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University Examinations 2024/2025

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF MEDICAL MICROBIOLOGY

HMM 3413: VACCINES AND VACCINOLOGY

DATE: JANUARY 2025 **TIME: 3 HOURS**

INSTRUCTIONS:
Answer ***All*** *questions*
Ensure that all your answers are properly numbered
Part I multiple Choice Questions (MCQ): Write the correct answer on the space provided in the answer booklet. Each MCQ is one mark
Part II: Short Answer Questions – Answer questions following each other on the answer booklet
Part III: Long Answer Questions – Answer each question on the answer booklet

SECTION A: MULTIPLE CHOICE QUESTIONS (20 marks)

1. Which of the following type of vaccine did the Moderna and Pfizer-BioNTech developed for COVID-19?
   a) mRNA vaccine
   b) Subunit vaccine
   c) Toxoid vaccine
   d) Vector-borne vaccine
2. Before the invention of the Polio vaccine in 1955, Poliomyelitis was a serious viral infection, it was a leading cause of death among children. Select the incorrect statement regarding the polio vaccine.

a) It is only present in the form of killed or inactivated vaccine

b) Live virus vaccine against poliovirus can be given orally

c) The doses of vaccines must be given before children turn 6 years of age

d) It is present in two forms, oral polio vaccine and inactivated polio vaccine

3. Hybridoma technique involves the fusion of

a) Plasma cells and dentritic cells

b) Cancer cells and B cells

c) B cells and T cells

d) Cancer cells and T cells

4. Which of the following is considered a main risk factor and a necessary cause of cervical cancer?

a) Human torovirus

b) Human papillomavirus

c) Machupo virus

d) Rotavirus C

5. The process of introducing a weakened pathogen into a human body is called

a) Attenuation

b) Vaccination

c) Immunization

d) Protection

6. Which of the following statement is Incorrect about the vaccine development process?

a) A vaccine consists of live attenuated or killed germ cells

b) Aluminum can be used as an adjuvant in a vaccine

c) Animal trials are not necessary for vaccines before going to the human trial

d) An effective and safe vaccine production can take up to 10 to 15 years

7. Most viral vaccines are thought to work by which of the following technique?

a) Inducing the production of antigens

b) Inducing the production of cell wall

c) Inducing the production of cytosolic proteins

d) Inducing the production of antibodies

8. What is the main feature of inactivated vaccines?
   a) They contain live pathogens that are weakened.
   b) They use only specific parts of the pathogen.
   c) They stimulate a strong immune response without any pathogen.
   d) They are made from killed pathogens.
9. What is the purpose of adjuvants in vaccines?
   a) To kill pathogens
   b) To provide a genetic template
   c) To stabilize the vaccine
   d) To enhance the immune response
10. What is the first step in the vaccine development process?
   a) Clinical trials
   b) Manufacturing
   c) Preclinical research
   d) Approval submission
11. What is the purpose of a Phase IV clinical trial?
   a) To determine initial safety
   b) To assess long-term effects and effectiveness
   c) To compare with existing vaccines
   d) To evaluate different dosages
12. Which of the following immunization techniques is typically used for live attenuated vaccines?
   a) Intravenous injection
   b) Inhalation
   c) Subcutaneous injection
   d) Oral administration
13. What type of vaccine is designed to treat existing cancer by stimulating the immune system?
   a) Prophylactic vaccine
   b) Therapeutic vaccine
   c) Subunit vaccine

d) Live attenuated vaccine

14. What is the primary goal of epitope mapping?
    a) To identify the structure of antibodies
    b) To determine the specific regions of an antigen recognized by antibodies
    c) To evaluate vaccine efficacy
    d) To analyze protein folding
15. Which part of the antibody is primarily involved in binding to an antigen?
    a) Constant region
    b) FC region
    c) Fab region
    d) Hinge region
16. How do adjuvants typically enhance the immune response?
    a) By directly killing pathogens
    b) By inducing fever
    c) By prolonging the presence of the antigen in the body
    d) By blocking immune checkpoints
17. What is the first step in the vaccine manufacturing process?
    a) Formulation
    b) Quality control
    c) Antigen production
    d) Filling and packaging
18. What is one of the primary challenges in scaling up vaccine production?
    a) Limited supply of raw materials
    b) Lack of regulatory guidelines
    c) Excessive funding
    d) Easy access to technology
19. What is a major concern regarding the production of live attenuated vaccines?
    a) They require expensive equipment.
    b) There is a risk of reversion to virulence.
    c) They cannot be stored at room temperature.

d) They are ineffective in inducing immunity.

20. What is one potential ethical challenge associated with vaccine manufacturing?
    a) Ensuring affordability for all populations
    b) The use of animal testing in production
    c) Intellectual property rights
    d) All of the above

SECTION B: SHORT ANSWER ALL QUESTIONS (40 MARKS)

1. Explain the following terms (4 marks)
    i) Attenuation
    ii) Paratrope
2. Explain the working principle of non-replicating viral vector vaccines (4 marks)
3. Describe any two types of cancer based vaccines (4 marks)
4. Explain any TWO ways used in the administration of vaccines (4 marks)
5. Write short notes on aluminium salts used in delivery of vaccines (4 marks)
6. Draw a well labeled diagram of a classic immunoglobulin molecule (4 marks)
7. Outline the different benefits of adjuvants on vaccines (4 marks)
8. Differentiate between a paratope and an epitope (4 marks)
9. Write short notes on toxoid vaccines with examples of the organisms that produce them (4 marks)
10. Explain the working principle of replicating viral vector vaccines (4 marks)

SECTION C: LONG ANSWER TWO QUESTIONS (40 MARKS)

1. i) Discuss the common challenges faced in vaccine manufacturing (10 marks)
   ii) Discuss the different immunization techniques use to administer vaccines (10 marks)
2. Write detailed notes on the molecular d cellular mechanism of immune responses induced by a multi-epitope vaccine. (20 marks)
3. Discuss the general mechanism of action of adjuvants (20 marks)