



FACULTY OF SCIENCE

DEPARTMENT OF BIOTECHNOLOGY AND FOOD TECHNOLOGY

B.TECH IN BIOTECHNOLOGY

MODULE BTN1Y14
 Industrial Biotechnology

CAMPUS DFC

MAIN EXAMINATION NOVEMBER 2019

DATE: 16/11/2019

SESSION: 12:30-15:30

ASSESSOR(S):

DR K KONDIAH

EXTERNAL MODERATOR

PROF K RUMBOLD

DURATION: 3 HOURS

MARKS: 120

NUMBER OF PAGES: 4

INSTRUCTIONS TO INVIGILATORS:

- 1. THIS QUESTION PAPER MUST BE RETURNED WITH SCRIPT.**
- 2. THIS IS AN OPEN BOOK EXAM.**
- 3. STUDENTS ARE ALLOWED TO BRING IN AND REFER TO COURSE LEARNING MATERIAL IN HARD COPY OR ANY ELECTRONIC FORMAT EXCEPT CELLPHONES.**
- 4. THE USE OF INTERNET IS STRICTLY PROHIBITED. THE USE OF INTERNET WILL BE CONSIDERED AS COPYING DURING THE EXAM.**

INSTRUCTIONS TO STUDENTS:

- 1. ANSWER ALL THE QUESTIONS.**
 - 2. RETURN EXAMINATION PAPER WITH SCRIPT.**
 - 3. IT IS IN YOUR BEST INTEREST TO WRITE CLEARLY AND LEGIBLY.**
 - 4. YOU MAY BRING IN COURSE LEARNING MATERIAL AS HARD COPY OR ELECTRONIC FORMAT (EXCEPT CELLPHONES) AND REFER TO THE MATERIAL WHEN ANSWERING ALL QUESTIONS.**
 - 5. THE USE OF INTERNET IS STRICTLY PROHIBITED AND WILL BE CONSIDERED AS COPYING DURING THE EXAM IF USED.**
 - 6. GOOD LUCK!**
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Question 1 (12 marks)

Describe the drivers of antibiotic resistance.

Question 2 (10 marks)

2.1 What class of antibiotics does penicillin belong to? (1)

2.2 Explain with the aid of a well labelled graph, the production of penicillin by *Penicillium chrysogenum* in relation to its growth. (6)

2.3 List three fermentation conditions under which penicillin is produced at the industrial scale. (3)

Question 3 (19 marks)

3.1 Explain why biomass pretreatment is important for biofuel production. (4)

3.2 Draw a table indicating the principle, one advantage and one disadvantage of using milling, dilute acid and ligninolytic enzymes as pretreatment strategies in biofuel production. (9)

3.3 Discuss two challenges faced by South Africa in the development of 2nd generation biofuels and why microalgae based biofuel can alleviate these challenges. (6)

Question 4 (23 marks)

4.1 Differentiate between the two main protein engineering strategies used to optimize industrial biocatalyst activity and specificity. (6)

4.2 List five properties required of support material used in the immobilization of industrial enzymes. (5)

4.3 With the aid of a well labelled drawing describe the most frequently used immobilization strategy used for detergent enzymes in terms of principle, benefits and drawbacks. (6)

4.4 Refer to the paper titled “Evaluation of a new lipase from *Staphylococcus* sp. for detergent additive capability” by Chauhan *et al.* (2013).

4.4.1 Briefly discuss the findings from any two factors that were optimised in the study. (4)

4.4.2 Considering the optimal conditions reported by the authors for maximal removal of oil stains, comment on the commercial application of this lipase in washing detergents. (2)

Question 5 (18 marks)

5.1 Discuss the benefits of using gold nanoparticles in the development of lateral flow assays (LFAs). (6)

5.2 Refer to Figure 2 in the paper titled “Multicolor immunochromatographic strip test based on gold nanoparticles for the determination of aflatoxin B1 and fumonisins” by Di Nardo *et al.* (2017).

Explain how the immunochromatographic strip produces a result of AFB1(-)/FMB1(-) and AFB1(+)/FMB1(+). (8)

5.3 List four advantages of LFAs in the context of South Africa's healthcare system. (4)

Question 6 (17 marks)

6.1 Why is it important to protect intellectual property (IP)? (3)

6.2 What is the difference between filing for a provisional patent and filing for a PCT (patent cooperation treaty) application? (6)

6.3 Discuss four factors that contribute to the growth and development of South Africa's biotech sector. (8)

Question 7 (13 marks)

7.1 Describe the long term beneficial impacts of industrial biotechnology. (8)

7.2 Why are microorganisms the preferred tool for industrial biotechnology? (5)

Question 8 (8 marks)

Comment on the impact South African's religious/cultural/traditional beliefs has on the public's perception of modern biotechnology.