ANNEXURE - I

SYLLABI - SEMESTER IV

SEMESTER-IV

COURSE TITLE: CYTOGENETICS (THEORY)

COURSE CODE: BOT-IV.C-6

NAME OF THE FACULTY: Ms. Amisha Shirodker

MARKS: 75

CREDITS: 3

COURSE OBJECTIVES:

This course will enable the students to understand fundamentals of genetics and evolution.

LEARNING OUTCOMES :

It will enable the students to understand the mechanism, role and importance of cell division, linkage and crossing over. The students will also know the various gene mutations and variations & their adverse effects.

SEMESTER-IV CYTOGENETICS THEORY -75 MARKS

Sr.No.	UNITS, TOPICS AND SUB-TOPICS	HOURS
UNIT I Mendelian genetics and principles of inheritance		**04**
1.1	Mendel's Laws, backcross and test cross,	**02**
1.2	Allelic and non-allelic interactions, Epistatic interactions	**02**
UNIT II Multiple allelism		**03**
2.1	Multiple alleles in Drosophila (eye colour),	**01**
	man (blood groups) and	**01**
	plants (self-incompatibility).	**01**
UNIT III Linkage and Crossing over		**05**

3.1	Meiosis, Comparison of Mitosis and Meiosis; Linkage- Coupling and Repulsion Hypothesis	03
3.2	Crossing over- Chromosome mapping, Three point test cross, Interference and coincidence	02
Unit IV	**Extranuclear inheritance and Maternal influence**	07
4.1	Extranuclear inheritance and maternal influence: Kappa particles in *Paramecium;* Streptomycin sensitivity in *Chlamydomonas*, CO_2 sensitivity in *Drosophila*; cytoplasmic inheritance in mitochondria and plastids; Shell coiling in snails; eye colour in flour moth. Cytoplasmic male sterility	06
4.2	Chemical basis of cytoplasmic inheritance	01
UNIT V	**Sex Determination and Sex Linkage**	07
5.1	Sex Chromosomes, Mechanisms of sex determination; Genic balance mechanism.	03
5.2	Sex-linked inheritance- X linked and Y linked inheritance.	03
5.3	Nutrition and environment theory of Sex determination	01
UNIT VI	**Genetic and Cytological effects of Mutations at genetic level**	07
6.1	Mutations and its types.	01
6.2	Types of mutagens, mode of action	03
6.3	Chromosomal aberrations – duplications, deletions, inversions and translocation	03
UNIT VII	**Molecular basis of mutations**	06
7.1	Transitions and transversions; frame shift mutations.	02
7.2	DNA repair mechanisms	03
7.3	Applications of mutations	01

UNIT VIII Genetic variation due to chromosome number		**06**
8.1	Variations in chromosome number; auto-and allo-polyploidy - types and effects; artificial induction of polyploidy. Auto and allo-polyploid crop species	**03**
8.2	Aneuploid segregations in plants- tetrasomics and nullisomics; triploid and tetraploid plants .	**02**
8.3	Applications of polyploidy	**01**
	TOTAL	**45** HOURS

COURSE TITLE: CYTOGENETICS (PRACTICAL)
COURSE CODE: BOT-IV.C-6
NAME OF THE FACULTY: Ms. AmishaShirodker
MARKS: 25
CREDITS: 1

Sr. No	Experiments	Practical
1.	Study of Mitosis using suitable plant material.	01
2.	Study of Meiosis suitable plant material.	01
3.	Karyotype analysis and preparation of idiogram	01
4.	Detection of anomalies in cell division using suitable plant material.	01
5.	Study of multiple allelism in blood groups of human beings.	01
6.	Effect of chemical mutagen on seed germination	01
7.	Effect of physical mutagen on seed germination	01
8.	Preparation of chromosome maps from 3-point test cross data and calculation of Interference and coincidence	01
9.	Induction of polyploidy using Colchicine treatment.	01
10.	Study of sex linked inheritance	01
11.	Study of CO_2 sensitivity in *Drosophila*	01
12.	Study of Streptomycin sensitivity in *Chlamydomonas*	01
	TOTAL	**12 P**

Reference Books:

1. Concepts of Genetics W. S. Klug, M. R. Cummings, C. A. Spencer. 8 Edition, Pearson Education International (2006)
2. Gardner, Eldon J.; Snustad, Peter D.; Principles of genetics; 7th edition; New York: John Wiley &Sons ,(1984).
3. Genetics : A Conceptual Approach B. Pierce, 3rd Edition, Freeman & Co., (2008)
4. Genetics Peter Russell, 2nd Edition, Pearson International, (2006)
5. Gupta, P.K. Genetics. Rastogi Publications. (1990).
6. Gupta, P.K.; Cytogenetics; 1st edition, reprint; Meerut :Rastogi Publications , (2004).
7. Gupta, P.K.; Genetics: A textbook for University students; 3rd edition; Meerut: Rastogi Publications , (2007).
8. Introduction to Genetic Analysis A. J. Griffiths, S. R. Wessler, R. C. Lewontin, S. B. Carroll. 9th Edition, Freeman and Company (2008)
   Molecular Biology of the Gene J. D. Watson, T. A. Baker, S. P. Bell, A. Gann, M. Levine, R. Losick. 5th Edition, Pearson Education (2004)
9. Principles of Genetics P. Snustad, M. Simmons, 4th Edition, John Wiley and Sons Co., (2006)
10. Shukla, R.S. and Chandel, P.S.; Cytogenetics, Evolution, Biostatistics and Plant Breeding. (2007)

SEMESTER-IV

COURSE TITLE: PLANT BREEDING & BIOSTATISTICS (THEORY)

COURSE CODE: BOT-IV.E-5

NAME OF THE FACULTY: Ms. Amisha Shirodker

MARKS: 75

CREDITS: 3

COURSE OBJECTIVES:

To enable the students to learn various techniques in plant breeding with regards to crop productivity.

LEARNING OBJECTIVES:

This course will enable the students to have basic knowledge of genetic improvement of crop plants.

BOT-IV.E-4 PLANT BREEDING & BIOSTATISTICS THEORY -75 MARKS

Sr.No.	UNITS, TOPICS AND SUB-TOPICS	HOURS
UNIT I - Plant breeding		08
1.1	Introduction, history, objectives, achievements and prospects	04
1.2	Genetic variability and its role in plant breeding	03
1.3	Centres of origin of crop plants.	01
UNIT II – Organizations & their mandate		03
2.1	ICAR, ICRISAT , IRRI (Indian & International)	03
UNIT III - Breeding for biotic and abiotic stresses		05
3.1	Physiological races and types.	01

3.2	Genetics of pathogenecity; vertical and horizontal resistance & breeding for various biotic stresses in rice/wheat .	02
3.3	Breeding for abiotic stresses - salinity and drought resistance	02
UNIT IV- Plant breeders' rights		03
4.1	Plant breeders' & Farmers' Rights	02
4.2	Phytosanitary and Seed Certifications	01
UNIT V–Hybridisation, Heterosis and Inbreeding Depression		12
5.1	Pure line and mass selection	03
5.2	Types and Techniques in hybridization	02
5.3	Hybridization in self- and cross-pollinated crops	03
5.4	Introduction, domestication and acclimatization	02
5.5	Heterosis and inbreeding depression.	02
UNIT VI- Mutations and polyploidy in plant improvement.		04
6.1	Varieties developed in India through mutation breeding	02
6.2	Limitations of mutation breeding	02
UNIT VII- Biostatistical methods		10
7.1	Introduction to biostatistics: Terms used in biostatistics, types of data	01
7.2	Sampling theories- random sample, sample size determination, precision,data collection, processing and presentation of data: qualitative and quantitative	03
7.3	Measures of central tendency: Mean, Median, Mode	01
7.4	Measures of variation: standard deviation, standard error	01
7.5	Concept of correlation between two variables and regression line	02
7.6	Chi square	01
7.7	Student's t- test	01
	TOTAL	**45 HOURS**

Reference Books:

1. Mahajan, B.K.; Methods in biostatistics; 6th edition; New Delhi : Jaypee Brothers, (1997)
2. Rastogi, Veer Bala.; Fundamentals of Biostatistics; 2nd edition, reprint; New Delhi :Ane Books India , 2006(2008).
3. Shukla, R.S. and Chandel, P.S.; Cytogenetics, Evolution, Biostatistics and Plant Breeding. (2007)
4. Singh, B.D.; A textbook of Plant Breeding; Kalyani Publishers. (2009)
5. Sokal R R and Rahlf H A. Biometry: the principles and practice of Statistics for Biology. research. 3rd edi W H Freeman and Co. (1995)
6. Zar J H, Biostatistical analysis 4th ed. Prentice Hall. (1998)

COURSE TITLE: PLANT BREEDING & BIOSTATISTICS (PRACTICAL)

COURSE CODE: BOT-IV.E-5

NAME OF THE FACULTY: Ms. Amisha Shirodker

MARKS: 25

CREDITS: 1

Sr. No	Experiments	Practical
1.	Emasculation and bagging of flowers using suitable plant material.	01
2.	Estimation of fruit and seed set in emasculated flowers	01
3.	Correlation of floral structure with pollination system	01
4.	Estimation of pollen fertility (pollen viability) in locally grown crop species.	01
5.	Study of centres of origin of some important crop plants.	01
6.	Study of soil pH using different soil types & relate it to crops	01
7.	Study of soil testing for N,P,K	01
8.	Analysis of data for mean, median & mode	01
9.	Standard deviation and standard error using suitable plant samples	01
10.	Setting of experimental design for randomized and non randomized design using pot	01
11.	Determination of correlation and regression	01
12.	Chi square analysis	01
13.	Students T-test	01
14.	Visit to ICAR	01
	TOTAL	14 P

PARVATIBAI CHOWGULE COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

DEPARTMENT OF BOTANY

PAPER TITLE: SYSTEMATICS OF FLOWERING PLANTS AND PHYLOGENY

PAPER CODE: BOT-IV.E-6

NAME OF FACULTY: Dr. (MRS). UMA MASUR

MARKS: 75

CREDITS: 3

COURSE OBJECTIVES:

To study the morphology , systematics and phylogeny of flowering plants.

LEARNING OUTCOME:

To enable the student to identify & classify the flowering plants and know their phylogenetic relationship.

BOT-IV.E-6 SYSTEMATICS OF FLOWERING PLANTS AND PHYLOGENY
THEORY-75 MARKS

Sr.No	Units, Topics and Sub-topics		Hours
	UNIT – I: Introduction		**03**
1.1	Plant classification, nomenclature & biosystematics		**03**
	UNIT – II: Herbarium		**06**
2.1	Field inventory; Functions of Herbarium; Important herbaria and botanical gardens (India & world), virtual herbarium; e-flora		02
2.2	Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access		04
UNIT – III: Systematics and Taxonomic hierarchy			**12**
3.1	Principles and rules (ICBN); Ranks and names; Typification, author citation, valid publication		03

3.2	Rejection of names, principle of priority and its limitations; Names of hybrids.	03
3.3	Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; species concept (taxonomic, biological, evolutionary).	03
3.4	Evidence from palynology, cytology, phytochemistry and molecular data.	03
UNIT – IV: SYSTEMS OF CLASSIFICATION; POSITION AND DIAGNOSTIC FEATURES OF FAMILIES		**15**
4.1	Concepts of evolution and phylogeny	01
4.2	Major contributions of Linnaeus, Bentham and Hooker, Engler and Prantl; Brief reference of Angiosperm Phylogeny group (APG III) classification.	04
4.3	Annonaceae, Capparidaceae, Brassicaceae, Tiliaceae, Rutaceae, Myrtaceae, Cucurbitaceae, Rubiaceae, Apocyanaceae, Asclepiadaceae, Solanaceae, Verbenaceae, Lamiaceae, Amaranthaceae, Orchidaceae, Araceae, Asteraceae, Zingiberaceae, Commelinaceae, Poaceae.	10
Unit V:	**Biometrics, numerical taxonomy and cladistics**	**06**
5.1	Characters; Variations; OTUs, character weighting and coding; cluster analysis	03
5.2	Phenograms, cladograms (definitions and differences)	03
UNIT VI: PHYLOGENY OF ANGIOSPERMS		**03**
6.1	Origin & evolution of angiosperms	02
6.2	Co-evolution of angiosperms	01
	Total:	**45**

PAPER TITLE: SYSTEMATICS OF FLOWERING PLANTS AND PHYLOGENY

PAPER CODE: BOT-IV.E-6

NAME OF FACULTY: Dr. (MRS). UMA MASUR

MARKS: 75

CREDITS: 3

Sr. No	Topics	Practical
1	Plant identification using flora book and database	01
2	Preparation of herbarium	01
3	Identification of 20 families mentioned in unit IV (Bentham & Hooker's system) studied in theory from locally available specimens (with floral diagram).	10
4	Use of taxonomic keys and construction of dichotomous keys	01
5	Taxonomic interpretation using pollen of related species	01
6	Construction of Phenogram and Cladogram	01
	Total	15

Suggested Reference Books:

1. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
2. Chopra, G. L. 1985. Angiosperm (Systematics& Life cycles). Pradeep Publications, Jaladhar, India, pp. 339-350.
3. Pandey, B. P. 1969. Taxonomy of Angiosperms. S. Chand and company Ltd. New Delhi, India, pp. 102-105.
4. Subrahmanyam N S, Modern plant taxonomy, Vikas publishing house pvt. Ltd.,1995.
5. Pandey S N , Taxonomy of angiosperms, ASE books India, 2008.
6. Mondal
7. Naik, V.N. 1984. Taxonomy of Angiosperms. Tata McGraw Hill, New Delhi.
8. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
9. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
10. Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.

SYLLABUS FOR THREE YEAR B.Sc. DEGREE COURSE IN BOTANY

PAPER TITLE: PLANT PATHOLOGY (THEORY)

PAPER CODE: BOT.IV.E-7

NAME OF THE FACULTY: Dr. SANGEETA G. SANKHALKAR

MARKS: 75

CREDITS: 3

Course Objectives

Make the students aware of various plant pathogens and their control

Learning outcome

It will enable the students to understand fundamental basis of plant-microbe interactions and plant health management.

BOT.IV.E-7: PLANT PATHOLOGY THEORY: 75 MARKS

Sr. No	UNITS, TOPICS AND SUB-TOPICS	Hours
UNIT-I: AN INTRODUCTION TO PLANTS DISEASES		**08**
1.1	Definitions and Importance	1
1.2	History and growth of plant pathology	1
1.3	Biotic causes of plant diseases.	02
1.4	Concepts of disease in plants	1
1.4	Types of plant diseases & their significances	03
UNIT-II: EPIDEMOLOGY OF PLANT DISEASES		**08**
2.1	Infectious agents (nematodes, protozoans, bacteria & viruses)	3
2.2	Growth, reproduction, survival and dispersal of important plant pathogens	3
2.3	Role of environment and host nutrition on disease development	2
UNIT III: PLANT DISEASE DEVELOPMENT (PATHOGENESIS)		**05**

3.1	Parasitism and pathogenicity	1
3.2	Symptomatology	1
3.3	Host parasite interaction	1
3.4	Recognition concept and infection,	1
3.5	Role of enzymes, toxins & growth regulators in pathogenesis	1
UNIT IV: BRIEF STUDY OF PLANT DISEASES IN INDIA		**07**
4.1	**Study of Diseases** (Name of disease, pathogen, symptoms and control measures need to be studied) Important diseases of Arecanut, Paddy, wheat &citrus, Vein clearing of Bhendi, Bunchytop of Banana Coffee rust, Stem bleeding of coconut; bud rot of coconut, Root wilt of coconut, Red rot of sugarcane	**07**
UNIT V: PLANT DISEASE MANAGEMENT		**10**
5.1	Quantitative resistance (Physical, Biological & cultural methods)	3
5.2	Biochemical defences	1
5.3	Defense strategies (oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors responses)	3
5.4	Defence through antimicrobial substances & Plantibodies	1
5.5	Resistance through chemical treatment & genetically engineered techniques.	1
5.6	Quarantine measures	1
UNIT VI: GENETICS OF PLANT DISEASE		**07**
6.1	Altered plant metabolism due to pathogens attack	1
6.2	Genetics of resistance ('R' & avr genes)	1
6.3	Mechanism of genetic variation in pathogens	2
6.4	Molecular basis for resistance & marker-assisted selection	2
6.5	Signalling and programmed cell death	1
	TOTAL	**45**

PAPER TITLE: PLANT PATHOLOGY (PRACTICAL)

PAPER CODE: BOT.IV.E-7

NAME OF FACULTY: Dr. SANGEETA G. SANKHALKAR

MARKS: 25

CREDITS: 1

	BOT.IV.E-7 PACTICAL (25 marks)	
Sr. No	**Topics**	**Practicals**
1	Isolation and culture of pathogens from fungal pathogen	01
2	Isolation and culture of pathogens from bacterial pathogen	01
3	Demonstration of Koch's postulates	01
4	Extraction of proteolytic enzymes from a fungal pathogen (*Penicillum* or *Fusarium*)	01
5	Assay for cellulase /pectinase enzyme from diseased plant	01
6	Study of plant diseases with reference to pathogen & symptomology (Fungal, Bacterial & viral) (any 10 as per theory)	05
7	Anatomical observations of fungal infected plants (rust, blight, rots)	03
8	Study of antagonistic behaviour of bacterial pathogens	01
	Total	**14**

References

1. Agros, G.N. (1997) Plant Pathology (4th ed) Academic Press.
2. Bilgrami K.H. & H.C. Dube (1976) A textbook of Modern Plant Pathology. International Book Distributing Co. Lucknow.
3. Mehrotra, R.S. (1980) Plant Pathology, TMH, New Delhi.
4 Pandey, B.P. (1999) Plant Pathology. Pathogen and Plant diseases. Chand & Co. New Delhi.
5 Rangaswami, G. (1999) Disease of Crop plants of India Prentice Hall of India Pvt. Ltd.
6 Sharma P.D. (2004). Plant Pathology Rastogi Publishers.
7 P Gunasekaran (2005)Laboratory manual in Microbiology. New Age International (P) Limited, Pub. New Delhi.
8 K.R. Aneja (2009).Experiments in Microbiology Plant Pathology & Biotechnology, 4th edition New Age International (P) Limited, Pub. New Delhi.

PARVATIBAI CHOWGULE COLLEGE OF ARTS AND SCIENCE

(AUTONOMOUS)

PAPER TITLE: HORTICULTURE, FLORICULTURE & LANSCAPING (THEORY)

PAPER CODE: BOT-IV.E-8

NAME OF FACULTY: Dr. (MRS). UMA MASUR

MARKS: 75

CREDITS: 3

COURSE OBJECTIVES:

Is to provide entrepreneur opportunities.

LEARNING OUTCOMES:

The course would enable student to learn technical knowhow in Horticulture, Floriculture & Landscaping

BOT-IV.E-8: HORTICULTURE, FLORICULTURE & LANDSCAPING

THEORY: 75 MARKS

Sr.No	Units, Topics and Sub-topics	Hours
UNIT – I: HORTICULTURE		**11**
1.1	Definition and importance; scope of Pomoculture Olericulture, Floriculture	04
1.2	Fertilizers: inorganic, Organic – biofertilizers: vermi composting, green manure, algal culture, FYM.	04
1.3	Pots & potting:– Earthen, Fibre, Polythene bags, Potting mixture, Potting, Re-potting, Top dressing.	01
1.4	Irrigation:- Surface, Sprinkle, Drip and Gravity irrigation	02
UNIT – II: PROPAGATION METHODS		**08**

UNIT – II: PROPAGATION METHODS		**08**
2.1	Sexual methods (seed propagation) – Definition, Merits and Demerits, Criteria for selection of seeds.	2
3.2	Asexual (Vegetative) propagation – Definition, and types- Cutting (root, stem, leaf), Layering (simple, air), Grafting (Whip, Approach) and Budding (T, patch), Stock –scion relationship in important horticultural crops.	3
3.3	Use of plant growth regulators in horticulture: Induction of rooting, flowering, fruit set, fruit development and control of fruit crops.	3
UNIT – III: Floriculture		**11**
3.1	knowledge of annual, biennials and perennials with reference to ornamental flowers.	02
3.2	Cultivation of commercial flowers – Rose, Jasmine, Chrysanthemum., crossendra & Orchid	03
3.3	Nursery maintenance; Cut flowers ; flower arrangements (including ikebana); improving shelf life of cut flowers.	03
3.4	Green house, Poly house, Moist chamber, Net frame	03
UNIT – IV: Landscaping		**15**
4.1	Types of garden: Formal, informal and kitchen garden.	03
4.2	Locations in the garden- edges, hedges, fence, lawn, flower beds, Avenue, water garden (with two examples of each). Focal point. Auto CAD in garden designing	05
4.3	National parks, Botanical gardens, water garden, rockery plants, Bonsai techniques, Hydroponics.	04
4.4	Lawn making: type of lawn grasses and maintenance. Plants suitable forhedges.	02
4.5	Aftercare: Weeding, top dressing methods of pruning and topiary	01
	Total:	**45**

PAPER TITLE: HORTICULTURE, FLORICULTURE & LANDSCAPING (PRACTICAL)

PAPER CODE: BOT-IV.E-8

NAME OF FACULTY: Dr. (MRS). UMA MASUR

MARKS: 25

CREDITS: 1

Sr. No.	Topics	Practical
1.	Preparation of nursery bed and polybag filling	01
2.	Preparation of potting mixture – Potting, repotting.	02
3.	Field work in cutting, grafting, budding, layering	02
4.	Garden designing using Auto CAD software	01
5. *	Familiarizing gardening tools and implements	01
6.	Preparation of organic compost& vermicompost	02
7.	Establishment of vegetable garden using organic compost & vermi-compost	03
8.	Flower arrangement	01
9.	Visit to nurseries, gardens and Report.	01
10	Improving the shelf life of cut flowers using chemicals	01
	Total	**15**

Suggested Reference Books:

1. Swarup V. (1997). Ornamental horticulture. MaMillan India Limited, New Delhi.
2. Randhava, G.S, 1973 – Ornamental horticultural in India Today andTomorrow Printers and Publishers, New Delhi.
3. Trivedi TP (2007). Ornamental horticultural in India. Indian Council of Agricultural Research New Delhi.
4. Nayak, K.C. South Indian fruits and their culture P.L. Varadaraj& Co.,&Lingichetti Street, Madras.
5. EdmentSenn Andrews 1994 Fundamentals of Horticulture – TataMcGraw Hill Publishing Co., Ltd., Delhi