Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER I
## SESSION 2016/2017

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|---|---|---|
| COURSE NAME | : | CELL AND TISSUE ENGINEERING TECHNOLOGY |
| COURSE CODE | : | BNN 20104 |
| PROGRAMME CODE | : | BNN |
| EXAMINATION DATE | : | DECEMBER 2016 / JANUARY 2017 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **ALL** QUESTIONS |



THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

**Q1.** (a) Cell is a basic structural, functional, and biological unit of all known living organisms. A cell is the smallest unit of life that can replicate independently, and cells are often called the "building blocks of life". Explain the function of the following organelles in the cell:

(i) Cell membrane
(ii) Nucleus
(iii) Cell wall
(iv) Cytoskeleton
(v) Golgi apparatus

(5 marks)

(b) Cell culture is the process by which prokaryotic, eukaryotic or plant cells are grown under controlled conditions.

(i) Relate the effect of controlled conditions (pH and temperature) in culture system on the cell growth.

(4 marks)

(ii) Growth and morphogenesis of plant tissue cultures can be improved by small amounts of some organic nutrients. Choose **THREE (3)** types of organic supplements with their function.

(5 marks)

(iii) The energy requirement for tissue culture technology depends on day temperature, day-length and relative humidity. These have to be controlled during the process of propagation. *Low cost tissue culture technology* is an options for reducing costs to establish and operate tissue culture facilities. Elaborate **FIVE (5)** explanations on what it means by *low cost tissue culture technology*.

(5 marks)

(c) Aseptic technique is a fundamental and important laboratory skill in the field of microbiology. Microbiologists use aseptic technique for a variety of procedures such as transferring cultures, inoculating media, isolation of pure cultures and for performing microbiological tests.

(i) Define the term *aseptic technique*.

(2 marks)

(ii) Provide **THREE (3)** importance of aseptic technique in performing microbiology experiments.

(3 marks)

**Q2.** (a) Nutrient Agar is a culture medium used for the cultivation of microbes supporting growth of a wide range of non-fastidious organisms. You are required to prepare this agar to sub culture the *Escherichia coli* in the laboratory.

(i) Define the term *culture medium.*

(2 marks)

(ii) Explain on how you would prepare this medium agar.

(3 marks)

(b) There are a few methods used to determine number of living cells, which can grow in an optimum condition for a particular bacteria. An accurate picture of the living cells in a microbial population can be observed if the cells grow in an optimum condition.

(i) Choose **TWO (2)** direct method of measuring microbial growth and sketch a diagram on how this method is accomplished in the laboratory.

(4 marks)

(ii) Sketch and label a complete diagram for different phases of microbial growth that occur in a closed culture system.

(3 marks)

(c) The streamlined operation of a tissue culture facility requires a specific layout of the laboratories and strategic location of the equipment. Based on the **Figure Q2(b)**, propose the location (either in transfer room or in preparation room) for the equipment listed below:

(i) Autoclave
(ii) Laminar flow cabinets
(iii) Bench and presses
(iv) Refrigerator
(v) Peristaltic pump
(vi) Water distillation and sink unit
(vii) Safety burner/ sterilizer
(viii) pH meter
(ix) Binocular microscope
(x) Hot plate stirrer



(5 marks)

(d) **Figure Q2 (d)** represents the view of the haemocytometer through a microscope. The circles represent cells that had previously been cultured in a Petri dish. A 0.5 ml suspension of cells were removed from the Petri dish and mixed with 0.5 ml Trypan Blue solution. The cross (x) in the figure represent dead cells that have taken up the Trypan Blue and the dots (•) are live cells.

(i) Count the live and dead cells in each of the four quadrants for each counting chambers (A and B) of the haemocytometer.
Calculate the average for each counting.

(2 Marks)

(ii) Given that the dilution factor is 2. Calculate the average number cells from chambers A and B, cell density and cell viability.

(2 Marks)

(iii) Trypan Blue is a stain that selectively stains dead cells. Interpret why did only the dead cells take up the Trypan Blue stain and not the living cells.

(3 marks)

**Q3.** (a) Cell death is the event of a biological cell ceasing to carry out its functions.

(i) Identify **SIX (6)** factors causing to the cell death.

(3 marks)

(ii) With an aid of a diagram, compare **TWO (2)** ways on how the cell death happens.

(5 marks)

(iii) Some types of cancers persist as a result of a cell's inability to undergo apoptosis. Explain the importance of apoptosis.

(5 marks)

(b) A recombinant DNA molecule is produced by joining two or more DNA fragments originating from different organism.

(i) Sketch a diagram of recombinant bacteria and explain how the recombinant process occur.

(9 marks)

(ii) Identify **THREE (3)** applications of recombinant DNA technology.

(3 marks)

**Q4.** (a) Tissue engineering technology addresses the basic science and development of biological substitutes for implantation into the body or the fostering of tissue remodelling for the purpose of replacing, repairing, regenerating, reconstructing or enhancing function.

(i) Differentiate between *in vitro* and *in vivo* tissue engineering technology.

(6 marks)

(ii) Most success in tissue engineering technology have been limited to tubular or thin tissues like blood vessels, skin, cartilage and cornea. Determine the main reason for this.

(2 marks)

(iii) Tissue engineering technology of more complicated organs like the heart, kidney, liver, and lung are more difficult. Identify what are the **THREE (3)** main challenges.

(3 marks)

(b) Cloning is the process of producing similar populations of genetically identical individuals that occurs in nature when organisms such as bacteria, insects or plants reproduce asexually. Critique on the advantages and disadvantages of cloning.

(6 marks)

(c) Organ donation is the donation of biological tissue or an organ of the human body, from a living or dead person to a living recipient in need of a transplantation. Evaluate your opinions on *Xenotransplantation* from the ethical point of view.

(8 marks)

**- END OF QUESTIONS -**

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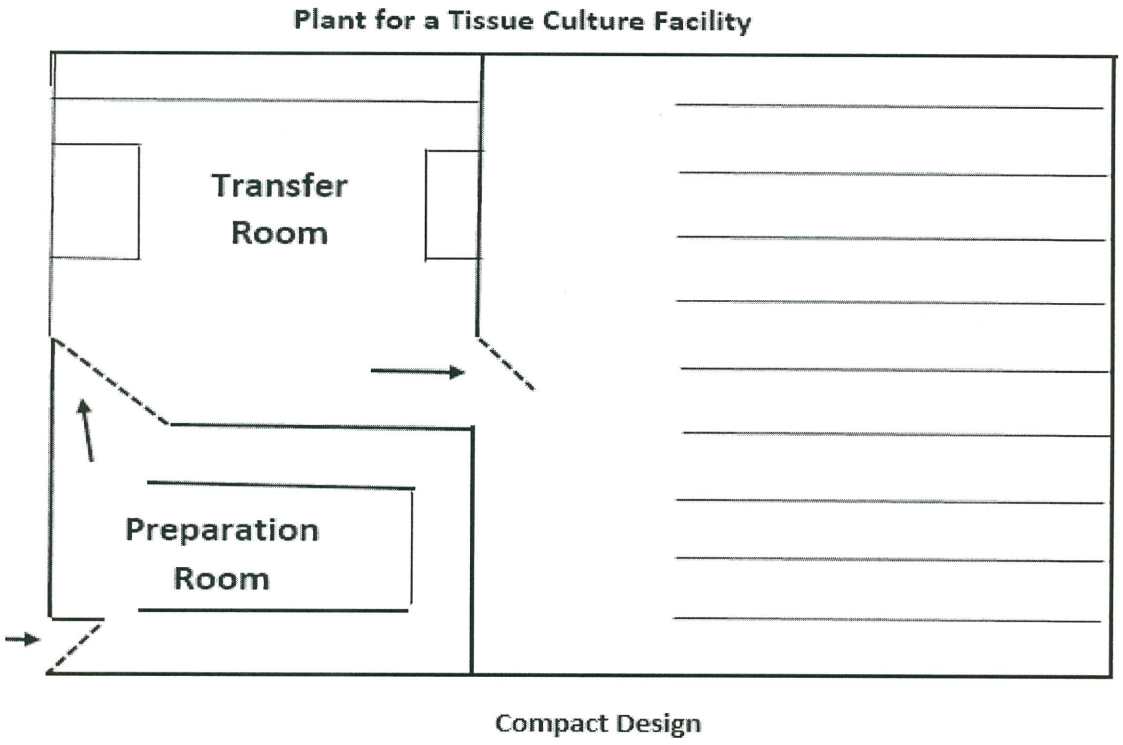


**Figure Q2 (b)**

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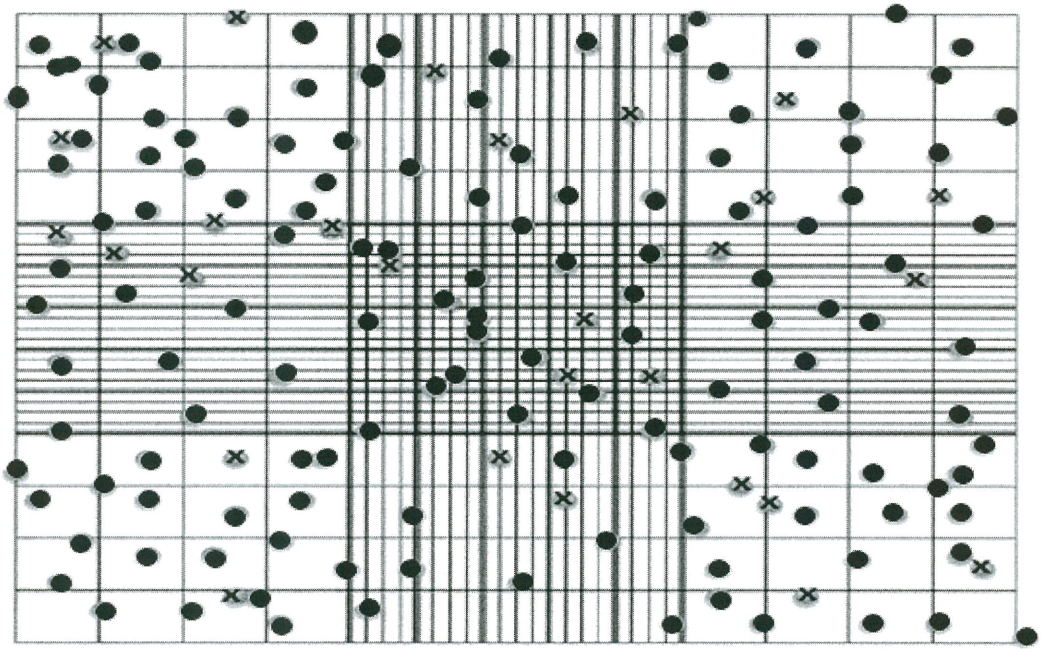
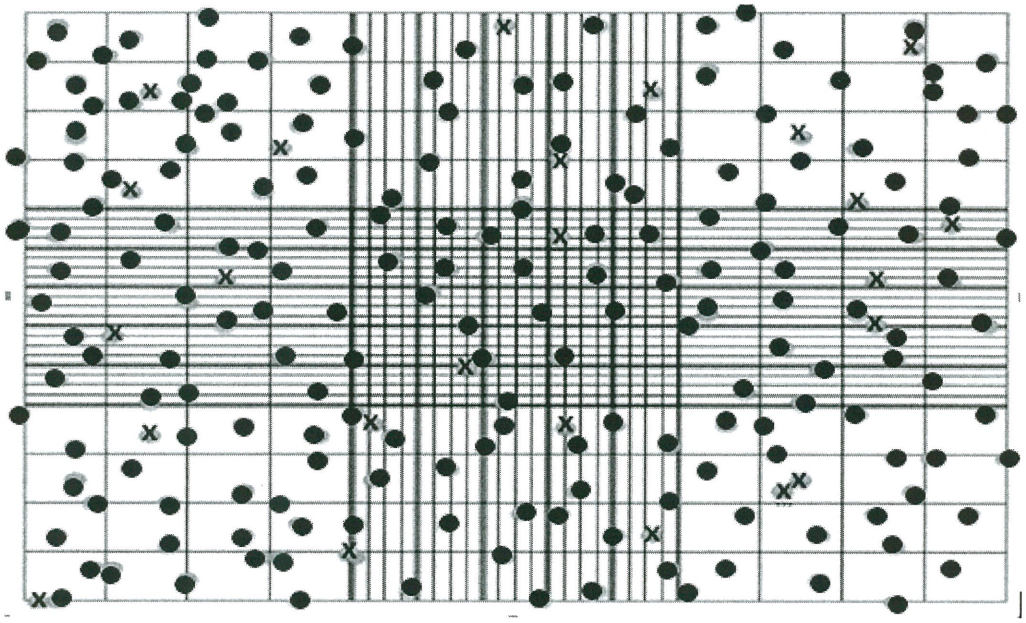
Chamber A



Chamber B



● Live Cells X Dead Cells with Trypan Blue



**Figure Q2 (d)**