



Department of Biotechnology	LP:BT22046
B.E/B.Tech/M.E/M.Tech : Biotechnology Regulation:2022	Rev. No: 00
PG Specialisation : Not Applicable	Date: 05-07-2024
Sub. Code / Sub. Name : BT22046 / Molecular Therapeutics and Diagnostics	
Unit : I	

Unit Syllabus: 1 GENE THERAPY AND GENE SILENCING TECHNOLOGY

9 Hrs

Gene therapy, Intracellular barriers to gene delivery, Overview of inherited and acquired diseases for gene therapy, Retro and Adeno virus mediated gene transfer, Gene silencing technology, Antisense therapy, si RNA, Tissue and organ transplantation, Transgenics and their uses.

Objective: To acquire the knowledge on gene therapeutic and gene silencing techniques.

Session No *	Topics to be covered	Ref	Teaching Aids
1	Introduction to gene therapy – Ex vivo, In vivo Gene delivery methods – Viral, Physical and Non viral	RB 5 Pg.419-420 RB 2 Pg.420-423	GCR
2	Gene therapy for inherited and acquired diseases- CF and Cancer Gene transfer using retro viruses – Life cycle and Types	TB 2 Pg.149-163 RB 4 Pg.33-60	GCR
3	Gene transfer using adeno viruses – Adeno associated virus Non viral gene delivery methods – Microinjection, Particle bombardment	RB 4 Pg.61-92	GCR
4	Liposomes and gene delivery – preparation and dispersion Nanoparticles and gene delivery – Conjugation	RB 2 Pg.93-112	GCR
5	Gene therapy for monogenic disease and multifactorial disease	RB 1 Pg.191-335	GCR
6	Introduction to gene silencing Antisense therapy and gene silencing Si RNA and its importance in gene silencing	TB2 Pg. 181-187	GCR
7	Organ transplantation	RB1 Pg. 481-490	GCR
8	Gene silencing in tissues Ethical issues in gene silencing technology	TB2 Pg. 189-204 TB2 Pg. 231-245	GCR
9	Basics of Transgenics technology and Transgenics animals	TB2 Pg. 83-97	GCR
Content beyond syllabus covered (if any): Dendrimers			

* Session duration: 50 minutes



Sub. Code / Sub. Name: **BT22046 / Molecular Therapeutics and Diagnostics**

Unit : II

Unit Syllabus :2 CELLULAR THERAPY

9 Hrs

Cellular therapy- Stem cells definition, properties and potency of stem cell, Sources - embryonic and adult stem cells, Concept of tissue engineering - Role of scaffolds, Role of growth factors, Role of adult and embryonic stem cells, Clinical applications, Ethical issues.

Objective: To inculcate the importance of cellular therapy.

Session No*	Topics to be covered	Ref	Teaching Aids
10	Introduction to stem cells and cellular therapy	RB 5 Pg.453-457	GCR
11	Stem cells, properties and potency – Totipotent, pluripotent and multipotent	RB 2 Pg.457-459	GCR
12	Various types of stem cells and their identification – flow cytometry	TB 2 Pg.137-145	GCR
13	Basic concepts in tissue engineering	TB 2 Pg.137-146	GCR
14	Biomaterials types	TB 2 Pg.137-146	GCR
15	Scaffolds and tissue engineering	TB 2 Pg.137-146	GCR
16	Growth factors in tissue engineering	TB 2 Pg.137-146	GCR
17	Clinical applications of stem cell therapy	TB 2 Pg.145-147	GCR
18	Ethical issues in stem cell therapy	TB 2 Pg.137-146	GCR
Content beyond syllabus covered (if any): CAR-T Cell Therapy			

* Session duration: 50 mins



Sub. Code / Sub. Name: **BT22046 / Molecular Therapeutics and Diagnostics**

Unit : III

Unit Syllabus: 3 RECOMBINANT THERAPY

9 Hrs

Recombinant therapy - Clinical applications of recombinant technology, Erythropoietin, Insulin analogs and its role in diabetes, Recombinant human growth hormone, Streptokinase and urokinase in thrombosis, Recombinant coagulation factors.

Objective: To impart the knowledge on recombinant DNA technology and its applications.

Session No *	Topics to be covered	Ref	Teaching Aids
19	Recombinant protein production technology	RB 5 Pg.37-56	GCR
20	Recombinant erythropoietin and its applications	RB 5 Pg.272-278	GCR
21	Diabetes	RB 5 Pg.291-292	GCR
22	Recombinant insulin and analogs	RB 5 Pg.292-304	GCR
23	Recombinant growth hormone and its applications	RB 5 Pg.307-309	GCR
24	Recombinant streptokinase in thrombosis	RB 5 Pg.350	GCR
25	Recombinant urokinase in thrombosis	RB 5 Pg.350	GCR
26	Recombinant coagulation factors	RB 5 Pg.329-339	GCR
27	Testing of recombinant products before human use	RB 5 Pg.74-104, 173-202	GCR
Content beyond syllabus covered (if any):			

* Session duration: 50 minutes



Sub. Code / Sub. Name: **BT22046 / Molecular Therapeutics and Diagnostics**

Unit : IV

Unit Syllabus: 4 IMMUNOTHERAPY

9 Hrs

Immunotherapy - Monoclonal antibodies and their role in cancer, Role of recombinant interferons, Immuno-stimulants, Immuno-suppressors in organ transplants, Role of cytokine therapy in cancers, Vaccines - types, recombinant vaccines and clinical applications.

Objective: To provide an insight on the immunotherapeutic techniques

Session No *	Topics to be covered	Ref	Teaching Aids
28	Introduction to immunotherapy	RB 5 Pg.371-373	GCR
29	Monoclonal antibody production – selection and screening	RB 5 Pg.373-378	GCR
30	Monoclonal antibodies in cancer treatment - rituximab	RB 5 Pg.379-395	GCR
31	Immunotherapy with recombinant interferons	RB 5 Pg.205-237	GCR
32	Recombinant cytokines and cancer therapy	RB 5 Pg.241-262	GCR
33	Principles and tests for organ transplant	RB 5 Pg.99-112	GCR
34	Immunostimulants and immunosuppressants in organ transplant	RB 1 Pg.491-494	GCR
35	Recombinant technology in vaccine production – vectors and hosts	RB 5 Pg.396-400	GCR
36	Recombinant vaccines and clinical applications – subunit vaccines, ScFv	RB 5 Pg.400-416	GCR

Content beyond syllabus covered (if any):

* Session duration: 50 mins



Sub. Code / Sub. Name: **BT22046 / Molecular Therapeutics and Diagnostics**

Unit : V

Unit Syllabus: 5 MOLECULAR DIAGNOSTICS

9 Hrs

Quality control in molecular diagnostics, Ethical Concerns in Molecular Diagnostics, Microfluidics and Lab-on-chip in molecular diagnostics, AI and ML in molecular diagnostics, Nanotechnology based molecular diagnostics, Single cell Analysis, Integration of Multi-omics Data.

Objective: To illustrate the application of molecular diagnostics in future perspectives

Session No *	Topics to be covered	Ref	Teaching Aids
37	Molecular Diagnostics techniques	Weblink	GCR
38	Quality control and Ethical Concerns in Molecular Diagnostics	Weblink	GCR
39	Microfluidic tools for biological research	Weblink	GCR
40	Introduction to Lab on Chip Miniaturized Devices for point of care molecular detection	Weblink Weblink	GCR
41	AI and ML in molecular Diagnostics	Weblink Weblink	GCR
42	Nanotechnology in molecular Diagnostics	Weblink	GCR
43	Single Cell Genomics – Analysis and Future perspectives	Weblink	GCR
44	Single Cell RNA seq – Immunology applications	Weblink	GCR
45	Integration of Multi omics Data	Weblink	GCR

Content beyond syllabus covered (if any): Nil



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TEXT BOOKS:

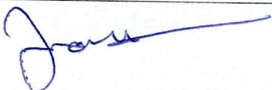
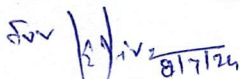
1. Bernhard, O. P & Sangeeta, N. B. Tissue Engineering, 2nd ed., Prentice Hall, 2009.
2. Pamela, G & Michelle, M. Molecular Therapeutics: 21st Century Medicine, John Wiley & Sons Limited, 2008.

REFERENCE BOOKS:

1. Goldsby, R.A., Kindt, T.J., Osbome, B.A & Kerby, J. Immunology, 5th Ed., W.H Freeman, 2003.
2. Winnacker, E.L., From Genes to clones: Introduction to Gene Technology, Panima Publishing Corporation, 2003.
3. Glick, B.R., & Pasternak, J.J., Molecular Biotechnology: Principles and applications of recombinant DNA, 3rd Ed., ASM Press, 2003.
4. Lemonie, N.R., & Cooper, D.N., Gene therapy, Oxford BIOS Scientific Publishers, 1996.
5. Gary Walsh, Pharmaceutical Biotechnology: Concepts and Applications, Wiley, 2007.

WEBLINK

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7108329/>
2. <https://www.degruyter.com/document/doi/10.1515/cclm-2011-0707/html>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2998071/pdf/nihms241651.pdf>
4. <https://www.elflow.com/microfluidic-reviews/general-microfluidics/introduction-to-lab-on-a-chip-review-history-and-future/>
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5285266/pdf/nihms845042.pdf>
6. <https://genomemedicine.biomedcentral.com/articles/10.1186/s13073-019-0689-8>
7. <https://www.nature.com/articles/s41388-021-01861-y>
8. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7121078/pdf/978-1-4939-6966-1_Chapter_4.pdf
9. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3907301/pdf/pgen.1004126.pdf>
10. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6460502/pdf/41423_2019_Article_214.pdf
11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7003173/pdf/10.1177_1177932219899051.pdf

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Remarks *: Nil		