



UNIVERSITY OF GHANA
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SECOND SEMESTER EXAMINATIONS: 2013/ 2014

LEVEL 400: BACHELOR OF SCIENCE IN ENGINEERING

BMEN 402: Tissue Engineering and Biotechnology (3 CREDITS)

TIME ALLOWED: 3 HOURS

Answer all the questions

1.

(a) Mention some of the advantages on the use of engineered autologous tissues for the reconstruction of vaginal organs over some of the existing techniques for the correction of vaginal aplasia? (5 marks)

(b) Describe how you will construct vaginal organs using autologous muscles and epithelial cells obtained via vulva biopsy from a patient? (5 marks)

(c) Provide a brief description on how to assess cell seeding uniformity, cell survival and proliferations when engineering vaginal cell-seeded scaffolds. (5 marks)

(d) Describe how you will evaluate the phenotypic expression, functional properties and histological morphology of engineered vaginal organs? (5 marks)

(e) State the reasons why an engineered vaginal organ should have similar phenotypic expression and functional properties similar to the native vaginal tissues. (5 marks)

Total: 25 marks

2.

(a) Mention how tissue engineering and regenerative medicine is currently being applied in clinical medicine in Ghana, by providing detailed examples within the healthcare sector. (10 marks)

(b) What are the potential ethical dilemmas and challenges pertaining to tissue engineering practice in Ghana and how to overcome these barriers? (5 marks)

(b) What are the benefits of embryonic stem cell research to the testing of new pharmaceutical drugs? (5 marks)

(c) Describe the relevance of 3D bioprinting of tissues to the diagnosis and treatment of cancer, as well as development of new drugs? (5 marks)

Total: 25 marks

3.

(a) Explain why *in vivo* implanted tissue-engineered device elicits both inflammatory and immunologic responses? (5 marks)

(b) Mention the most important criteria that must be considered if biomedical devices are to function adequately and appropriately in their *in vivo* environment. (5 marks)

(c) With the aid of a diagram, illustrate the sequence of events accompanying inflammatory responses and cell types following the implantation of tissue-engineered devices. (10 marks)

(d) Describe the immune response mechanisms and the type of interactions that follows the implantation of a tissue-engineered construct. (5 marks)

Total: 25 marks

4.

(a) As a biomedical engineer in an under-resourced laboratory, describe how you will construct a simple hybrid printing system that integrates both inkjet printing and electrospinning platforms for fabricating cartilage tissues. You may use schematic representations of your design to support your explanation.

(10 marks)

(b) Explain why hybrid tissue constructs composed of synthetic polymers and naturally-derived hydrogels are needed for load bearing tissue engineering applications. (10 marks)

(c) Describe briefly the techniques and principles involved in measuring the structural and mechanical properties of the hybrid printed constructs. (5 marks)

Total marks: 25

Overall Total: 100

