JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE & TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCINCE IN BIOLOGICAL SCIENCES

4th YEAR FIRST SEMESTER 2016/2017 ACADEMIC YEAR

MAIN CAMPUS - REGULAR

COURSE CODE: **SBI 3442**

COURSE TITLE: **MICROBIAL GENETICS**

EXAM VENUE: **STREAM: (BSC BIO)**

DATE: **EXAM SESSION:**

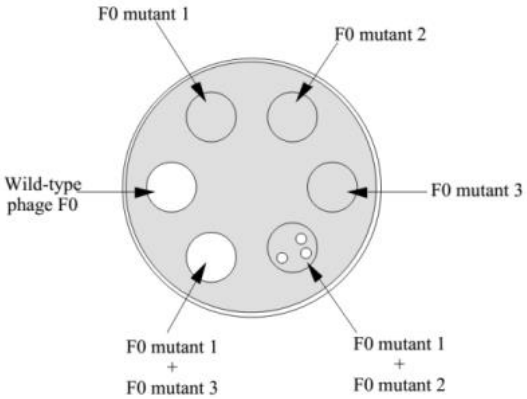
TIME: 2 HOURS

Instructions:

1. **Answer ALL questions in Section A and Any two questions in Section B**
2. **Candidates are advised not to write on question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

SECTION A: SHORT ANSWER QUESTIONS (30 MARKS)

1. Outline three common properties of cloning vectors (3 Marks)
2. Describe the structural characteristics of plasmids and explain the roles they play in microbial cells (3 Marks)
3. In the *E. coli* lac operon, explain how the gene expression would be affected if one of the following segments was missing.
    a) lac operon promoter
    b) operator site
    c) lac A gene
4. Define the terms polylinker, prophage and episome (3 Marks)
5. Differentiate between the three major types of RNA (3 Marks)
6. Once a series of recombinant plasmids or phages have been produced, describe three ways in which plasmids or phages containing a particular insert may be identified. (3 Marks)
7. Describe the structural characteristics of plasmids and explain the roles they play in microbial cells. (3 Marks)
8. Differentiate among Hfr, F+ and Resistant Plasmid Conjugations in bacteria. (3 Marks)
9. Outline the steps involved in creating an expression vector (3 Marks)
10. F0 is a virulent phage. When wild-type phage F0 phage is spotted on a lawn of *S. typhimurium* the cells are lysed (indicated by a white spot in the figure below). Three conditional mutants were isolated that prevent cell lysis. All three of these mutants affect the synthesis and assembly of the phage head, a complex structure that requires proper interactions between several different proteins. To determine if these mutations affect different genes, cells were coinfected with two different mutant phage under nonpermissive conditions as shown in the figure below.



    a) Do mutant 1 and mutant 2 map in different genes? Briefly explain your answer. (1 Mark)
    b) How can you explain the rare plaques in this spot containing mutant 1 and mutant 2 (2 Mark)

SECTION B: ESSAY QUESTIONS (40 MARKS).

11. Using diagrams where necessary, discuss the natural mechanisms of genetic recombination in bacteria. (20 Marks)
12. Define cloning vector and discuss the various types of cloning vectors (20 Marks)
13. Describe both lytic and lysogenic life cycles of bacteriophage (20 Marks)
14. Discuss cloning strategies in *E. coli and* Yeast (20 Marks)