DEPARTMENT OF PLANT PATHOLOGY

Course No. H/MIBO-121 **Course title: Introductory Microbiology**
Credits: (1+1) 2 **Semester: II**
Theroy

History and Scope of Microbiology: The discovery of micro-organism. Spontaneous generation conflict, germ theory of diseases, microbial effect on organic an inorganic matter. Development of microbiology in India and composition of microbial world.

Microscopy and Specimen Preparation : The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eukaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-curve techniques. Microbial growth in models of bacterial, yeast and mycelia growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. DNA as genetic material. Antibiosis, symbiosis, intra-microbial and extra-microbial association. Sterilization methods-Physical and chemical, Isolation of pure cultures and preservation of cultures, Plant growth promoting microorganisms in large scale production and common microbial fermentations.

Practical

Examination of natural infusion and living bacteria; examination of stained cells by simple staining and Gram staining. Methods for sterilization and nutrient agar preparation. Broth culture, agar slopes, streak plates and pour plants, turbid metric estimation of microbial growth, mushroom culture-Spawn production, Culture and production techniques, harvesting, packing and storage.

Theory : Teaching Schedule and weightages

Lecture No.	Topics	Weightages (Percent)
1	History and Scope of Microbiology	5
2	The discovery of micro-organism. Spontaneous generation conflict, germ theory of diseases	5
3	microbial effect on organic and inorganic matter.	5
4	Development of microbiology in India and composition of microbial world.	5
5	Microscopy and Specimen Preparation : The bright field microscope, fixation, dyes and	7
6	simple staining, differential staining.	8
7	Difference between prokaryotic and eukaryotic cells. Prokaryotic cell structure and functions.	8
8&9	Types of culture media and pre-curve techniques. Microbial growth in models of bacterial, yeast and mycelia growth curve.	10
10	Measurement of bacterial growth.	5
11	General properties of viruses and brief description of bacteriophages.	8

12	Antibiosis, symbiosis, intra-microbial and extra-microbial association.	8
13	Sterilization methods-Physical and chemical, Isolation of pure cultures and preservation of cultures	10
14&15	Beneficial microbes: Plant growth promoters and microbes used for Bio control.	8
16	Industrially important microorganisms in large scale production and common microbial fermentations	8
	Total	**100**

pRACTICAL

PRACTICAL	**Topics**
1	Introduction and use of equipments used in microbiology laboratory.
2	Microscope and microscopy.
3	Structure, Morphology and methods of reproduction of bacteria.
4	Structure, morphology and methods of reproduction in fungi
5	Sterilization and methods of sterilization
6	Media used in culturing micro organisms and Preparation of Broth culture, agar slopes, streak plates and pour plants,
7	Preparation of Nutrient agar medium
8	Preparation of PDA.
9	Isolation of micro organisms by pore plate method
10	Isolation of micro organisms by dilution plate method
11	Stains and staining. Simple staining of bacteria
12	Gram staining of bacteria
13	Isolation of *Rhizobium* from root nodules.
14	Isolation of *Azotobacter* from soil.
15	Isolation of phosphate solubilizing micro organisms from soil
16	Maintenance and preservation of microbial cultures

Reference Books:

1. Microbiology – M.J.Pelzar , ECS. Chan and N.R.Krieg Fifth edition tata McGraw Hill Pub. Co.Ltd.
2. Fundamentals of microbiology- Martin Frobisher 9 th edn W. B. Saunders Co. Ltd.
3. Experiments in microbiology plant pathology and Bio Technology- K. R. Aneja 4th edn New Age international PVT LTD.
4. Microbiology fundamentals and application- S.S. Purohit 7th edn

e-reading: **http://ecourses.iasri.res.in/**

DEPARTMENT OF PLANT PROTECTION

Course No. H/PATH-231 **Course title: Fundamentals of Plant Pathology**
Credits: (1+1) 2 **Semester: III**

Theory: Introduction to the science of phytopathology, its objectives, scope and historical background. Classification of plant diseases, symptoms, signs, and related terminology. Parasitic causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants), their characteristics and classification. Non-parasitic causes of plant diseases.Infection process.Survival and dispersal of plant pathogens.Plant disease epidemiology, forecasting and disease assessment.Principles and methods of plant disease management.Integrated plant disease management.Fungicides classification based on chemical nature, Commonly used fungicides, bactericides and nematicides.

Practical: Familiarity with general plant pathological laboratory and field equipments. Study of disease symptoms and signs and host parasite relationship. Identification and isolation of plant pathogens.Koch'spostulates.Preparation of fungicidal solutions, slurries, pastes and their applications.

Lesson plan

Lecture no.	Topic	Weightages/Marks
1	Importance of plant diseases, scope and objectives of Plant Pathology in relation to the diseases Late blight of Potato, Coffee Rust, Downy mildew of Grapes, Dutch elm disease. Terms and concepts in Plant Pathology, Pathogenesis	5
2	History of Plant Pathology with special reference to Indian work History of Plant Pathology: History and development of Plant Pathology in ancient, dark, premodern, modern present eras. Contribution made by– Surpal, Theophrastus, Pliny, Iwanowski, Robert Hook, Anton van Leeuwenhoek, Needham, Linnaeus, Tillet, Prevost Robert Loch, Marshal Ward, Millardet, Jenson, Meyar, Burril, E.F. Smith, Erikson, Biffen, Iwanwasky, Stakman, Cragie, Luthra, Stanley, Bowden and Pierie, Doi and Asuyama, Butler, Mehta, Mundkur, Dastur, Kulkarni, Bhide, Uppal, Tirumalachar, Patel and Rangaswamy.	5
3	Classification of plant diseases (Classification of the plant basis of mode of survival. dispersal, plant parts affected, occurrence , cause etc. Causes of Plant Disease Biotic (fungi, bacteria, fastidious vesicular bacteria, Phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoaand nematodes) and abiotic causes with examples of diseases caused by them. Study of phanerogamic plant parasites.(Phanerogamic plant parasites Cuscutaceae (stem parasite) Genus: Cuscuta, the dodders 2. Viscaceae (stem parasites) Genus: Arceuthobium, the dwarf mistletoes of conifers Phoradendron, the American true mistletoes of broad leaved trees Viscum, the European tree mistletoes Dendrophthoe, the giant mistletoes 3. Orobanchaceae (root parasite) Genus: Orobanche, the broomrapes 4. Scrophulariaceae (root parasite) Genus: Striga, the witchweeds)	10
4	Symptoms of plant diseases Sign and symptoms, Classification of symptoms (Hyperplasia, Hypoplasia, Necrosis, with categorization of different symptoms with	10

	suitable example), Diseases and symptoms due to abiotic causes. Deficiencies or excess of nutrients (e.g. 'Khaira' disease of rice due to Zn deficiency),Light, Moisture, Temperature, Air pollutants (e.g. black tip of mango), Lack of oxygen (e.g. hollow and black heart of potato), Toxicity of pesticides, Improper cultural practices, Abnormality in soil conditions (acidity, alkalinity, PH)	
5-6	Fungi general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, Fungi, General morphology, characters and somatic structures of fungi: Thallus, Branching habit of mycelium: Dichotomous, sympodial, lateral, opposite, verticilliate, monopodial etc.somatic structures: Rhizoides (rootlike), appressorium (pl. appressoria), haustorium (pl. haustoria), hyphopodium (pl. hyphopodia).Hyphal aggregations and tissues: P*lectenchyma* (i.e.woven tissue). *Prosenchyma* (i.e. approaching a tissue) and *pseudoparenchyma* (a type of plant tissue). *Stroma* (mattress), *sclerotium* (hard structure) and *rhizomorph* (root shaped). Reproduction (asexual and sexual): Reproduction in fungi (asexual and sexual). Reproduction in fungi: Fungi reproduce by three processes viz., (A) Vegetative, (B) Asexualand (C) Sexual reproduction. Vegetative reproduction (Fragmentation, Rhizomorph, Fission, Chlamydospores, Budding ,Sclerotium etc. Asexual reproduction a. Exogenous. b. Endogenous: Sexual reproduction a. Monoecious or hermaphroditic, b. Dioecious: Four distinct phases of sexual reproduction are: somatogamy, plasmogamy, karyogamy and meiosis. These phases occur by any one of the following five general methods of sexual reproduction,(Gametic copulation – (a) Isogamy and (b) Anisogamy, Gametangial contact, Gametangial copulation , Spermatization, Somatogamy (Anastomosis)	10
7	Classification of fungi.Key to divisions, sub-divisions, orders and classes.(Classification of fungi. Key to divisions, sub-divisions, orders and classes) The classification of Ainsworth (1966 and 1972) be thought along with the distinguishing characters for the classification of Division, Sub-division, class, orders ,family and each important genera of family	5
8-9	Bacteria: general morphological characters,Classification and reproduction: General morphological characters Shape Size, Reproduction (Sexual and Asexual). Basic methods of classification Major divisions of bacteria on the basis of cell wall structure Kingdom : Prokaryotae Division I : Gracilicutes Division II : Firmicutes, Division III : Tenericutes ,Division IV : Mendosicutes and Classification on the basis of Bergey's Manual of Systematical Bacteriology (1984). Sexual and Asexual reproduction in bacteria (Binary fission, Transformation, Transduction and Conjugation) Viruses: nature, architecture, multiplication and transmission Viruses: nature, architecture, multiplication and transmission Architecture of viruses and viriods Morphologically, virus particles are (i) isometric (spherical, polyhedral) and (ii) anisometric	10

	Classification of viruses Mollicutes: general morphological characters. A. Mycoplasma and Spiroplasma Kingdom : Prokaryotae, Division : Tenericutes, Class : Mollicutes,Order : Mycoplasmatales Family : 1. Mycoplasmataceae Genus: *Mycoplasma* 2. Spiroplasmataceae Genus: *Spiroplasma* 3. Acholeplasmataceae Genus: *Acholeplasma* B. Fastidious vascular bacteria : There is no well accepted classification (taxonomy) made so far for these organisms. Hence classification for Rickettsia (RLO) and Fastidious bacteria (e.g.Xellella) are mentioned below: B1: Rickettsia (RLO) Kingdom : Prokaryotae, Division : Gracilicutes (Gram-ve bacteria), Class : Proteobacteria ,Sub-class : Alpha Proteobacteria ,Order : Rickettsiales ,Family : Rickettsiaceae Tribe : Rickettsiae B2. Fastidious vascular bacteria ,Kingdom : Prokaryotiae ,Division : Gracilicutes (Gram-ve bacteria) ,Class : Proteobacteria ,Sub-class : Gamma Proteobacteria,Order : Not classified,Family : Not classified ,Tribe : Not classified ,	
10	Survival and dispersal of plant pathogen	10
11	Mechanism of infection- Penetration and avenues of penetration	8
12	Epidemiology and factors influencing epidemic development and forecasting of plant diseases	10
13-14	Principles and methods of plant disease management A. Principles of plant disease management: There is six basic concept or principles or objectives lying under plant disease management.(Avoidance of the pathogen, Exclusion of the pathogen, Eradication of the pathogen, Protection of the host , Disease resistance, Therapy) B. Methods of plant disease management 1. Avoidance of the pathogen (Choice of geographical area, Selection of a field, Adjustment of time of sowing, Use of disease escaping varieties, Use of pathogen-free seed and planting material Modification of cultural practices) 2. Exclusion of inoculum of the pathogen (Treatment of seed and plating materials, Inspection and certification, Quarantine regulations, Eradication of insect vector) 3. Eradication of the pathogen (Biological control of plant pathogens, Eradication of alternate and collateral hosts, Cultural methods, Crop rotation, Sanitation of field by destroying/burning crop debris, Removal and destruction of diseased plants or plant parts, Rouging, Heat and chemical treatment of diseased plants, Soil treatment: by use of chemicals, heat energy, flooding and fallowing) 4. Protection of the host (Chemical control: application of chemicals (fungicides, antibiotics) by seed treatment, dusting and spraying,Chemical control of insect vectors,Modifications of environment, Modification of host nutrition 5. Disease resistance (Use of resistant varieties: Development of resistance in host is done by Selection and hybridization for disease resistance,Chemotherapy,Host nutrition,Genetic engineering, tissue	10

	culture) 6. Therapy Therapy of diseased plants can be done by Chemotherapy,Heat therapy, Tree-surgery	
15-16	Nature, chemical combination, classification fungicides group (sulphur compounds Inorganic and organic (dithio - carbomates)), mercurial compound, heterocyclic nitrogenous compounds, organophosphorus compounds, oxathins , benzimidazoies , morpholines , organophosphorus , phenol derivatives chloroneb , triezoles triedimefon and antibiotics	7
	Mode of action of fungicides of group (sulphur compounds Inorganic and organic (dithio - carbomates)), mercurial compound, heterocyclic nitrogenous compounds, organophosphorus compounds, oxathins , benzimidazoies , morpholines , organophosphorus , phenol derivatives chloroneb , triezoles triedimefon and formulations of fungicides (Characteristic of an ideal fungicide, formulations of fungicides (Wettable powder , Dust ,Granules Emulsified concentrates, Solutions, Slurries or suspensions) and antibiotics	
	Total	**100**

Practical Schedule

Ex. No.	Practical
1.	Acquaintance with various laboratory equipments and microscopy
2.	General study of different structures of fungi.
3.	Study of symptoms of various plant diseases.
4.	Study of representative fungal genera
5.	Staining and identification of plant pathogenic bacteria
6	Study of phanerogamic plant parasites
7	Transmission of plant viruses
8	Study of morphological features and identification of plant parasitic nematodes.
9	Preparation of media
10	Isolation and purification of fungi and bacteria
11	Extraction of nematodes from soil
12	Koch's postulates
13	Study of fungicides and their formulations
14	Methods of pesticide application and their safe use
15	Calculation of fungicide sprays concentrations**.**
16	Collection and preservation of disease specimen

Text books:

1. Walia RK & Bajaj HK. 2003. *Text Book on Introductory Plant Nematology*. ICAR, New Delhi

Reference books:

1. Pathak, V. N. Essentials of Plant Pathology. Prakash Pub., Jaipur
2. Agrios, GN. 2010. *Plant Pathology*. Acad. Press.
3. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur
4. Singh RS. 2008. *Plant Diseases.*8th Ed. Oxford & IBH.Pub.Co.
5. Singh RS. 2013. *Introduction to Principles of Plant Pathology.*Oxford and IBH Pub.Co.
6. Alexopoulos, Mims and Blackwel. Introductory Mycology
7. Mehrotra RS & Aggarwal A. 2007.*Plant Pathology.*7th Ed. Tata Mc Graw Hill Publ. Co. Ltd.
8. Gibbs A & Harrison B. 1976. *Plant Virology - The Principles*. Edward Arnold, London.
9. Hull R. 2002. *Mathew.s Plant Virology*. 4th Ed. Academic Press, New York.
10. Verma JP. 1998. *The Bacteria*. Malhotra Publ. House, New Delhi.
11. Goto M. 1990. *Fundamentals of Plant Bacteriology*. Academic Press, New York.
12. Dhingra OD & Sinclair JB. 1986. *Basic Plant Pathology Methods*. CRC Press, London,Tokyo.

13. Nene YL & Thapliyal PN. 1993. *Fungicides in Plant Disease Control.* 3rd Ed. Oxford & IBH, New Delhi.
14. Vyas SC. 1993. *Handbook of Systemic Fungicides*. Vols. I-III. Tata McGraw Hill, New Delhi.
15. Rajeev K & Mukherjee RC. 1996. Role of Plant Quarantine in IPM. Aditya Books.
16. Rhower GG. 1991. Regulatory Plant Pest Management. In: Handbook of Pest Management in Agriculture. 2nd Ed. Vol. II. (Ed. David Pimental). CRC Press.
17. Singh RS & Sitaramaiah K. 1994. *Plant Pathogens – Nematodes*. Oxford & IBH, New Delhi.
18. Thorne G. 1961. *Principles of Nematology*. McGraw Hill, New Delhi.

e-reading: **http://ecourses.iasri.res.in/**

Course No. H/PATH-352 Course title: Diseases of fruit, plantation, medicinal and Aromatic crops

Credits: (2+1) 3 **Semester: V**

Theory: Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits, plantation, medicinal and aromatic crops viz mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear, peach, plum, almond, walnut, strawberry, areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Tephrosia. Important post-harvest diseases of fruit, plantation, medicinal and aromatic crops and their management.

Practical: Observations of disease symptoms, identification of casual organisms and host parasite relationship of important diseases. Examination of scrapings and cultures of important pathogens of fruits, plantation, medicinal and aromatic crops.

Teaching (Lecture) Schedule and weightages

Lecture No.	Topic	Weightages
	Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of	
	Fruit Crops *viz.,*	
1,2	Mango	10
3,4	Banana	10
5,6	Grape	10
7,8	Citrus	10
9, 10	Guava, sapota, fig	5
11	Papaya	5
12,13	Pomegranate	5
14	Ber, custard apple, aonla, jamun	5
15	Jackfruit , pineapple,	5
16,17	Strawberry, almond, cashew, walnut,	5
18,19	Apple, pear, peach, plum	5
	Plantation Crops *viz.,*	
20, 21	Betelvine, arecanut, coconut, oil palm	5
22, 23	Coffee, tea, cocoa, rubber	5
	Medicinal and Aromatic Crops *viz.,*	
24, 25	Senna, neem, hemp, belladonna, pyrethrum	5
26, 27,28	Camphor, costus, crotalaria, datura, discorea, mint, opium, *Solanium khasianum* and tephrosia	5
29,30,31,32	Important post -harvest diseases of fruit, plantation, medicinal and aromatic plants and their management.	5
	Total	**100**

Lesson Plan

Lesson No.	Topic
	Etiology, Symptoms, Mode of Spread, Epidemiology and Integrated Management of the Diseases of :
	Fruit Crops viz:
1, 2	Mango: Malformation, Anthracnose, Powdary mildew, Bacterial blight Stone graft mortality, Red Rust Giant Mistletoe (Loranthus)
3, 4	

	Infectious chlorosis, Cigar end rot Fan Leaf Virus
7, 8	Citrus: Gummosis, Leaf fall and Fruit Rot , Anthracnose, *Diplodia* , *Ganoderma* root rot , Powdary mildew , Canker, Mottling Greening, Tristeza, Psorosis, Citrus Exocortis Quick and Slow Decline, *Khaira* Disease (Zinc Deficiency)
9	*Papaya: Pythium soft rot, Powdary midew, Anthracnose, Fruit rot,Viruses: Ring spot ,leaf curl and mosaic*
10	a) Guava: Wilt, Canker, *Pestolatia* leaf spot, Anthracnose
10	b) Sapota: Root rot, Leaf spots, Fruit rots
10	c) Fig: Fig rust
11	Pomegtanate: *Alternaria*, *Helminthosporium* and *ColletotrichumCercospora* leaf and fruit spots, Wilt, Bacterial Blight
12	a) Ber: Powdery mildew
12	b) Custard Apple: Pythium Seedling Mortality and Fruit Rots
12	c) Aonla: Emblica Rust (Ravenalia sp.)
12	d) Jamun: Fruit rot and foliage diseases
13	a)Jackfruit: Die Back , Fruit Rot
13	b) Pineapple: Heart rot, Base rot and Wilt
14	a) Strawberry: Leaf spots
14	b) Almond: Leaf spots
14	c) Cashew: Leaf spots
14	d) Walnut: Leaf spots
15	a)Apple: Fire blight , Root and Collar rot, Cankers, Powdery mildew, Scab, Fruit Rots, Crown Gall, Mosaic
15	b)Pear: Rust , Leaf spots and Blight, Scab, Mosaic
15	c) Peach: Rust, Blight, Scab and Leaf Curl
15	d) Plum: Bacterial Canker, Wilt, Mosaic and Leaf Curl
15	e) Stone Fruit: Crown gall
	Plantation Crops viz:
16	a)Betelvine: *Phytophthora* wilt, *Sclerotium* foot rot, Powdary mildew
16	b) Arecanut: Koleroga,
17	c) Coconut: Wilt, Stem bleeding, Stem rot, Bud rot, Cadang –cadang disease, Lethal yellow
17	d) Oil Palm: Major foliage diseases
18	e) Cofee: Rust
18	f) Tea: Rust
18	e) Cocoa: Major diseases
19	f) Rubber: Major diseases
	Medicinal and Aromatic crops viz.
20, 21	b) Camphor, Costus, Crotolaria: Major Diseases a)Senna, Neem, Hemp, Belladona, Pyrethrum: Major Diseases
24, 25,26	c) Datura, Discorea, Mint, Opium: Major Diseases
27,28,29	d) *Solanum khasianum* and Tephrosia: Major Diseases
30,31,32	Important Post Harvest Diseases of above Fruit, Plantation, Medicinal and Aromatic Plants and Their Management.

Practical

Practical No.	Crop	Syllabus

	Observations of disease Symptoms, identification of Causal Organism and Host- parasite relationship and Integrated Disease Management of following important diseases of:	
	Fruit Crops *viz.,*	
1	Mango	Malformation, anthracnose, powdary mildew, bacterial blight stone graft mortality, red rust giant mistletoe (loranthus)
2, 3	Banana	Wilt, sigatoka, anthracnose, *erwinia* rot, bunchy top, heart rot infectious
4, 5	Grape	chlorosis, cigar end rot leaf virus
6, 7	Citrus	Gummosis, leaf fall and fruit rot , anthracnose, *Diplodia* , *Ganoderma* root rot , powdary mildew, canker, mottling greening, tristeza, psorosis, citrus exocortis quick and slow decline, *Khaira* Disease (Zinc Deficiency)
8	Papaya	*Pythium soft rot, powdery midew, anthracnose, fruit rot, viruses: ring spot ,leaf curl and mosaic*
9	Guava	Wilt, canker, *Pestolatia* leaf spot, anthracnose
9	Sapota	Root rot, leaf spots, fruit rots
9	Fig	Fig rust
10	Pomegtanate	*Alternaria*, *Helminthosporium* and *ColletotrichumCercospora* leaf and fruit spots, wilt, bacterial blight
11	Ber	Powdery mildew
11	Custard Apple	Pythium seedling mortality and fruit rots
11	Aonla	Emblica rust (*Ravenalia* sp.)
11	Jamun	Fruit rot and foliage diseases
12	Jackfruit	Die back , fruit rot
12	Pineapple	Heart rot, base rot and wilt
12	Strawberry	Leaf spots
12	Almond	Leaf spots
12	Cashew:	Leaf spots
12	Walnut	Leaf spots
13	Apple	Fire blight , root and collar rot, cankers, powdery mildew, scab, fruit rots, crown gall, mosaic
13	Pear	Rust , leaf spots and blight, scab, mosaic
13	Peach	Rust, blight, scab and leaf curl
13	Plum	Bacterial canker, wilt, mosaic and leaf curl
13	Stone Fruit	Crown gall
	Plantation Crops v*iz.,*	
14	Betelvine	*Phytophthora* wilt, *Sclerotium* foot rot, Powdary mildew
14	Arecanut	Koleroga
14	Coconut	Wilt, stem bleeding, stem rot, bud rot, cadang –cadang disease, lethal yellow
14	Oil Palm	Major foliage diseases
14	Coffee	Rust
14	Tea	Rust
14	Cocoa	Major diseases
14	Rubber	Major diseases
	Medicinal and Aromatic crops *viz.,*	
15	Camphor, costus, crotolaria: major diseases	
15	b) a) Senna, neem, hemp, belladona, pyrethrum: major diseases	
15	c) Datura, discorea, mint, opium: major diseases	
15	d) *Solanum khasianum* and tephrosia: major diseases	
16	Important post harvest diseases of above fruit, plantation, medicinal and aromatic plants and their management	
	Total: 16	

Reference books:

1. Agrios, GN. 2010. *Plant Pathology*. Acad. Press

2. Diseases of Horticultural Crops fruits (1999) By Verma L.R and Sharma R.c,Indus Publishing company, New Delhi
3. Diseases of fruit crops (1986) By V.N.Pathak ,Oxford & IBH publication, New Delhi
4. Diseases of fruit crops (1986) By R.S.Singh ,Oxford & IBH publication, New Delhi
5. Diseases of Fruits and vegetables (2007) S.A.M.H. Naqvi,Springer Science & Business Media
6. Diseases of Plantation Crops (2014) By P.Chowdappa, Pratibha Sharma IPS 263pp
7. Diseases of Horticulture Crops and their management ,ICAR e-book for B.Sc.(Agri) & B.Tech (Agri) By TNAU pp172
8. Advances in the diseases of Plantation crops & spices (2004) P.Santha Kumari,International Book Distributing Company , 247 pp
9. Mehrotra RS & Aggarwal A. 2007. *Plant Pathology.* 7th Ed. Tata Mc Graw Hill Publ. Co. Ltd

e-reading: **http://ecourses.iasri.res.in/**

Course No. H/PATH-363 **Course title: Disease of Vegetable, Ornamental and Spices crops**

Credits: (2+1) 3 **Semester: VI**

Theory: Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, crossandra, tuberose, gerebera, anthurium, geranium. Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical: Observations of symptoms, causal organisms and host parasitic relationship of important diseases, examination of cultures of important pathogens of vegetables, ornamental and spice crops in field as well as in protected cultivation.

Teaching (Lecture) schedule and weightages

Sr. No.	Topic	Lecture No.	Weightages
	Etiology , symptoms, mode of spread, epidemiology and integrated disease management in diseases of :		
	Vegetables crops *viz.,*		
1	Potato, tomato	1,2,3,	12
2	Brinjal, chilli	4,5,	08
3	Cabbage, cauliflower, broccoli	6,7,	09
4	Radish, knol-khol, beetroot	8,9,	06
5	Ladies finger (bhendi/okra)	10,	05
6	fenugreek and other leafy vegetables	11,	05
7	pea, beans	12,13,	07
8	Onion garlic	14,15,	06
9	Ginger ,turmeric	16,17,	06
	Ornamental crops *viz.,*		
10	Rose, chrysanthemum	18,19,	06
11	Gerbera, marigold, jasmine	20,21,	04
12	Gladiolus, carnation	22,23,	04
13	Crossandra, geranium	24,25,	04
	Spice crops *viz.,*		
14	Pepper, cumin, cardamom	26,27,	07
15	Nutmeg, coriander, clove, cinnamon	28,29,	05
16	Important post-harvest diseases of vegetables and ornamental crops and their management	30,31, 32	06
	Total	**32**	**100**

Lesson Plan

Sr. No.	Lesson
	Etiology, symptoms, mode of spread, epidemiology and integrated disease management in diseases of :
	Vegetables crops *viz.,*
1, 2, 3	Potato: Early & late blight, wart, scab, bacterial ring rot, viruses: X, Y, roll, rugose, crinkle Tomato: Damping off, early & late blight, wilts: *Fusarial, Verticillium*, bacterial, virus: mosaic, spotted wilt virus
4, 5	Brinjal: Damping off,wilt, *Alternaria&Phomopis* blight, rust, little leaf chili: damping off, powdery mildew, dieback, *Churda Murda,* little leaf
6, 7	Cabbage, cauliflower, broccoli: club root, *Alternaria* blight, wilt, downy mildew, molybdenum and

	boron deficiency
8, 9	Radish: White rust Knol-khol, beetroot: major diseases
10	Ladies finger (bhendi/okra): powdery mildew, *Alternaria*, yellow vein mosaic virus
11	Fenugreek and other leafy vegetables: powdery and downy mildew and *Alternaria* blights
12, 13	Pea: Powdery mildew, wilt, root rot, enation and necrosis virus Beans: Powdery mildew in cluster and other beans, bacterial and *Alternaria* blight, anthracnose
14, 15	Onion: *Alternaria* blight, smudge, downey mildew Garlic: Alternaria blight
16, 17	Ginger: Rhizome rot, *Colletotrichum* leaf spot Turmeric: *Taphrina* leaf spot, anthracnose
	Ornamental Crops *viz.,*
18, 19	Rose: Powdery mildew, rust, die back, stem canker Chrysanthemum: Powdery mildew
20, 21	Merigold: Powdery mildew Jasmine: Rust, *Alternaria*
22, 23	Gladiolus, carnation: major diseases Gerbera: Powdery mildew
24, 25	Crossandra: Wilt Geranium: Major diseases
	Spice Crops viz:
26, 27	Pepper: Phytophthora foot rot, anthracnose, slow wilt Cumin: Wilt, powdery mildew Cardamum: Major diseases
28, 29	Nutmeg: Die back, wilt Coriander: Powdery mildew, wilt, stem gall Clove: Die back, *Colletotrichum* Cinnamom: Leaf spot, die back
30, 31, 32	Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical Schedule

Exercise No.	Exercise
1	Club root of crucifers *viz,.*cabbage, cauliflower
2	Damping off diseases of tomato, brinjal, chilli, cabbage, cauliflower, bhendi Rhizome rot of ginger, white rust of radish
3	Late blight of potato, tomato
4	Downey mildew of onion, cucurbits, fenugreek, aster
5	*Taphrina* leaf spot of turmeric
6	Ectophytic powdery mildew of cucurbits, *bhendi*, pea, beans, fenugreek, coriander, rose, cumin
7	Endophytic powdery mildew of cluster bean , chili
8	Alternaria blight of bhendi, garlic, potato, tomato, cabbage, beans, onion, jasmine
9	Anthracnose of chilli, turmeric, beans, pepper, nutmeg, clove.
10	Fusarial wilt of tomato, brinjal, *bhendi*, pea, cabbage, crossandra, cumin, *Verticillium* wilt of brinjal, tomato
11	Root rots in vegetables *viz.,* tomato, brinjal, and pea. *Macrophomina* leaf spot in vegetables & spices *viz.,* brinjal, pea
12	Rusts of brinjal, beans, roses, jasmine and onion smudge
13	Bacterial wilts of brinjal, tomato. Phytoplasma diseases *viz.,* little leaf of brinjal, aster yellows, *Orobanche* and *Cuscuta* sp. on brinjal
14	Virus disease of potato: mosaic - X, Y, roll and crinkle virus, viruses of tomato, cucurbits, C*hurda-murda* of chilli.
15	Viral disease bhendi: yellow vein mosaic

	Pea viruses: Enations and top necrotic virus
16	Deficiency diseases *viz.,* black heart of potato, boron and molybdenum deficiency in cabbage & cauliflower, important post harvest diseases of vegetables , ornamentals, spices & their management.

Reference books:

1. Agrios, GN. 2010. *Plant Pathology*. Acad. Press
2. Vegetable Diseases : A Colour full Hand book (2006) by Steven T.Koike ,Peter Gladers and Albert Paulus ,Academic Press, pp448
3. Diseases of Vegetables crops by R.S.Singh (1987) Oxford & IBH publication, New Delhi
4. Plant Diseases.(2008) Singh RS. 20088th Ed. Oxford & IBH. Pub. Co.
5. Diseases of Crops Plants in India (2009) By PHI learning Pvt. Ltd, pp 548
6. Diseases of Vegetable crops (2005) by Alferd Steferud ,Biotech Books ,New Delhi
7. Mehrotra RS & Aggarwal A. 2007. *Plant Pathology.* 7th Ed. Tata Mc Graw Hill Publ. Co. Ltd
8. Diseases of Vegetable Crops ,Diagonosis and Management (2014) Dinesh Singh and P.Chodappa, Today and Tomorrow Printers ,pp734
9. Singh H. 1984. *House-hold and Kitchen Garden Pests - Principles and Practices.* Kalyani Publishers.

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Course No. H/PATH-364 **Course Title: Mushroom Production Technology**
Credits: (0+1) 1 **Semester: VI**

Practical:

Introduction to mushroom, Nutritional and medicinal value of mushroom. Morphology and types of mushroom. Material equipment and basic facilities required for mushroom entrepreneurship. Preparation of mushroom culture by tissue isolation method. Spawn production: Types of spawn and method of spawn production. Preparation of compost for button mushroom production. Preparation of substrate for oyster mushroom production. Spawning and methods of spawning. Casing for button mushroom production and after care during spawn run. In button and oyster mushroom production. Harvesting indices, packing and preservation of Button. Harvesting indices, packing and preservation of oyster mushroom. Preparation of mushroom recipes. Disease management in mushroom production. Pest management in mushroom production. Methods of disinfection and fumigation in Mushroom house. Visit to nearby Mushroom Unit.

Practical No.	Topics
1	Introduction to mushroom, Nutritional and medicinal value of mushroom.
2	Morphology and types of mushroom
3	Material equipment and basic facilities required for mushroom entrepreneurship.
4	Preparation of mushroom culture by tissue isolation method
5	Spawn production: Types of spawn and method of spawn production
6	Preparation of compost for button mushroom production.
7	Preparation of substrate for oyster mushroom production.
8	Spawning and methods of spawning.
9	Casing for button mushroom production and after care during spawn run. In button and oyster mushroom production.
10	Harvesting indices, packing and preservation of Button
11	Harvesting indices, packing and preservation of oyster mushroom.
12	Preparation of mushroom recipes.
13	Disease management in mushroom production
14	Pest management in mushroom production
15	Methods of disinfection and fumigation in Mushroom house.
16	Visit to nearby Mushroom Unit.

Reference Books:

1. Mushroom cultivation Technology- S. T. Change

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