Specimen of Lesson Plan

Name of the Faculty : Dr. Mukesh Kumar & Dr. Ravika

Discipline : Genetics & Plant Breeding

Semester : 2nd

Subject : Fundamentals of Genetics (102)

Lesson Plan Duration : weeks (5 January, 2018- 28 April, 2018)

Work Load (Lecture / Practical) per week (in hours): Lectures- 02, Practicals-04

Week	Theory		Practical	
	Lecture Day	**Topic**	**Practical Day**	**Topic**
1st	1st	Pre and Post Mendelian concepts of heredity	1st	Study of microscope
	2nd	Mendelian principles of heredity		
2nd	1st	Cell division – mitosis,	1st	Study of cell structure
	2nd	meiosis		
3rd	1st	Probability and Chi-square	1st	Experiments on monohybrid and dihybrid cross
	2nd	Dominance relationships, gene interaction		
4th	1st	Multiple alleles	1st	Experiments on trihybrid cross
	2nd	pleiotropism and pseudoalleles		
5th	1st	Sex determination	1st	Experiments on test cross and back cross
	2nd	sex linkage		
6th	1st	sex limited and sex influenced traits	1st	Experiments on epistatic interactions including test cross and back cross
	2nd	Blood group genetics		
7th	1st	Linkage and its estimation	1st	Practice on mitotic cell division
	2nd	crossing over mechanisms		
8th	1st	chromosome mapping	1st	Practice on meiotic cell division
	2nd	Structural changes in chromosome		
9th	1st	Mutation, classification	1st	Experiments on probability test
	2nd	Methods of inducing mutation & CIB technique		
10th	1st	mutagenic agents and induction of mutation	1st	Experiments on Chi-square test
	2nd	Qualitative & Quantitative traits		
11th	1st	Polygenes and continuous variations, multiple factor hypothesis,	1st	Determination of linkage (through two point test cross and three point test cross data)
	2nd	Epistatic interactions with examples		
12th	1st	Cytoplasmic inheritance. Genetic disorders	1st	Determination of cross over analysis (through two point test cross and three
	2nd	Nature, structure & replication of		

		genetic material		point test cross data)
13th	1st	Protein synthesis	1st	Study on sex linked inheritance in Drosophila
	2nd	Transcription mechanism of genetic material		
14th	1st	translational mechanism of genetic material	1st	Study of models on DNA structure.
	2nd	Gene concept		
15th	1st	Gene structure, function and regulation	1st	Study of models on RNA structure.
	2nd	Lac and Trp operons		

LESSON PLAN

Name of the faculty: Dr. Yogender Kumar (Theory) and Dr. Omender Sangwan (Practical)

Discipline: Plant Breeding

Semester: 1st Semester 2017-18

Subject: Principles of Plant Breeding (GP 201)

Lesson Plan Duration: 15 Weeks (From 1st August, 2017 to 18th November, 2017)

Week	Theory		Practical	
	Lecture Day	Topic	Practical Day	Topic
1st	1st	**Plant Breeding**: aims and objectives, activities in plant breeding, allied disciplines and their importance	1st	To study crossing and emasculation techniques
	2nd	**Modes of reproduction**: modes (asexual, sexual) and its significance in crop improvement programmes and classification of crops based on their mode of reproduction		
2nd	3rd	**Apomixis**: its types and application in crop improvement including fixation of heterosis	2nd	To study floral structure of cotton
3rd	4th	**Modes of pollination**: types (self and cross pollination), genetic consequences of self and cross pollination. Differences between self and cross pollination. Methods to identify their mode of pollination, mechanisms to promote self pollination and cross pollination		Practice on crossing and emasculation in cotton
	5th	**Methods of Breeding**: Introduction (Primary and Secondary Introductions, plant introduction agencies in India, objectives of NBPGR, purpose and procedure of plant introduction) and acclimatization		
4th	6th	**Selection** and its principles, Mass Selection, its merits and demerits	3rd	To study floral structure of ground nut
	7th	Pure line concept. Johnson experiments and its conclusion. Genetic basis of pure line. **Pure line** selection method of breeding: its merits and demerits		
5th	8th	**Hybridization and its objectives:** Handling of segregating generations through: Pedigree method of breeding, its procedure, merits and demerits	4th	To study floral structure of sesamum
6th	9th	Bulk method of breeding, its procedure, merits and demerits	5th	To study floral structure of moong bean
7th	10th	Back cross method: Procedure for transferring a character (a) governed by a dominant gene (b) governed by a recessive gene	6th	To study floral structure of pearlmillet
	11th	**Self incompatibility:** Systems, mechanisms, relevance, elimination, temporary suppression		

		and importance of self incompatibility and how the seed production may be done using self incompatibility and utilization in crop improvement		
8th	12th	**Male sterility:** Origin, creation, types, maintenance and utilization of male sterility (Genetic Male Sterility, Transgenic male sterility, Temperature Sensitive Genetic Male sterility, Photoperiod Sensitive Genetic Male sterility)		Practice on crossing and emasculation in pearlmillet
9th	13th	**Male sterility:** Cytoplasmic Male Sterility, Cytoplasmic genetic male sterility, Chemical induced Male Sterility)	7th	To study floral structure of castor
10th	14th	**Heterosis and Inbreeding depression**: Theories of heterosis, exploitation of hybrid vigour. Development of inbred lines, single cross and double cross hybrids		Practice on crossing and emasculation in castor
11th	15th	**Population Improvement Programmes**: Recurrent selection, its procedure, its types and applications	8th	To study floral structure of cowpea
12th	16th	**Synthetics and Composites:** differences, procedure for development of synthetics and composites, merits and demerits of these varieties		Practice on crossing and emasculation in cowpea
	17th	**Methods for vegetatively propagated crops:** Clonal Selection		
13th	18th	**Mutation Breeding:** Definition of important terms like mutons, mutant, mutagen etc., induction of mutation through chemical and physical mutagens, method of breeding, merits and demerits	9th	To study floral structure of peagonpea
14th	19th	**Ploidy Breeding:** Classification, role in evolution and importance in crop improvement	10th	To study floral structure of sorghum
15th	20th	**Wide Hybridization:** Inter specific, Intergeneric and protoplast fusion (definition and objectives), problems in wide hybridization		Practice on crossing and emasculation in sorghum
	21st	**Wide Hybridization:** methods to overcome problems, successful examples *e.g.* Wheat, Triticale, Cotton, Tobacco, Brassica and oats, significance in crop improvement		

Specimen of Lesson Plan

Name of the Faculty : Dr. Mukesh Kumar & Dr. Ravika

Discipline : Genetics & Plant Breeding

Semester : 1st

Subject : Principles of Biotechnology (301)

Lesson Plan Duration : weeks (29 July, 2017- 18 November, 2017)

Work Load (Lecture / Practical) per week (in hours): Lectures- 02, Practicals-04

Week	Theory		Practical	
	Lecture Day	**Topic**	**Practical Day**	**Topic**
1st	1st	history of plant tissue culture and plant genetic engineering	1st	Requirements for plant tissue culture laboratory
	2nd	scope and importance in crop improvement		
2nd	1st	totipotency and morphogenesis	1st	techniques in plant tissue culture- media components and preparations;
	2nd	nutritional requirements of in-vitro cultures		
3rd	1st	techniques of in-vitro cultures	1st	sterilization techniques and inoculation of various explants
	2nd	micro propagation, anther culture		
4th	1st	pollen culture, ovule culture	1st	aseptic manipulation of various explants
	2nd	embryo culture, test tube fertilization, endosperm culture		
5th	1st	factors affecting in-vitro culture; applications and achievements	1st	callus induction and plant regeneration; micro propagation of important crops;
	2nd	somaclonal variation, types, reasons		
6th	1st	somatic embryogenesis and synthetic seed production technology	1st	anther, embryo and endosperm culture;
	2nd	protoplast isolation, culture, manipulation and fusion		
7th	1st	products of somatic hybrids and cybrids	1st	hardening / acclimatization of regenerated plants
	2nd	applications in crop improvement		
8th	1st	genetic engineering	1st	somatic embryogenesis and synthetic seed production
	2nd	restriction enzymes		
9th	1st	vectors for gene transfer	1st	Isolation of protoplast; demonstration of culturing of protoplast;
	2nd	vectors for gene transfer		
10th	1st	gene cloning	1st	demonstration of isolation of DNA
	2nd	direct and indirect method of gene transfer		

11th	1st	transgenic plants and their applications	1st	demonstration of gene transfer techniques
	2nd	PCR		
12th	1st	blotting techniques (southern, northern, and eastern)	1st	direct methods; demonstration of confirmation of genetic transformation
	2nd	DNA probes: DNA finger printing using		
13th	1st	DNA markers – RAPD,RFLP	1st	demonstration of gel-electrophoresis techniques
	2nd	AFLP, SSR, SNP		
14th	1st	mapping QTLs	1st	PCR amplification
	2nd	marker assisted selection		
15th	1st	and its application in crop improvement	1st	Demonstration of DNA quantification
	2nd	future prospects		

DEPARTMENT OF GENETICS AND PLANT BREEDING

Lecture Schedule: GP 401 (1+2) Semester I

Sr.No.	Topic	No. Of Lectures
1	Pollination behaviour in relation to breeding methods	1
2	Sexual and asexual reproduction	1
3	Specific breeding objectives of major field crops and Mechanism promoting autogamy and allogamy	1
4	Genetic basis of breeding self and cross fertilized crops: Genetic consequences of self & cross fertilization, Genetics of Self Incompatibility, Mating system, Qualitative & quantitative traits & their behaviour in segregating generation, Component of variation: single & multiple gene concept, epistatis & gene interaction, Selection: Response to selection, selection differential intensity & realised advance, Heterosis and Inbreeding depression	3
5	Seed classification; breeder seed production; seed certification regulations	1
6	Classification of variability and Relative importance of different components of genetic variation in crop improvement	1
7	Centres of origin and Domestication	1
8	Different breeding methods for developing varieties including composites/synthetics/hybrids of major field crops: Mass selection, Pure-line selection, Pedigree selection, Bulk population, Backcrossing breeding method, multiline breeding, Recurrent selection, Composite and synthetic breeding, Inbred and hybrid development	4
9	Specific and general combining ability in crop improvement: Features , importance and uses of GCA and SCA	1
10	Importance of varietal resistance and breeding for disease resistance	1
11	Physiological breeding: Need of physiological breeding, Traditional breeding vs Physiological breeding, Steps for incorporating physiological criteria into a breeding strategy, Selection for physiological traits	1
	Total	**16**

TOTAL LECTURES: 16

Specimen of Lesson Plan

Name of the Faculty : Dr. Mukesh Kumar & Dr. Subhash Chander

Discipline : Genetics & Plant Breeding

Semester : 1st

Subject : Special techniques in Plant Breeding (402)

Lesson Plan Duration : weeks (29 July, 2017- 18 November, 2017)

Work Load (Lecture / Practical) per week (in hours): Lectures- 01, Practicals-04

Week	Theory		Practical	
	Practical Day	**Topic**	**Lecture Day**	**Topic**
1st	1st	Use of male sterility in hybrids seed production	1st	Cell division
	2nd	Use of male sterility in hybrids seed production		
2nd	1st	Use of self incompatibility in hybrids seed production	1st	gametogenesis and fertilization
	2nd	Use of self incompatibility in hybrids seed production		
3rd	1st	use of mutagens and colchicines	1st	apomixes: its classification and use
	2nd	use of mutagens and colchicines		
4th	1st	*in vitro* techniques	1st	male sterility and its uses in crop improvement
	2nd	*in vitro* techniques		
5th	1st	*in vitro* techniques	1st	incompatibility mechanisms and their role in plant breeding
	2nd	*in vitro* techniques		
6th	1st	methods for producing distant hybrids	1st	role of mutation and polyploidy in plant breeding
	2nd	methods for producing distant hybrids		
7th	1st	study of meiosis	1st	intra-and inter-specific hybridization
	2nd	study of meiosis		
8th	1st	study of mitosis	1st	biotechnology and its role in the improvement of crop species
	2nd	study of mitosis		
9th	1st	flower morphology of male sterile plants	1st	anther culture, tissue culture
	2nd	flower morphology of male sterile plants		
10th	1st	pollen staining by Alexander stains	1st	protoplast fusion, micropropagation
	2nd	pollen staining by Alexander stains		
11th	1st	pollen staining by	1st	molecular marker like

		Acetocarmine stains		RAPD, RFLP
	2nd	pollen staining by Acetocarmine stains		
12th	1st	use of colchicines	1st	AFLP, SSR, SNP
	2nd	use of colchicines		
13th	1st	study of lab equipments used for marker analysis	1st	EST, RGA
	2nd	study of lab equipments used for marker analysis		
14th	1st	study of lab equipments used for marker analysis	1st	marker assisted selection
	2nd	study of lab equipments used for marker analysis		
15th	1st	Gel scoring and analysis	1st	mapping population
	2nd	Gel scoring and analysis		

Specimen of Lesson Plan

Name of the Faculty : Dr. Ravika

Discipline : Genetics & Plant Breeding

Semester : 1st

Subject : Plant Genetic Resources (GP 404)

Lesson Plan Duration : weeks (29 July, 2017- 18 November, 2017)

Work Load (Lecture / Practical) per week (in hours): Lectures- 01, Practicals-02

Week	Theory		Practical	
	Practical Day	**Topic**	**Lecture Day**	**Topic**
1st	1st	Introductory lecture on germplasm collection	1st	Terminology related to plant genetic resources
2nd	1st	Collection of germplasm from various agro ecological regions	1st	Definitions and concepts of germplasm
3rd	1st	Documentation and cataloguing of germplasm	1st	Gene pools concept: Primary, secondary and tertiary.
4th	1st	Preparing a catalogue of germplasm lines collected by students during field visits	1st	Importance of genetic resources in crop improvement
5th	1st	Classification of germplasm into different clusters using biometrical approaches	1st	centres of origin and diversity
6th	1st	Biometrical approaches: D^2 analysis	1st	Germplasm: exploration, collection, characterization, evaluation and cataloguing
7th	1st	Biometrical approaches: Metroglyph analysis	1st	introduction and exchange of germplasm
8th	1st	Descriptors of important field crops	1st	conservation of germplasm: in situ and ex situ
9th	1st	Descriptors of mungbean crop	1st	Germplasm conservation Modules- short, medium and long term conservation
10th	1st	Data recording on DUS characters of mungbean crop	1st	Maintenance of germplasm in relation to breeding behaviour
11th	1st	Descriptors of Pigeon pea crop	1st	Germplasm maintenance in self pollinated crops
12th	1st	Data recording on DUS characters of Pigeon pea crop	1st	Germplasm maintenance in cross pollinated crops
13th	1st	Data Analysis	1st	Registration of plant genetic resources