



Solapur University, Solapur

**M. Sc. Genetics Part – I
(Choice Based Credit System Syllabus)
(Semester I & II)**

(w.e.f. June 2015-16)

SOLAPUR UNIVERSITY, SOLAPUR

Revised Syllabus (C.B.C.S.) for M.Sc. PART - I GENETICS Semester I & II

(w. e. f. JUNE 2015-16)

1) Title of the Course: M.Sc.-I Genetics (C.G.P.A.)

2) Introduction: This course provides a broad overview of genetics and how it applies to the current research and various life science sectors. Major theoretical perspectives and concepts are presented, including Biochemistry and Molecular medicine which is an application oriented subject.

3) Objectives of the course:

- To learn and understand the basic as well as advanced part of the fundamental unit of life which is DNA.
- A course on genetics would be a totally specialized course focusing on the genetic aspect of not just humans but all living things in the ecosystem.
- A specialized course would enhance the knowledge of the students in one dimension and thus would have an edge of being specialized candidate when compared with the others for the job perspective.

4) Advantages of the Course:

- With the understand of the life, need for the more and more Geneticist is the need of the future
- After completing M.Sc. Genetics students can easily get into the research field as most of the research today is done at genetic level.
- Pharmaceutical Industries being more focused on the gene based drugs thus students have opportunity in such industries
- India being agriculture based country, Agriculture sector would seeks students of M.Sc. Genetics for incorporating the genetics knowledge in plant and animal breeding and creating a conducive breed.
- Apart from the usual life science industry students can also work as a genetic counsellor which is a need of future.

5) Eligibility of Course:

- For admission into Master's degree of Genetics, the candidate should be graduate from a recognized University with any of the life science subject.

6) Duration:

- The duration for this program is of 2 years with semester pattern having a total of 4 Semesters.

7) Medium of Instruction: English

8) Structure of the Course:

- Structure of M.Sc. course in faculty of Science has total of 4 semesters for 2 years.
- M. Sc. I comprises of total two semesters and M. Sc. II comprises of total two semesters.

- Each semester includes four theory papers and two practical course i.e. M.Sc. I Semester I comprises four theory papers (Paper I, II, III, and IV) carrying 100 marks each and two practical papers (Paper I and II) carrying 100 marks each. M.Sc. I Semester II comprises four theory papers (Paper V, VI, VII, and VIII) carrying 100 marks each and two practical papers (Paper III and IV) carrying 100 marks each.
- Each theory paper comprising of 5 units which are distributed in total 45 lecture hours having weightage of 4 credits.
- Practical papers are to be conducted at the end of their respective semester.
- Final year project work should begin in 3rd semester and the complete thesis should be submitted during the practical exam of the 4th and the final semester.
- Student would have to present his/her project work during the project report submission which would be evaluated by the internal as well as the external examiner.
- As per the credit system, the assessment of Theory paper of 100 marks weightage will be as: 70 marks theory assessment by University examination (UA) and 30 marks internal assessment by the college (CA). For internal assessment of candidate, periodical tests/seminars/ viva/oral / quiz etc. may be suitably adopted.
- As per the credit system, the assessment of practical paper of 100 marks weightage will be as: 70 marks theory assessment by University examination (UA) and 30 marks internal assessment by the college (CA).
- In each semester student has to give a compulsory seminar which has weightage of 25 marks in each semester.

SOLAPUR UNIVERSITY, SOLAPUR

Syllabus for M.Sc. I Genetics

(w.e.f. June 2015-16 onwards)

Semester I

Theory Papers						
Paper No.	Paper Code	Title of Paper	Marks			Credits
			UA	CA	Total	
I	GEN-101	Concepts of Genetics	70	30	100	4
II	GEN-102	Biostatistics and Population genetics	70	30	100	4
III	GEN-103	Cytogenetics and Genome Organization	70	30	100	4
IV	GEN-104	Cellular and Molecular Biology	70	30	100	4
Practical Papers						
Paper No.	Paper Code	Title of Paper	Marks			Credits
			UA	CA	Total	
I	GEN-105	Concepts of Genetics, Biostatistics and Population genetics	70	30	100	4
II	GEN-106	Cytogenetics, Genome organization, Cellular and Molecular Biology	70	30	100	4
		Seminar	--	25	25	1
Total Marks and Credits			625			25

Semester II

Theory Papers						
Paper No.	Paper Code	Title of Paper	Marks			Credits
			UA	CA	Total	
V	GEN-201	Regulation of gene expression and developmental genetics	70	30	100	4
VI	GEN-202	Concepts of Biochemistry	70	30	100	4
VII	GEN-203	Advanced microbial genetics	70	30	100	4
VIII	GEN-204	Plant breeding and Tissue culture	70	30	100	4
Practical Papers						
Paper No.	Paper Code	Title of Paper	Marks			Credits
			UA	CA	Total	
III	GEN-205	Gene expression, Developmental genetics and Concepts of Biochemistry	70	30	100	4
IV	GEN-206	Microbial genetics, Plant breeding and Tissue culture	70	30	100	4
		Seminar	--	25	25	1
Total Marks and Credits			625			25

SEMESTER - I

Theory Syllabus

Paper - I: CONCEPTS OF GENETICS

Total lectures: 45

Total Credit : 04

UNIT 1 [10]

Introduction: Cell Division – Mitosis and Meiosis. Model systems in genetic analysis: General Outline of genome of *E.coli*, *Neurospora crassa*, maize, *Drosophila*, Life cycle of *S.cerevisiae*, *C.elegans*, *Arabidopsis thaliana*, *Homo Sapiens*.

UNIT 2 [10]

Laws of Inheritance: Mendel's Law of Dominance, segregation, and Independent assortment. Test cross, Back cross, Co-dominance, Incomplete dominance, Allelic Interaction, multiple allele Linkage: Concept, Recombination, Crossing Over, Gene mapping in Prokaryotes and Eukaryotes, Complementation test.

UNIT 3 [08]

Structure of Sex Chromosomes, Sex linked Inheritance: Complete and incompletely sex linked genes. Inheritance of XY linked genes, Y linked genes, X linked genes, Sex limited and Sex influence gene. Quantitative inheritance: Concept, Genes and Environment: heritability, Penetrance and expressivity.

UNIT 4 [09]

Mutation: Types - Spontaneous and Induced Mutations, Chemical and Physical Mutagenic agents, Mechanism of action of Mutagenic agents, Transposon mediated mutagenesis. Changes in Chromosome number and Structure: Polyploidy, Aneuploidy, Chromosomal aberrations – Intra and Inter chromosomal aberrations.

UNIT 5 [08]

DNA Damage and Repair: Base excision repair (BER), Nucleotide excision repair (NER), Mismatch repair (MMR), Homologous recombination (HR), Nonhomologous end joining (NHEJ), Photo reactivation and Dark repair.

References:

1. Concepts of Genetics- Klug W. S. And Cummings M. R Prentice-Hall
2. Genetics-a Conceptual Approach Pierce B. A. Freeman
3. Genetics- Analysis of Genes and Genomes Hartle D. L. And Jones E. W. Jones & Bartlett
4. An Introduction to Genetic Analysis- Griffith A. F. et al Freeman
5. Principles of Genetics -Snustad D. P. And Simmons M. J. John Wiley & Sons.
6. Genetics- Strickberger M. W. Prentice-Hall
7. Genetics - B.D.Singh
8. Genetics - Verma & Agrawal
9. Genetics - P.K.Gupta

UNIT 1 [12]

Basic terms, measures of central tendency and dispersion: Population, Sample, sampling method, variable, parameter, classification of data, Frequency distribution, tabulation, graphic and diagrammatic representation. Mean, median, mode, quartiles and percentiles, measures of dispersion: range, variance, standard deviation, coefficient of variation, symmetry: measures of skewness and kurtosis **Probability and distributions:** Definition of probability (frequency approach), independent events. conditional probability, Examples of Bernoulli, Binomial, Poisson and Normal distributions. Coefficient of distribution, Use of these distributions to describe in biological models.

UNIT 2 [10]

Bivariate data: Scatter plot, correlation coefficient (r), properties (without proof), Interpretation of r, linear regression. Fitting of lines of regression, regression coefficient, coefficient of determination. **Hypothesis Testing:** Hypothesis, critical region, and error probabilities. Z-test, 't'-test, Chi-square test for independence. P-value of the statistic. Confidence limits, Introduction to analysis of variance.

UNIT 3 [07]

Introduction: Overview of history and evolutionary theories with more emphasis on synthetic theory of evolution, Mendelian and Biometrician controversy, Population Genetics and Birth of Neo-Darwinism, Genetics polymorphism, Hardy-Weinberg genetic Equilibrium with example, Forces affecting the Hardy-Weinberg Genetic equilibrium. Causes of changes in allele frequency through natural selection/artificial selection.

UNIT 4 [09]

Heritability and measurement of variability. Genetic load – overview and causes. Co-adapted gene complex – Traits controlled by two loci, three loci and multi-loci. Isolating mechanisms: Classification – (a) Geographic isolation (b) Reproductive isolation – (i) Premating isolation – Climatic, Seasonal, Habitat, Ethological (ii) Post mating isolation – gametic mortality, zygotic mortality, Hybrid inviability, Hybrid sterility, Hybrid breakdown (c) Origin of reproduction isolation – Muller's view, Dobzhansky view. Speciation: (a) Species types (b) Species categories (c) Concepts of species (d) Models of speciation (e) Hybridization and speciation (f) Phyletic gradualism and punctuated equilibrium (g) Molecular aspect of speciation -speciation genes.

UNIT 5 [07]

QTL mapping strategies; Statistical methods for mapping QTL in experimental cross populations (experimental design, linkage map construction, single-marker analysis, interval mapping and multiple interval mapping), Estimation of breeding values and genetic variances in general pedigrees, association mapping, genomic selection, direct and associative models of general group and kin selection, genotype by environment interaction models.

References:

1. DNA markers Protocols, applications and overviews- Anolles G. C. & Gresshoff P. Wiley-Liss
2. Molecular markers in Plant Genetics and Biotechnology -Vienne De. D. Science Publishers
3. Genetics of Population- Hedrick P.W. Jones & Bartlett

4. Principle of Population Genetics -Hartl D. L. and Clark A.G Sinauer Associates
5. Biostatistics- Danial, W. W Wiley
6. Statistical methods in Biology- Bailey, N.T.J Cambridge Univ.Press
7. Statistical Genetics: Linkage, Mapping and QTL analysis, Ben Hui Liu – CRC Press
8. Statistical Genetics: Gene Mapping Through Linkage and Association, ed. By B Neale, M Ferreira, S Medland, D Posthuma – Taylor Francis
9. The Fundamentals of Modern Statistical Genetics NM Lairdand, C Lange - Springer
10. Computational Molecular Evolution, Z Yang, 2006, Oxford University Press.

Paper - III CYTOGENETICS AND GENOME ORGANIZATION

Total Lectures: 45

Total Credit :04

UNIT 1 [10]

Chromosome structure, Organization: Chromatin structure, Nucleosomal and Higher order, Telomere and its maintenance. Mitotic and Meiotic Chromosomes. Heterochromatin and euchromatin, Special types of chromosomes – Polytene chromosome, Lamp-brush chromosome. B chromosome, Sex chromosome.

UNIT 2 [06]

Chromosome Banding – (G, Q, C, R) and Painting, Karyotyping, *In-situ* hybridization (FISH and GISH), Somatic cell hybridization, Somaclonal Variation

UNIT 3 [10]

Extra Nuclear inheritance - Maternal inheritance, Mitochondrial, and Chloroplast, P-element in *Drosophilla*. Plasmids: Types, detection, replication, incompatibility, partitioning, copy number control and transfer. Properties of some known plasmids.

UNIT 4 [09]

Genome organization in viruses, bacteria, animals and plants. Mechanisms of sex determination in plants, animals and *Drosophila* (Dosage compensation), Organization of nuclear and organellar genomes.

UNIT 5 [10]

Genome mapping (Physical maps) and functional genomics; Repetitive DNA-satellite (minisatellite, microsatellite DNA). Introduction to Transposable Elements in Prokaryotes and Eukaryotes, C-value paradox, LINES, SINES, Alu family, Fine structure of gene, multigene families.

References:

1. Essential Cell Biology -Alberts B. et al. Garland
2. Molecular Biology of The Cell- Alberts B et al. Garland
3. The Eukaryotic Chromosome- TBostock C. J. & Summer A. T.T Elsevier
4. The Chromosome- Hamsew and Flavell Bios
5. Advanced Genetic Analysis- Hawley & Walker Blackwell
6. Structure & Function of Eukaryotic Chromosomes- Hennig Springer
7. Genes IX- Lewin B. Pearson
8. Molecular Cell Biology -Lodish, H. et al. Freeman
9. Cell and Molecular Biology- De Robertis & De Robertis Lippincott & Wilkins
10. Genome 3 -Brown T. A. Garland

UNIT 1 **[09]**

Types of replication, DNA replication in prokaryotes and eukaryotes - i) Initiation of replication process: Origin of replication in Prokaryotes and Eukaryotes, ii) Elongation: coordinated synthesis of Leading and Lagging strands. iii) Termination: End of replication. Transcription mechanism-Initiation, Elongation and Termination in Prokaryotes and Eukaryotes, RNA Polymerase.

UNIT 2 **[10]**

Genetic code- deciphering the code, codon usage, Eukaryotic and Prokaryotic Translation. Membrane Trafficking: Vesicular transport from Endoplasmic reticulum to Golgi Apparatus, Endoplasmic reticulum and its function, Vesicular transport in Golgi apparatus. Golgi Complex and its function

UNIT 3 **[06]**

Antisense, RNAi, Micro RNA - Mechanism and Examples, Ribozyme Tailor made for gene silencing.

UNIT 4 **[10]**

Cytoplasmic Membrane: Chemical Composition of Membrane, Structure and function of Membrane proteins, Fluid Mosaic Model, Movement of substances across cell membrane – Diffusion, Active transport. Cell Cycle and Cell-Cell Adhesion: Cell Cycle Phases, Extracellular space, Desmosomes, Hemidesmosomes, Integrins, Selectins, Cadherins, Tight Junction, Gap Junction.

UNIT 5 **[10]**

Signal Transduction: G protein coupled receptor, tyrosine Kinase receptor - Ras- MAP Kinase pathway, Hedgehog pathway, WNT signalling pathway, Notch Pathway, Nf- κ B Pathway.

References:

1. Molecular Biology of the Gene- Watson, J. et al. Benjamin Cummings
2. Molecular Cell Biology -Lodish,H. et al. W. H. Freeman
3. The World of the Cell- Becker, W.M. et al. Benjamin Cummings
4. Essential Cell Biology- Alberts B. et al. Garland
5. Molecular Biology of The Cell -Alberts B et al. Garland
6. Cell & Molecular Biology by Karp
7. Genetics by B.D.Singh
8. Genetics by Verma & Agrawal
9. Genetics by P.K.Gupta
10. Cell and Molecular Biology by P.K.Gupta

Practical Syllabus

Paper - I: Concepts of Genetics, Biostatistics and Population genetics

1. Study of mitosis
2. Study of meiosis.
3. To Study the effect of mutagens on germination, seedling growth and on mitosis.
4. Mendelism problem: one factor & two factor with examples.
5. Problems on non-Mendelian genetics.
6. Problem on gene mapping.
7. Problems on Linkage.
8. Study of adaptation in *Drosophila* by biotic/abiotic effect.
9. Spontaneous mutation: Fluctuation test – StrR.
10. Spontaneous mutation: Replica plate method-StrR
11. Study of data presentation-graphical.
12. Study of data presentation-diagrammatic.
13. Study of measures of central tendency.
14. Study of measures of dispersion.
15. Study of correlation and regression.
16. Study of probability.
17. Examples on student 't' test.
18. Examples based on pedigree analysis.
19. Examples based on Hardy Weinberg Equilibrium.

Paper - II: Cytogenetics, Genome organization, Cellular and Molecular Biology

1. Preparation of *Drosophila/Chironomas* polytene Chromosomes
2. *Drosophila* genetic crosses.
3. Study of different morphology of nucleus.
4. Chromosome preparation from human blood lymphocytes.
5. Identification of inactivated X chromosome as Barr body.
6. G-banding and karyotyping.
7. DNA isolation from plants.
8. Problems on extrachromosomal inheritance.
9. Quantitative analysis of DNA using DPA method.
10. Qualitative analysis of DNA - Physical Property (T_m Melting Temperature).
11. Isolation and estimation of RNA from Bacteria.
12. Quantization of DNA by spectrophotometer.
13. Size fractionation of total DNA using electrophoresis.
14. Ligation of DNA using electrophoresis.
15. Isolation of Mitochondria.
16. Isolation of Chloroplast.
17. Isolation of organellar DNA.
18. Isolation of total Protein from Bakers Yeast (Translation).
19. Estimation of total Protein from Bakers Yeast (Translation) .

SEMESTER II

Theory Syllabus

Paper - V: REGULATION OF GENE EXPRESSION AND DEVELOPMENTAL GENETICS

Total lectures: 45
Total Credit : 04

UNIT 1 [11]

Gene regulation in prokaryotes: Operon model of regulation (with examples of *lac*, *trp* and *ara*). Negative, positive and attenuation control in bacteria. Control of lysis and lysogeny in Lambda phage. Gene regulation in eukaryotes: Overview of gene regulation using examples of galactose-utilization in yeast; heat shock gene expression; Signal integration in Human β -Interferon gene.

UNIT 2 [10]

Transcriptional control – changes in chromatin structure, epigenetics controls, Post transcriptional regulation – alternative RNA splicing, RNA editing, RNA stability, Translational regulation – RNA structure, control at initiation, codon usage, Post Translational modification. Regulation of SV40 and CaMV 35S viral promoters. Hormonal control of gene regulation in animals (thyroxine and insulin) and plants (cytokinin & gibberellins). Regulation of Cell cycle.

UNIT 3 [10]

Basic concepts in development: Potency, commitment, specification, induction, competence, determination and differentiation; Production of gametes, cell surface molecules in sperm-egg recognition in animals; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryo sac development and double fertilization in plants; embryogenesis, establishment of symmetry in plants; seed formation and germination.

UNIT 4 [09]

Cell aggregation and differentiation in *Dictyostelium*; axes and pattern formation in *Drosophila*, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.

UNIT 5 [05]

Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*.

References:

1. Genes and Signals- Mark Ptashne and Alexander Gann CSHL Press
2. A Genetic Switch- Mark Ptashne CSHL Press
3. Gene Regulation- David S Latchman Chapman & Hall
4. Genes- Benjamin Lewin Prentice Hall
5. Molecular Cell Biology- Lodish, H. et al. W. H. Freeman
6. Principles of Developmental Genetics, -Sally A. Moody Academic Press

7. Advances in Anatomy, Embryology and Cell Biology, -Korf, H.-W., Beck, F., Clascá, F., Haines, D.E., Hirokawa, N., Putz, R., Timmermans, J.-P. Springer
8. Developmental Biology- Gilbert S. F. Sinauer
9. Development of *Drosophila melanogaster* (Vol I & II)- Bates and Arias CSHL Press
10. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. &Williams, R.J. Saunders College, Publications, London.
11. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.

Paper - VI: CONCEPTS OF BIOCHEMISTRY

Total lectures: 45

Total Credit : 04

UNIT 1 [05]

Laws of Thermodynamics: Concept of Free Energy, Standard free energy change and chemical equilibrium, Biological oxidation reduction reaction, Redox potential, ATP as energy-rich compound.

UNIT 2 [10]

Protein - classification according to its function. Amino Acids, Classification of amino acids. Peptides, The primary, secondary and tertiary and quaternary structure of proteins. Ramachandran Plot. Enzymes as biocatalysts; enzyme classification, Properties of enzymes, Active site. Mechanism of enzyme action, Michaelis-Menten Equation, inhibition of enzymes.

UNIT 3 [05]

Vitamins - Classification, Structure and biological role of - Thiamin, Riboflavin, Nicotinic acid, Biotin, Folic acid , Ascorbic Acid, Vitamin A, D ,E, K.

UNIT 4 [13]

Carbohydrate - Classification, structure, general properties and functions, Glycolysis, Gluconeogenesis, Cori Cycle, TCA, HMP Shunt, Glycogen metabolism, Oxidative phosphorylation, Structure of ATPase. Photosynthesis: Structure of Chloroplast, Light and Dark Reaction, Photophosphorylation, Calvin Cycle, HSK Pathway, CAM Pathway.

UNIT 5 [12]

Lipids - Classification, structure, properties and functions of fatty acids; Storage lipids Phospholipids, sphingolipids, steroids, Biosynthesis of fatty acids, Beta oxidation of fatty acid, Reactions of amino acid metabolism – transamination, deamination, decarboxylation, Urea Cycle, Nucleotides, Purines and Pyrimidines, Nucleotide Biosynthesis – Salvage and De NOVO.

References:

1. Principles of Biochemistry -Lehninger et al. Freeman
2. Biochemistry -Devlin, T.M. Wiley-Liss
3. Biochemical Calculation -Sehgal I. H. Wiley
4. 4 Fundamentals of Enzymology -TPrice N. C. and Lewis S.T Oxford University Press
5. Biochemistry -TBerg, J. M. Tymoczko, J. L and Stryer L.T W. H. Freeman

Paper - VII: ADVANCED MICROBIAL GENETICS

Total lectures: 45

Total Credit : 04

UNIT 1 [09]

Conjugation: Discovery, nature of donor strains and compatibility, interrupted mating and temporal mapping, Hfr, F, map of F plasmid, mechanism of chromosome transfer in bacteria.

UNIT 2 [09]

Transformation: Natural transformation systems, Biology and mechanism of transformation, Competency, regulation of competency in *B. subtilis*, Artificial induced competency- calcium ion induction and electroporation.

UNIT 3 [09]

Transduction: Generalized and specialized or restricted transduction, Phage P1 and P22-mediated transduction, mechanism of generalized transduction, abortive transduction. Temperate phage lambda and mechanism of specialized transduction.

UNIT 4 [10]

Techniques for studying bacteriophages: Virulent phage (T4) and Temperate phage (phage lambda). Important aspects of lytic cycle, phage-host relationships, immunity and repression. Bacterial mutagenesis: Mutation, evidence of spontaneous nature of mutation, Fluctuation test, Methods of isolation of autotrophic mutants, drug resistant mutants and phage resistant mutants, analysis of mutation in biochemical pathways.

UNIT 5 [08]

Overview of Fungal Biology: Fungal life cycle and various phases, Fungi in nature, fungi in biotechnology, and as experimental tools. Yeast Mating - Type Switching mechanism,

References:

1. Microbial Genetics -Maloy S., Cronan J., Freifelder D Jones and Bertlett
2. Fundamental Bacterial Genetics- Trun N and Trempey J Blackwell Publ.
3. Modern Microbial Genetics- Streips U. N. and Yasbin R E. Wiley-Liss
4. Molecular Genetics of Bacteria- Sneider L. and Champness W. ASM Publishers
5. Genetics of Bacteria- Scaife J. Academic Press
6. Genetics of Bacteria and Viruses- Birge E. A. Springer
7. Molecular Genetics of Bacteria- Dale J.W. and Park S Wiley
8. Fungal Genetics: Principles and Practice Bos C J. CRC
9. The Mycota Ed. Esser K. & Lemke P. A. Springer
10. Essential Fungal Genetics-Moore D.& Frazer N. Springer
11. Fungal Genetics- Fincham Springer

UNIT 1

[09]

History; Genetic resources- centers of diversity and origin of crop plants, Law of Homologous variation, genetic resources. Breeding methods for self-pollinated, cross-pollinated and clonally propagated crops. Component, recombinational and transgressive breeding. Single seed descent. Populations, their improvement methods and maintenance, Hybrid breeding and genetic basis of heterosis. Ideotype breeding. Mutation breeding.

UNIT 2

[09]

Plant Breeding for Stress Resistance and Nutritional Quality: Genetic basis and breeding for resistance to diseases and insect-pests. Breeding for vertical and horizontal resistance to diseases. Genetic and physiological basis of abiotic stress tolerance. Breeding for resistance to heat, frost, flood, drought and soil stresses. Important quality parameters in various crops, their genetic basis and breeding for these traits. Role of molecular markers in stress resistance breeding: MAS, MARS and MABB.

UNIT 3

[09]

Plant regeneration pathways - Organogenesis and Somatic embryogenesis; Endosperm culture and triploid production; Anther and pollen culture, and production of haploid and doubled haploid plants; Protoplast culture and fusion, Somatic hybrids; Organelle transfer and cybrids; Micropropagation, artificial seed and bioreactor technology, Virus-free plants by meristem culture; Use of somaclonal and gametoclonal variation for crop improvement; In vitro mutagenesis and mutant selection; Preservation of plant germ plasm *in-vitro*.

UNIT4

[09]

Cryopreservation -Principle and types. Biosynthesis- batch, continuous cultures, immobilized plant cell, Biotransformation of precursors by cell culturing, metabolic engineering for production of secondary metabolites, Hairy root culture, elicitation.

UNIT 5

[09]

Transgenic crops for resistance against biotic and abiotic stresses; Transgenic plants-Edible vaccine, Golden rice; Engineering crops for male sterility and modification of flower colour, flowering, fruit ripening and senescence; GM crops for nutritional quality and quantity; RNAi-mediated crop improvement; Molecular pharming; Other applications; Global status and biosafety of transgenic plants.

References:

1. Principles of Plant Breeding, Allard RW – Wiley
2. Plant Breeding Theory and Practice, Stoskopf NC, Tomes DT and Christie BR – Westview Press
3. Quantitative Genetics, Genomics and Plant Breeding, Kang MS – CABI Publishing
4. Plant Molecular Breeding, Newbury HJ – CRC Press
5. Plant Cells in liquid culture (1991), Payne Shuler Hanser Publishers.
6. Introduction to plant tissue culture- M.K. Razdan
7. Plant tissue culture-Theory & practice-S.S.Bhojwani & M.K. Razdan
8. Plant tissue culture-Kalyankumar Dey
9. Biotechnology- H.S. Chawla

Practical Syllabus

Paper - III: Gene expression, Developmental genetics and Concepts of Biochemistry

1. Induction and assay of β - galactosidase from *E.coli*.
2. Observation of homeotic mutants of *Drosophila*
3. Study of Chick embryo development (preparation of whole mounts & permanent slides)
4. Study of different types of sperms by smear technique- Frog, Hen, Rat and Human
5. Study of Cleavage, Blastula and Gastrula –Frog and Hen (Slide/ICT)
6. Study Teratogenic effect on development of Frog / Chick embryo
7. Study of developmental phases in human (By ICT)
8. To study types of ovules and male gametophytes (by permanent slides)
9. Study of floral patterning in any suitable flower
10. Quantitative estimation of Protein by Biurete method.
11. Quantitative estimation of Protein by Lowry's method.
12. Quantitative estimation of Glucose by DNSA method.
13. Quantitative estimation of Total sugar by anthrone method.
14. Quantitative estimation of Cholesterol from serum by Zacs method.
15. Determination of acid value, Iodine number, and saponification of fat/oil.
16. Isolation of casein from milk.
17. Isolation of starch from potato.
18. Immobilization of enzyme (Calcium chloride and Sodium alginate).
19. Assay of amylase by iodometric method.
20. Qualitative analysis of Carbohydrate/lipid/amino acids.


Paper - IV: Microbial genetics, Plant breeding and Tissue culture

1. Isolation of Rhizobium from root nodule.
2. Seed dressing and inoculation with *Rhizobia*.
3. Perform experiment to study bacterial transduction.
4. Perform experiment to study bacterial Conjugation
5. Perform experiment to study bacterial Transformation
6. Detection and estimation of protease inhibitors from pulse seeds.
7. Isolation of vitamin B12 auxotrophic mutants.
8. Isolation and quantification of genomic DNA from bacteria.
9. Isolation of Plasmid DNA from bacteria.
10. Induction of polyploidy using colchicines. (Root Tip)
11. Cytological analysis of polyploidy plants. (Root Tip)
12. Study of Pollen fertility.
13. Isolation of genomic DNA from Plants.
14. Isolation of Ti Plasmid from Agrobacterium.
15. Media preparation, sterilization and callus culture.
16. Somatic embryogenesis and somaclonal variation, micro-propagation.
17. Cell suspension culture.
18. Isolation of protoplast by chemical and mechanical methods.
19. Synthetic seeds preparation.
20. Visit to commercial R & D green houses, agro based industries.

Examination Pattern (UA - University assessment)

The examination for theory / practical (70 marks) are conducted semester wise by university as per University Time Table.

Nature of Theory question paper for each theory paper.

	Solapur University, Solapur Nature of Question Paper for Semester Pattern (New C.B.C.S.) Faculty of Science M.Sc. Genetics
Time:- 3 hrs	Total Marks-70
Note: 1) Section - I Compulsory 2) Answer any four questions from Section - II	
Section - I	
Q. 1 A) Multiple choice questions	(07)
i) ----- a) b) c) d)	
ii) iii) iv) v) vi) vii)	
B) Define the following terms	(07)
i) ii) iii) iv) v) vi) vii)	
Section - II	
Q. 2) Long answer type question	(14)
Q. 3) Long answer type question	(14)
Q. 4) Long answer type question	(14)
Q. 5) Answer any TWO of the following	(14)
i) Short answer type question ii) Short answer type question iii) Short answer type question	
Q. 6) Write Short notes on any TWO of the following	(14)
i) Short note ii) Short note iii) Short note	

