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|  | FORM ISO 9001: 2015 – KLE TECH Department of Biotechnology | Document #: FMCD2005 | Rev: 1.1 |
| | Detailed Content | Page of <hr/> Year: | |

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|---|---|---|
| Program: Biotechnology | | |
| Course Title: Vaccine Technology | | Course Code: 21EBTE401 |
| L-T-P: 3-0-0 | Credits: 03 | Contact Hours: 03 Hours/Week |
| CIE Marks: 50 | SEE Marks: 50 | Total Marks: 100 |
| Teaching Hours: 40 | Examination Duration: 03 Hours | |
| Unit I | | |
| 1 History of Vaccine Discovery and Development | | |
| <p>Variolation and Vaccination in Late Imperial era, early methods of vaccination, Edward Jenner's Role in the Introduction of Smallpox Vaccine, Eradication of small pox. Fight against polio, Historical background of vaccination, vaccine preventable infectious diseases, Over view of bacterial and viral vaccines and their importance to public health. Epidemiology and pathophysiology of vaccine preventable diseases with special emphasis on Diphtheria, and Tetanus</p> <p style="text-align: right;">07 Hours</p> | | |
| 2. Role of vaccines in epidemiology and public health system. | | |
| <p>Active and passive immunization, General immunization practices, Strategies for improving vaccination levels. Timing and Spacing of Vaccines.. Adverse Reactions Following Vaccination. Contraindications and Precautions to Vaccination. Role of B and T cells, primary and secondary immune response, Immunological memory, Booster doses, Factors influencing the magnitude of vaccine performance, adjuvants. Immune correlates in vaccine development.</p> <p style="text-align: right;">08 Hours</p> | | |
| Unit II | | |
| 3. Vaccine design, development and types: | | |
| <p>Subunit vaccine component - antigen, delivery system. Structure-based Vaccine design - tools and techniques. Characters of effective vaccines: Vaccines, Live, killed, attenuated, sub unit vaccines, conjugated vaccines. Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein based vaccines, plant-based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines, Edible vaccines.</p> <p style="text-align: right;">06 Hours</p> | | |
| 4. Vaccine manufacturing and Quality Control. | | |
| <p>Commercial scale vaccine manufacturing: Upstream (use of cell lines, human diploid) and downstream (chromatography) of active substances. Vaccine formulation (liquid and lyophilization). Use of additives/adjuvants/stabilizers. Vaccine safety and efficacy of vaccines (in vitro and in vivo). cGMP implementation in the production of safe vaccines. Case study of vaccine manufacturing: HBV and polio vaccine</p> <p style="text-align: right;">09 Hours</p> | | |

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Unit III

5. Policies, ethical considerations and Regulatory affairs of vaccines.

Regulation and testing of vaccines, Regulation of vaccines in developing countries, Role and functioning of National Regulatory Authorities (ICMR) and WHO. Different stages of review and regulation of vaccines (investigational new drug application, biologics license application, post-licensure). Evolution of vaccine regulations overtime and the current status of NRAs functionality globally. Brief on Indian regulatory system.

05 Hours

6. Recent advancements in vaccinology:

Concepts of reverse vaccinology, case study of Reverse Vaccinology. Novel vaccine delivery systems. Tools & servers for computational Vaccine design-from Genome to Vaccine. Antigenicity modification, epitope replacement, germline targeting. Antigenically variable infectious agents and their vaccines.

05 Hours

Text Books


1. IAP Textbook of Vaccines by Nitin K Shah, Rohit Agrawal, Vipin M Vashishtha, TU Sukumaran
2. Vaccines. 6th Edition, Stanley Plotkin Walter Orenstein Paul Offit.

Reference Books

1. Vaccine Development and Manufacturing. Emily P. Wen (Editor), Ronald Ellis (Editor), Narahari S. Pujar (Editor).
2. Vaccines & Vaccine Technologies. Jose Ronnie Vasconcelos

Scheme for End semester examination (ESA)

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter numbers | Instructions |
|------|--|-----------------|----------------------|
| I | 3 Questions to be set of 20 Marks Each | 1, 2 | Solve Any 2 out of 3 |
| II | 3 Questions to be set of 20 Marks Each | 3, 4 | Solve Any 2 out of 3 |
| III | 2 Questions to be set of 20 Marks Each | 5, 6 | Solve Any 1 out of 2 |

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|--|---|---|
| Program: Biotechnology | | |
| Course Title: Genomic Data Analysis | | Course Code: 21EBTE402 |
| L-T-P: 3-0-0 | Credits: 03 | Contact Hours: 03 Hours/Week |
| CIE Marks: 50 | SEE Marks: 50 | Total Marks: 100 |
| Teaching Hours: 40 | Examination Duration: 03 Hours | |

Unit I

1. Introduction to Genomics and Data science:

Genomics- Introduction, Structure of prokaryotic and eukaryotic genome, Central dogma, Genome analysis- Introduction, necessity and tools of genome analysis Genome Sequencing methods, Next Generation Sequencing, Introduction to Data Science: Data, Information, Data science, Data science process, Data analytics process, exploratory data analysis, data types and plotting. **5 Hours.**

2. Python for genomic data science:Part I

Introduction, Installation, Jupyter note book, types and sequence, python numbers and strings, variables, handling numerical data, python objects, data structure. **10 Hours**

Unit II

3. Python for genomic data science:Part II

Ifs and loops, python functions, library, communication with outside, modules and package. **5 Hours**

4. Genomic analysis: Algorithms

Introduction, DNA as string, manipulation of DNA, Dynamic programming: Local and Global alignment, BLAST algorithm, DNA assembly. **5 Hours**

5. Biopython


Introduction, working with sequence, sequence objects, sequence alignment, reading genomic sequence files. **5 Hours**

Unit III

6. Introduction to Galaxy software

Introduction, galaxy platform, working with genomic data, creation of work flow, annotation, sharing and publishing of genomic data, Genome and RNA sequence analysis. **5 Hours**

7. Introduction to Bioconductor for Sequence Data

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Sequencing Resources, Ranges Infrastructure, DNA /amino acid sequence from FASTA files, Reads from FASTQ files, Aligned Reads from BAM files, Called Variants from VCF files, Genome Annotations from BED, WIG, GTF files. **5 Hours**

Text Books

1. Bioinformatics with Python Cookbook, Second Edition: Tiago Antao, Ingram short title; 2nd edition (1 January 2018), ISBN-13 : 978-1789344691.
2. R Bioinformatics Cookbook, Dan MacLean, Packt Publishing Limited (11 October 2019), ISBN-13 : 978-1789950694.
3. Hahne F, Huber W, Gentleman R, Falcon S. Bioconductor Case Studies. Springer Publishing Company, 2008. Mathur SK.

Reference Books

1. Lee JK. Statistical Bioinformatics: A Guide for Life and Biomedical Science Researchers. Hoboken, N.J.: WileyBlackwell, 2010.
2. Statistical Bioinformatics with R. Academic Press, 2010.
3. Genome Data Analysis, Ju Han Kim, 2019, Springer Singapore

Scheme for End semester examination (ESA)

| UNIT | 8 Questions to be set of 20 Marks Each | Chapter numbers | Instructions |
|-------------|---|------------------------|----------------------|
| I | 3 Questions to be set of 20 Marks Each | 1, 2 | Solve Any 2 out of 3 |
| II | 3 Questions to be set of 20 Marks Each | 3,4,5 | Solve Any 2 out of 3 |
| III | 2 Questions to be set of 20 Marks Each | 6,7 | Solve Any 1 out of 2 |