

**FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)**  
**Department of Biochemistry**  
**Course Curriculum**

<b>PART- A: Introduction</b>			
<b>Program: Bachelor in Science</b> (Degree/Honors)		<b>Semester - V</b>	<b>Session: 2024-2025</b>
1	<b>Course Code</b>	BCSC-05 T	
2	<b>Course Title</b>	Gene Replication, Expression and Regulation	
3	<b>Course Type</b>	Discipline Specific Course (Theory)	
4	<b>Pre-requisite (if, any)</b>	As Per the Program	
5	<b>Course Learning Outcomes (CLO)</b>	<p><i>On successful completion of the course, the student shall be able to:</i></p> <ul style="list-style-type: none"> <li>➤ Distinguish the process of replication in prokaryotes &amp; eukaryotes.</li> <li>➤ Distinguish the process of transcription in prokaryotes &amp; eukaryotes.</li> <li>➤ Distinguish the process of translation in prokaryotes &amp; eukaryotes.</li> <li>➤ Discuss the transcriptional regulation in prokaryotes &amp; eukaryotes.</li> </ul>	
6	<b>Credit Value</b>	<b>3 Credits</b>	<i>Credit = 15 Hours - learning &amp; Observation</i>
7	<b>Total Marks</b>	<b>Max. Marks: 100</b>	<b>Min Passing Marks: 40</b>
<b>PART -B: Content of the Course</b>			
<b>Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)</b>			
<b>Unit</b>	<b>Topics (Course contents)</b>		<b>No. of Period</b>
<b>I</b>	<b>Basic Concepts of Genetic Information:</b> Salient features of Eukaryotic, prokaryotic and viral genomes; highly repetitive, moderately repetitive and unique DNA sequences. T <sub>m</sub> and buoyant density and their relationship with G-C content in DNA. Chirality of DNA, tertiary Structure of DNA. Structure and properties of RNA: secondary and tertiary structures. Nucleic acid hybridization: Cot value and satellite DNA.		<b>12</b>
<b>II</b>	<b>DNA replication:</b> Features of replication, enzymes and proteins in DNA replication, E coli DNA polymerases, stages of replication initiation, elongation and termination. <b>Replication In Eukaryotes:</b> end replication problem, telomerase, various modes of replication. Comparison of replication in prokaryotes and eukaryotes. Inhibitors of DNA replication.		<b>11</b>
<b>III</b>	<b>Transcription in prokaryotes:</b> RNA polymerases, transcription cycle in bacteria, sigma factor, bacterial promoters, identification of DNA binding sites by DNA footprinting, various stages of RNA synthesis, initiation, elongation and termination, rho-dependent and rho-independent termination. Inhibitors of transcription and applications as antimicrobial drugs. <b>Transcription in eukaryotes:</b> Comparison between prokaryotic and eukaryotic transcription. The three classes of eukaryotic RNA polymerases, transcription by RNA polymerase II, RNA polymerase II core promoters, general transcription factors, transcription by RNA polymerase I and III. Inhibitors of eukaryotic transcription and their applications <b>RNA Processing:</b> Types of RNA processing- polyadenylation and capping, the spliceosome machinery, splicing pathways, group I and group II introns, alternative splicing, exon shuffling and RNA editing.		<b>11</b>

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<b>IV</b>	<p><b>Translation:</b> Genetic code and its characteristics, triplet nature, degenerate, deciphering the genetic code, Wobble hypothesis. Suppressor tRNAs. Exceptions to the nearly universal genetic code. Messenger RNA, transfer RNA, charging of tRNA. The structure of ribosome. Three stages of translation-initiation, elongation and termination. Translation in eukaryotes. Regulation of translation. Comparison of prokaryotic and eukaryotic protein synthesis. Inhibitors of translation and their clinical importance.</p> <p><b>Regulation of gene expression in prokaryotes:</b> Principles of gene regulation, negative and positive regulation, concept of operons, regulatory proteins, activators, repressors, DNA binding domains, regulation of lac operon and trp operon.</p>	<b>11</b>
<b>Keywords</b>	Chirality, DNA Replication, Transcription, Translation, Gene Expression, Operon.	

### PART-C: Learning Resources

#### Text Books, Reference Books and Others

##### Text Books Recommended –

- Molecular Cell Biology (2013) 7th ed., Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P., W.H. Freeman & Company (New York), ISBN:13:978-1-4641-0981-2.
- Principles of Biochemistry (2008) 3rd ed., Voet, D.J., Voet, J.G. and Pratt, C.W., John Wiley & Sons, Inc. (New York), ISBN:13: 978-0470-23396-2
- Molecular Biology of the Gene (2008) 6th ed., Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., Cold Spring Harbor Laboratory Press, Cold Spring Harbor (New York), ISBN:0-321-50781 / ISBN:978-0-321-50781-5.

##### Online Resources – e-Resources / e-books and e-learning portals

- <https://www.genome.gov/genetics-glossary/DNA-Replication>
- <https://www.nature.com/scitable/topicpage/gene-expression-14121669/>
- <https://www.genome.gov/genetics-glossary/Mutation>
- <https://www.frontiersin.org/articles/10.3389/fmicb.2020.624830/full>

### PART -D: Assessment and Evaluation

#### Suggested Continuous Evaluation Methods:

**Maximum Marks: 100 Marks**

**Continuous Internal Assessment (CIA): 30 Marks**

**End Semester Exam (ESE): 70 Marks**

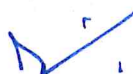
<b>Continuous Internal Assessment (CIA): (By Course Teacher)</b>	Internal Test / Quiz-(2): <b>20 +20</b>	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against <b>30 Marks</b>
	Assignment / Seminar - <b>10</b>	
	Total Marks - <b>30</b>	
<b>End Semester Exam (ESE):</b>	<b>Two section – A &amp; B</b>	
	Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks	
	Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40 Marks	

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1	<b>Course Code</b>	BCSC-0 5P	
2	<b>Course Title</b>	Gene Replication, Expression and Regulation	
3	<b>Course Type</b>	Discipline Specific Course (Practical)	
4	<b>Pre-requisite (if, any)</b>	As Per the Program	
5	<b>Course Learning Outcomes (CLO)</b>	On successful completion of the course, the student shall be able to: <ul style="list-style-type: none"> <li>➤ Demonstrate assay for nucleic acid by various methods.</li> <li>➤ Demonstrate isolation process of DNA from different samples.</li> <li>➤ Apply electrophoresis technique for different isolated compounds.</li> <li>➤ Illustrate SDS-PAGE techniques.</li> </ul>	
6	<b>Credit Value</b>	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	<b>Total Marks</b>	<b>Max. Marks: 50</b>	<b>Min Passing Marks: 20</b>
<b>PART -B: Content of the Course</b>			
<b>Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)</b>			
<b>Module</b>	<b>Topics (Course contents)</b>		<b>No. of Period</b>
<b>Lab./Field Training/ Experiment Contents of Course</b>	<ul style="list-style-type: none"> <li>➤ Estimation of DNA by diphenylamine method.</li> <li>➤ Effect of temperature on the viscosity of DNA using Oswald's viscometer.</li> <li>➤ Extraction of RNA and its estimation by Orcinol method.</li> <li>➤ Isolation and estimation of RNA from yeast.</li> <li>➤ Agarose Gel Electrophoresis and separation of DNA</li> <li>➤ Isolation of DNA from bacteria/eukaryotic cells and check its purity</li> </ul>		<b>30</b>
<b>Keywords</b>	<b><i>Isolation, DNA Estimation</i></b>		

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**PART-C: Learning Resources****Text Books, Reference Books and Others****Text Books Recommended –**

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**Online Resources–**

- **e-Resources / e-books and e-learning portals**
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2874567/>
- <https://pubmed.ncbi.nlm.nih.gov/22546956/>

**PART -D: Assessment and Evaluation****Suggested Continuous Evaluation Methods:****Maximum Marks: 50 Marks****Continuous Internal Assessment (CIA): 15 Marks****End Semester Exam (ESE): 35 Marks**

<b>Continuous Internal Assessment (CIA): (By Course Teacher)</b>	Internal Test / Quiz-(2): <b>10 &amp; 10</b> Assignment/Seminar +Attendance - <b>05</b> Total Marks - <b>15</b>	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against <b>15 Marks</b>
<b>End Semester Exam (ESE):</b>	<b>Laboratory / Field Skill Performance: On spot Assessment</b> A. Performed the Task based on lab. work - <b>20 Marks</b> B. Spotting based on tools & technology (written) – <b>10 Marks</b> C. Viva-voce (based on principle/technology) - <b>05 Marks</b>	<b>Managed by Course teacher as per lab. status</b>

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