Bharatiya Vidya Bhavan

Bhavan's Vivekananda College
of Science, Humanities and Commerce
Autonomous – Affiliated to Osmania University
TEACHING PLAN: 2018-'19
Program: BSc. (Mb/Bt/G/C)
Course Title: GT132: Transmission Genetics

Name of the faculty: Dr Jyothi Nayar	Department: Genetics & Biotechnology	Year/Semester: I/I	No. of classes per week: 2

Learning objectives: To explain the genetics of cell division and chromosome segregation. To understand the fundamentals of recombination and gene mapping.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 3rd week	II	**Cell Division and Chromosome Segregation.** Objectives and outcomes of Transmission Genetics. Introduction to cell cycle		Chalk & Board	Understanding the objectives and outcomes of Transmission Genetics.
2	June 4th week	II	Phases of cell cycle and genes determining the cell cycle – Types of cyclins	Cytoplasmic rhythms correlating and differentiating it with cell cycle	Chalk & Board	Understanding the different phases of cell cycle and the checkpoint that control the cell cycle.
3	July 1st week	II	Role of p^{53}. Mitotic cell division	Tumor suppressor gene p^{RB} and its role. Inhibitory proteins of cyclins and CDKs	Chalk & Board	Understanding the role of p^{53} and other tumor suppressor genes in cell cycle. Preparing and observing the slides of onion root tips to understand the different stages of mitosis in plant cells.
4	July 2nd week	II	Meiosis and its stages		Chalk & Board	Understanding and observing the different stages of meiosis and the cells in which meiosis occurs
5	July 3rd week	II	Significance of Meiosis;	Position of the kinetochores in determining whether the chromosomes separate or the chromatids that ultimately results in reduction or equational division	Chalk & Board	Understand the significance of meiosis in maintaining the chromosome number and in the evolution and genetic variation.
6	July 4th week	II	Synaptonemal complex and Kinetochores. Gametogenesis - Spermatogenesis		Chalk & Board	Understand the process of spermatogenesis
7	August 1st week	II	Oogenesis, Microsporogenesis and megasporogenesis in plants		Chalk & Board	Understand the process involved in the formation of the ovum and its maturation. To differentiate the

						process involved in animals and human. Understand the process involved in the formation and development of pollen and ovule in plants.
8	August 2nd week	II	**Linkage, Recombination and Mapping of Genes in Eukaryotes** Discovery of Linkage		Chalk & Board	To understand that the II law of Inheritance given by Mendel is not universal.
9	August 3rd week	II	Phases of linkage. Definition of linkage & types. Crossing over and cytological proof for CO in *Drosophila*. Cytological proof of CO in Maize. Linkage map and map units		Chalk & Board	Understanding that crossing over involves exchange of chromosomal segments using heteromorphic X-chromosomes in *Drosophila* and heteromorphic 9th-chromosomes in Maize.
10	August 4th week	IV	-		-	-
11	August 5th week	IV	Linkage map 2-point test cross & 3-point test cross	CO involving non-sister chromatids lead to recombination while CO between sister chromatids does not lead to recombination	Chalk & Board	Solving problems using 2 –point and 3-point test cross to map the genes in eukaryotes.
12	September 1st week	IV	Interference and co-efficient of co-incidence.		Chalk & Board/ICT	Understanding the effect of a CO on the frequency of CO in the adjacent regions of the chromosome
13	September 2nd week	IV	Tetrad analysis – Ordered and unordered tetrad.	Probability-product rule and sum rule	Chalk & Board/ICT	. To map the genes using ordered tetrad data and unordered tetrad data in *Neurospora*.
14	September 3rd week	IV	Mitotic Recombination in *Aspergillus*.		Chalk & Board	Understanding that recombination can also occur during mitosis – white conidia - Haploidization
15	September 4th week	IV	Mitotic Recombination in *Aspergillus*.		Chalk & Board	Understanding that recombination can also occur during mitosis yellow conidia
Learning outcomes: On completion of the course the students will get an in-depth view of the molecular mechanisms in cell cycle and chromosomal segregation. Solving problems using recombination and crossing over help them understand the process of gene transmission and mapping of genes.						

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TEACHING PLAN: 2018-'19

Program: BSc. (Mb/Bt/G/C)

Course Title: GT332: Gene Structure, Organisation and Expression.

Name of the faculty: Dr Jyothi Nayar	Department: Genetics & Biotechnology	Year/Semester: II/III	No. of classes per week: 2

Learning objectives: To understand the detailed structure of nucleic acids - DNA and RNA. To learn the different types of sequences in the Eukaryotic genome and understand the dynamics of Reassociation Kinetics.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 2nd week	I	**Nucleic Acids:** Objectives and outcomes of the course. Introduction to the Nucleic acids. Primary structure of DNA - structure of phosphate, deoyribose sugar and nitrogenous bases	Alternate names of the nitrogenous bases that helps in drawing their chemical structures.	Chalk & Board	Understanding the objectives and outcomes of Gene structure, organization and expression. Draw the chemical structures of sugar and nitrogenous bases.
2	June 3rd week	I	Secondary structure of the DNA – formation of polynucleotide structure and H-bonds between the bases to form ds structures		Chalk & Board	Draw the polynucleotide structure with bonds between PO_4, sugar and bases, H-bonds between the bases to form ds structures.
3	June 4th week	I	Watson and Crick model and alternate forms of the DNA. Structure of eukaryotic RNA polynucleotide		Chalk & Board	Understanding the Watson and crick model of the DNA double helical structure and to differentiate the alternate forms of the DNA. Draw the structure of RNA
4	July 1st week	I	m-RNA, r-RNA and t-RNA		Chalk & Board	Draw the structure of m-RNA, r-RNA; primary,
5	July 2nd week	I	t-RNA. Experiments to prove DNA as genetic material.	Properties required for DNA/RNA/proteins to be considered as genetic material	Chalk & Board	secondary and tertiary structures of t-RNA. To differentiate between the three types of RNA. Assignment: sn-RNA, mi-RNA and i-RNA Understanding the principles involved in the experiments to prove that DNA is the genetic material in most organisms.
6	July 3rd week	I	Experiments to prove DNA-Hershey –Chase Experiment and RNA as genetic material. DNA replication- Messelson and Stahl's experiment to prove	Harlequin chromosomes to prove semi-conservative method of DNA	Chalk & Board	Understanding the principles involved in the experiments to prove that RNA is the genetic material in some

			semi-conservative method of replication;	replication.		organisms. To estimate the amount of DNA in the given sample by DPA method and RNA by Orcinol method. Understanding the different methods of DNA replication and the experiment to prove the semi-conservative method.
7	July 4th week	I	DNA replication - initiation process. Chain elongation,		Chalk & Board	Understanding the process involved in replication –initiation, .chain elongation – leading and lagging strands.
8	August 1st week	I	Editing, proof reading, termination and unlinking. and the enzymes involved – DNA Polymerases.		Chalk & Board	Understanding the process involved in replication- editing, termination and unlinking to separate the two DNA double helices. Understand the functions of the enzymes involved in DNA replication. Draw the structure of DNA pol. III.
9	August 2nd week	I	Enzymes involved in the replication of prokaryotic DNA. Replication of Eukaryotic DNA		Chalk & Board	Understand the functions of the enzymes involved in DNA replication To understand the difference in the process of DNA replication of eukaryotes and prokaryotes.
10	August 3rd week	II	**Genome Organisation:** Definition, size and number of genes in eukaryotic genome. Benzer's functional units of the gene Cistron,	Experiments (*Drosophila* and yeast genome) to prove how many genes are essential and how many are non essential in the eukaryotic genome.	Chalk & Board	To understand the modern definition of a gene; determine the size and number of genes expected in a eukaryotic genome
11	August 4th week	II	-	-	-	-
12	August 5th week	II	Benzer's functional units of the gene Muton and Recon. Types of genes. Prokaryotic and eukaryotic genome organization. Dissociation / Reassociation and Denaturation / Renaturation of DNA.		Chalk & Board	Understanding the different types of genes in the eukaryotic genome. To differentiate between eukaryotic and prokaryotic genome organization. Understanding the difference between Dissocaition and Denaturation; Reassociation and

						Renaturation.
13	September 1st week	II	Melting temperature Tm of the DNA.Properties of DNA affected by denaturation. Renaturation factors. C- value, C-value paradox;	Techniques to measure the amount of DNA reassociated.	Chalk & Board	Melting temperature based on denaturation.Understanding hyper and hypo chromic effect of DNA due to denaturation; factors that influence the process of renaturation
14	September 2nd week	II	Reassociation Kinetics, Cot values and Cot curves. Kinetic complexity of the genome – kinetic components		Chalk & Board	To determine the Reassociation kinetics of the DNA based on the II order Kinetics; to differentiate the kinetic components of the DNA based on Reassociation kinetics and to establish the kinetic complexity.
15	September 3rd week	II	Kinetic classes of the DNA-Unique sequences	Tri-nucleotide repeats and their effect on human diseases- FRAXA and Huntington's disease.	Chalk & Board	To differentiate the different kinetic classes or the DNA – characteristic features of single/unique sequences.
16	September 4th week	II	Moderately repetitive sequences- tandem and interspersed Highly repetitive sequences. Satellite DNA Organisation of the eukaryotic gene	Palindromic repeats	Chalk & Board	To understand the features of MRS & HRS and satellite DNA. Determine the location of Satellite DNA in the genome Differentiate between the eukaryotic and prokaryotic gene structure.

Learning outcomes:

On completion of the course the students will have an in-depth knowledge of the structure of the nucleic acids that forms the basis of molecular biology. The study helps them to understand the Reassociation Kinetics of the DNA, the kinetic classes and other sequences in the eukaryotic genome.

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TEACHING PLAN: 2018-19

Program: BSc. (Mb/Bt/G/C)

Course Title: GT232: Genetic Analysis

Name of the faculty: Dr Jyothi Nayar	Department: Genetics & Biotechnology	Year/Semester: I/II	No. of classes per week: 2

Learning objectives: To understand the significance of Cytogenetics in detecting chromosomal anomalies. Recombination and Gene mapping Procedures in Bacteria and Viruses.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	II	**Chromosome structure, chromatin organization and variation** Chromosome morphology- size and shape;Euchromatin	Karyotyping and Karyogram	Chalk & Board	Understanding the chromosome morphology and preparation of the karyotype
2	November 4th week	II	Heterochromatin Components of chromatin: Histone Proteins.	Histones as land mark proteins	Chalk & Board	Understanding the chemical composition of the chromosome
3	December 1st week	II	Nucleosome model: Higher level organisation		Chalk & Board	Understanding the packing of the DNA into the chromatin to form the highly condensed metaphasic chromosome
4	December 2nd week	II	Specialised chromosomes: Lampbrush, Polytene and Supernumerary		Chalk & Board	Differentiate the different types of specialized chromosomes Dissecting the *Drsophila* larvae for Polytene chromosomes (Salivary gland)
5	December 3rd week	II	Chromosome variation- Structural aberrations: Deletions and Duplications		Chalk & Board	Understand the chromosomal modifications and their genetic implications
6	December 4th week	II	Structural aberrations: Inversions and Translocations	Maintenance of mutant *Drosophila* stocks in the lab Balanced lethals Position Effect : CML and ALL	Chalk & Board	Understand the chromosomal modifications and their genetic implications
7	January 1st week	II	Numerical aberrations: Euploidy - Autopolyploidy		Chalk & Board	Understand the chromosomal

						modifications and their genetic implications
8	January 2nd week	II	Numerical aberrations: Allopolyploidy , Aneuploidy		Chalk & Board	Understand the chromosomal modifications and their genetic implications Assignment : Human diseases and Chromosomal aberrations
9	January 3rd week	IV	**Recombination and mapping of genes in Bacteria and Viruses** Bacterial Conjugation		Chalk & Board / ICT	Understand the 3 process of conjugation
10	January 4th week	IV	Conjugation Mapping of genes	mapping of closely linked genes	Chalk & Board	Mapping of bacterial gene by conjugation using time interval, frequency of gene transfer
11	January 5th week	IV	Transformation and Mapping	Transformation in *B. subtilis* & *H. influenzae*	Chalk & Board / ICT	Understanding the process of Transduction in *S pneumoniaea.* Mapping of genes by transformation
12	February 1st week	IV	Transduction and Mapping		Chalk & Board / ICT	Understanding the process of Generalised and Specialized Transduction. Mapping of genes by generalised transduction
13	February 2nd week	IV	Recombination in Viruses		Chalk & Board/ICT	Understanding the types of Viral mutants; intragenic and intergenic recombination
14	February 3rd week	IV	Extra chromosomal Inheritance- Maternal Inheritance; Chloroplast Inheritance		Chalk & Board	Understanding the mode of extra chromosomal inheritance – maternal and choloroplast with examples
15	February 4th week	IV	Extra chromosomal Inheritance-Mitochondrial Inheritance		Chalk & Board	Understanding mitochondrial inheritance pattern with examples

Learning outcomes:

On completion of the course the students will get an in-depth view of the structure of the chromosome and chromosomal aberrations leading to various disorders. Recombination and gene mapping procedures help them understand the underlying principles of Genetic Analysis.

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TEACHING PLAN: 2018-19

Program: BSc. (Mb/Bt/G/C)

Course Title: GT432: Molecular Genetics

Name of the faculty: Dr Jyothi Nayar	Department: Genetics & Biotechnology	Year/Semester: II/IV	No. of classes per week: 2

Learning objectives: To understand the effect of mutagenic agents and gene mutations at the molecular level; DNA repair mechanisms. To study the role of transposable genetic elements on mutations.

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S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	III	**Gene Mutations:** Types of mutations. Spontaneous and Induced and other types	Other types – Somatic/Germinal/ Conditional/lethals	Chalk & Board/ICT	Understanding the different types of mutations
2	November 4th week	III	Mutations at molecular level. Transitions and Transversions		Chalk & Board/ICT	Understanding the mutations at the molecular level- changes that damage the DNA
3	December 1st week	III	Effect at the protein level. Frameshift . Spontaneous Lesions	Spontaneous Lesion- deamination and depurination	Chalk & Board/ICT	Understanding the effect of mutations at the protein level
4	December 2nd week	III	Mutagenic Agents: Base analogs, Alkylating agents		Chalk & Board/ICT	Understanding the effect of chemical mutagens on the DNA
5	December 3rd week	III	Acridines, Deaminating agents and Hydroxylating agents. Physical Mutagens – X-Rays	Chemical Mutagens: Acridines, Deaminating agents and Hydroxylating agents.	Chalk & Board/ICT	Understanding the effect of X-rays on the DNA and its mutagenic effect
6	December 4th week	III	Physical mutagens- UV rays		Chalk & Board /ICT	Understanding the effect of UV-rays on the DNA and its mutagenic effect
7	January 1st week	III	Test for Mutagens- Prokaryotes Ames test. Eukaryotes – Russel's Test in mice	Replica plating technique in prokaryotes.	Chalk & Board	Understanding the tests for the detection of mutations in Prokaryotes
8	January 2nd week	III	DLTS test in mice. SLRL- CIB test and attached – X test in *Drosophila*.		Chalk & Board	Problem solving in detecting mutations in

						Drosophila
9	January 3rd week	III	Revision of Unit III			Understand the 3 process of conjugation
10	January 4th week	IV	**DNA Damage and Repair Mechanisms; Transposable Elements** Bacterial Tansposons – IS elements, Composite , Tn3 elements	Mechanism of transposition-conservative and replicative	Chalk & Board	Mapping of bacterial gene by conjugation using time interval, frequency of gene transfer
11	January 5th week	IV	Maize- Ac and Ds elements		Chalk & Board	Understanding the process of Transduction in *S pneumoniaea*. Mapping of genes by transformation
12	February 1st week	IV	Maize Spm system		Chalk & Board	Understanding the process of Generalised and Specialized Transduction. Mapping of genes by generalised transduction
13	February 2nd week	IV	*Drosophila* : P-elements		Chalk & Board	Understanding the types of Viral mutants; intragenic and intergenic recombination
14	February 3rd week	IV	Yeast – Ty elements Plasmids. DNA Repair Mechanism: Photo-reactivation, Excision repair.		Student Seminar (DNA Repair)	Seminar to be given by the students
15	February 4th week	IV	SOS repair, Recombination repair and Error prone repair.		Student Seminar	Seminar to be given by the students

Learning outcomes:

On completion of the course the students will have an in-depth knowledge of the molecular basis of mutations and the mode of action of physical and chemical mutagens. The study helps them to understand the different types of DNA repair mechanisms and the consequences of the defects of the repair process.

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TEACHING PLAN: 2018-19

Program: BSc. (MbGC&BtGC)

Course Title: GT532: Population Genetics

Name of the faculty: Dr B. Kalpana	Department: Genetics & Biotechnology	Year/Semester: III/V	No. of classes per week: 3

Learning objectives: To understand core concepts of Population Genetics like Genetic equilibrium, Hardy Weinberg Law, applications of HWL, role of micro evolutionary forces- Mutation, Selection, Migration and Drift in altering gene frequencies, to apply theoretical concepts to derive mathematical formulae and solve numerical problems to understand genetic equilibrium and causes for genetic disequilibrium.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 2nd week	I	**Structure of populations and Genetic Equilibrium:** Concept of Genetic/Mendelian population	Levels of hierarchy ina population: individual, family groups, Demes and Local Population; random mating.	Chalk & Board	Understanding the concept of a Genetic population as compared to a Population in demographic context.
2	June 3rd week	I	Genetic composition of a population and attributes of a population	Gene, Genotype frequencies and Genetic equilibrium; Size, Density, Growth rate, Birth rate, Age structure, Survival curve of a population	Chalk & Board	Solving problems on gene and genotypic frequencies of a population; Understanding the attributes of a population
3	June 4th week	I	Genetic Equilibrium- Hardy Weinberg Law (HWL); Snyder's Ratios and its application	Attainment of equilibrium for a diallelic locus showing co dominance; Snyder's ratios- S_2, S_1, S_0	Chalk & Board	Drawing graph to understand the relation between gene and genotype frequencies in a population in Hardy Weinberg Equilibrium (HWE) and solving numerical problems to understand attainment of equilibrium for a diallelic locus; Deriving Snyder's ratios mathematically.
4	July 1st week	II	**Applications of HWL; Mutation:** Application of HWL for an autosomal locus showing complete dominance& X-linked locus	Frequency of carriers in the whole population (H) and among the dominant individuals (H'); Attainment of equilibrium for an X-linked gene.	Chalk & Board	Solving problems on frequency of carriers and understanding the significance of carriers in case of recessive genetic disorders; Drawing graph to understand the attainment of equilibrium for an X-linked locus.

5	July 2nd week	II	Application of HWL for a multiple allelic locus	Calculation of gene frequencies for a multiple allelic locus, Eg: locus coding for isozymes, ABO locus	Chalk & Board	Solving problems on calculation of gene frequencies for a multiple allelic locus
6	July 3rd week	II	Application of HWL for multiple loci	Linkage disequilibrium (LD) and reasons for LD in a population. An overview of association mapping- candidate gene approach, genome wide association studies (GWAS)	Chalk & Board and PPT	Understanding the reasons for LD with respect to two loci; Appreciating the use of LD in mapping, especially association studies for polygenic/multifactorial conditions.
7	July 4th week	II	Microevolutionary processes - Mutation	Irreversible and Reversible mutations, evolutionary significance of mutation.	Chalk & Board	Deriving equations for allele frequency changes due to irreversible and reversible mutations, equilibrium gene frequencies in case of reversible mutations
8	August 1st week	III	**Selection**: Introduction	Fitness, components of fitness, selection coefficient, calculation of fitness based on survival and fertility	Chalk & Board	Solving problems on calculation of fitness based on survival and fertility
9	August 2nd week	III	Complete elimination of recessive genes	Allele frequency changes after one generation of selection against recessive deleterious and lethal alleles (q_1 and Δq); Industrial melanism in peppered moth (Bistonbetularia) as an example of selection against recessives	Chalk & Board/PPT	Deriving equations to understand selection against deleterious recessive and lethal recessive alleles. Understanding the phenomenon of industrial melanism in the peppered moth.
10	August 3rd week	III	Selection against dominants	Allele frequency changes after one generation of selection against dominants (p_1 and Δp)	Chalk & Board	Deriving equations to understand selection against dominants; Understanding how selection against dominants is more effective than selection against recessives.
11	August 4th week	----	CIA I	----	----	-----
12	August 5th week	III	Selection favoring heterozygotes	Stable equilibrium/ balanced polymorphism; Eg: sickle cell heterozygotes and falciparum malaria	Chalk & Board/PPT	Deriving equations for allele frequency changes due to overdominance; Understanding stable equilibrium/balanced polymorphism whenselection favors heterozygotes.
13	September 1st week	III	Selection against heterozygotes	Unstable equilibrium Eg: Rh incompatibility	Chalk & Board	Deriving equations for allele frequency changes due to underdominance; Understanding unstable

						equilibrium when selection acts against heterozygotes.
14	September 2nd week	III	Joint effects of mutation and selection Selection at the phenotypic level	Allele frequencies at mutation- selection equilibrium for recessive and dominant deleterious alleles; Selection at phenotypic level: Directional, Stabilizing and Disruptive selection	Chalk & Board	Deriving equations forgene frequencies at mutation-selection equilibrium; Understanding different types of selection at the phenotypic level with suitable examples.
15	September 3rd week	IV	**Polymorphism; Migration and Drift:** Polymorphism	Mechanisms for maintenance of polymorphism: heterozygote advantage, selection in a variable environment, mutation-selection equilibrium, mutation-drift equilibrium, neutral variation, frequency dependent selection	Chalk & Board/PPT	Understanding the various mechanisms for maintenance of polymorphism at different loci
16	September 4th week	IV	Migration Genetic Drift	Effect of migration on gene frequencies; Effective population size, relationship between sample size and effect of drift, predicting the range of allele frequency change due to drift using variance/standard deviation. Extreme cases of drift: Bottleneck effect and Founder effect	Chalk & Board/PPT	Deriving equations to study the effect of migration on gene frequencies. Working out a numerical example to understand how gene flow has occurred from Caucasians to US African population. Working out a numerical example to understand the effect of sampling variations on allele frequencies in populations. Understanding extreme cases of drift – Bottleneck and Founder effect with suitable examples
Learning outcomes: On completion of the course the students learn the role of micro evolutionary forces in altering gene frequencies thereby disturbing the genetic equilibrium and how such processes drive evolution over long periods of time. Students understand the application of Population Genetics such as - calculating frequency of carriers from the incidence of a recessive genetic disorder which can help in Genetic Counselling and disease prevention.						

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TEACHING PLAN: 2018-19

Program: BSc. (MbGC&BtGC)

Course Title: GT632: Inbreeding, Breeding techniques and Genome evolution

Name of the faculty: Dr B. Kalpana	Department: Genetics & Biotechnology	Year/Semester: III/VI	No. of classes per week: 3

Learning objectives: To understand the effect of Inbreeding in a population, how inbreeding can increase the frequency of recessive genetic disorders, the application of Genetic principles in Plant and Animal breeding, the use of marker assisted selection (MAS) in plant breeding, importance of artificial selection in breeding programs, application of Molecular Phylogenetics, mechanisms driving genome evolution, concept of Molecular clock, UPGMA method for constructing phylogenetic treesfrom molecular data, Nei's index of genetic distance to assess evolutionary relationships between organisms.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	I	**Inbreeding and its effects:** Types of Assortative mating	Positive and negative assortative mating, Inbreeding	Chalk & Board	Deriving the effect of inbreeding on gene and genotype frequencies mathematically in a tabular form.
2	November 4th week	I	Inbreeding coefficient, genotype frequencies under inbreeding.	Path analysis, increase in homozygotes at the expense of heterozygotes	Chalk & Board	Drawing Arrow pedigrees to calculate inbreeding coefficient and deriving genotype frequencies under inbreeding.
3	December 1st week	I	Applications of inbreeding	Increased frequency of recessive genetic disorders in a population	Chalk & Board	Solving problems related to inbreeding coefficient and genotype frequencies in case of first-cousin mating, uncle-niece mating etc.
4	December 2nd week	I	Inbreeding depression and Genetic load	Manifestations and genetic basis of inbreeding depression, factors that contribute to genetic load	Chalk & Board	Understanding the types of genetic load and their implications in a population.
5	December 3rd week	II	**Selection and breeding methods in Plants:** selection methods in self-pollinated crops	Mass selection, Pureline selection, and Line breeding	Chalk & Board	Making flow charts for the different methods of selection in self-pollinated crops.
6	December 4th week	II	Selection methods in cross-pollinated crops	Mass selection, Ear-to-row selection	Chalk & Board	Making flow charts for the different methods of selection in cross-pollinated crops.
7	January 1st week	II	Production of hybrids	Synthetic breeds, Composite breeds, Single cross hybrids, double-cross hybrids,	Chalk & Board	Understanding the steps in hybrid production and application of CGMS in hybrid

				Cytoplasmic Genetic Male Sterility (CGMS) systems in plants.		production
8	January 2nd week	II	Heterosis	Average heterosis, Heterobeltiosis, Economic heterosis, heterozygote advantage.	Chalk & Board	Assignment on Green Revolution
9	January 3rd week	II	Marker Assisted Selection	Genetic markers, DNA markers- RFLPs, RAPDs, AFLPs, SSRs, and SNPs	Chalk & Board/ICT	Making a powerpoint presentation on the procedures used for different types of DNA markers.
10	January 4th week	III	Steps in Marker assisted selection in plants	Inbred parents, selection among F1, F2, F3, F4, F5 and F6 generations to achieve homozygosity for the desired marker.	Chalk & Board	Understanding the steps used in marker assisted selection in plant breeding.
11	January 5th week	III	Quantitative Trait Loci (QTLs)	Optimum number of QTLs used in plant breeding, flanking markers.	Chalk & Board	Understanding the significance of QTLs in plant breeding.
12	February 1st week	III	**Selection and breeding methods in Animals:** Inbreeding, Line breeding, Outcrossing and Cross breeding	Top-crossing, Grading – up, Two-breed, Three-breed, Criss-cross method of cross breeding, Synthetic breeds.	Chalk & Board	Drawing Raw pedigrees to understand Line breeding in animals.
13	February 2nd week	III	Artificial Selection-selection for a single quantitative trait.	Selection gain, Selection differential, Broad and Narrow-Sense Heritability,.	Chalk & Board	Drawing and graphically understanding the response to selection in case of quantitative traits.
14	February 3rd week	III	Genetic effects of selection, Selection of individual animals	Positive or negative correlated response to selection, Probable breeding value (PBV).	Chalk & Board	Understanding the importance of PBV in selection of parents for breeding programs.
15	February 4th week	III &IV	**Genome evolution and population variation:** DNA and Protein sequence phylogenetics	Molecular clock, Unit Evolutionary Period (UEP)	Chalk & Board	Calculating UEP of Globin genes using the concept of Molecular clock and drawing an evolutionary tree of the Globin gene family.
16	March 1st Week	IV	Role of non-coding DNA and transposable elements in genome evolution, construction of evolutionary trees.	Unweighted Pair Group Method using Arithmetic Mean (UPGMA), Nei's Index of genetic distance.	Chalk & Board	Constructing a rooted phylogenetic tree using the UPGMA method and deriving the Nei's index of genetic distance.

Learning outcomes:

On completion of the course the students learn the applications of inbreeding coefficient, genetic basis of plant and animal breeding methods, and applications of Molecular Phylogenetics.

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Program:B.Sc Course - Bt//Mb/G/C

Course Title : Gene structure, Organization and expression

Academic Year - 2018-19

Name of the faculty: Dr I Rachana Kumari	Department: Genetics	Year/Semester: II/III	No. of classes per week: 2
Learning objectives: Appreciating the classical experiments like One gene- One enzyme hypothesis, deletion mapping etc. To give an insight into the protein synthesis mechanism in prokaryotes and eukaryotes. Learning the basic concepts in molecular biology helps the students to motivate towards research.			

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 3rd week	III	Gene families-Hemoglobin genes	Evolution of genes	Chalk & Board	Phylogenetic relationship
2	4th week		Histone genes Mitochondrial	Evolution of nuclear genes	Chalk & Board	Structure of genomes
3	5th week		Chloroplast genome	Examples	Chalk & Board	
4	July, 1st week		Compound eye locus in Drosophila,	Lozenge & white eye	Chalk & Board	Plaque morphology, Exercises on deletion mapping
5	2nd week		One Gene-One enzyme hypothesis	Neurospora & Human beings	Chalk & Board	
6	3rd week		rII locus in t4 pahge	Intragenic recombination	Chalk & Board	
7	4th week		Colinearity between gene and polypepetide Intracodon recombination		Chalk & Board	
7	August,1st week	IV	Transcription in Prokaryotes	Regulatory elements	Chalk & Board, Youtube videos	
8	2nd week		Transcription in eukaryotes		Chalk & Board, Youtube videos	
9	3rd week		Splicing mechanisms	Polyadenylation &capping	Chalk & Board	
10	4th week		Reverse transcription	Life cycle in viruses	Chalk & Board	
11	September, 1st week		Translation in prokaryotes		Chalk & Board, You tube videos	
12	3rd week		Translation in eukaryotes, Genetic Code	Properties of Genetic code	Chalk & Board	
13	4th week		Differences between Eukaryote and Prokaryote translation		Chalk & Board	

14.	October, 1st week		Revision		Chalk & Board	
Learning outcomes: : Students appreciate the discoveries related to the fine structure of the gene. They also learn the fundamental aspects of gene expression.						

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Bhavan's Vivekananda College

of Science, Humanities and Commerce

Autonomous – Affiliated to Osmania University

2018-19

Program: B Sc (BtGC/MbGC)

Course Title: Molecular Genetics

Name of the faculty: Dr I Rachana Kumari	Department: Genetics & Biotechnology	Year/Semester:II/ IV	No. of classes per week: 2

Learning objectives: To know the phenomenon of gene expression with reference to the regulation of genes in prokaryotes & eukaryotes. Introducing the students to the basics of Recombinant DNA technology.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 4th week	I	Basic concepts of Gene Regulation in prokaryotes	Inducible/ Repressible Negative//positive	Chalk & Board	Learning the concept of operons and types of regulation.
2	5th week		Lactose & Tryptophan operon	Concept of operon	Chalk & Board	Lactose operon
3	December 1st week		Bacteriophage regulation	Concept of operon in phages	Chalk & Board	
4	2nd week		Lytic cycle & Lysogenic cycle		Chalk & Board	Insight into organization of phage genome.
5	3rd week		Gene Regulation in Eukaryotes	Regulatory elements of eukaryotes	Chalk & Board Powerpoint	Structure of DNA motifs and their role.
6	January 1st week		Gal locus regulation in yeast		Chalk & Board	
7	2nd week		Mating type switch in yeast	Significance of enhancer	Chalk & Board	
8	3rd week	II	Differential expression of hemoglobin	Study of genetic switch	Chalk & Board	The genes in a family switch on/off during the different stages of development.
9	4th week		Genetic Engineering	Basics of recombinant DNA	Chalk & Board	Exercises based on Restriction digestion
10	February 1st week		Vectors	Introducing gene of interest	Chalk & Board	
11	2ndweek		Cloning strategies		Chalk & Board Powerpoint	Importance of transgenic plants & animals
12	3rd week		Genomic & cDNA libraries	Uses of cloning	Chalk & Board Powerpoint	
13	4th week		cDNA libraries		Chalk & Board	

Learning outcomes: At the end of the semester, students understand the response of genes to external stimuli. They also analyze the importance of rDNA technology and its applications in the development of transgenic animals & plants.

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Program:B.Sc Course – (Bt/G/C)

Course Title :Advanced techniques in Genome analysis and Genetic Engineering

Academic Year - 2018-19

Name of the faculty: Dr I Rachana Kumari	Department: Genetics	Year/Semester: III/V	No. of classes per week: 2
Learning objectives: To learn the various techniques involved in the genome analysis and Genetic engineering. This gives an overview on the theoretical aspects as well the practical persepective of the various techniques with the applications involved in the development of Transgenic plants and animals.			

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 3rd week	I	Biophysical techniques-Chromatography	Principle involved	Chalk & Board	Paper chromatography of amino acids – experiment
2	4th week		Types of chromatography techniques	Types of Electrophoresis	Chalk & Board	SDS-PAGE and AGE were conducted inthe practical sessions
3	5th week		Electrophoresis, PCR ,	Application in the study of point mutations	Chalk & Board	Inducing point mustations
4.	July, 1st week	II	Types of PCR Autoradiography Hybridization techniques	Types of Hybridizations	Chalk & Board	Uses of Hybridization techniques, Site-directed mutagenesis
5	2nd week		DNA Microarray DNA sequencing	Methods of sequencing	Chalk & Board	Advantages of microarrays in disease diagnosis
6	3rd week		Monoclonal Antiboides,	Hybridoma technology,	Chalk & Board	Uses in the production of vaccines.
7	4th week		Banding techniques , Flow Cytometry	Types of banding	Chalk & Board	Importance of bands- position of genes.
8	August, 1st week	III	DNA fngerprinting Physical	Application in forensic science	Chalk & Board	Examples of medico –legal cases Examples in plants &

			& chemical methods of gene transfer			animals
9	2nd week		Plant vectors	Designing of vectors	Chalk & Board	
10	3rd week	IV	Transgenic plants-Biotic stress	Need for developing trangenic plants	Chalk & Board	
11.	4th week		Abiotic stress tolerant plants		Chalk & Board	Examples of transgenic plants
12	September, 1st week	III	Animal vecotrs Engineering stem cells	Types of stem cells	Chalk & Board	Selection of engineered stem cells. Ethical concerns in using stem cells
13	3rd week	IV	Transgenic animals-Cloning	Protocol for cloning	Chalk & Board	Ethical issues/ disadvantages of cloning
14	4th week		Transsgenic cattle, Birds & fish	Need for developing transgenic animals	Chalk & Board	Use of transgenic animals as bioteactors
15	October, 1st week		Transginic mice	Animal models-Oncomouse	Chalk & Board	Treatment of genetic diseases, Ethical issues
Learning outcomes: The students learn various advanced techniques of genome analysis, strategies of gene transfer and development of transgenic organisms.						

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2018-19

Program: B Sc (BtGC)

Course Title: Human Genetics & Biostatistics

Name of the faculty: Dr I Rachana Kumari	Department: Genetics & Biotechnology	Year/Semester: III/ VI	No. of classes per week: 3

Learning objectives: To understand core concepts of Human Genetics like risk prediction, genetic counseling, prenatal diagnosis, treatment of genetics diseases, gene therapy and genome projects, to apply principles of Biostatistics like probability, correlation & Regression for data Analysis.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 4th week	I	Single gene disorders	Examples of genetic diseases	Chalk & Board	Exercises on pedigree analysis- pattern of inheritance
2	December 1st week		Carrier detection, Risk calculation	Methods involved	Chalk & Board	Exercises on pedigree analysis- Biochemical markers
3	2nd week		Empiric risk	Application of Probability	Chalk & Board Powerpoint	Exercises on pedigree analysis- risk assessment
4			Genetic counseling Prenatal diagnosis	Role of genetic counsellors in genetic clinics. Invasive & non invasive methods	Chalk & Board Powerpoint	Discussion on the need for genetic counsellors/prenatal diagnostic methods.
5	3rd week	II	Treatment of genetic disorders. Gene Therapy	Strategies of treatment	Chalk & Board	
6	4th week		Strategies of gene therapy	Examples of gene therapy trials	Chalk & Board	
7	January 1st week		Vectors used in Gene Therapy		Chalk & Board Powerpoint	
8	2nd week		Ethical issues of Gene Therapy		Chalk & Board	
9	3rd week		Human genome project Bioinformatics	Programs & tools in bioinformatics	Chalk & Board	
10	4th week	III	Humulin, Subtilisin & Vaccines	Production of Commercial products - Microorganisms	Chalk & Board	
11	5th week		Phytase	Uses of Phytase	Chalk & Board	
12	February 1st week		Biofertilisers, Biopesticides & bioreactors	Applications of fermentation	Chalk & Board	
13	2nd week	IV	Probability distributions, Random variable, Probability distributions	Exercises on probability distributions	Chalk & Board	
14	3rd week		Test of hypothesis-	Chi square test, independence test, t test	Chalk & Board	Problems on Chi square, t-test, z test
15	4th week		Normal deviate test,	z test , Curves	Chalk &	Problems on

			Correlation & regression		Board	correlation & Regression

Learning outcomes: On completion of the course the students learn the applications of prenatal diagnosis, genetic counseling and statistical analysis in genetics

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Program:B.Sc Course- BtGC/MbGC/MBiC

Course Title : SEC - Genetic Counseling

Academic Year - 2018-19

Name of the faculty: Dr I Rachana Kumari	Department: Genetics	Year/Semester: II/IV	No. of classes per week: 2

Learning objectives: Overview on genetic disorders and discuss the importance of Genetic counseling in our life. Knowledge of Prenatal diagnostic techniques and the role of molecular techniques in detection. Methods available in the treatment of genetic diseases.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November,4th Week	I	Basic Concepts of Genetic Counseling	Genetic disorders of single gene	Chalk & board	Identification of genetic disorders
2	November,5th week		Structural & Numerical Anomalies	Common chromosomal disorders	Chalk & Board	Examples of cases-Discussion
3	December,1st week		Steps in Genetic Counseling	Importance of Counselor	Chalk & Board	
4	December 2nd week		Carrier detection and risk prediction	Concept of Carriers & Risk	Chalk & Board	Methods of Carrier detection
5	December 3rd week		Prenatal diagnosis	Types of techniques and the principle involved	Powerpoint, Chalk & Board	Relevance of techniques in our life.
6	January 1st week		Indications of Prenatal Diagnosis	Awareness on prenatal diagnosis		Students' interactive session
7	January, 2nd week		Molecular Genetic techniques	Basic techniques of molecular biology	Chalk & Board	
8	January,3rd week		New techniques-applications	Underlying principle of advanced techniques	Chalk & Board	
9	January, 4th week		Treatment of Genetic disorders	Differentiating between Management and prevention	Chalk & Board	
10	February, 1st week		Strategies of treatment	Options available in treating genetic disorders	Chalk & Board	Discussion on treatment facilities in Hyderabad

Learning outcomes: Students learn the basics of human genetic disorders, the steps involved in genetic counseling, prenatal diagnostic techniques and the treatment methods. Hands on training program is at the Institute of Genetics & Hospital for Genetic diseases, Osmania University, Begumpet, Hyderabad.

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TEACHING PLAN: 2018-19

Program: BSc. (Mb/Bt/G/C)

Course Title: GT132: Transmission Genetics

Name of the faculty: Dr Sushma Patkar	Department: Genetics & Biotechnology	Year/Semester: I/I	No. of classes per week: 2

Learning objectives: To learn the basic concepts of Classical Genetics and cell division. To understand extensions to Mendelian Genetics, like codominance, incomplete dominance, epistasis etc. To develop an understanding of fundamentals of recombination and gene mapping. To help students to have a comprehensive understanding of Genetics so that they can appreciate the recent developments and trends in biological sciences.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 4th week	I	**Mendelian Inheritance** Mendel's experiments	Reason of success and comparison with predecessors	Chalk & Board	Understanding the importance of Mendel's experiment
2	July 1st week	I	Monohybrid cross- Law of Segregation	Biological basis of Law and test cross ratio	Chalk & Board	Solve problem based on Law of segregation
3	July 2nd week	I	Dihybrid cross- Law of Independent assortment	Biological basis of Law of independent assortment and test cross ratio	Chalk & Board	Solve problem based on Law of Independent Assortment
4	July 3rd week	I	Trihybrid cross	Fork line method	Chalk & Board	Solve numerical problems on trihybrid cross.
5	July 4th week	I	Mendilian Inheritance in Man	Pedigree and their significance	Chalk & Board	Solve numerical problems on pedigrees
6	July 5th week	I	Autosomal recessive Inheritance	Human Autosomal recessive disorders	Chalk & Board	Understand molecular concepts of AR disorders
7	August 1st week	I	Autosomal dominant Inheritance	Human Autosomal Dominant disorders	Chalk & Board	Understand molecular concepts of AD disorders
8	August 2nd week	I	X linked Dominant and recessive inheritance	Human Sex linked disorders	Chalk & Board	Understand the molecular basis of x linked disorders
9	August 3rd week	III	**Extension to Mendelian Segregation pattern:** Variation to dominance	Co dominanace and Incomplete Dominance	Chalk & Board/ICT	Solve numerical problems on codominance and incomplete dominance
10	August 4th week	III	Lethal genes and epistasis	Types of lethal genes	Chalk & Board /ICT	Solve numerical problems on lethal gene and epistasis
11	August	III	Lethal genes and epistasis	Types of lethal	Chalk & Board /	Solve numerical

	5th week			genes	ICT	problems on lethal gene and epistasis
12	September 1st week	III	Multiple Alleles	Multiple alleles in man, Drosophila,	Chalk & Board /ICT	Solve numerical problems on multiple alleles
13	September 2nd week	III	Multiple Alleles	Multiple alleles in man, Drosophila,	Chalk & Board / ICT	Blood typing
14	September 3rd week	III	Paramutation and segregation distortion	Understand the genetic basis of paramutaion	Chalk & Board/	Understand the basis of segregation distortion
15	September 4thweek	III	Self incompatibility	Genetic basis of self incompatibility	Chalk & Board/	Understand the Genetic basis of self incompatibility

Learning outcomes:

Students learn the two basic laws of Genetics and their application to human pedigrees.. They understand the molecular mechanisms involved in cell cycle. They learn the extensions of Mendel's laws like epistasis and multiple alleles with examples. Students learn the basics of gene mapping and recombination.. The students are well versed with the fundamentals of Genetics.

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TEACHING PLAN: 2018-19

Program: BSc. (Mb/Bt/G/C)

Course Title: GT232: Genetic Analysis

Name of the faculty: Dr Sushma Patkar	Department: Genetics & Biotechnology	Year/Semester: I/II	No. of classes per week: 2
Learning objectives: To understand the significance of Cytogenetics in detecting chromosomal anomalies. Recombination and Gene mapping Procedures in Bacteria and Viruses.			

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	I	**Polygene and Multifactorial Inheritance** Complex Loci Rh blood group system	Maternal fetal incompatibility and erythroblastosis fetalis	Chalk & Board	Understanding the complexicity of Rh blood group system
2	November 4th week	I	Histocompatibility loci.	MHC antigens Type I, II and III	Chalk & Board	Understanding the role of MHC in graft rejection
3	December 1st week	I	Effect of temperature on gene expression; Phenocopies and twin studies	Infra and ultra bar eye in drosophila, Microcephaly, phocomelia, cleft lip and palate	Chalk & Board	Understanding the role of teratogens
4	December 2nd week	I	Quantitative traits	Additive effect, kernel color, skin color, height and IQ in man	Chalk & Board	Solve numerical problems on mean, median mode, variance and standard deviation.
5	December 3rd week	I	Quantitative traits	Additive effect, kernel color, skin color, height and IQ in man	Chalk & Board	Solve numerical problems on mean, median mode, variance and standard deviation
6	December 4th week	I	Multifactorial Inheritance: Hypertension, diabetes mellitus	Diabetes mellitus type I and II	Chalk & Board	Understand multifactorial inheritance in hypertensions and diabetes
7	January 1st week	I	Multifactorial Inheritance: Hypertension, diabetes mellitus	Diabetes mellitus type I and II	Chalk & Board	Understand multifactorial inheritance in hypertensions and diabetes
8	January 2nd week	III	**Genetics of sex determination and sex linked inheritance:** primary and secondary determination	Chromosomal Sex determination	Chalk & Board	Understand the basic mechanism of sex determination
9	January 3rd week	III	Mechanism of sex determination	Melandrium, man, Drosophila, Bonellia	Chalk & Board / ICT	Understand the various mechanisms of

						determination including environmental sex determination
10	January 4th week	III	Mechanism of sex determination	Melandrium, man, Drosophila, Bonellia	Chalk & Board / ICT	Understand the various mechanisms of determination including environmental sex determination
11	January 5th week	III	Mechanism of sex determination	Melandrium, man, Drosophila, Bonellia	Chalk & Board / ICT	Understand the various mechanisms of determination including environmental sex determination
12	February 1st week	III	Sex linked inheritance	Color blindness, Hemophilia, DMD, Vitamin D resistant rickets	Chalk & Board	Understanding the inheritance of X linked diseases
13	February 2nd week	III	Sex chromatin and X inactivation	Inactivation center, dosage compensation	Chalk & Board/	Understanding the molecular mechanism of X inactivation and screening for Barr bodies
14	February 3rd week	III	Gynandromorphs, Y linked inheritance	Holandric genes, SRY gene	Chalk & Board	Understanding the Y linked inheritance and role of SRY region
15	February 4th week	III	Partial sex linkage and sex limited and sex influenced traits	Bobbed bristles, PAR region in man	Chalk & Board	Understanding partial sex linkage and sex limited and sex influenced traits

Learning outcomes:

On completion of the course the students will get an in-depth view of the structure of the chromosome and chromosomal aberrations leading to various disorders. Recombination and gene mapping procedures help them understand the underlying principles of Genetic Analysis.

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Autonomous – Affiliated to Osmania University
TEACHING PLAN: 2018-19
Program: SeCBt/Mb/GC, MBiC
Course Title: SE 332 Genetically Modified Crops

Name of the faculty:	Department:	Year/Semester:	No. of classes per week:
Dr Sushma Patkar	Genetics & Biotechnology	III / VI	2

Learning objectives: To give an insight into various gene transfer strategies for the development of Genetically Modified Organisms. To make the students aware that in order to cater to the needs of growing populations at the national and international level, the development of transgenic plants is a promising solution. To give an awareness into the usage of genetically modified crops in India. To acquaint students with advantages and disadvantages of genetically modified crops To make students understand the importance of Genetic Engineering in Agriculture especially in India where economy depends mainly on Agriculture

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 4th week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics'
2	July 1st week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics
3	July 2nd week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics
4	July 3rd week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics
5	July 4th week	II	Cultivation, marketing and sales of Genetically Modified crops in India.	Use of GMC in India	Chalk & Board/	Assignment
6	August 1st week	I	Stress tolerant Transgenic plants	Oxidative stress	Chalk & Board	Understand the effect of stress on plants
7	August 2nd week	I	Stress tolerant Transgenic plants	Oxidative stress	Chalk & Board	Understand the effect of stress on plants
8	August 3rd week	I	Stress tolerant Transgenic plants	Oxidative stress	Chalk & Board	Understand the effect of stress on plants
9	August 4th week	I	Transgenics for quality	Importance of transgenics	Chalk & Board	Understand the need of quality crops
10	September 1st week	I	Ethical issues	Advantages and disadvantages of transgenics	Chalk & Board	Student seminar
11	September 2nd week	I	Ethical issues	Advantages and disadvantages of transgenics	Chalk & Board	Student seminar
12	September 2nd week	I	Ethical issues	Advantages and disadvantages of	Chalk & Board	Student seminar

				transgenics		
13	September 3rd week	I	Ethical issues	Advantages and disadvantages of transgenics	Chalk & Board	Student seminar
14	September 4th week	I	Assessment	Internal Assessment	Chalk & Board	

Learning outcomes:

Students learn the basic concepts of gene transfer protocols. They learn to appreciate the role of Agrobacterium as a natural genetic engineer. They are acquainted with the significant role of transgenic plants in agriculture. .Students learn from their field study the usage of GMOs in the local area.They become aware of the ethical issues concerned with GMOs.

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TEACHING PLAN: 2018-19

Program: BSc. (MbGC)

Course Title: GT532A: Advanced Techniques in Genome analysis and Genetic Engineering

Name of the faculty: Dr Sushma Patkar	Department: Genetics & Biotechnology	Year/Semester: III / V	No. of classes per week: 3

Learning objectives: Cob1: To examine biophysical techniques such as electrophoresis, hybridization, PCR etc.
Cob2: To discuss advanced genome analysis techniques like NGS and DNA Microarray.
Cob3: To describe gene transfer strategies for the development of Genetically Modified Organisms.
Cob4: To report the uses of transgenic plants and animals.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 2nd week	I	**Biophysical techniques:** Chromatography	Types of chromatography, affinity etc	Chalk & Board/	Identification of unknown amino acid using paper chromatography
2	June 3rd week	I	Chromatography	Types of chromatography, affinity etc	Chalk & Board/	Identification of unknown amino acid using paper chromatography
3	June 4th week	I	Separation of amino acids and nucleic acids	AGE & PAGE	Chalk & Board/	Separation of Proteins and DNA using AGE and PAGE
4	July 1st week	I	PCR and its applications	Types of PCR, RT PCR anchored etc	Chalk & Board/ICT	Assignment
5	July 2nd week	I &II	Autoradiography **Advanced Techniques in Genome Analysis:** Hybridization techniques	Southern, Northern & Western Blotting	Chalk & Board/ICT	Assignment
6	July 3rdweek	II	DNA microarray, FISH, DNA sequencing	NGS	Chalk & Board /ICT	Understand the different sequencing methods
7	July 4th week	II	Monoclonal Antibodies, chromosome banding	Types of banding	Chalk & Board	G Banding Karyotyping
8	August 1stweek	III	**Strategies of Gene transfer:** Physical and chemical methods of gene transfer, plant vectors, Ti plasmid	Gene Gun, Liposome method, significance of Agrobacterium	Chalk & Board	Assignment
9	August 2nd week	III	Plant and animal vectors	CaMV, Gemini BPV and SV40	Chalk & Board	Understand the modifications of genomic DNA to create vector
10	August 3rd week	III	Engineered embryonic stem cell method	Positive negative selection and PCR method	Chalk & Board	Understand selection methods in Engineered embryonic stem cell

11	August 4th week	IV	Genetic Engineering of plants and animals: Transgenic plants	Need for developing Transgenic plant	Chalk & Board	Understand the molecular mechanism for development of transgenic plants
12	September 1st week	IV	Insect and Herbicide resistant plants, stress tolerant plants	Role of transgenic plants	Chalk & Board	Understand the molecular mechanism for development of transgenic plants
13	September 2nd week	IV	Transgenic animals and Nuclear cloning	Need for developing transgenic animals	Chalk & Board	Understand the significance of nuclear cloning
14	September 3rd week	IV	Transgenic cattle, fish and mice	Methods used for creation of transgenic animals	Chalk & Board	Understand the molecular mechanism for development of transgenic animals
15	September 4th week	IV	Transgenic mice models	Mice models for various human diseases	Chalk & Board	Understand the need for developing mice models

Learning outcomes:

CO1: To value biophysical techniques such as electrophoresis, Hybridization techniques, PCR etc.
CO2: To appreciate advanced genome analysis techniques like NGS and DNA Microarray.
CO3: To differentiate gene transfer strategies for the development of Genetically Modified Organisms.
CO4:To appraise the uses of transgenic plants and animals.

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TEACHING PLAN: 2018-19

Program: BSc. (MbGC)

Course Title: GT632A: Human Genetics & Biostatistics

Name of the faculty: Dr Sushma Patkar	Department: Genetics & Biotechnology	Year/Semester: III/ VI	No. of classes per week: 3

Learning objectives: To understand core concepts of Human Genetics like risk prediction, genetic counseling, prenatal diagnosis, treatment of genetics diseases, gene therapy and genome projects, to apply principles of Biostatistics like probability, correlation & Regression for data Analysis.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	I	**Management of Inherited Human Diseases:** Types of Genetic disorders	Single gene, Chromosomal and multi factorial disorders	Chalk & Board/	Understanding the different types of genetic disorders
2	November 4th week	I	Identification of Carriers	Biochemical and DNA Marker analysis	Chalk & Board/	
3	December 1st week	I	Risk Estimation and Genetic Counselling	Bayesian Analysis	Chalk & Board/	Solving problems on Genetic Counseling
4	December 2nd week	I	Prenatal Diagnosis and treatment of genetic Disorders	Invasive and non Invasive Techniques	Chalk & Board/ICT	Assignment
5	December 3rd week	II	**Gene therapy, Genome projects and Bioinformatics:** Gene therapy	Somatic and Germline gene therapy	Chalk & Board/ICT	Student seminar
6	December 4th week	II	Gene therapy	Exvivo Invivo gene therapy	Chalk & Board /ICT	Student seminar
7	January 1st week	II	Vectors in gene therapy	Adeno viruses and Retro viruses	Chalk & Board	Student seminar
8	January 2nd week	II	Gene therapy trials and ethical issues	ADA, Cystic Fibrosis, Hypercholesterolemia and cancer	Chalk & Board	Student seminar
9	January 3rd week	II	Human Genome project and Bioinformatics	Achievements and ethical issues of HGP; applications of Bioinformatics	Chalk & Board	Student seminar
10	January 4th week	III	**Genetic Engineering and Industrial Products:** Humulin and Vaccines	Types of DNA Vaccines	Chalk & Board	Student seminar
11	January	III	Vaccines		Chalk & Board	Student seminar

	5th week					
12	February 1st week	III	Commerical Enzymes and Bioreactors	Subtisilin and Phytase, Types of bioreactors	Chalk & Board	Student seminar
13	February 2nd week	III	Biopesticides and biofertilizers	Role of Biopesticides and comparision with chemical pesticides	Chalk & Board	Student seminar
14	February 3rd week	III & IV	Bio remediation, theory of probablility	Gene manipulation in bioremediation; probablility laws and ditributions	Chalk & Board	understand bioremediation using microorganisms
15	February 4th week	IV	Sampling, Test of hypothesis, chi-square, correlation and regression.	Test of significance, t test, Z test	Chalk & Board	Solving Problems on Chi square test, t test, z test, correlation and regression
16	March 1st Week	IV	Correlation and Regression.	types of correlation	Chalk & Board	Solving problems on correlation and regression

Learning outcomes:

On completion of the course the students learn the applications of prenatal diagnosis, genetic counseling and statistical analysis in genetics.

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TEACHING PLAN: 2018-19
Program: SeCBt/Mb/GC, MBiC
Course Title: GE632: Wine Making

Name of the faculty:	**Department:**	**Year/Semester:**	**No. of classes per week:**
Dr Sushma Patkar	**Genetics & Biotechnology**	III / VI	**2**

Learning objectives: To give an insight into various gene transfer strategies for the development of Genetically Modified Organisms. To make the students aware that in order to cater to the needs of growing populations at the national and international level, the development of transgenic plants is a promising solution. To give an awareness into the usage of genetically modified crops in India. To acquaint students with advantages and disadvantages of genetically modified crops To make students understand the importance of Genetic Engineering in Agriculture especially in India where economy depends mainly on Agriculture

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 4th week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics'
2	July 1st week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics
3	July 2nd week	I	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics
4	July 3rd week	1	Gene transfer methods	Physical & chemical methods	Chalk & Board/	Understand methods of creation of transgenics
5	July 4th week	1I	Cultivation, marketing and sales of Genetically Modified crops in India.	Use of GMC in India	Chalk & Board/	Assignment
6	August 1st week	I	Stress tolerant Transgenic plants	Oxidative stress	Chalk & Board	Understand the effect of stress on plants
7	August 2nd week	I	Stress tolerant Transgenic plants	Oxidative stress	Chalk & Board	Understand the effect of stress on plants
8	August 3rd week	I	Stress tolerant Transgenic plants	Oxidative stress	Chalk & Board	Understand the effect of stress on plants
9	August 4th week	I	Transgenics for quality	Importance of transgenics	Chalk & Board	Understand the need of quality crops
10	September 1st week	I	Ethical issues	Advantages and disadvantages of transgenics	Chalk & Board	Student seminar
11	September 2nd week	I	Ethical issues	Advantages and disadvantages of transgenics	Chalk & Board	Student seminar
12	September 2nd week	I	Ethical issues	Advantages and disadvantages of	Chalk & Board	Student seminar

				transgenics		
13	September 3rd week	I	Ethical issues	Advantages and disadvantages of transgenics	Chalk & Board	Student seminar
14	September 4th week	I	Assessment	Internal Assessment	Chalk & Board	

Learning outcomes:

Students learn the basic concepts of gene transfer protocols. They learn to appreciate the role of Agrobacterium as a natural genetic engineer. They are acquainted with the significant role of transgenic plants in agriculture. .Students learn from their field study the usage of GMOs in the local area.They become aware of the ethical issues concerned with GMOs.

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TEACHING PLAN: 2018-19

Program: BSc. (Bt/G/C)

Course Title: BT133: cell Biology and Genetics

Name of the faculty: Dr S. Nagamanju	Department: Genetics & Biotechnology	Year/Semester: I/I	No. of classes per week: 2
Learning objectives: To make students aware of the various cell culturing methods both animal cells and plant cells. Introduce them to various types of media formulations and role of hormones. Teach about applications of animal biotechnology in IVF, gene therapy. Students are exposed to plant tissue culture methods			

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 3rd week	I	**Structure, function of cells,** Cell theory	Understanding cell theory	Chalk & Board, Chart	Students understood the concepts of cell theory.
2	June4th week	I	**Prokaryotic cell and fungal cell.**	Microscopic observation of various eukaryotic cells	Chalk & Board ICT	Students made relevant charts to understand the prokaryotic cell
3	July 1st week	I	**Eukaryotic cell structure Cell wall and Nucleus.**			Students observed cells of different types of prokaryotic and eukaryotic cells under microscope.
4	July 2nd week	I	**Cell organelles like endoplasmic reticulum and golgi complex**	Importance of endoplasmic reticulum in protein synthesis and role of Golgi complex in protein folding	Chalk & Board.	They wrote an assignment the ultra structure of both Eukaryotic and Prokaryotic cell highlighting on the differences between both Plant and Animal cell.
5	July 3rd week	I	**Cytoskeleton, Mitochondria and Chloroplast**		Chalk & Board	Students understood the role of cell cytoskeleton.
6	July 4th week	II	**Mitochondria and chloroplast functions**	Highlighted on the role of the Kinetochores and Synaptonemal complex in cell division.	Chalk & Board	Students understood the importance of mitochondria and chloroplast as energy transducing organelles of cell.
7	August 1st week	II	**Prokaryotic Chromosome Organization**	Emphasized on the compaction of chromosome	Chalk & Board	Students understood the different steps in compaction of chromosome

8	August 2nd week	II	**Eukaryotic chromosome compaction**		Chalk & Board	
9	August 3rd week	II	**Eukaryotic chromosome compaction Heterochromatin**		Chalk & Board	Understood the different steps involved in the compaction of eukaryotic chromosome.
10	August 5th week	II	Euchromatin, Lampbrush chromosomes and Polytene chromosomes, Necrosis, Apoptosis and senescence		Chalk & Board	Students learnt about the giant chromosomes.
11	September 1st week	II	Cell division Mitosis		Chalk & Board	Students carried out mitosis experiments in garlic root tips to observe different phases of mitosis under microscope
12	September 2nd week	II	Significance of mitosis Synaptonemal complex		Chalk & Board	Importance of cell division
13	September 3rd week	II	Crossing over Chaisma formation and its significance Cell cycle and checkpoints	Students understood the significance of chiasma for crossing over	Chalk & Board	Students appreciated the role of chiasma . understood the role of check points, cyclins and CDKs

Learning outcomes:

On completion of the course the students will get an in-depth knowledge on different types of cells, their structure and function including the role of different cell organelles in making the cell the structural and functional unit of life. They also appreciate mechanism involving the compaction of cell genome and cell division. Students will also excel in understanding the basic concepts of genetics and also gain knowledge on the role of linkage in recombination frequency. They even appreciate the role of autosomes and sex chromosomes in the determination of sex of organisms. They also understood the role of x-linked disorders in the inheritance of hemophilia and colorblindness.

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TEACHING PLAN: 2018-19

Program: BSc. (Bt/G/C)

Course Title: BT233: Nucleic acids, Biostatistics and Bioinformatics

Name of the faculty: Dr S. Nagamanju	Department: Genetics & Biotechnology	Year/Semester: I/II	No. of classes per week: 2

Learning objectives: To understand the significance of Genetic material, its structure and the role of different cell organelles in helping the cell carryout various cellular functions. To make students understand the importance of biostatistics and bioinformatics in biotechnology. Students learnt to do problems in biostatistics. They get exposed to the use of bioinformatics in present research.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	I	**Structure, function of nucleic acids** Griffith's experiment	Time line in recognition of genetic material	Chalk & Board	The importance of genetic material in transformation of organisms. Was made clear to students.
2	November 4th week	I	DNA as genetic material DNA structure, Chargaff's rules		Chalk & Board	Various experiments leading to the discovery of DNA as genetic material, and its chemical composition. Was introduced to students.
3	December 1st week	I	X-ray diffraction of Rosalind, Watson and Crick model of DNA Different forms of DNA, A, B & Z forms		Chalk & Board Chart paper model of Watson and Crick model of DNA.	Rosalind X-ray diffraction experiments were signified in deducing the structure of DNA by Watson and Crick. Assignment on different forms of DNA
4	December 2nd week	I	Topoisomerase enzymes role in supercoiling of DNA Structure of mRNA and rRNA		Chalk & Board	Students understood the role of topoisomerases and wrote an assignment on different types of RNA, miRNA, snRNA, hnRNA
5	December 3rd week	I	tRNA structure	Highlighted on the arrangement of arms of tRNA in recognition of ribosome, amino acid and codon on mRNA	Chalk & Board	core concepts on the structure of tRNA in its role as transfer RNA was made clear for students
6	December 4th week					
7	January 1st week	IV	Concepts of Bioinformatics		Chalk & Board	students were made to appreciate Importance of bioinformatics in biotechnology

8	January 2nd week	IV	Biological data bases and nucleotide databases		Chalk & Board	Understand.
9	January 3rd week	IV	types of nucleotide databases GenBank, EMBL and DDBJ		Chalk & Board /ICT	Understood the relationship between the functioning and updating of information in GenBank, EMBL and DDBJ
10	January 4th week	IV	types of Protein databases		Chalk & Board	Acquired a sound knowledge on PDB, SWISS-PROT, UNI-PROT
11	January 5th week	IV	Data Retrieval tool BLAST		Chalk & Board, ICT	students learnt how to do sequence homology search for similar and dissimilar sequences
12	February 1st week	IV	Data Retrieval tool ENTREZ		Chalk & Board	The ENTREZ program made the students aware of sequence analysis
13	February 2nd week	IV	Literature databases PubMed and OMIM		Chalk & Board	Students were made aware of the importance of literature databases for getting information needed to carryout research.
14	February 3rd week	IV	PROSITE, Sequence Alignment		Chalk & Board	students appreciated the importance of alignment of sequences
15	February 4th week	IV	Local and Global alignment of sequences, Pairwise sequence alignment		Chalk & Board	Students were exposed to alignment of a pair of protein and nucleotide sequences
16	March 1st week	IV	Multiple sequence alignment			The alignment of more than two sequences of protein and nucleotide for their significance in evolution was made to understand .

Learning outcomes:

On completion of the course the students will get an in-depth knowledge on Genetic material its structure and replication including the role of different enzymes in its structural stability, and duplication by replication. Understanding of biostatistics and bioinformatics makes the students appreciate the role of these subjects in present day research.

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TEACHING PLAN: 2018-19

Program: BSc. (Bt/G/C)

Course Title: BT533 A: Animal and Plant Biotechnology

Name of the faculty: Dr S. Nagamanju	Department: Genetics & Biotechnology	Year/Semester: III/V	No. of classes per week: 3

Learning objectives: To understand the significance of Cell culturing along with various vessels and media used for culturing both animal and plants cells along with their significance in basic and applied research. Understand the importance of stem cells IVF and Gene therapy. Students learnt about plant tissue culture and do callus and shoot induction in the laboratory. They get exposed to the use of plant hormones in callus and shoot induction.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1.	June 2nd week	I	**Principles of Animal cell culturing**		Chalk & Board, Chart	Students understood he kinetics and cell surface markers in the culturing of cells.
2.	June 3rd week	I	**Animal cell culture vessels.**	Laboratory setup essential for the culturing of cells under highly sophistication.	Chalk & Board, ICT	Students understood about different types of vessels for culturing different types of cells.
3	June 4th week	I	**Suspension cell culture vessels Natural cell culture medium.**	Identification of different types of cell culture media	Chalk & Board, Chart	Students understand the importance of cell culture medium in culturing of cells.
4	July 1st week	I	**Cell disaggregation and establishment of cell cultures,**	Students understood how tissues are disaggregated to get cells.	Chalk & Board ICT	Students wrote an assignment on different types of cell lines
5	July 2nd week	I/II	**cell lines Stem cells and their applications.**	Appreciated the various applications of stem cells.	Chalk & Board.	Students appreciated the important applications of stem cells.
6	July 3rd week	II	**IVF and Embryo transfer technology**	Importance of Invitro fertilization in treatment of couples facing fertility issues	Chalk & Board ICT	Students understood the importance of embryo transfer technology in obtaining a high yielding variety of cattle
7	July 4th week	II	**Method of Gene transfer and transgenic animals**	Various trans genic animals raised and their applications Highlighted on the role of the gene therapy in solving medical alignments	Chalk & Board	Students understood the role of various gene transfer techniques employed to get transgenic animals and molecular pharming. including the importance gene therapy.

8	August 1st week	III	**Transgeneic animals Gene therapy Principles of plant cell culture Plant cell culture media**	Emphasized on the exvivo and invivo gene therapy.	Chalk & Board ICT	Students appreciated the importance of gene therapy as personalized therapy.
9	August 2nd week	II/III	**Exvivo Genethrapy Plant cell culture media**	Emphasized on methods of sterilization including autoclaving, and fumigation of laboratory	Chalk & Board ICT	Students understood role of plant growth regulators in plant issue culturing and prepared plant tissue culture media MS media..
10	August 3rd week	III	**Sterilization, Autoclaving and Filtration. Plant growth regulators sterilization**	Students understood the importance of NAA, BAP, IAA, 2-4D, kinetin and Zeatin hormones	Chalk & Boar ICT	.Students prepared stock solutions and medium for the culturing of plant tissues.
11	August 5th week	III	**Callus induction and OrganogenesisMeriste m culture for virus free plants. Embryogenesis**	Students appreciated the induction of embryogenesis in somatic tissues.	Chalk & Board	Students conducted callus induction and shoot induction in the laboratoryStudents encapsulated seed embryos to understand the preparation of synthetic seeds.
12	September 1st week	III	**Meristem culture and clonal propogation**	Applications of meristem culture	Chalk & Board ICT	Acquired a sound knowledge on the importance of meristem culture.
13	September 2nd week	III/IV	**Orgnaogenesis, Somatic embryogenesis. Batch and continuous cultures**	Importance of somatic embryogenesis	Chalk & Board	Students understood the various bioreactors employed for the mass cultivation of plant cells.
14	September 3rd week	IV	Commercial production of Shikonin, Capsaicin and Saffron Agrobacterium and gene gun mediated gene transfer		Chalk & Board	Students were made aware of the various cell products in cell cultures.
15	September 4th week	IV	Applications of rDNA technology and production of transgentic plants	Students learnt to about the various applications of rDNA technology.	Chalk & Board	students appreciated the role of r DNA technology
16	October 1st week	IV	Transgenic plants for production of therapeutic proteins		Chalk & Board	Students appreciated the importance of transgenic plants

Learning outcomes:

On completion of the course the students will get an in-depth knowledge on different types of cell culturing methods including the various media formulated to culture animal and plant cells. They will gain knowledge in obtaining cells from tissues for culturing analyzing them for viability and using them for various basic and applied research. Students will also excel in plant tissue culture like callus induction and shoot induction. They even appreciate the role of different gene trans methods employed to raise transgenic animals and plants.

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TEACHING PLAN: 2018-19

Program: BSc. (BtGC)

Course Title: BT 633A: Industrial and Environmental biotechnology

Name of the faculty: Dr S Nagamanju	Department: Genetics & Biotechnology	Year/Semester: III/VI	No. of classes per week: 3

Learning objectives: To understand core concepts fermentation technology and the various products of fermentation.
Introduce to students to the importance of nanotechnology in present day science and medicine.
Bring awareness among students on environment, energy recourses and bioremediation along with phytoremediation

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	November 3rd week	I	**Bioreactors and fermentation technology:** Design of the fermentator		Chalk & Board/	Knowledge on the basic design of a fermentator
2	November 4th week	I	Types of fermentators', fermentation technology industrially important microbes		Chalk & Board/	Concepts on fermentation along with the types of fermentation and types of fermentators
3	December 1st week	I	Strain improvement of industrially important microbes highlighting on mutant selection	Student involvement the preparation of wine from fresh fruits like grapes and tomatoes	Chalk & Board/	Significance of improving the industrially important microbe fermentator compatible
4	December 2nd week	I& II	Primary and secondary metabolites **Fermentation technology** fermentation technology		Chalk & Board	Highlighted to students the different products obtained from microbes
5	December 3rd week	II	Microbial fuels and chemicals, microbial enzymes and antibiotic production	Isolation of microbes from industrial effluents	Chalk & Board	Significance of the importance of microbial fuels and antibiotics.
6	December 4th week	II	Fermented foods, bread and Cheese Animal cells as bioreactors		Chalk & Board	A very clear understanding on the role of microbes in fermentation of food
7	January 1st week	II	Strategies for over production of targeted proteins- hGH production		Chalk & Board	core concepts on strategies for overproduction of recombinant proteins was made clear
8	January 2nd week	II	Over production of α & β interferons and MABs GMP, Biosafety and bioethics IPR and Patents	Significance on Intellectual property rights and GMPs for patenting	Chalk & Board	Assignment on biotechnology products of India patented

				Bio-safety measures for safe lab practice.		
9	January 3rd week	III	**Energy resources and Nanotechnology** Renewable and non-renewable energy resources		Chalk & Board	Students were taught to appreciate the significance of renewable resources
10	January 4th week	III	Conventional and non-conventional fuels and their impact, microbial production of hydrogen	Use of various types of biomass for bio-fuels production using microbes	Chalk & Board	importance of Biofuels in protecting the environment was made to understand by students
11	January 5th week	III	Bioethanol and biogas production	Laboratory production of biogas	Chalk & Board	Importance of ethanol as a substitute for fossil fuels
12	February 1st week	III	Nanotechnology applications	Information on various nano products available in market in use.	Chalk & Board	Student were made to understand and appreciate the significance of nanotechnology
13	February 2nd week	III & IV	Nanotechnology in medicine Microbial analysis and bioremediation microbiology of milk, food and water	MBRT for analysis the quality of milk	Chalk & Board	role of nanotechnology in medical field analysis the quality of food in terms of microbial infestation
14	February 3rd week	III & IV	Microbial degradation of pesticides and Xenobiotics Biopesticides and Biofertilizers	BOD of water to monitor the	Chalk & Board	Importance of Biopesticides and Biofertilizers was made clear for students to appreciate the use of them in future
15	February 4th week	IV	Microbial ore leaching and bioremediation.		Chalk & Board	Significance of microbes in low grade ore recovery was introduced to students
16	March 1st Week	IV	Phytoremediation	History of phyto-remediation	Chalk & Board	Role of plants in bringing bioremediation was appreciated by students

Learning outcomes:

On completion of the course the students learned to appreciate the importance of microbes in industry for the production of various metabolites. Students even understand the significance of nanotechnology in medicine. Importance of bioremediation and use of Biofuels and Biopesticides and Biofertilizers.

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TEACHING PLAN: 2018-19

Program: BSc. (Bt/G/C)/ MGC/MBiC

Course Title: SE333: Integrated Pest Management

Name of the faculty: Dr S. Nagamanju	Department: Genetics & Biotechnology	Year/Semester: II/III	No. of classes per week: 2
Learning objectives: To make students aware of the various types of pest present which belong to various taxa, emphasizing on the reasons for pest out break and measures to control by adopting environmental friendly IPM Strategies.			

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 3rd week	I	**Introduction to IPM**	Understanding Integrated Pest management	Chalk & Board, Chart	Students understood the concepts IPM.
2	June4th week	I	**Basic concept of Pest**	Students observed various insects present in the college campus	Chalk & Board ICT	Students were made aware of various types of pest
3	July 1st week	I	**IPM Concepts**		Chalk & Board ICT	Students were sent on a short survey in the college campus to take the pictures of insects
4	August 1st week	I	**Insect Pests and IPM**	Emphasized on the compaction of chromosome	Chalk & Board	Students made a scrapbooks of the various insects they came across in their daily lives.
5	August 3rd week	I	**IPM tools**	Emphasis was made on the eco-friendly strategies of IPM	Chalk & Board	Understood the different methods adopted by IPM
6	August 5th week	I/II	IPM pesticides and Chemical pesticides	Highlighted on the harmful effects of chemical pesticides.	Chalk & Board	Students listed the various chemical pesticides available in the market
7	September 1st week	I/II	Advantages of Bio-pesticides		Chalk & Board	Students wrote an assignment on the importance of using bio-pesticides.
8	September 2nd week	II	Success stories of IPM		Chalk & Board	Students appreciated the goals of IPM in controlling pest by adopting eco-friendly strategies.

Learning outcomes:

On completion of the course the students will get an in-depth knowledge on different types of pests that cause damage to the agricultural yield and also to the mankind by spoiling various important items of highest significance in day to day life. They will understand the functioning of IPM in controlling the pest by not causing any damage to the surrounding environment as it adopts various methods to control the pest and not just rely on the use of harmful chemical pesticides

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TEACHING PLAN: 2018-19

Program: BSc. BtGC /MGC/ MBiC

Course Title: SE433: Bioinformatics

Name of the faculty: Dr S Nagamanju	Department: Genetics & Biotechnology	Year/Semester: II/IV	No. of classes per week: 2
Learning objectives: To understand core concepts use of the information technology in understanding the interpretation of results in biological research and make the date available universally to every research scholar on the same platform of information technology.			

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	December 2nd week	I	Bioinformatics introduction	Student learnt the role of computers to analyze biological research	Chalk & Board/	Significance of information technology in biological research was highly acknowledged by students.
2	December 3rd week	I	Role of internet in Bioinformatics	Computational biology	Chalk & Board	Highlighted to students the different programs that make computers accessible to analyze biological date
3	December 4th week	I	Abbreviations and definitions		Chalk & Board	A preliminary understanding Bioinformatics
4	January 1st week	I	Applications of Bioinformatics and various biological databases.	Understanding of the concept of storage of large amount to f biological date	Chalk & Board ICT	Role of computers in organizing the biological data
5	January 2nd week	I	Types of Biological databases **GenBank, EMBL and DDBJ**	Various nucleotide and protein databasesAnalyzed the Nucleotide databases	Chalk & Board	Understood the functioning of the three very important nucleotide databases.
6	February 3rd week	I	PIR,PDB, SwissProt, UniProt		Chalk & Board	Student were made to use the databases in the computer lab sessions
7	February 1st week	I/II	ENTREZ,BLAST Program	Understood the Protein databases	Chalk & Board	Role of Blast and Entrez Students were given accession no o retrieve data and analyze the data using various programs of blast.

Learning outcomes:

On completion of the course the students learned to analyze the research data generated and use various tools to retrieve data from the various databases available online and do homology research. They will try doing small data retrieval project using the accessions numbers give to them as a part od an assignment.

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TEACHING PLAN: 2018-19

Program: BSc. (Bt/G/C) MGC

Course Title: SE533: Plant Tissue Culture

Name of the faculty: Dr S. Nagamanju	Department: Genetics & Biotechnology	Year/Semester: III/ V	No. of classes per week: 2

Learning objectives: To understand the significance of Micro propagation to achieve more number of plants in a very short period of time by employing the technique of tissue culture which otherwise is not possible by following simple plant breeding techniques.

S.No.	*Month & Week*	*Units*	*Syllabus*	*Additional Input/ value addition*	*Teaching method*	*Student/learning activity*
1	June 4th week	I	**Introduction to Plant Tissue culture.**		Chalk & Board, ICT	Students were introduced to the concepts of Plant tissue culture
2	July 1st week	I	**Organogenesis**	Students understood how tissues are use to induce organogenesis	Chalk & Board ICT	Students appreciated the concept
3	July 2nd week	I	**Plant Tissue culture medium**	Introduced to various tissue culture mediums present.	Chalk & Board. ICT	Students were taught to make stock solutions to made the MS medium for plant tissue culture.
4	July 3rd week	I	**Direct and Indirect Organogenesis**	Importance of Callus and generation of tissue cultured plants in laboratory.	Chalk & Board ICT	Students learnt how to induce organogenesis and callus in cultured tissues in the laboratory
5	July 4th week	I	**Somatic embryogenesis**		Chalk & Board	Students were introduced the concept of getting embryos from somatic cells.
6	August 1st week	I/II	**Synthetic seeds**	Emphasized on conversion of somatic embryos to synthetic seeds	Chalk & Board	Students were made to encapsulate normal seed embryos in sodium alginate and prepare synthetic seeds
7	August 2nd week	I/II	**Callus induction**	Emphasized on laboratory procedure for plant tissue culture.	Chalk & Board ICT	Students hand hands on training on the process of raising callus from the plant tissues in laboratory.
8	August 3rd week	I/II	**Root and Shoot induction**	Students understood the importance of NAA, BAP, IAA, 2-4D, kinetin and Zeatin hormones	Chalk & Boar ICT	Students inoculated the culture tubes with the explants to induce organogenesis in the plant tissues.

Learning outcomes:

On completion of the course the students will get an in-depth knowledge on different types of cell culturing methods including the various media formulated to culture plant cells. Students will get hands on training in plant tissue culture like callus induction and shoot induction. They even appreciate the role of different gene trans methods employed to raise transgenic animals and plants.

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