KUMARAGURU
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M.TECH. DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

BIOTECHNOLOGY

P18BTE0005**:** Cell Culture and Vaccine Technology

COURSE OUTCOMES

CO1: Comprehend knowledge about the animal cell culture and for control of large-scale Cell culture.

CO2: Classify and understand about different microbial vaccine preparation methods.

CO3: Understand advancement of therapeutic vaccines and technological applications.

CO4: Acquire fundamental research knowledge to implement rational vaccine design.

CO5: Develop and design vaccine research using computational tool.

CO6: Understand the *in vitro* experimental validations through software predictions Animal testing, commercialization, quality control.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Arrange the steps in passaging of mammalian cells.   CO1   [K$_3$]

    1. Suspension of cell pellet in fresh medium
    2. Removing the old medium and washing the cells with PBS
    3. Addition of trypsin to dislodge the cells from the culture substrate
    4. Incubate at 37°C and centrifuging cell suspension to form a pellet

    a) 1-2-3-4   b) 2-1-3-4

    c) 3-4-2-1   d) 1-2-4-3

2. Hyperplasia means………….   CO1   [K$_2$]

    a) Non-dividing cells   b) Cells with Limited life span

    c) Non-tumorigenic cells   d) Transformed cells

3. The minimum gap that should be allowed in between to administer two live   CO2   [K$_2$]
    vaccines:

    a) 2 weeks   b) 4 weeks

    c) 4 weeks   d) 8 weeks

4. Match the particulars in column I and II CO2 [K₁]

Vaccines	Specification
A. The first recombinant antigen vaccine for human use	i. Rabies virus
B. The first vaccine developed by Louis Pasteur	ii. Hepatitis B vaccine
C. First scientifically approved vaccine	iii. Polysaccharide vaccine
D. Hib vaccine	iv. Smallpox vaccine

a) A-ii, B-i, C-iv, D-iii   b) A-iii, B-i, C-iv, D-ii

c) A-iii, B-i, C-ii, D-iv   d) A-ii, B-i, C-iii, D-iv

5. What is the key information required to develop a vaccine? CO3 [K₂]

a) Molecular pathogenicity of the disease

b) Molecular pathogenicity of the disease and the disease-causing organism

c) Molecular pathogenicity of the disease-causing organism

d) Unique immunologic response from the host

6. Who demonstrated a plasmid-induced immune response using mice by inoculating with a plasmid expressing human growth hormone which elicited antibodies instead of faltering growth?. CO3 [K₂]

a) Stephen Johnston

b) Edward Jenner

c) Robert Hook

d) Joseph Miester

7. Assertion (A): Crystallography provides a very detailed static picture of an epitope. CO4 [K₄]
Reason (R): By these techniques, it is difficult to appraise the dynamic and functional aspects of antibody recognition.

a) A is false but R is true

b) Both A and R are individually true but R is not the correct explanation of A

c) A is true but R is false

d) Both A and R are individually true and R is the correct explanation of A

8. Which of the following two whole organism genomes were published in late 1990's? CO4 [K₂]

a) *Pseudomonas sp* and *Aspergillus niger*

b) *Haemophilus influenzae* and *Mycoplasma genitalium*

c) *Staphylococcus aureus* and *E.coli*

d) *Bacillus sp* and *Salmonella typhi*

9. Find out preclinical study in vaccine R&D workflow. CO5 [K₃]

P. Antigen detection

Q. Affinity detection

R. *Invivo* efficacy evaluation

S. *Invitro* efficacy evaluation

T. Toxicity evaluation

a) P and Q   b) R and S

c) Q and T   d) P and R

10. Animal models are typically used to ……   CO6   [K3]

    a) determine optimal route of delivery   b) access vaccine stability

    c) determine quality regulation in vaccine production   d) enhance protectivity of vaccine

PART B (10 x 2 = 20 Marks)

11.	Comments on: *Invitro* age of cell culture.	CO1	[K3]
12.	Abbreviate: HAT and HGPRT.	CO1	[K1]
13.	How are Lyme disease managed by using subunit vaccine? – Give an example.	CO2	[K2]
14.	Mention a therapeutic vaccine and their specification, which was approved by US-FDA for prostate cancer.	CO2	[K2]
15.	Why do we need to use machine learning approaches to understand vaccine candidates?	CO3	[K3]
16.	CpG adjuvants activate both innate and adaptive immune systems- Justify.	CO3	[K4]
17.	How will you define ideal epitopes to raise antibody?	CO4	[K3]
18.	Immune epitope data base (IEDB) is widely used to study T cell epitope – Justify.	CO4	[K4]
19.	How quality control measures for vaccine production are developed in US by FDA?	CO5	[K3]
20.	How will you assess the potential impact of commercialization vaccine?	CO6	[K3]

PART C (6 x 5 = 30 Marks)

21.	Illustrate enzymatic method for cell dissociation for primary culture establishment.	5	CO1	[K2]
22.	Distinguish active and passive immunity.	5	CO2	[K4]
23.	Recommend any five important factors in the rational design of vaccines.	5	CO3	[K3]
24.	Give suggestion to find out genomic comparison of genetically related organism.	5	CO4	[K5]

25.	List challenges in implementing quality regulation guidelines for production vaccine	5	CO5	[K$_2$]

26.	How will you validate experimental studies for large scale production of vaccine?	5	CO6	[K$_2$]

Answer any FOUR Questions
PART D (4 x 10 = 40 Marks)

27.	Suggest challenges in use of stem cells for vaccine production.	CO1	[K$_5$]

28.	Compare salient features of live, killed, attenuated and subunit vaccines.	CO2	[K$_4$]

29.	How will you design, T - Cell expression cloning for identification of vaccine targets for *Salmonella typhi* (intracellular pathogen)?	CO3	[K$_2$]

30.	How people are predicting immunogenic peptides of B and T lymphocytes.	CO4	[K$_3$]

31.	Suggest challenges in rational design to clinical trials.	CO5	[K$_5$]

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