Semester VII

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Molecular Diagnostics (BCH-DSE-13)	**4**	**2L**		**2P**	**Class XII with Science and Biology**	**-**

Learning Objectives

The course is designed to enable the students to provide an understanding for students about the significance and scope of molecular diagnostics. The course aims to provide information about protein and DNA/ RNA based molecular diagnostic methods for various genetic, infectious and lifestyle associated diseases. It would expose students to specific disease markers aiding diagnosis. This course would also highlight the advantages and disadvantages of using molecular-based methods compared to conventional methods in disease diagnosis.

Learning Outcomes

On successful completion of the course, a student will:

- By finishing this module, the students will have clarity about the molecular diagnostic methods, their significance and goals.

- Students will get an idea about the Quality assurance and safety procedures that need to be followed in the molecular diagnostic lab.

- The students will be able to understand the application of proteomic, DNA and / RNA based molecular diagnostic methods in various diseases including, cancers, infectious diseases, cardiovascular diseases, and genetic diseases.

- The students would learn about various disease markers.

SYLLABUS OF DSE-13

BCH-DSE-13: MOLECULAR DIAGNOSTICS

Semester – VII

Theory

Credits: 2 **Total Hours: 30**

Unit 1: Introduction to Molecular Diagnostics **No. of hours: 4**

History of diagnostics, Age of molecular diagnostics, Significance, Scope, Rise of diagnostic industry in Indian and global scenario. Ethical issues related to molecular diagnostics. Personal safety and laboratory safety. GLP for handling highly infectious disease samples and documentation.

Unit 2: Protein based molecular diagnostics: **No. of hours: 10**

FDA definition of disease markers, Role of markers in Disease diagnosis. Approaches and methods in the identification of disease markers, predictive and diagnostic value.
Molecular diagnosis of Cancer/ Tumour, Inflammation, cardiovascular diseases (myocardial infarction, hypertension, thrombosis/ clotting defects), cytoskeletal disorders, and diabetes by specific markers.
Applications of molecular diagnostics. Major Histocompatibility Complex (MHC), HLA typing. Role of Molecular diagnostics in bone marrow transplantation and organ transplantation

Unit 3: DNA/ RNA based molecular diagnostics: No. of hours: 10

PCR, RT-PCR, relative-quantitative PCR, multiplex PCR, SNP chromosomal microarrays, RFLP based genetic tests for following disorders: Thalassemia, Sickle Cell anaemia, Fragile-X syndrome, Alzheimer's disease.
Molecular diagnosis of various infectious diseases / vector borne: Dengue, Chikungunya, Ebola and Influenza (H1N1), Corona and HIV.
Whole genome sequencing for diagnosis of drug resistance in bacterial pathogens.

Unit 4: Molecular diagnostics of chromosomal disorders: No. of hours: 06

Chromosomes, Human disorders, and Cytogenetic analysis. Molecular karyotyping/cytogenetics techniques involving Fluorescence in situ hybridization (FISH)-based technology, Array- comparative genomic hybridization and next generation sequencing technologies (NGS). Prenatal diagnosis. Molecular diagnosis for early detection of cerebral palsy, Down's syndrome.

2.3 Practical:

Credit: 2 Total Hours: 60

1. Karyotyping of normal and abnormal human chromosome sets
2. Estimation of C-reactive protein
3. Genotyping of candidate genes for diseases by RFLP
4. Detection of DNA damage by comet assay
5. Troponin T test (Cardiac troponin I (cTnI)) test
6. Haemoglobin A1c (HbA1c) Test for Diabetes
7. D- Dimer test for blood clotting disorder
8. Case studies

Essential Readings:

1. George Patrinos Wilhelm Ansorge Phillip B. Danielson (2016). Molecular Diagnostics (3rd Edition) Elsevier Publishing Group. ISBN: 9780128029718

2. Nader Rifai A. Rita Horvath Carl T. Wittwer Jason Park (2018). Principles and Applications of Molecular Diagnostics. Elsevier Publishing Group. ISBN: 9780128160619
3. Wayne W. Grody and Frederick L. Kiechle (2010). Molecular Diagnostics Techniques and Applications for the Clinical Laboratory. Elsevier Publishing Group. ISBN: 9780123694287
4. Jim Huggett and Justin O'Grady (2014). Molecular Diagnostics – Current Research and Application. Caister Academic Press. ISBN: 978-1-908230-41-6
5. William B. Coleman and Gregory J. Tsongalis (2005). Molecular Diagnostics for the Clinical Laboratorian. Springerlink. ISBN: 978-1-59259-928-8

3. Teaching Learning Process and Assessment Methods

Facilitating the Achievement of Course Learning Outcomes**

Unit No.	Course Learning Outcomes	Teaching and Learning Activity	Assessment Tasks
I	Students would learn about GLP followed in Molecular diagnostics lab.	Teaching will be conducted both through black board mode and power point presentation mode. Students would also learn concepts by conducting lab practicals.	Students will be given questions that are application based and require analytical skills. Quizzes will be held to gauge their conceptual understanding. Lab skills will be tested.

II	Students would learn about various protein markers in disease diagnosis.	Teaching will be conducted both through black board mode and power point presentation mode. Students would also learn concepts by conducting lab practicals.	Students will be given questions that are application based and require analytical skills. Quizzes will be held to gauge their conceptual understanding. Lab skills will be tested.
III	Students would learn about various DNA / RNA based diagnostic methods.	Teaching will be conducted both through black board mode and power point presentation mode. Students would also learn concepts by conducting lab practicals.	Students will be given questions that are application based and require analytical skills. Quizzes will be held to gauge their conceptual understanding. Lab skills will be tested
IV	Students would learn about diagnosis of various chromosomal disorders,	Teaching will be conducted both through black board mode and power point presentation mode. Students would also learn concepts by conducting lab practicals.	Students will be given questions that are application based and require analytical skills. Quizzes will be held to gauge their conceptual understanding. Lab skills will be tested

(Assessment tasks enlisted here are indicative in nature)**

Keywords:

Molecular diagnostics, protein disease markers, DNA / RNA based diagnosis, chromosomal disorders