

**MASINDE MULIROUNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

MAIN CAMPUS

**UNIVERSITY EXAMINATIONS  
2021 / 2022 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF SCIENCE MEDICAL BIOTECHNOLOGY  
MAIN EXAMS**

**COURSE CODE: BMB 326**

**COURSE TITLE: STEM CELL CULTURE AND TISSUE  
ENGINEERING**

**DATE: 29/04/2022**

**TIME: 12.00 - 2.00 PM**

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**INSTRUCTIONS TO CANDIDATES**

This paper is divided into three sections, **A B** and **C**, carrying respectively: Multiple Choice Questions (**MCQs**), Short Answer Questions (**SAQs**) and Long Answer Questions (**LAQs**).

TIME: 2 Hours

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 4 Printed Pages. Please Turn Over.

## SECTION A: MULTIPLE CHOICE QUESTIONS (20 MKS)

### Instructions to the candidate

- The section has twenty (20) multiple choice questions (MCQs)
- Each question has a stem and four (4) completion options, of which only one is correct
- Write your answers on the provided university examination booklet.

1. The concentration of formalin used for fixation of stem cells is:
  - A. 40% w/v
  - B. 10% v/v
  - C. 4% w/v
  - D. 4% v/v
2. The advantage of using paraffin wax for embedding during sectioning is that:
  - A. Forms a ribbon when sectioned
  - B. Removes all the water from the tissue
  - C. It is readily available
  - D. It is cheap in terms of cost
3. The method used to examine the genes expressed and their relative levels is:
  - A. Laser capture microdissection
  - B. In situ hybridization
  - C. RNA sequencing
  - D. Flow cytometry
4. The method of viewing cells one by one in suspension is
  - A. Laser capture microdissection
  - B. In situ hybridization
  - C. RNA sequencing
  - D. Flow cytometry
5. The method that combines histology with the sophisticated analysis of gene expression offered by modern molecular techniques
  - A. Laser capture microdissection
  - B. Flow cytometry
  - C. In situ hybridization
  - D. RNA sequencing
6. A method of detecting the location of specific messenger RNA in a specimen
  - A. Laser capture microdissection
  - B. Flow cytometry
  - C. In situ hybridization
  - D. RNA sequencing
7. The intrinsic cell cycle mechanism depends on proteins called:
  - A. Cyclin dependent kinases
  - B. M-phase promoting factor
  - C. Cyclins
  - D. Maturation promoting factor
8. Cells are mobilized from the G<sub>0</sub> to G<sub>1</sub> state by phosphorylating the \_\_\_\_\_ protein.
  - A. ERK signal transduction pathway
  - B. E2F-DP transcription complex
  - C. Platelet derived growth factor
  - D. Retinoblastoma
9. The most specific protein to be stained to identify dividing cells throughout the cell cycle
  - A. Proliferating cell nuclear antigen (PCNA)
  - B. Ki67
  - C. Phosphohistone H3
  - D. Tritiated thymidine

10. A co-factor of DNA polymerase that is present during S phase
- A. Proliferating cell nuclear antigen (PCNA)
  - B. Ki67
  - C. Phosphohistone H3
  - D. Tritiated thymidine
11. A proliferation marker specific for M phase:
- A. Proliferating cell nuclear antigen (PCNA)
  - B. Ki67
  - C. Phosphohistone H3
  - D. Tritiated thymidine
12. An extrinsic DNA label that is metabolized to 3H-TTP and becomes incorporated into DNA during replication.
- A. Proliferating cell nuclear antigen (PCNA)
  - B. Ki67
  - C. Phosphohistone H3
  - D. Tritiated thymidine
13. The use of Viruses to introduce genes into cells is called.
- A. Transfection
  - B. Electroporation
  - C. Hybridization
  - D. Transduction
14. Which of the following is a reverse transcriptase protein encoded by Retroviruses:
- A. pol
  - B. gag
  - C. env
  - D. Nucleosides
15. Which of the following is a capsid protein encoded by Retroviruses:
- A. pol
  - B. gag
  - C. env
  - D. Cadherin
16. Which of the following is a envelope protein encoded by Retroviruses:
- A. pol
  - B. gag
  - C. env
  - D. Desmosome
17. \_\_\_\_\_ is an endonuclease enzyme from phage P1 which cuts DNA only at specific sites
- A. Tet
  - B. Cre
  - C. CreER
  - D. TRE
18. The media pH indicator is \_\_\_\_\_ colour in acidic pH:
- A. Red
  - B. Blue
  - C. Yellow
  - D. Colourless

19. Tissue culture cells are usually grown in atmospheric oxygen concentration
- 10%
  - 20%
  - 30%
  - 40%
20. The pH control is achieved by \_\_\_\_\_ when culturing cells
- Bicarbonate-CO<sub>2</sub> buffers
  - Calcium
  - Magnesium
  - Potassium

### SECTION B 40 MARKS

- Outline the characteristics of stem cell behaviour [5 Marks]
- Describe embryonic stem cells [5 Marks]
- Label retention is not always a stem cell behavior. Explain [5 Marks]
- Outline the important components of serum in culture [5 Marks]
- Illustrate the phases of cell growth in culture media [5 Marks]
- Describe the suitability of tissue culture flask ("T flask") for culturing cells [5 Marks]
- Explain the role of salts in culture media [5 Marks]
- Explain the importance of tissue culture in stem cell biology [5 Marks]

### SECTION C: LONG ANSWER QUESTIONS (60 MKS)

#### Instructions

- This section has THREE long answer questions (LAQs), totalling a maximum of SIXTY (60) marks
- Answer all questions
- Write your answers on the provided university examination booklet

- Give a detailed account of transcription factors and telomerase complex as stem cell markers [20 Marks]
- Elucidate the processes of transfection and electroporation [20 Marks]
- Describe the process of sectioning in characterizing cells [20 marks]