30.	Protozoa with emphasis on distribution, occurrence and morphology	Know about protozoa distribution	Lecture	BT 1204.5	MTE 2 Quiz End Term
31.	Protozoa with emphasis on mode of reproduction	Know about the mode of reproduction of protozoa	Lecture	BT 1204.5	MTE 2 Quiz End Term

32.	Protozoa with emphasis economic importance	Understand the economic importance of protozoa	Lecture	BT 1204.5	MTE 2 Quiz End Term
33.	Tutorial	Discussion of Cellular organism	Tutorial	BT 1204.6	Quiz
34.	Role of microbes in chemical processes	Learn about the role of microbes in chemical processes	Tutorial	BT 1204.6	Class test/ Quiz End Term
35.	Role of microbes in chemical processes	Learn about the role of microbes in chemical processes	Lecture	BT 1204.6	Quiz End Term
36.	Conclusion and course summarization	Conclusion and course summarization	Lecture	BT 1204.6	Quiz End Term
Lab Sessions	Hands on training on microbiology	Learn various techniques	Lab sessions	NA	Experimental results and lab sessions; End Term Practical Examination

Course Articulation Matrix: (Mapping of COs with POs)

CO	STATEMENT	CORRELATION WITH PROGRAM OUTCOMES							CORRELATION WITH PROGRAM SPECIFIC OUTCOMES		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
[BT 1204.1]	Recall the background history and contribution in the field of microbiology	1	1					1	3		2
[BT 1204.2]	Understand the diversity among the microorganisms		1					1		1	
[BT 1204.3]	Apply the characteristics of different divisions of microbes to classify them			1				2	1		2
[BT 1204.4]	Analyze the characteristics of different groups of microbes				1		1		3	2	
[BT 1204.5]	Evaluate the microorganisms on the basis of their distribution and occurrence, morphology, mode of reproduction and economic importance					1					1
[BT 1204.6]	Develop an idea of planning, production and management of microbes for chemical processes in different industries to increase employability skills						1	1		2	1

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation