The Kelkar Education Trust's

V. G. Vaze College of Arts, Science and Commerce

(Autonomous)

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Vinayak Ganesh Vaze College of Arts, Science & Commerce

AUTONOMOUS

College with Potential for Excellence

Syllabus for M. Sc. Part-II Programme

BOTANY

Syllabus as per Choice Based Credit System (NEP-2020)

(To be implemented from June 2024 Onwards)

Submitted by

Department of Botany

Vinayak Ganesh Vaze College of Arts, Science and Commerce (Autonomous)

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Syllabus as per Choice Based Credit System (NEP 2020)
Syllabus for Approval

Sr. No.	Heading	Particulars
1	**Title of Programme**	M. Sc. Botany: Semester III and IV
2	**Eligibility for Admission**	The B.Sc. degree examination of this university with Botany 6 units or 3 units or degree of any other universities recognized as equivalent thereto.
3	**Passing marks**	Minimum D Grade or equivalent minimum marks for passing at the Graduation level.
4	**Ordinances/Regulations (if any)**	---
5	**No. of Years/Semesters**	One year/Two semester
6	**Level**	P.G. part - I: Level-6
7	**Pattern**	Semester
8	**Status**	Revised
9	**To be implemented from the Academic year**	2024 – 2025

Date: …….

Signature BOS Chairperson:

…….

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Post Graduate Programs in Botany

Year 2 Yr PG	Level	Sem. (2 Yr)	Major		RM	OJT / FP	RP	Cum.Cr.	Degree
			Mandatory*	**Electives Any One**					
1	6.0	Sem-III	For Cytogenetics, Plant Biotechnology and Molecular Biology Specialization Course 1 Credits 4:**Molecular Biology and Cytogenetics (VGVPSMBO301)** Course 2 Credits 4: **Molecular Biology I (VGVPSMBO302)** Course 3 Credits 4: **Cytogenetics I and Plant Breeding (VGVPSMBO303)** Course 4 Credits 2: **Practicals based on Course 1 and Course 2(VGVPSMBOP301)**	**Credits 4 (2+2)** Course 1: **Nanotechnology I(VGCPSELBOP301)** **OR** Course 2: **Fermentation Technology (VGCPSELBOP302)**	--	--	04	22	PG Diploma (after 3-Year Degree)
		Sem-IV	For Cytogenetics, Plant Biotechnology and Molecular Biology Specialization Course 1 Credits 4**: Plant Biotechnology IVGVPSMBO401** Course 2 Credits 4: **Molecular Biology IIVGVPSMBO402** Course 3 Credits 4: **Molecular Biology and Cytogenetics IIVGVPSMBO403** Course 4 Credits 2:**VGVPSMBOP401**	**Credits 2** **Course 1: Food Technology (VGCPSELBOP401)** **OR** **Course 2: Enzyme Technology (VGCPSELBOP402)**	-- --	 --	 06	 22	
Cum. Cr. for PG Diploma			**28**	**8**	**4**	**4**	**--**	**44**	
Exit option: PG Diploma (44 Credits) after Three Year UG Degree									

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Programme: M.Sc. Botany **Semester**: III

Course:Molecular Biology and Cytogenetics I

Course code:**VGVPSMBO301**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
4	-	2	4	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives
To understand the control points in a cell cycle
To apply principles of microbial genetics
To understand the structure of the cell membrane, its function and cell-cell Interactions.
The study of different banding techniques will help in understanding the karyotype related to human syndromes. To study the principle, technique and applications of FISH, CGH, SKY

Course Outcomes
Students will be able to understand the checkpoints in cell cycle and process of Apoptosis.
The students will be able to acquaint the structure and function of the cell membrane and cell-cell interactions. The students will understand the role of genetic counselling and gene therapy in resolving genetic disorders.
The students will be familiar with different various molecular cytogenetic methods like FISH, CGH, SKY.

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Semester – III

Paper I

	Molecular Biology and Cytogenetics I	
Unit I	**Cell Cycle and Apoptosis**	**10 Hrs**
	Checkpoints during cell cycle - G1 to S, Progression of S phase, G2 to M phase, Anaphase check points and components involved as regulators of checkpoints, role of RBs, E2Fs and DP proteins.	
	Different types of Cyclin dependent CDKs.Role of cyclins and CDKs, synthesis and degradation of cyclins, structural features of CDKs and cyclins, activation and inactivation of cyclin dependent kinases.	
	P53, different types of Cyclin dependent CDKs, CDC25, CAKs, Wee1 proteins, nim proteins, SCFs, Anaphase Promoting Complex APC (Cyclosomes).	
Unit II	**Genetics**	**10 hrs**
	Microbial Genetics: Molecular basis of Transformation, transduction, conjugation; fine structure of the gene, T4 Phage, complementation analysis, deletion mapping, cis-trans tests.	
	Tetrad analysis in Neurospora: Linkage detection (2 genes and centromere)	
Unit III	**Cytology**	**10 hrs**
	Cell membrane and permeability: Molecular models of cell membrane, cell permeability. Differentiation of cell membrane, intercellular communications and gap junctions. Cell coat and cell recognition, cell surface.	
	Karyotype studies: Analysis of Nomenclature, Banding Techniques- Giemsa banding, C-banding and R- banding. Techniques of detecting human syndromes.	
	Molecular Cytogenetics Methods: Principle, Technique and Applications of FISH, CGH, SKY.	
Unit IV	**Non-Mendelian Genetics**	**10 hrs**
	Multiple and lethal alleles, Essential genes.	
	Gene expression and the environment, Gene Interactions involving modifier genes.	
	Modification of dominance relationships and modified Mendelian ratios.	
	Maternal effect, Extranuclear inheritance.	

References:

1. Glick. B.R. & Thompson. J.E. 1993. Methods in Plant Molecular Biology andBiotechnology. CRC Press, Boc Raton, Florida.

2. Sybenga. J. 1973. General Cytogenetics. American Elsevier Pub. Co., New York.

3. Swanson, Merz& Young. 1967. Cytogenetics. Prentice Hall India.

4. Lewis. K.R. & John. B. 1963. Chromosome Marker. J & A Churchill Co., London.

5. Alberts. B., Breyer. D., Hopkin. K., Johnson. A.D., Lewis. J., Raff M., Roberts. K.Watter. P. 2014. Essential Cell Biology. 4th Edition. Garland Publishers, New York.

6. Karp. G. 2013. Cell and Molecular Biology – Concepts and Experiments. 7th Edition. Wiley Global Education, USA.

7. De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and MolecularBiology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].

Teaching Scheme (Hrs/Week)	Continuous Internal Assessment (CIA) 40 marks	End Semester Examination	Total

8. Sadova David – 2004 (First Indian Edition). Cell Biology, New Delhi.

9. Albert et al 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science(Taylor and Francis) New York Group.

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L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
4	-	2	4	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Programme: M.Sc. Botany **Semester**: III

Course Name: Molecular Biology I

Course code: **VGVPSMBO302Credits:** 04

Course Objectives
To Develop basic understanding of cellular and molecular biology, understand various molecular mechanisms of replication, RNA processing and translation.
To Distinguish between molecular mechanisms of prokaryotes and eukaryotes.

Course Outcomes
The study on Replication, Transcription and Translation will develop a keen understanding of the molecular mechanisms involved in these processes.

Semester III

Paper II

	Molecular Biology I	Credits 04
Unit I	**DNA Replication**	**Lectures 10**
	Molecular details of DNA replication in prokaryotes and eukaryotes. Assembly of raw DNA into nucleosomes.	
	DNA recombination, holliday model for recombination.	
Unit II	**Transcription**	**Lectures 10**
	Classes of RNA and the associated genes.	
	Transcription of protein coding genes in prokaryotes and eukaryotes, mRNA molecules.	
	Transcription of other genes: ribosomal RNA, and ribosomes, tRNA.	
Unit III	**RNA processing**	**Lectures 10**
	Capping, polyadenylation, splicing, introns and exons.	
	snRNAs : Types and Significance, snRNA in Spliceosome	
Unit IV	**Translation**	**Lectures 10**
	Protein structure, nature of genetic code, translation of genetic message.	
	Post-translational modification, Localization and Chaperons	

References:

1. Lewin B. 2000. Genes VII. Oxford University Press, New York.
2. Alberts, B., Bray, D Lewis, J., Raff, M., Roberts, K and Walter 1999. Molecular biology of the Cell. Garland Publishing, Inc., New York.
3. Wolfe S.L 1993 Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
4. Gupta. P.K. 1995. Cytogenetics. Rastogi& Co., Meerut.
5. Glick. B.R. & Thompson. J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boca Raton, Florida.
6. Sybenga. J. 1973. General Cytogenetics. American Elsevier Pub. Co., New York.
7. Swanson, Merz& Young. 1967. Cytogenetics. Prentice Hall India.
8. Lewis. K.R. & John. B. 1963. Chromosome Marker. J & A Churchill Co., London
9. Wilson. J.,& Hunt. T. 2007. Molecular Biology of the Cell. 5th Edition. The Problems Book. 2nd Edition. Garland Publisher, New York.

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Programme: M.Sc. Botany **Semester**: III

Course:Cytogenetics I and Plant Breeding

Course code: **VGVPSMBO303**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
4	-	2	4	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives
To understand the role of genetic counselling and gene therapy in solving the problems of genetic disorders.
To study the nature of various biochemical and sex-linked disorders.
To understand the components of the immune system and applications in health care.

Course Outcomes
The students will understand the role of genetic counselling and gene therapy in resolving genetic disorders.
Study of the immune system will help students to understand its application in healthcare.

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Semester – III
Paper III

Course Code: VGVPSMBO303 **Credits: 4**

	Cytogenetics I and Plant Breeding	
Unit I	**Plant Breeding**	**10 hrs**
	Aims and objectives, plant introductions and acclimatization.	
	Selection – mass, pure line and clonal	
	Hybridization techniques, hybridization in self-pollinated and cross-pollinated plants	
	Genetic control and manipulation of breeding systems including male sterility and apomixis.	
Unit II	**Immune System**	**10hrs**
	Phylogeny of immune system, innate and acquired immunity, nature and biology of antigens, major histocompatibility complex cells of immune system, regulation of immune responses. Production of antibodies by plant cells and organs.	
	Immunity in Health and Diseases: Immunodeficiency and AIDS	
Unit III	**Genetic Disorders**	**10hrs**
	Genetic disorders (Down syndrome, Thalassemia, Tay-Sachs Disease, Sickle Cell Anaemia)	
	Sex linked disorders (Colour blindness and Haemophilia)	
	Biochemical disorders (Phenylketonuria)	
	genetic counselling and gene therapy	
Unit IV	**Molecular Evolution**	**10Lectures**
	Patterns and modes of Substitutions	
	Molecular clocks and Phylogeny	
	Acquisition and origins of new functions	
	Arabidopsis genome	

References:

1. Al Chaudhari, H.K. (1984). Elementary principles of plant breeding Oxford IBH, New Delhi lards R W (1995). Principles of Plant Breeding. John Wiley and Sons, Inc.
2. Allard, R.W, 1960. Principles of plant breeding. John Willeg, New York.
3. Chaudhary, H. K. (2001) Plant Breeding Theory and Practice, Oxford IBH Ltd, New Delhi, India
4. David Allen Sleper, John Milton. (2006). Breeding Field Crops. Blackwell Publishing

5. Dwivedi and Singh (1980) Essentials of Plant Techniques, 2nd Ed., Scientific Publishers. Moan Bhavan Udaipur, India.
6. Gardner, E.J. (1972). Principles of genetics. Wiley Eastern Pvt.Ltd.
7. Ghahal G S and Gosal S S (2002). Principles and procedures of Plant Breeding. Narosa Publishing House.
8. Hays, K.K. Immer, F.R. and Smith, D.C. (1985). Methods in plant breeding .Tata McGraw Hill.Newyork.
9. Neal.C.Stopskopf. (1999). Plant Breeding Theory & Practices. Scientific Publ, Jodhpur.
10. Sharma J R (1994). Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers
11. Singh,B.D. 2001. Plant Breeding, Principles and Methods.Kalyani Publications,
12. Swaminathan, M.S, P.K.Gupta and V.Singa. (1983). Cytogenetics of crop plants. Macmillan India Ltd, New Delhi.
13. Sharma J R (1994). Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers
14. Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.
15. Swanon. M. & Young. 1982. Cytogenetics. Prentice Hall, India
16. Snustad. P & Simmons. M.J. 2003. Principles of Genetics. 3rd Ed. John Wiley & Sons Inc., USA

Sr. No.	**Practicals Based on Paper I (Molecular Biology and Cytogenetics I)**	**Credits 02**
1.	Effect of plant extracts on cell division.	
2.	Blue-white screening for bacterial transformation.	
3.	Problems based on Neurospora tetrad analysis.	
4.	Giemsa staining	
5.	Aseptic techniques, safe handling of microorganisms, establishing pure cultures, streak plate method, Maintenance of cultures - Paraffin embedding, Lyophilisation.	
6.	Preparation of culture medium, stock solutions and growth curve, determination of viable cells, determination of cell number.	
7.	Isolation of Genomic DNA and Quantification	
8.	Agarose Gel Electrophoresis	

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Programme: M.Sc. Botany **Semester**: III

Course: Nanotechnology (Elective I)

Coursecode: **(VGCPSELBOP301)**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
02	-	02	2	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives
To understand the concepts of Nanotechnology, its importance and need in biological systems.
The need for Nanotechnology in the modern era of multidisciplinary aspects of biology and its uses.
To understand the rapidly developing field of nanotechnology and developing skills for advanced research endeavors in nanotechnology.
To understand the pros and cons of nanotechnology and applicability of the same in various fields.
To comprehend the requirements and technologies involved in food biotechnology and implementation of quality control parameters.

Course Outcomes
They will learn the sources, extraction, formation of Nanoparticle and applications of Nanotechnology.
They will get acquainted with the role of Nanotechnology in plant science and human science.
The study of various concepts of nanotechnology will develop the skills of application of nanoparticles in various fields of science.
The studies related to biotechnology will make the students aware of the applications of different factors in the Food industry.

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Elective 1: **Nanotechnology I**

Course Code: VGCPSELBOP301 **Credits: 2**

	Nanotechnology I	
Unit I	Introduction, synthesis of nanomaterials.	**10 hrs**
	Green synthesis of Nano-materials: Use of microbial system and plant extracts, use of proteins and templates like DNA.	
Unit II	Application of nanomaterials in food, cosmetics, agriculture, environment management and medicine.	
	Risk of Nanomaterials to human health and Environment.	

Elective 2: Fermentation Technology

Course Code: VGCPSELBOP302 **Credits: 2**

	Fermentation Technology	
Unit I	Introduction and Principles of microbial growth	**10 hrs**
	Media design for fermentation processes and solid substrate fermentation	
	Fermentation Technology	
Unit II	Bioreactors/ Fermenter and its scale up	
	Technology of Mammalian and Plant cell culture, downstream processing	

References:

1. Bagchi, D., Lau, F.C. and Ghosh, D.K. (Eds.). 2010. Biotechnology in functional foods and nutraceuticals. CRC Press, Boca Raton, Florida, USA.
2. Duggan, C., Watkins, J.B. and Walker, W.A. (Eds.). 2008. Nutrition in pediatrics: basic science and clinical applications. People's Medical Publishing House, Hamilton, USA.
3. Government of Canada, 2013. Nutraceuticals / Functional Foods and Health Claims on Foods. Policy Paper. Hasler, C.M. (Ed.) 2005. Regulation of functional foods and nutraceuticals: A global perspective. IFT Press and Wiley-Blackwell, Ames, Iowa, USA.
4. Katsilambros, K. 2011. Clinical nutrition in practice. John Wiley & Sons, New York. USA.
5. Nestle, M. 2002. Food politics. University of California Press, Berkeley, USA.

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Semester – IV

Programme: M.Sc. Botany **Semester**: IV

Course: Plant Biotechnology I

Course code: **VGVPSMBO401**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	T	P	C	CIA-1	CIA-2	CIA-3	CIA-4	Lab	Written	
4	-	2	4	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives
To Understand the basic concepts, technical skills, hands-on experience and training in plant tissue culture.
To Develop competency in production and enhancement of secondary metabolites.
To Understand advanced methods of biotransformation for product enhancement.
To Apply the fundamental principles of transgenic plants in phytoremediation and in vitro germplasm conservation.
To Understand the basic principles of effective bioreactor design for large scale production of metabolites

Course Outcomes
Tissue culture methodology will make the students acquainted with different culturing methods, factors affecting in-vitro and Ex-vitro cultivation.
Study of Cell cultures will help in understanding the role of suspension cultures and elicitors in increasing the production of secondary metabolites.
Tissue culture techniques will also help in conservation of germplasms of endangered plants.
Students will also understand the commercial applications of Plant Tissue Culture which will open new avenues in the field of entrepreneurship.

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Semester IV

Paper I

Course code: **VGVPSMBO401**

	Plant Biotechnology I	Credits 04
Unit I	**Plant Tissue Culture-I**	**Lectures 10**
	Micropropagation of floricultural and medicinal plants using organogenesis and embryogenesis.	
	Factors responsible for *in vitro* and *ex vitro* hardening.	
	Plant improvement through somaclonal variations, anther culture.	
	Metabolic engineering: production of useful secondary Metabolites through biosynthetic pathway in cell and tissue suspension culture	
Unit II	**Plant Tissue Culture-II**	**Lectures 10**
	Plant cell cultures as chemical factories: Cell suspension, enhancement of product formation using biotic and abiotic elicitors, immobilization, permeabilization and product recovery.	
	Plant cell culture systems: A potential source of flavors, fragrances and colorants	
	Biotransformation using cell cultures for e.g. Vanillin production from *Capsicum* cell cultures.	
Unit III	**Plant Tissue Culture-III**	**Lectures 10**
	In vitro storage of germplasm, cryopreservation.	
	Studies on *Agrobacterium* mediated transformed root cultures.	
	Transgenic plants in phytoremediation	
	Scale-up of secondary metabolites from hairy roots	
Unit IV	**Commercial applications of plant tissue culture**	**Lectures 10**
	The quest for commercial production from plant cell scaling up of cell cultures.	
	Bioreactors: important factors for bioreactor design, pneumatically agitated bioreactors, comparison of bioreactors, operating mode, batch, fed-batch, semicontinuous, two stage operation, continuous cultivation, facts for growth in bioreactors	
	Study of Shikonin production by *Lithospermum erythrorhizon* cell cultures.	

References :

1. Bhojwani. S.S. & Razdan. M.K. 1996. Plant Tissue Culture: Theory and Practice Rev.Ed.). Elsevier Science Publishers, New York.
2. Chawla. H.S 1999. Introduction to Plant Biotechnology. Oxford & IBH.
3. Collin. H.A & Edwards. S. 1998. Plant Cell Culture. Bioscientific Publishers, Oxford, UK.
4. Gamborg& Phillips. Plant Cell, Tissue and Organ Culture. Narosa Publications.
5. Jain. S.M., Sopory. S.K. &Valleux. R.E. 1996. In Vitro Haploid Production in Higher Plants. Volumes 1 to 5. Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecth, Netherlands.
6. Kalyan Kumar De. 1997. Plant Tissue Culture. NCB Agency, Kolkata.
7. Ramawat. K.G. &Merillon. J.M. 2007. Biotechnology: Secondary Metabolites. 2nd Ed. Science Pub., Netherlands.
8. Razdan. M.K. 2003. An Introduction to Plant Tissue Culture. Oxford & IBH, New Delhi.
9. ShuklaY. M, Patel N. J. ,Jithendra J D, Bhatnagar R, Talati J. G , Kathiria K. B. 2009, Plant Secondary Metabolites, New India Publishing Agency, Gujarat.

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V. G. Vaze College of Arts, Science and Commerce (Autonomous)

Programme: M.Sc. Botany **Semester**: IV

Course: Molecular Biology II

Course code:**VGVPSMBO402**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
4	-	2	4	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives
To Compare expression of gene regulation in prokaryotes and eukaryotes.
To Understand the working of the operon models
To understand the basics of cell signaling and different forms of signaling
To Analyze different signaling pathways which play an important role in metabolism and development of the organism

Course Outcomes
The study of gene regulation will make students understand the various factors responsible for regulation of gene expression in prokaryotes and eukaryotes.
Students will get acquainted with various signaling pathways in the cell and will also understand the interactions of different signals (Ligand) to its receptor.

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Paper II

Course Code: **VGVPSMBO402**

	Molecular Biology II	Credits 04
Unit-I	**Gene Regulation- I**	**Lectures 10**
	Regulations of gene expression in bacteria – *trp* operon, arabinose Operon, Lactose Operon	
Unit-II	**Gene Regulation- II**	**Lectures 10**
	Regulation of gene expression in bacteriophage λ.	
	Gene Editing – CRISPR-cas technology	
Unit-III	**Gene Regulation -III**	**Lectures 10**
	Genetic regulation of development in *Drosophila*, Developmental stages in *Drosophila*- Embryonic development, imaginal discs, homeotic genes	
Unit-IV	**Cell signalling**	**Lectures 10**
	Bacterial and plant two component systems, bacterial and chemotaxis and quorum sensing	
	Light signalling in plants	

References:

1. De Robertis & De Robertis, 2004. Cell and Molecular Biology. Lippincott. Williams and Wilkins. USA.
2. Freifelder, 1990. Molecular Biology, Narosa Publishing House, New Delhi.
3. Jain, H.K. 2000. Genetics, Oxford & IBH, New Delhi 13. Jocelyn E Krebs, Elliott S Goldstein, Stephen T Kilpatrick (2011). Lewin's Genes X. Jones and Bartlett Publishers.
4. Mary A. Schuler Raymond and E.Zielinski, 2005. Methods in Plant Molecular Biology, Academic Press an imprint of Elsevier.
5. Peter Porella, 1998. Introduction to Molecular Biology, McGraw – Hill, New York
6. Rastogi, S.C. 2004. Cell Biology. New age International Pub. New Delhi.
7. Robert J Brooker (2009). Genetics: analysis and principles (III Edn). McGraw Hill.
8. Schuler MA and Selinski, R. 1989. Methods in molecular Biology
9. David A Micklos, Greg A Freyer with David A Crotty (2003). DNA Science: A first course (II Edn).
10. Swanson, C.P. 1972. Cytology and Cytogenetics. Mac Millan. New York.
11. Goodenough U, 1990. Genetics. Armugam N, 1992. Organic evolution.
12. Basu.S.B. and M.Hossain.2004. Principles of Genetics. Books and Allied (P). Ltd, Kolkata.
13. Benjamin, Levin. 2004. Genes VIII. Oxford university press. Blackwell Science Ltd.

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Programme: M.Sc. Botany **Semester**: IV

Course: Molecular Biology and Cytogenetics II

Course code: **VGVPSMBO403**

Teaching Scheme (Hrs/Week)				**Continuous Internal Assessment (CIA) 40 marks**					**End Semester Examination**	**Total**
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
4	-	2	4	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives
To understand the fundamental aspects of plant breeding and hybridization along with the latest molecular techniques.
To apply the principles of plant breeding for large scale production of high yielding, abiotic and biotic stress resistant plants in agriculture and horticulture.
To outline various applications and achievements of distant hybridization in crop improvement
To apply DNA-based molecular marker aided breeding techniques in plant genetic engineering.

Course Outcomes
Studies related to plant breeding and hybridization along with the help of molecular techniques will help in understanding the importance of plant breeding in crop improvement.
Application of Gene Transfer techniques will help in understanding the role of transgenic plants.
Use of molecular markers will make the students understand the difference between pure line and hybridized lines or transgenics.

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Paper III

Course code: **VGVPSMBO403**

	Molecular Biology and Cytogenetics II	Credits 04
Unit-I	**Plant Breeding-II**	**Lectures 10**
	Distant hybridization: In nature. In plant breeding – Barriers to the production of distant hybrids; Unreduced gametes in distant hybridization; Sterility in distant hybrids; Consequences of segregation in distant hybrids	
	Applications and Achievements of distant hybridization in crop improvement; Limitations of distant hybrids.	
Unit-II	**Cancer Biology**	**Lectures 10**
	Cancer cells: Characteristics, division, spread, treatment. Course of cancer cell formation,	
	Carcinogens: radiations, chemicals, and oncogenic viruses.	
	Cancer and mutations, reproductive properties of transformed animal cells in culture, oncogenes, proto-oncogenes and their conversion. Oncogenes and growth factors.	**Lectures 10**
	Stem cells, Regenerative medicines	
Unit-III	**Population Genetics**	
	Genetic Structure of Population - Genotypic frequencies, Allele frequencies.	
	Hardy-Weinberg's Law - Assumptions, predictions and derivatization of law, Random, Genetic Drift in Natural Population, Mutations, Natural Selection, Migration.	
	Fitness and Co-efficient of Selection, Mating, Inbreeding, Speciation	
Unit-IV	**Genomics**	**Lectures 10**
	The human genome Project, ethical, legal and social implications of human genome	
	Assembling and annotating genome sequences	
	Genome sizes and Gene densities (Bacteria, archaea,Eukarya)	
	Future directions in Genomics	

References:

1. Al Chaudhari, H.K. (1984). Elementary principles of plant breeding Oxford IBH..New Delhi lards R W (1995). Principles of Plant Breeding. John Wiley and Sons, Inc.
2. Allard, R.W, 1960. Principles of plant breeding. John Willeg, New York.
3. Chaudhary, H. K. (2001) Plant Breeding Theory and Practice, Oxford IBH Ltd, New Delhi, India

4. David Allen Sleper, John Milton. (2006). Breeding Field Crops. Blackwell Publishing
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	Practicals: Molecular Biology and Cytogenetics II	Credits 06
	Project Work and Dissertation • Presentations based on some advanced techniques, • Research in Botany with well-defined materials and methods, research methodology • Results and discussions, conclusions, applications • References.	

The Kelkar Education Trust's

V. G. Vaze College of Arts, Science and Commerce (Autonomous)

Programme: M.Sc. Botany **Semester**: IV

Course: Food Technology

Course code: **(VGCPSELBOP401)**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
02	-	02	2	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives

To comprehend the requirements and technologies involved in food biotechnology and implementation of quality control parameters.

Course Outcomes

The studies related to biotechnology will make the students aware of the applications of different factors in the Food industry.

Elective 1

Course Code:VGCPSELBOP401 **Credits: 2**

	Food technology	
Unit I	Production of polysaccharides, amino acids, organic acids and vitamins.	**10 hrs**
	Single Cell Protein and Single Cell Oil.	
Unit II	Factors affecting food spoilage.	
	Quality control of foods.	

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V. G. Vaze College of Arts, Science and Commerce (Autonomous)

Programme: M.Sc. Botany **Semester**: IV

Course: Enzyme Technology

Course code: **(VGCPSELBOP401)**

Teaching Scheme (Hrs/Week)				Continuous Internal Assessment (CIA) 40 marks					End Semester Examination	Total
L	**T**	**P**	**C**	**CIA-1**	**CIA-2**	**CIA-3**	**CIA-4**	**Lab**	**Written**	
02	-	04	2	15	15	10	-	-	60	100
Max. Time, End Semester Exam (Theory) -2Hrs.										

Course Objectives

To comprehend the requirements and technologies involved in enzyme technology and implementation of quality control parameters.

Course Outcomes

The studies related to biotechnology will make the students aware of the applications of different factors in the enzyme industry.

Elective 2

Course Code:VGCPSELBOP402 **Credits: 2**

UnitI	**Enzyme technology**	**10 hrs**
	Introduction and application of enzymes used in various industries: Proteases, Amylase, Cellulase, Lipase, lactates, invertase.	
	Uses of enzymes in solution: Detergents, Leather industry and pharmaceuticals.	
Unit II	Immobilization of enzymes: Methods of Immobilization, advantages and disadvantages. Uses of immobilised enzymes	
	Enzyme engineering: Objectives, Principles and method	

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(Autonomous)

Syllabus Prepared by:	
1.	**Prof. (Dr.) Ajit Kengar: Member, Syllabus Committee** Head, Dept. of Botany, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.
2.	**Dr. Supriya Thale: Member, Syllabus Committee** Assistant. Professor, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.
3.	**Mr. Jatin Vaity: Member, Syllabus Committee** Assistant Professor, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.
4.	**Dr. Rajni Shirsat: Member, Syllabus Committee** Assistant. Professor, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.
5.	**Ms. Siddhi Baskaware: Member, Syllabus Committee** Assistant Professor, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.
6.	**Ms. Nupoor Telawane: Member, Syllabus Committee** Assistant Professor, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.
7.	**Dr. Jayshri Jagtap: Member, Syllabus Committee** Assistant Professor, KET's V.G. Vaze College (Autonomous), Mulund (East), Mumbai.