GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 8
Subject Name: Advance Vaccinology
Subject Code: 1380407

Prerequisite: The prerequisites for Advanced Vaccinology typically include a strong foundation in microbiology, immunology, molecular biology, and biotechnology. A background in medicine, pharmacy, life sciences, or a related field is beneficial. Basic knowledge of vaccine development, including antigen design, adjuvants, and immunization strategies, is also essential. Familiarity with regulatory aspects, clinical trials, and bioprocessing techniques can be advantageous for understanding advanced topics in vaccinology.

Rationale: Advanced vaccinology is essential for developing next-generation vaccines that are safer, more effective, and accessible. With emerging infectious diseases, antimicrobial resistance, and evolving pathogens, there is a growing need for innovative vaccine platforms, such as mRNA, viral vectors, and recombinant proteins. Additionally, optimizing adjuvants, delivery systems, and immunological responses enhances vaccine efficacy. Advanced vaccinology also addresses global health challenges by improving vaccine equity, storage stability, and rapid deployment during pandemics.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		**Practical**		
L	**T**	**PR**	**C**	ESE (E)	PA(M)	ESE (V)	PA (I)	
4	0	8	8	70	30	30	20	150

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Unit 1: Basics of Immunology and Vaccination** • Immune Mechanisms in Vaccination • Types of Immunity: Active, Passive, Herd Immunity • Vaccine Development: From Concept to Commercialization • Global Immunization Programs and Policies • Vaccine Hesitancy and Public Health Challenges	**12**	**20**
2	**Unit 2: Types of Vaccines and Their Development** • Live Attenuated, Inactivated, Subunit, and Conjugate Vaccines • mRNA Vaccines and Their Mechanisms (COVID-19 Vaccines) • DNA Vaccines and Vector-Based Vaccines • Adjuvants and Vaccine Formulation • Vaccine Stability and Cold Chain Logistics	**12**	**20**

3	**Unit 3: Clinical Trials and Regulatory Framework** • Preclinical to Phase IV Trials in Vaccinology • Good Clinical Practice (GCP) Guidelines for Vaccines • Regulatory Approvals: WHO, FDA, EMA, CDSCO • Vaccine Efficacy and Post-Marketing Surveillance • Ethical Considerations in Human Trials	**12**	**20**
4	**Unit 4: Cancer and Therapeutic Vaccines** • Oncolytic Virus-Based Vaccines • CAR-T Cell Therapy and Tumor Vaccines • Peptide and Personalized Cancer Vaccines • Future of AI-Driven Vaccine Design	**12**	**20**
5	**Unit 5: Emerging Trends and Future Perspectives** • Universal Influenza Vaccines • AI and Computational Vaccinology • Challenges in Pandemic Preparedness • Future of Oral and Edible Vaccines	**12**	**20**

Reference Books:

1. Rahul Dubey, “An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications”, Cengage India Publication
2. Raj Kamal, “Internet of Things: Architecture and Design Principles, Mc Graw Hill Education
3. Hanes et al “IoT Fundamentals”, Cisco Press
4. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, Paperback, 2015.
5. A. McEwen, H. Cassimally, “Designing the Internet of Things”, Wiley, 2013.
6. Yashwant Kanetkar, “21 Internet of Things Experiments”, Kindle edition
7. Adeel Javed, “Building Arduino projects for Internet of Things”, Apress publication
8. Donald Noris, “The Internet of Things: Do it yourself Projects with Arduino, Raspberry PI and BeagleBone Black” Mc Graw Hill Publication
9. Adrian McEwen & Hakim Cassimally, “Designing the Internet of things”, Willey publication

List of Experiments (Minimum 6 to be performed):

1. Antigen Characterization using ELISA
2. Antibody Characterization using ELISA
3. Antigen Characterization using Western Blotting
4. Post vaccine immune profiling
   T cell proliferation assay