

Khulna University

Biotechnology and Genetic Engineering Discipline

Year: 2

Term: I

Examination Year: 2026

Session: 2024-25

Course Code: **0512 07 BGE 2101**

Course Title: **Molecular Biology**

Total Marks: **60**

Time: **03 Hours**

Instructions (if any): Use separate answer script for each section.

Section A

There are **Four (04)** questions in this section. Answer any **Three (03)** questions.

Question No.	Question Description	Marks	Level (L1-L6)	CLO No.
1. a)	Explain how Avery, MacLeod and McCarty did prove that DNA is the genetic material.	04	02	01
b)	Double-stranded DNAs have polarity and they are antiparallel- explain.	03	02	01
c)	Discuss the covalent and non-covalent forces involved in the formation of double -stranded DNA.	03	06	01
2. a)	"DNA replication is semi-conservative"- justify with experimental example.	04	05	01
b)	Explain the catalytic mechanism of DNA polymerase III with appropriate diagram.	04	02	01
c)	Why histone deacetylation is necessary during DNA replication?	02	06	02
3. a)	What is DNA mutation? What are the consequences of DNA mutation?	03	01	01, 02
b)	List and explain the physical and chemical mutagenic agents responsible for DNA mutation.	04	02	01
c)	Illustrate and explain the nucleotide excision repair system of DNA.	03	02	01
4. a)	Discuss the histone-DNA interaction in a nucleosome.	03	06	01
b)	Define twist and writhe. Discuss the effect of twist and writhe on DNA topology.	03	01, 06	01
c)	Illustrate and explain the formation of higher order structure in DNA.	04	02	02

Khulna University

Biotechnology and Genetic Engineering Discipline

Year: 2

Term: I

Examination Year: 2026

Session: 2024-25

Course Code: **0512 07 BGE 2101**

Course Title: **Molecular Biology**

Total Marks: **60**

Time: **03 Hours**

Instructions (if any): Use separate answer script for each section.

Section B

There are **Four** (04) questions in this section. Answer any **Three** (03) questions.

Question No.	Question Description	Marks	Level (L1-L6)	CLO No.
5. a)	Illustrate and explain the fine structure of prokaryotic gene and prokaryotic RNA polymerase.	04	02	01
b)	Describe the organization and regulation of <i>lac</i> operon with appropriate diagram.	04	02	01
c)	Write a narrative on reverse transcriptase.	02	02	01
6. a)	Describe the initiation, elongation and termination process of prokaryotic transcription.	06	02	01
b)	Illustrate only the prokaryotic translation process using appropriate diagram.	04	02	02
7. a)	Illustrate the fine structure of a tRNA molecule. Briefly explain the attachment of amino acids to tRNA.	04	02	01
b)	Discuss how Nirenberg and Khorana deciphered the genetic code.	03	06	02
c)	Explain the nature and characteristics of genetic code.	03	02	02
8. a)	What is signal sequence? Describe the role of signal sequence in protein transport.	03	02	01, 02
b)	Compare and contrast between cotranslational transport and post-translational transport.	03	02	01
c)	Describe the ubiquitin-proteasome mediated protein degradation.	04	02	01

Biotechnology and Genetic Engineering Discipline
Khulna University

Year: 2nd;
Course No: **0512 07 BGE-2103**;
Full Marks: 60;

Term: I;

Examination Year: 2026;

Course Title: **Bioenergetics and Metabolic Regulation**

Time: 03 Hours;

Session: 2024-25

Credit: 03

- Figures in the margin indicate full marks. Questions are of equal value.
- Use separate answer script for each section.

Section-A

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
1. (a)	Explain how electrons are transferred from one molecule to another during biological oxidation-reduction reaction.	04	2	1
(b)	Illustrate the pathway of electron flow from NADH to coenzyme Q through NADH-Q oxidoreductase.	04	2	2
(c)	How $FMNH_2$ acts as an electron carrier?	02	1	1
2. (a)	What is high energy compound? Explain their role in metabolic pathways.	04	1, 2	2
(b)	Explain the structural basis of the high phosphoryl transfer potential of ATP.	04	2	2
(c)	"Standard free energy change are additive"- elaborate the statement.	02	3	1
3. (a)	Outline the key features of chemiosmotic hypothesis.	03	1	2
(b)	How proton motion across the membrane drives rotation of C-ring of ATP synthase?	04	2	2
(c)	Discuss the role of proton conducting units of ATP synthase.	03	6	1
4. (a)	Define photosystem and thylakoid membrane.	02	1	2
(b)	Explain the light-driven electron transport process during photophosphorylation.	04	2	2
(c)	Design a flowchart showing how light energy is converted into chemical energy during photosynthesis.	04	6	2

Biotechnology and Genetic Engineering Discipline
Khulna University

Year: 2nd;
Course No: **0512 07 BGE-2103**;
Full Marks: 60;

Term: I;

Examination Year: 2026;

Course Title: **Bioenergetics and Metabolic Regulation**

Time: 03 Hours;

Session: 2024-25

Credit: 03

- Figures in the margin indicate full marks. Questions are of equal value.
- Use separate answer script for each section.

Section-B

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
5. (a)	Discuss different types of hormones based on their chemical diversity.	05	6	2
(b)	Explain the roles of LH and FSH in endocrine system.	03	4	1
(c)	Why peptide and amine hormones are faster acting than steroid and thyroid hormones? Explain.	02	2	2
6. (a)	What is signal transduction? Briefly describe the general features of signal transduction.	04	1, 2	1
(b)	Explain the role of G-protein during signal transduction.	04	2	2
(c)	How does Ca^{2+} act as second messenger? Explain.	02	1, 4	2
7. (a)	What is allosteric modulation of enzyme? How cAMP dependent protein kinase A (PKA) is regulated by allosteric modulation?	04	1	1
(b)	Explain how the activity of glycogen phosphorylase is regulated by covalent modification.	04	2	1
(c)	Describe the role of rpoN sigma factor in bacterial nitrogen metabolism.	02	2	2
8. (a)	Write short notes on the followings	2.5x4 = 10	2	1, 2
	(i) Cascade amplification			
	(ii) Self-inactivation of G-protein			
	(iii) Light harvesting complex			
	(iv) Hormone receptor			

Biotechnology and Genetic Engineering Discipline Khulna University

Year: 2nd;
Course No: **0512 07 BGE-2105**;
Full Marks: 60;

Term: I;

Examination Year: 2026;
Course Title: **Plant Breeding**
Time: 03 Hours;

Session: 2024-25

Credit: 03

- Figures in the margin indicate full marks. Questions are of equal value.
- Use separate answer script for each section.

Section-A

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
1. (a)	Define plant breeding. "Plant breeding is an art and science of improving crop plants"- explain.	03	1, 2	1, 2
(b)	Discuss the contribution of plant breeding in food security in our country.	03	2	2
(c)	Explain the mechanisms and genetic significance of pollination control methods.	02	2	2
(d)	Describe self-incompatibility and male sterility with their importance in crop improvement.	02	2	1
2. (a)	Differentiate between qualitative and quantitative characters in crop plants.	02	1, 2	2
(b)	Explain polygenic inheritance and continuous variation with suitable example.	02	2	2
(c)	Describe the concept of yield in crop plants. Explain different yield contributing characters in important grain crops	03	2	1
(d)	Explain how a pure line variety becomes impure after several years of development.	03	2	
3. (a)	Summarize the major selection strategies for plant breeding.	02	4	2
(b)	Explain the basic principle of pure line selection and discuss its applications in crop improvement.	04	2, 6	2
(c)	Explain the concept and significance of recombinant inbred lines and near-isogenic lines in plant breeding program	04	6	1
4. (a)	Mention different types of heterosis and explain how it is estimated in crop plants.	02	2	2
(b)	What do you mean by 2-line and 3-line rice hybrid?	02	1	2
(c)	Mention the desirable morphological characteristics of A-line and R-	02	2	2

- line.
- (d) Briefly describe the hybrid seed production of rice from A-line and R-line in the field. 04 2

Section-B

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
5. (a)	Illustrate and explain the procedure of developing hybrid variety of watermelon.	04	2	5
(b)	Compare and contrast between clone and inbred line.	03	5	3
(c)	Discuss the role of ploidy level changes in breeding of self-pollinated, cross-pollinated and clonally propagated crops.	03	6	4
6. (a)	Define germplasm. Enlist the gene banks available in Bangladesh and summarize the activities of a gene bank in a research institute.	03	1, 2	1
(b)	Suppose you have collected ten (10) varieties of wheat from different countries. How will you evaluate the performance of the collected exotic wheat varieties? Demonstrate the protocol.	04	1, 5	7
(c)	What is distant hybridization? Mention the barriers of producing distant hybrids.	03	1, 2	4
7. (a)	Interpret the concept of disease triangle.	02	4	1
(b)	Analyze the impact of plant diseases globally. "Cultivating disease-resistant varieties is a sustainable approach for controlling plant diseases"- justify.	04	4, 5	1
(c)	Demonstrate a breeding strategy to transfer salt tolerant trait from a wild land race of rice to a salt sensitive commercial variety.	04	5	7
8. (a)	Distinguish between horizontal and vertical resistance.	02	2	4
(b)	How would you test for bacterial leaf blight resistance potentiality of introduced or segregating population of rice? Explain.	03	1, 2	7
(c)	Mention the advantages of mutation breeding.	02	2	1
(d)	Briefly explain intellectual property right, plant breeder's right and farmers' right.	03	2	4

Biotechnology and Genetic Engineering Discipline Khulna University

Year: 2nd;
Course No: **0512 07 BGE-2107**;
Full Marks: 60;

Term: I;

Examination Year: 2026;

Course Title: **Algal and Fungal Biology**

Time: 03 Hours;

Session: 2024-25

Credit: 03

- Figures in the margin indicate full marks. Questions are of equal value.
- Use separate answer script for each section.

Section-A

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
1. (a)	Define the following terms with suitable example- (i) Thallus (ii) Heterocyst (iii) Mycorrhiza	03	1	1
(b)	Differentiate between Chlorophyceae and Phaeophyceae based on pigments, reserve food and flagella.	03	2	2
(c)	Analyze the life cycle of <i>Spirogyra</i> with a labelled diagram and discuss the significance of conjugation in genetic variation.	04	4	3
2. (a)	Describe the characteristic features of Cyanophyceae.	02	2	1
(b)	Explain the structure and reproduction of <i>Volvox</i> .	03	2	1, 2
(c)	Evaluate the ecological and biotechnological importance of algae in biofuel production, wastewater treatment and food industries.	05	5	3, 4
3. (a)	What are lichens? Mention their different types.	02	1	2
(b)	Narrate the types of reproduction in the family of Chlorophyceae.	03	1	2
(c)	Explain the classification, economic importance and pathogenic effects of fungi in agriculture and human health.	05	4	3, 4
4. (a)	What are the algal species that are being used for the production of agar, carrageenan and alginates?	03	1	1
(b)	Write the characteristics and importance of Xanthophyceae.	03	1	1, 2
(c)	Assess the economic importance of brown algae and red algae in pharmaceutical and industrial applications.	04	5	3, 4

Section-B

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
5.	(a) What are fungi?	02	1	1, 2
	(b) Would you place fungi in a separate kingdom? Explain.	04	2	2, 3
	(c) Critically evaluate the beneficial and harmful roles of fungi in food and pharmaceutical industry.	04	5	3, 4
6.	(a) Write the differences between myxomycotina and eumycotina.	03	2	2, 3
	(b) Describe the cause and symptoms of black wart disease of potato.	03	2	1, 2
	(c) Write two distinctive characteristics of the followings- <i>Mucor</i> , <i>Aspergillus</i> , <i>Penicillium</i> and <i>Saccharomyces</i>	04	2	1, 2
7.	(a) Distinguish between Ascomycetes and Basidiomycetes.	02	2	2
	(b) What is unique about Deuteromycetes, making it different from other class of fungi?	02	1, 2	1, 3
	(c) Illustrate the five distinct spore stages in the life cycle of <i>Puccinia graminis-tritici</i> .	04	2	2, 3
	(d) Describe the symptoms of red rot disease of sugarcane.	02	2	2
8.	(a) What is mycosis? Describe the different types of mycosis in human.	03	1, 2	1
	(b) Describe the production process of penicillin from fungi.	03	2	1
	(c) Propose suitable biotechnological applications of algae and fungi for sustainable agriculture and environmental management.	04	6	3, 4

Biotechnology and Genetic Engineering Discipline

Khulna University

Year: 2nd;
Course No: 0512 07 BGE-2109;
Full Marks: 60;

Term: I;

Examination Year: 2026;

Course Title: **Animal Physiology and Reproduction**

Time: 03 Hours;

Session: 2024-25

Credit: 03

- Figures in the margin indicate full marks. Questions are of equal value.
- Use separate answer script for each section.

Section-A

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
1. (a)	Define seminal plasma. Discuss the importance of scrotum in normal sperm formation.	04	1, 2	1
(b)	Draw and label the different stages of follicular development in the ovary.	02	1, 2	1
(c)	List the primary reproductive organs of a cow.	02	1	1
(d)	Discuss how the knowledge of animal physiology and reproduction could be employed in Biotechnology.	03	6	1
2. (a)	What is cortical reaction? Explain how it prevents polyspermy during fertilization.	03	1, 2	1
(b)	Name the two layers of bilaminar embryonic disc and describe their origin with the help of a labelled diagram.	03	1, 2	1
(c)	Describe the role of trophoblast during early embryonic development. Differentiate between the morula stage and blastocyst stage.	04	2, 4	1
3. (a)	What does a lactation curve represent? Sketch and compare the curves for the first, second and third lactations of a Holstein Friesian cow.	05	1, 5	1
(b)	Illustrate the alveolar structure of the mammary gland using appropriate diagram.	03	2	1
(c)	Compare the composition of milk and colostrum.	02	4	1
4. (a)	Discuss the process of microbial digestion in the rumen of ruminants.	04	4	2
(b)	Classify the feed stuff of livestock. Discuss the utilization of ammonia in ruminants.	04	2, 4	2
(c)	Explain why ruminants generally do not require dietary supplementation of vitamin B and vitamin K.	02	2	2

Section-B

There are four (04) questions in this section. Answer any three (03) questions.

Question no.	Question Description	Marks	Level (L1-L6)	CLO No.
5. (a)	How do mating systems represent the attributes of animal reproduction, morphology and behavior? Explain.	03	1	3
(b)	Briefly explain the mechanisms of COC pick up for entering the fallopian tube lumen.	04	5	3
(c)	Define anestrus. Discuss different factors that affect postpartum anestrus.	03	1, 6	3
6. (a)	Define spermatogenesis. Explain the process of sperm capacitation and its importance for fertilization.	04	1, 2	3
(b)	Explain the role of seminal vesicles, prostate gland and bulbourethral glands during the process of ejaculation.	03	2	3
(c)	Discuss the effect of hormonal imbalance on male fertility in cattle.	03	6	3
7. (a)	What is MRP? What type of changes does a cow face after conception?	03	1	3
(b)	"The estrus cycle of a cow is hormonally regulated"- elaborate the statement.	03	6	3
(c)	Briefly explain the mechanism of survival of spermatozoa in the female reproductive tract of a cow.	04	5	4
8. (a)	What is "Golden Hour" conception? Briefly describe different actions to assist the newborn calf to survive.	04	1, 6	5
(b)	"Cattle pheromones can be used as an efficient tool to improve reproduction"- justify the statement.	03	5	5
(c)	What is involution of uterus? How is the rate of involution determined in bovine uterus?	03	1, 2	5