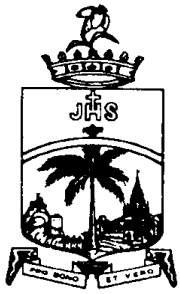
MASTER OF PHILOSOPHY IN PLANT BIOLOGY & PLANT BIOTECHNOLOGY

SYLLABUS - 2007-09



ST. JOSEPH'S COLLEGE (AUTONOMOUS)

(Nationally Reaccredited with A+ Grade / College with Potential for Excellence)

TIRUCHIRAPPALLI - 620 002

TAMIL NADU, INDIA

ST. JOSEPH'S COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 620 002
DEGREE OF MASTER OF PHILOSOPHY (M. PHIL.)
FULL TIME – AUTONOMOUS REGULATIONS

GUIDELINES

1. ELIGIBILITY

- A Candidate who has qualified for the Master's Degree in any Faculty of Bharathidasan University or of any other University recognized by the University as equivalent there to (including old Regulations of any University) subject to such conditions as may be prescribed therefore shall be eligible to register for the Degree of Master of Philosophy (M.Phil.) and undergo the prescribed course of study in a Department concerned.
- A candidate who has qualified for Master's degree (through regular study / Distance Education mode / Open University System) with not less that 55% marks in the subject concerned in any faculty of this university or any other university recognized by Bharathidasan University, shall be eligible to register for M.Phil. SC / ST candidates are exempted by 5% from the prescribed minimum marks.

2. DURATION

The duration of the M.Phil. course shall be one year, consisting of two semesters for the full-time programme.

3. COURSE OF STUDY

The course of study shall consist of

Part – I : 3 written papers
Part – II : Dissertation and *Viva Voce*

The three papers under Part I shall be :

Course I : Research Methodology
Course II : Advanced General Paper in the Subject
Course III : Field of Specialization

One paper under Part II shall be :

Course IV : Recent Trends in Biology - a self study report Dissertation

Paper I & II shall be common to all candidates in a course. Paper I, II & III shall consists of 5 units covering the subject requirements of the course offered. The syllabi for Papers I, II & III shall be approved by the Board of Studies of the Department concerned. The syllabus for Paper III shall be prescribed by the research advisor which also to be approved by the Board of Studies. The number of specialized papers by the research advisor can be more than one.

Papers I & II shall be set externally and valued by two examiners, one internal and one external. The HOD concerned will be in the Board of Examiners to pass the results. Paper III shall be set and valued by the Research Adviser concerned. The examinations for Papers I, II and III shall be conducted by the Controller of Examinations.

4. SCHEME OF EXAMINATION

4.1 Part-I (First Semester)

Paper I : Research Methodology
Paper II : Advanced General Paper in the Subject
Paper III : Field of Specialization

4.2 Written Examination

The examinations for Paper-I, II and III shall be taken at the end of the first semester. Each paper shall have 100 marks for the semester examination (written) and 100 marks for Continuous Internal Assessment. The CIA components are: Mid-Semester: 35 Marks, End-Semester: 35 Marks, Seminar-I: 15 Marks and Seminar-II: 15 Marks. Both the CIA marks and the external marks should be mentioned separately in the mark sheet. The duration of each semester examination shall be 3 hours. A candidate shall be declared to have passed Part-I examination by securing not less than 50 of the marks each in the CIA and the semester examination respectively. The aggregate of the marks secured in the semester examinations and CIA marks taken together must be 50% in each of the Papers I, II and III.

4.3 First Semester Credits

Paper	Name	Contact Hours	Library Hours	Total Hours	Credits	CIA Marks
I	Research Methodology	6	6	12	10	100
II	Core Subject	6	6	12	10	100
III	Optional Subject	2	4	6	5	100
	Total			30	25	300

4.4 Part-II (Second Semester)

4.4.1 Course-IV: Recent Trends in Biology - A Self Study Report

Course-IV is a special paper aiming at promoting the self-study culture and train the students to collect source materials, on a specific topic of recent trend, in any field of Biology, study in detail, compile the information logically write a report on the topic chosen. The topic and the final report has to be approved by the respective guides. The student will submit the report along with the source material to the Department and also present the same in a seminar. The source materials and the report will be valued by an internal (Guide) and an External Examiners and the student will present the report in a public *viva voce*.

Course-IV	**CIA Marks**	**External Marks**	**Total**	
			Marks	**Credits**
Source Material	25	25	50	2
Seminar	25	–	25	1
Report	50	25	75	5
Viva Voce	–	50	50	2
Total	100	100	200	10

4.4.2 Dissertation

For carrying out the dissertation the mandatory requirements is a Pass in Paper III. Every student is expected to give two seminars, one concerning Review of Literature within three weeks from the beginning of the second semester and the other on data analysis before the submission of the dissertation

Candidates shall submit the Dissertation to the Controller of Examinations during the 6 month of the II Semester in the full time programme. The above said time limit shall start from 1st of the month which follows after the month in which Part – I examinations are conducted. If a candidate is not able to submit the Dissertation within the period stated above, he/she shall be given an extension time of 3 months in the first instance and another 3 months in the second, with Extension Fees. If a candidate does not submit the Dissertation even after the two extensions, the registration shall be treated as cancelled and he/she has to re-register for the course subject to the discretion of the Principal. However the candidate need not go through Part-I if he / she has already passed these Papers. For the valuation of dissertation the mandatory requirement is a pass in papers I and II. One external examiner and the Research Adviser shall value the Dissertation. The external examiner should be selected only from outside the college and shall be with in the colleges affiliated to Bharathidasan University. In case of non-availability, the panel can include examiners from outside of Bharathidasan University. The external examiner shall be selected from a panel of 3 experts suggested by the Research Adviser. However, the Controller of Examination may ask for another panel if he deems it necessary. Both the internal and external examiner will evaluate the Dissertation and award the marks separately. However the *viva voce* will be done by both of them together and the average marks will be considered.

4.4.3 Second Semester Credits

Internal Examination (the split up for CIA)

Project	Credits	Marks
Seminar on review of literature	3	30
Seminar on Data analysis	2	20
Dissertation Evaluation	15	150
Viva voce	5	100
Total	25	300

External Examination

	Credits	Marks
Dissertation Evaluation	20	200
Viva voce	5	100
	25	300

4.4.4 *Viva voce*

The external examiner who valued the Dissertation and the Research Adviser shall conduct the *Viva Voce* for the candidate for a maximum of 100 marks. A Candidate shall be declared to have passed Part-II examination by securing not less than 50% marks prescribed for Dissertation and 50% marks in the aggregate of marks secured in *Viva voce* and Dissertation valuation.

5. CLASSIFICATION OF SUCCESSFUL CANDIDATES

The candidates who pass the Part – I and Part – II examinations in first attempt shall be classified as follows.

No.	Total Marks secured in Part – I and Part – II Examinations	Classification
1.	80% and above in the case of Science Subjects & 75% and above in the case of Arts and Social Science Subjects	I Class with Distinction
2.	60% to 79% in the case of Science Subjects & 60% to 74% in the case of Arts and Social Science Subjects	I Class
3.	50% to 59% in all the subjects (Mathematics, Statistics and Computer Science / Applications shall be treated as Science Subjects)	II Class

6. ATTENDANCE

- ✧ Daily attendance for 90 working days should be enforced for the students.
- ✧ Periodical report of a student to the guide concerned should be recorded in the register kept by the guide.

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M.PHIL. PLANT BIOLOGY & PLANT BIOTECHNOLOGY
COURSE PATTERN - 2007

Sem	***Code***	**Course**	**Title of the paper**
I	07 MPB 101	I	Research Methodology
	07 MPB 102	II	Biotechnology
II	07 MPB 203	III	*In vitro* Physiology
	07 MPB 204	III	The Science of GM Crops
	07 MPB 205	III	Biosafety
	07 MPB 206	III	Plant Tissue Culture
	07 MPB 207	III	Soil Microbiology
	07 MPB 208	III	Mycorrhizas - Classical and Molecular Approaches
	07 MPB 209	III	*In vitro* Technique in Plant Tissue Culture
	07 MPB 210	III	Insect - Plant Interactions (Applied Entomology)
	07 MPB 211	III	Water Resources and Water Pollution
	07 MPB 212	III	Plant Systematics

Sem-I Hours/week: 4
07MPB101 Credits: 3

Paper I: RESEARCH METHODOLOGY

Objectives

- ✧ To initiate the students into research activities and to learn to handle various instruments, their principle and applications.

Unit-I

Buffers: Characteristics and preparation – pH meter – principles, measurements of pH, pKa. Electrometric determination, glass and reference electrodes. Gas-measuring electrodes – basic principles, applications of Clark electrode. Centrifuges – principles, types and operation. Microscopy-Electron Microscopy (TEM, SEM) Fluorescence Microscopy.

Unit-II

Chromatography – basic principles – Detailed study of HPLC, principles of ion exchange; molecular sieve and affinity chromatography and TLC.

Electrophoresis – basic principles – its types, electrophoretic mobility and factors influencing electrophoretic mobility; isoelectric focusing, application, PAGE.

Unit-III

Tracer techniques – nature of radioactivity, pattern of decay, half life autoradiography – detection of radiation and measurements by GM counter, Scintillation counter and applications of isotopes. Applications in Biology – principles, instrumentation – Spectrophotometer UV/Vis. Flame photometer, Atomic absorption spectrophotometer NMR and ESR. Biosensors.

Unit-IV

Measures of Central Values and Dispersion – Probability; Binomial, Poisson and Normal – Correlation and Regression for simple and linear data – Testing of significance-large sample test, t test and chi-square test. Analysis of variance; One and Two way ANOVA. Principles of experimental design; CRD, RBD.

Unit-V

Research – types, objective and approaches. Sample – types; Sampling Techniques Hypothesis; Definition, characteristics, types, significance. Literature collection, web browsing. Writing review of Literature and Journal article. Structure of thesis. Manuscript for publication and proof correction.

Test Books

1. Gupta, S.P., 1990, Statistical Methods, Sultan Chand & Sons.
2. Kothari, C.R., Research Methodology – Methods & Techniques, Wishwa Prakashan.

Books for Reference

1. Block, R.J., Durrum, E.L., Zweign, G., 1958, A manual of Paper Chromatography and Paper Electrophoresis, Academic Press inc, New York.
2. David T. Plummer, 1988, An Introduction to practical Biochemistry, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3. Harborne, J.B., 1973, Phytochemical methods – A Guide to Modern Techniques of Plant Analysis, Chapman and Hall Ltd., London.
4. Jayaraman, J., 1972, Techniques in Biology. Higginbothoms P Ltd., Chennai
5. Keith Wilson & John Walker, Practical Biochemistry-Principles and Techniques, 2000, (5ed.), Cambridge University Press.
6. Ragava Rao, D., 1983, Statistical Techniques in Agricultural and Biological Research, Oxford & IBH Publishing Co., New Delhi.
7. Ralph, R., 1975, Methods in Experimental Biology, Blackie Pub., London.
8. Stock, R., & Rice, C.B.E., Chromatographic Methods, 1977, Chapman and Hall Ltd. London.
9. Umbreit, W.W., 1972, Manometric and Biochemical Techniques Burgess Publishing Co., Minnesota.

Sem-I Hours/week: 12
07MPB102 Credits: 10

Paper II : BIOTECHNOLOGY

Objectives

- ✧ To study the techniques used in genetic engineering.
- ✧ To explore the possible applications and future potentiality of biotech.

Unit-I

Basic principles – mechanism of natural gene transfer by Agrobacterium; Ti plasmids. Generation of foreign DNA molecules – Enzymes used in Genetic Engineering – restriction enzymes – their types and target sites; cutting and joining of DNA molecules – linkers, adapters, homopolymers; cloning vehicles and their properties – natural plasmids, in vitro vectors, phages, cosmids and T-DNA based hybrid vectors. Cloning with sstr. DNA vectors.

Unit-II

Cloning strategies – cDNA and genomic libraries; recombinant selection and screening methods. Expression of cloned genes – problems and solutions, shuttle vectors; DNA sequencing strategies – Sanger's and Maxam-Gilbert's methods. Applications of PCR and DNA hybridization – Southern, Northern and Western blotting.

Unit-III

Techniques of tissue culture – culturing explants and haploids, protoplasts fusion and embryoids. Methods of gene transfer to plants, animals and bacteria – Ca transfection, electroporation, shot gun, micro injection, biolistics and lipofection. Transgenic plants, GM foods and biopesticides. Gene knockouts and transgenic animals – animal pharming and xenografting. Biodegradation stimulation and its applications. Bioleaching.

Unit-IV

GMOs and GM foods biosafety - Genetic use Restriction Technology (GURT); patenting of genes, cell and life forms; TRIP rights; Genomics – Arabidopsis, rice, human. Gene therapy – types, principles and applications. Gene drain – the tangled genes – uniformity and genetic loss; directed recombination and recombinant DNA technology.

Unit-V

Methodology and protocol in the development and production of plantibodies, plantigens, food vaccines and bioplastics. Production of plants transgenic to tolerance to herbicides, drought, salt and diseases. Anti-sense RNA technology-its mechanism and application. Golden rice technology and biotransformation of high value metabolites through cell culture. RNA interference and silencing of selective genes-their application in gene regulation.

Books for Reference

1. Freifelder, D. (1993): Molecular Biology, Jones and Bartlett, Publishers, London.
2. Glick BR and Pasternak JJ. 2002. Molecular Biotechnology, ASM Press, Washington.
3. Old RW and Primrose SB (1989): Principles of gene manipulation, Blackwell Scientific Publication, London.
4. Primrose SB (1993): Animal biotechnology, Blackwell Scientific Publication, London.
5. Watson JD *et al*., (1987): Cell and Molecular biology, John Wiley Publications, NY.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III : *IN VITRO* PHYSIOLOGY

Dr D I Arockiasamy

Objectives

- ✧ To learn the recent Advances in the *in vitro* propagation.
- ✧ To train in the innovative application of the various techniques in tissue culture to conserve the endemic, endangered plants and improve the quality of the economically important plants.

Unit-I

History and milestones in Tissue Culture Advantages of tissue culture over intact plants. Laboratory organization – Infrastructure for Tissue Culture laboratory equipments and general practice. Major components of a culture medium – Stock preparation. Composition of a culture medium – Stock preparation – Composition of standard media, Additions to basic media – Preparation and sterilization of media.

Unit-II

Callus and organ culture – Source of explants – surface sterilization of explants – Principle of callus culture – Initiation of callus – Types of callus – Maintenance of callus culture – Initiation and maintenance of cell suspension culture – Principles and protocol – Importance and application – Organ culture – Root, shoot tip and meristem – their uses and advantages.

Unit-III

Regeneration and organogenesis: Totipotency – cytodifferentiation – Induction of regeneration – Principles and factors influencing organogenesis – Applications – Decline in totipotency in tissue culture – Somatic embryos – Production of synthetic seeds – Preservation – Applications and advantages of synthetic seed production – Haploid culture. Anther culture – Ovary and ovule culture – Doubling of chromosome numbers – Dihaploid (homozygous) production – Genetic variation in dihaploids – Somaclonal variation. Sources of Somaclonal variation. Selection of somaclones – progeny testing of somaclones – Application of somaclonal variation to crop improvement.

Unit-IV

Protoplast culture: Important properties of protoplast, protoplast isolation and culture. Methods of protoplast fusion – Chemofusion, electrofusion – Somatic hybrids – Cybrids – Principles, protocols and importance.

Selection of heterokaryons. Preservation and cryopreservation of germplasm – Principles, procedure and uses. Reduction in growth rates of preserved cells and tissues – Inhibition of growth of cells and tissues by cryopreservation – confirmation of viability and stability of cryopreserved tissues.

Unit-V

Secondary plant product synthesis by plant tissue culture – Secondary plant products – types and their importance – Effect of tissue culture conditions on secondary plant product synthesis – Cell selection in vitro for high yielding cell lines – genetic modification of tissue cultures – large scale culture of plant cells. Micropropagation techniques in horticulture and crop improvement – sources of tissue for micropropagation – methods of micropropagation – Problems that arise in vitro during micropropagation – Problems that arise in vitro after micropropagation – Variation in clonal plants. Advantages and disadvantages of micropropagation. Strategy for plant transformation through gene transfer – Gene manipulation with Agrobacterium tumefaciens – Non tissue culture based transformation using A. tumefaciens – Tissue culture transformation not based on A tumefaciens – Genetically engineered characters in crop plants.

References

1. Edwin F. George and Paul sherington, D. 1984. Plant Propagation by Tissue Culture. Exegetics Ltd., Edington, Westbury, England.
2. Indra K. Vasil. 1980. Cell Culture and Somatic Cell Genetics of Plants Academic Press inc., New York.
3. Kalyanakumar De. 1997. An Introduction to Plant Tissue Culture, New Central Book Agency, Calcutta.
4. R.L.M. Pierik, 1987. *In vitro* culture in higher plants. Martinus Nijhoff Publishers, Boston.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: THE SCIENCE OF GM CROPS

Dr G Melchias

Objectives

- ✧ To comprehend the advances in GM Crops
- ✧ To understand and inform the potential dangers of the GM Crops.

Unit-I

Introduction – GM trades and the rationale. Role of science in the regulatory process: Risk, hazard and exposure. Substantial equivalence, precautionary principle, labeling, constainment and cabinets. GM plant breeding, transgenes vs redident genes. Why regulate and how? Identifying and defining hazards and potential consequences.

Unit-II

Foods containing GMOs. The safety of food and animal feed derived from GM Crops. Possible nutritional, toxicological and allergenic properties. Food allergies, fate of transgenic DNA. Effect of GM derived feed in the food chain.

Unit-III

Environmental impacts of GM crops. Invasiveness/persistence. Toxicity to wildlife. Development of resistance. New weed control strategies offered by GM herbicide tolerant crops, horizon scanning, changes in agricultural practices and limitations of science. Ecological disruption – altered weediness, changes to weed population and biodiversity impacts and impacts on soil biota. Unintended consequences of plant transformation.

Unit-IV

Gene flow and its measurements between crop varieties. Gene flow from GM crops to agricultural weeds and wild relatives. Transfer of DNA from GM crops to soil microbes and to viruses. Consequences of gene flow and criteria for field testing.

Unit-V

The areas of public concerns: the Corr Willbourn report. Questions about GM crops and foods. Intended and unintended effects. Communicating biosafety issues and results to the public. Addressing uncertainty of GM crops. Applying risk analysis to the regulation of GMOs. Risk management and monitoring.

References

1. Filipecki and Malepszy. 2006. Unintended consequences of plant transformation: A molecular insight. J. Appl. Genet. 47(4): 277-286.
2. Glover J. 2002. Geneflow study. BRS, Canberra.

3. MacRae *et al*., 2002. Against the grain. Greenpeace, USA.
4. Mellon and Rissler. 2004. Gone to seed. Union of Concerned Scientists. Cambridge, USA.
5. Rose *et al*., 2006. Confinement of genetically engineered crops during field testing. (Proc.) Biotechnology Regulatory Services, Australia.
6. Smith et al., 2001. Superfluous transgene integration in plants. Critical Reviews in plant Sciences 20(3): 215-249.
7. Visser *et al*., 2000. Crops of uncertain nature? Greenpeace, The Netherlands.
8. Wolfenbarger, 2003. Environmental and ecological impacts from transgenic plants: Unintended effects. Information System for Biotechnology, Virginia Tech.USA.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: BIOSAFETY

Dr G Melchias

Objectives

- ✧ To understand the nightmares of biotechnology.
- ✧ To put in place the safety measures.

Unit-I
Introduction to biosafety: meaning and the rationale. Access to information, advance informed consent and precautionary principle. Classification of biological risk materials. Major risks from GMOs.

Unit-II
Engineered microbes and the risks: pathogenicity, transmission, stability, inoculum potential and inflections dose/concentration, origin, surveillance and evaluation. Biological weapons and bioterror. Laboratory biosafety level criteria: I-IV.

Unit-III
Trangenic plants: field containment, Bt and terminator – technology protecting systems. (GURTs). GM Foods: substantial equivalence, safety testing and labeling. Research animals: working with primates and pigs – Xenografting and animal organ donors.

Unit-IV
Containment: primary and secondary. Biosafety cabinets and their classification. Measures: transportation (transfer) of biological agents. Laboratory security and emergency response – detection and control. Risks and risk reduction strategies. Handling biotoxins – general and standard protocols. Deliberate release of GMOs into the environment.

Unit-V
International protocols on biosafety: the UNIDO, IPPC, CBD and the *Cartegena* protocol. Essential elements and modalities of an ideal protocol. International organizations on biosafety.

References

1. Eigner WW 1994. Just Technology? CACL, York Univ. Ontario.
2. Mce-Wan Ho 1997. Genetic Engineering – Dreams or Nighmares? RFSTE/TWN, New Delhi.
3. Melchias G 2000. Biodiversity and Conservation. Science Publ. Inc. New Hampshire. USA.
4. Mulongoy K J 1997. Transboundary Movement of Living Modified Organisms. Int. Acad Envir. Geneva.
5. Pistorius R 1997. Scientist Planta and Politics, IPGRI, Rome.
6. TWN 1996, Biosafety – Scientific Findings and Elements of a Protocol, Malaysia.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper-III: PLANT TISSUE CULTURE

Dr R Jeyachandran

Objectives

- ✧ To know the basic techniques for *in vitro* culture of plants.
- ✧ To study the latest techniques in tissue culture of plants.

Unit-I

Laboratory organization and Techniques in Plant Tissue Culture. Organ culture, root, shoot tip or meristem, ovary, flower and ovule culture and their importance.

Unit-II

Callus culture-principle, protocol and significance. Cell suspension culture – Principle, protocol and its importance. Totipotency, cytodifferentiation and organogenesis - Principle, factors influencing Organogenesis and applications.

Unit-III

Somatic embryogenesis and synthetic seeds – Principle, protocol and importance. Single cell culture, embryo culture – Principle, protocol and applications.

Unit-IV

Anther and Pollen culture – Principle, protocol and its significance.

Protoplast, isolation, fusion and culture somatic hybridization, chemofusion, electrofusion important properties of protoplast, somatic hybrids, cybrids – Principle, protocol and importance.

Unit-V

Somaclonal variation – Causes and significance, plant tissue culture in forestry, micropropagation, clonal propagation, production of useful biochemicals – Gene conservation bank – plant tissue culture in biotechnology.

References

1. Edwin F. George and Paul Sherington, D. 1984. Plant Propagation by Tissue Culture. Exegetics Ltd., Edington, Westbury, England.
2. Indra K. Vasil, 1980. Cell Culture and Somatic Cell Genetics of Plants. Academic Press Inc. New York.
3. Kalyanakumar De. 1997. An Introduction to Plant Tissue Culture, New Central Book Agency, Calcutta.
4. R.L.M. Pierik, 1987. *In vitro* culture in higher plants. Martinus Nijhoff Publishers, Boston.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: SOIL MICROBIOLOGY

Dr J John

Objectives

- ✧ To learn the diversity of microbes in soils.
- ✧ To understand the various biochemical transformations occur in soil environment mediated by soil microbes.

Unit-I

Soil as a habitat for micro organisms, physio-chemical properties of soil-soil organic matter, soil water, soil air and soil microbes.

Unit-II

Microbial decomposition of soil organic matter – Cellulose, hemi cellulose, lignin. Water soluble components and proteins.

Unit-III

Factors affecting organic matter decomposition, litter quality, temperature, aeration, soil pH, soil moister and inorganic chemical.

Unit-IV

Bio geo chemical cycling – Carbon, Nitrogen, Phosphorus and Sulphur – Role of soil microbes in bio geo chemical cycling.

Unit-V

Phosphate solubilizing microbes (PSM) isolation and characterization mass production of phosphate solubilizing microbes – Mechanism of phosphate solubilization.

References

1. Debey, R.C and Maheswari, D.K. 2000. Text book of Microbiology, S. Chand & Co. Ltd., New Delhi.
2. Martin Alexander, 1969. Introduction to Soil Microbiology. Wiley International Edition, New York.
3. Pelczar *et al*., 1998. Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: MYCORRHIZAS – CLASSICAL AND MOLECULAR APPROACHES

Dr S Senthilkumar

Objectives

- ✧ To study the evolutionary aspects of symbionts
- ✧ To assess phylogenetic aspects of fungus using the molecular methods.

Unit-I

Evolutionary aspects of mycorrhizal symbionts, host plants. Classical taxonomy of mycorrhizal fungi – arbuscular, ectomycorrhizas,methods for molecular phylogeny, mycorrhizal types.

Unit-II

Genetics of mycorrhizal symbiosis –host genetic variation for mycorrhizal symbiosis, genetic control of infection, genetic variation in amfungi-spores, colonization, nutrition, molecular regulation, symbiosis regulated genes, Genetic variation in ectomycorrhizal fungi.

Unit-III

Molecular regulation of P nutrition in mycorrhizas, cytological aspects of phosphate metobolism in mycorrhizas,Molecular physiology of phosphorus acquisition and transport in plants, lipid metabolism in AM fungus, nitrogen exchange in ectomycorrhizas.

Unit-IV

Ecology of mycorrhizal fungi – genetic markers and molecular methods, genetic variation in mycorrhizas, microbial interaction, mycorrhiza in saline and boreal environment, agricultural practices of mycorrhizal fungi.

Unit-V

Introduction to genetic transformation, mycorrhizal fungi – application, methods for GE of mycorrhizal fungi, mycorrhiza in transgenic host, transgenic mycorrhizal fungi. Protoplast and cell fusion techniques, Agrobacterium mediated genetic transformation of mycorrhizal fungi. *In vitro* culture of mycorrhizal fungi.

Reference books

1. A.Verma, 1999. Mycorrhiza, Springer-Verlag, Berlin
2. E.Smith and D.Read, 1997. Mycorrhizal symbiosis, Academic press, London
3. K. R. Krishna, 2005. Mycorrhizas- A molecular analysis, Oxford &IBH Publishers, New Delhi.
4. S. C. Wallanda, T. Hampp, R. Salsar and A. Hager, 1997. Mycorrhizae - Backley's Publishers, The Netherlands

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: *IN* VITRO TECHNIQUE IN PLANT TISSUE CULTURE

Prof S Sahaya Sathish

Objectives

- ✧ To inculcate the basic principles of various tissue culture techniques
- ✧ To teach the various procedures involved in the tissue culture techniques.

Unit-I

Introduction to new technologies – laboratory organization – nutrient medium. Facilities and equipments, units of solution preparation, medium composition, protocol – sterilization techniques.

Unit-II

Totipotency – cytodifferentiation – organogenic differentiation – types of culture. Principle, protocol and application of seed culture, embryo culture, callus culture, organ culture, cell culture and protoplast culture.

Unit-III

Micropropagation meristem and shoot tip culture – bud culture – embryogenesis – principle, factors influencing organogenesis and its applications.

Unit-IV

Cell suspension culture: Batch culture, continuous culture, semicontinuous culture, growth measurements and synchronization of suspension culture cells – Techniques for single cell culture and its applications – anther culture – microspore culture.

Unit-V

Protoplast isolation – protoplast development – protoplast fusion (somatic hybridization – identification and selection of hybrid cells – somatic hybrids – cybrids – somaclonal variation, nomenclature, schemes and application.

Reference

1. Camborg, OL and Phillips, GC. (1995). Plant cell, tissue and organ culture – fundamental methods. Narosa Publishing House. New Delhi.
2. Chawla, HS. (2005). Introduction to plant biotechnology. Oxford & IBH publishing Co. Pvt. Ltd. New Delhi.
3. Edwin F. George and Paul Sherington, D. (1984). Plant propagation by tissue culture. Exegetics Ltd., Edington, Westburg, England.
4. Indra K Vail (1980). Cell culture and somatic cell genetics of plants. Academic Press Inc. New York.
5. Kalyanakumar D. (1997). An introduction to plant tissue culture. New Central Book Agency, Calcutta.
6. Pierik, RLM. (1987). *In vitro* culture in higher plants. Martinus Mijhoff Publishers. Boston.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: INSECT – PLANT INTERACTIONS (APPLIED ENTOMOLOGY)

Prof. K. Rajan

Objectives

- ✧ To understand the nature of pest damage and their control
- ✧ To understand the interactions between the insects and plants

Unit-I

Type of pests and their damages: Pests of crops and stored products. Methods of pest controls – biological, chemical, hormonal and uses of genetic manipulation in insect control.

Unit-II

Allelochemical interaction among plants. Herbivores and their predators - Allomones – plant produced, predator, herbivore released allomones - Kairomones – plant produced, predator, herbivore released kairomones - Synomones - plant produced, predator, herbivore released synomones - Antimones.

Unit-III

Influence of plant produced allelochemical on the host/pest selection behaviour of entomophagous insects. Plant produced allelochemicals and host/prey habitat location. General plant influences. The role of allelochemicals synomones. The role of allelochemicals resistance. Implications for the use of entomophagous insects in applied biological control.

Unit-IV

Development of insect resistant plants through application of phytochemicals/genes. Phytochemicals as pesticides. Principles of hormones involved in insect resistance. Insect attractants and repellents. Plant protection methods.

Unit-V

Feeding stimulants and deterrents. Plant compounds and resin in resistance mechanisms. Plant compounds as precursors of semiochemicals. Substances that control the feeding behaviour and the growth of the silkworm. Insect antifeedants in plants.

Reference

1. Ananthakrishnan, TN. 2002. Insects, Plants and Molecular interactions. Madras Science Foundation, Chennai.
2. Carde RT and WJ Bell. 1995. Chemical Ecology of insects-2. Chapman and Hall, New York.
3. Jermy, T. 1976. The host-plant in relation to insect behaviour and reproduction. Plenum Press, New York and London.
4. Pedro Barbosa and Debrorah K. Letourneau (Eds.) 1988. Novel aspects of insect-plant interactions. A Wiley-interscience Publication, New York.
5. Teja Tscharntke and Bradford A. Hawkins. 2002. Multitrophic level interactions. Cambridge University Press.
6. Vasantharaj David B and Kumarasami, T. 1998. Elements of Economic Entomology. Popular Book Depot. Chennai.
7. Wood. 1970. Control of Insect Behaviour by Natural products. Academic Press, INC. New York.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper III: WATER RESOURCES AND WATER POLLUTION

Prof A Egbert Selwin Rose

Unit-I

Water resources: Introduction- The hydrologic cycle. Surface Water Resources- Rainfall, infiltration, evapotranspiration, runoff, springs and lakes. Groundwater Resources- Rock properties affecting groundwater, vertical distribution of groundwater, Zone of Saturation, Geologic formations as aquifers, type of aquifers and groundwater basin.

Unit-II

Environmental Influences on Water Resources. Water quality parameters - criteria and standards - Sources of salinity, changes in chemical composition, temperature. National water policy- Salient features.

Unit-III

Water pollution: Types, sources and their effect on water quality and organisms. Characteristics of domestic, industrial agricultural wastes - Human health effects of water pollution. Eutrophication- natural and manmade, measures of eutrophication and indicator organisms.

Unit-IV

Methods of water and wastewater analysis - Chemical and bacteriological sampling and analysis. Heavy metals in aquatic systems, species distribution in non-marine and marine waters. Wastewater treatment- primary and secondary treatment of wastewater, oxidation methods using algae and macrophytes. Sewage for irrigation, wastewater for restoration of wastelands. Water pollution control and case study.

Unit-V

Bioremediation - Principles and its application. Cloning of useful gene products related to microbial degradation of waste products. Use of engineered microbes in leaching of metals from ores, detoxification of industrial wastes, production of ethanol Sand methane. Potential use of biotechnology in problems of water reclamation. Recent trend in remediation technologies. Identification of plants for Bioremediation, phytoremediation.

Reference

1. Ignacimuthu, S. 1998. Environmental awareness and protection. Phoenix Publishing House Pvt. Ltd. New Delhi.
2. Shukla, SK and Srivastava, PR. 1992. Environmental pollutions and chronic diseases. Commonwealth Publishers, New Delhi.
3. Tyler Miller, JR. 2004. Environmental sciences, Jack Carey, London.
4. Walter A Rosenbacum. 1991. Environmental politics and policy. Affiliated East-west Press Pvt. Ltd. New Delhi.

Sem-I Hours/week: 6
07MPB103 Credits: 5

Paper-III: PLANT SYSTEMATICS

Dr S Soosairaj

Objectives

1. To study the classical taxonomy with reference to different parameters.
2. To understand the relevance of molecular techniques in plant systematics.

Unit - I

Concept of taxonomic characters and various character states. Taxonomic hierarchy. Plant nomenclature - basis, ICBN rules and typification. Taxonomic key. Taxonomic literature - flora, monograph and revisions.

Unit - II

Comprehensive view of various approaches to plant classification - natural, artificial, phylogenetic, general and special purpose, their advantages and disadvantages. Phenetic and numerical taxonomy - OTU, weighting, cluster analysis. Digital taxonomy - need and application, various data bases in taxonomy.

Unit - III

Taxonomic evidences from morphology, anatomy, karyology, embryology, palynology, paleobotany, ecology and physiology. Phytogeography- definition, various geographic regions proposed by Grisebuch, Drude and Good. Speciation.

Unit - IV

Plant genome as source of taxonomic evidence - gene mapping, sequencing, base ratio, hybridization. Application of PCR, RFLP, RAPD in plant systematics. Proteins - amino acids sequencing, storage proteins, serology and isoenzymes.

Unit - V

Application of secondary metabolites as sources of taxonomic evidence - alkaloids, flavonoids, terpenoids, sugars, polysaccharides. Hydrocarbons, Fatty acids, lipids and pigments - betalains, anthocyanins and betacyanin.

Reference

1. Davis, P.H. & Heywood, V.M. 1963. Principles of Angiosperm Taxonomy, Oliver & Boyd.
2. Harborne, J.B. & Turner, B.L, 1984. Plant Chemosystematics, Academic Press, London.
3. Heywood, V.H., 1967, Plant Taxonomy. The English Language Book Society, London.
4. Heywood,V.K. & Moore, D.M. 1984. Current Concepts in Plant Taxonomy, Academic Press, London.
5. Hillis, DM., Moritz, C & Mable, BK (eds) 1996, Molecular Systematics, Sinaver Associates, Sunderland, USA
6. Jeffrey, C., 1982, Introduction of Plant Taxonomy, Cambridge Uni. Press, Cambridge.
7. Lawrence, G.H.M.1955. The Taxonomy of Vascular Plants, Central Book Depot., MacMillan, New York.
8. Young DA and Seiyler DS (eds.) Phytochemical and angiosperm phylogeny. Praeger publications. NY.

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