

**MANGALORE UNIVERSITY**  
**Department of Applied Botany**  
**SYLLABUS AND SCHEME OF EXAMINATION FOR Ph.D. COURSE WORK**  
**IN APPLIED BOTANY**

Papers	Particulars	Hours of Instruction per week	Duration of Examination (hrs)	Marks			Credits
				IA	Theory	Total	
Paper I	Research Methodology	4	3	30	70	100	4
Paper II	Theoretical Foundations	4	3	30	70	100	4
Paper III	Recent Developments *	4	3	30	70	100	4
Paper IV	Reviewing of Literature and Planning of the Proposed Research Work with a Tentative Title	16	-	-	-	200	8
		Total					20 Credits

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- i) Morphology and Taxonomy
- ii) Plant Physiology and Bio-chemistry
- iii) Genetics and Plant Breeding
- iv) Microbiology
- v) Seed Technology
- vi) Plant Pathology
- vii) Tissue culture and Bio-Technology
- viii) Ecology, Environment and Plant Conservation

Note: 1. The subjects to be offered under Paper III will be decided by the Department in each academic year depending on the faculty /facility available.

2. Candidate has to present one Seminar in the paper I and one assignment each in Paper II & III which will be evaluated for Internal Assessment by the concerned guide.

Ph.D. Course Work in Applied Botany  
Paper I – Research Methodology

Max. Marks: 70

- I. Research prerequisites:
- Testing of hypothesis – refinement of experiment
  - Field/Lab. techniques. design, sample size
  - Collection, compilation, analysis, interpretation of data and drawing conclusions.
  - Literature retrieval, citation methods.
  - Format in writing research paper/dissertation.

- 2) Principles of Instrumental Analysis:  
Microscopy and Photomicrography:
- Tissue preparation
  - Light Microscopy
  - Fluorescent Microscopy
  - EM-Transmission & Scanning
  - Auto –radiography

Analytical Techniques:

- Ultracentrifugation (Tissue fractionation)
- Chromatography techniques (HPLC, TLC, GC, Paper)
- Electrophoresis
- Spectrophotometry

3. Biostatistical and mathematical methods:
- Standard deviation
  - Theory of probability
  - Student-t-test
  - Analysis of variance
  - Graphical representation
  - Principles of computing
  - Computer application in biological research

4. Safety and Toxicology (Occupation)
- Inhalation safety
  - Permissible limits
  - Safety appliances
  - Biosafety; Ethical Issues  
LD50 measures

5. Future prospectives in the relevant branch.  
6. Patenting; IPR

**References:**

J.E. Celis, (1994): Cell Biology – a laboratory hand book, Vol. I, II and III, Academic press.

C. Hawkins and M. Sorgi (Eds) (1985) Research how to plan, speak and write about it, Springes- Verlag; Hiedelberg.

T.H. Hassard (1991) Understanding Biostat. Mosby year book, London

Norman T.J. Bailey (1994) Statistical methods in biology, 3<sup>rd</sup> edition, Cambridge University Press.

Philip Sheeler (1987) Cell and Molecular Biology, III edition, John Wiley New York.

Sadasivam S. and Manickam (1996) Biochemical Methods, New Age International Publishers, New Delhi.

Wilson, K. and Kenneth H. Goulding, 1987. A Biologist's Guide to principles and Techniques of Practical Biochemistry, 3<sup>rd</sup> Edition, English Language Book Society.



Ph.D. Course Work in Applied Botany  
Paper II – Theoretical Foundation

Nomenclature, Herbarium methodology, BSI, Cytotaxonomy, Chemotaxonomy,  
Numerical Taxonomy, Molecular taxonomy  
Food, Feed, fibre from plants, Secondary metabolites  
Stress Physiology  
Biological Rhythms

Culturing and identification of bacteria, fungi, Actinomycetes, production of  
metabolites Mycorrhizae  
Biofertilizers, Biodegradation, Bioremediation

Micropropagation, Organogenesis  
Pollen culture, Anther culture, Embryo culture

Somatic embryogenesis – Applications

Biodiversity – Levels, values and significance  
Conservation methods  
Endemism, IUCN threatened categories  
Biodiversity laws

Diseases of major/important crop plants  
Host-parasite interactions  
Epidemiology and taxonomy of pathogens  
Transmission of crop diseases  
Management practices for control of plant diseases.

Seed quality testing  
Seed production, certification and improvement  
Seed processing, treatment and marketing

Chromosomes and gene mutation  
Breeding for resistance and crop improvement

**References:**

- Agrios, N. 1997. Plant Pathology, Academic Press, New York.
- Bhattacharya B. and B.M. Johre. 1998. Flowering plants - Taxonomy and phylogeny. Narosa Publishing House, New Delhi.
- Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA
- Bhojwani S.S. Plant tissue culture, Theory & practice. Agrosociences books centre.
- Krishnamurthy K.V. 2003. An advanced textbook on Biodiversity – Principles and Practice Oxford & IBH Publishing Co. New Delhi. Pp 260.

Lewin, B. 2000. Genes VII. Oxford University Press, New York.

Singh T. and Agarwal K. 2001 Seed Technology and Seed Pathology. International Books and periodicals supply services.

Taiz, L. and Zeiger, E. 2003. Plant Physiology. Sinauer Associates, Inc., Publishers, Massachusetts. USA.

Thomas D. Brock, Michael T. Madigan. 2000. Biology of Microorganisms – 6<sup>th</sup> edition



### Paper III (I) – Morphology & Taxonomy

Taxonomy of Algae, Bryophyta, Pteridophyta and Gymnosperms.

Taxonomy of Angiosperms, Systems of classification of Plants.

Plant nomenclature

Cytotaxonomy, Chemotaxonomy

Numerical taxonomy

Molecular taxonomy

Study of important families of angiosperms with their phylogeny

Conservation of Flora

#### References:

Bennet, S.S.R. 1979. An Introduction to Plant nomenclature. International Book Distributors. 9/3. Rajpur Road, Dehra Dun 248001. India.

Bhattacharya B. and B.M. Johre. 1998. Flowering plants - Taxonomy and phylogeny. Narosa Publishing House, New Delhi.

Biswas. C., and Johri B.M. 1997. The Gymnosperms. Narosa Publishing House, New Delhi.

Coulter & Chamberlains. 1959. Morphology of gymnosperms. Central Book depot. Hyderabad.

Davis, P.H., V.H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd., Tweeddale Court, Edinburgh., pp. 558.

Gurucharan Singh, 1999. Plant systematics - Theory and practice. Oxford and IBH Publishing Co., Pvt Ltd., New Delhi.

Heywood, V.H. and Moore, D.M. 1984. Current Concepts in Plant Taxonomy. Academic Press, London.

Hutchinson. J. 1973. The Families of Flowering Plants. Oxford University Press, Elky House, London. W.I., pp. 968.

Lawrence, H.M. 1966. Taxonomy of Vascular Plants. The MacMillon Company. New York, pp. 823.

### Paper III (II) – Plant Physiology and Biochemistry

Photosynthesis, Respiration and Transpiration in higher plants and blue green algae.

Mineral elements and their role in metabolism

Mechanism of ion uptake, translocation of water, minerals.

Metabolism and transport

Growth and growth hormones

Physiology of flowering, pollination and fertilization

Development of fruit and seed, abscission

Metabolism of carbohydrates lipids, fats and proteins; enzymes and vitamins

#### References:

Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

Burgess, J. 1989. An introduction to plant cell development. Cambridge University Press, Cambridge.

Hale M.G. and D.M. Orcutt 1987. The physiology of Plants under stress. A Wiley - interscience publication. New York.

Hopkins G.H. (2005) Introduction to plant physiology. John Wiley and sons. Inc. New York.

Lea, P.J. and R.C. Leegood, 1993. Plant Biochemistry and Molecular Biology, John Wiley and Sons. USA

Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer-Verlag, New York, USA.

Salisbury and Ross. 2003. Text book of Plant physiology, CBS Publishers and Distributors, New Delhi

Taiz, L. and Zeiger, E. 2003. Plant Physiology. Sinauer Associates, Inc., Publishers, Massachusetts. USA.

### Paper III (III) – Genetics and Plant Breeding

Organisation of cell; Chromosome – structure, organization, chemistry, chromosomal aberration

Gene-gene concept

Chromosomal and gene mutations

Methods of Breeding, self and cross pollination incompatibility and male sterility

Genetics and physiological basis of inbreeding depression and heterosis

Role of genetics and cytogenetics in plant breeding

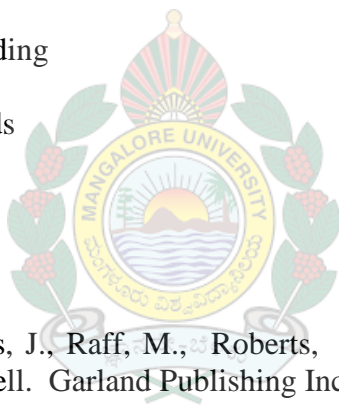
Mutation and polyploidy in breeding programmes

Interspecific and intergeneric hybrids

Breeding for resistance and crop improvement

Biotechnology and Plant Breeding

Release of varieties and hybrids



#### References:

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, J.D. 1999. Molecular Biology of the Cell. Garland Publishing Inc., New York.

Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, For Worth, USA.

Gunning, B.E.S. and Steer, M.W. 1996. Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers, Boston, Massachusetts.

Lewin, B. 2000. Genes VII. Oxford University Press, New York.

Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell biology (4th Edition). W.H. Freeman and Co., New York, USA.

Sharma J.R. 1994. Principles and practice of Plant Breeding. Tata McGraw Hill Publishing Co. Ltd. New Delhi. pp 599.



### Paper III (IV) – Microbiology

Taxonomy of Microorganisms: bacteria, Actinomycetes, fungi, Mycoplasma

Culture of Bacteria, Fungi, Actinomycetes and Mycoplasma, culture of viruses in plant tissue culture

Growth and phases of growth, factors affecting growth and death.

Microbiological techniques

Structure and genetics of viruses

Bacterial genetics

Microbial nutrition

Sources of energy and metabolism

Microbes and Plants, Nitrogen, Phosphorus and carbon cycle, N<sub>2</sub> Fixation

Microbial Immunology

Symbiosis, Mutualism Mycorrhizae

Microbial biodegradation

Microbial toxins

Microbes in food, dairy, water and sewage

Microbes in Industry

Edible Mushrooms and their cultivation

Microbial culture collection centers

#### References:

Alexopoulos, C.J., Mims C.W. and Blackwell, M. 1996. Introductory Mycology, John Wiley & Sons Inc.

Collee J.G., Applied Medical Microbiology – 2 edit – 1981 –

Costa, M.S. Da Ed Microbiology of extreme environment & its potential for biotechnology – 1989

Freifelder David – 1987. Microbial genetics

Jacquelyn G. Black, microbiology (Principles & Explanations) – 4<sup>th</sup> Edition – 1999



Larry McKane/Judy kandel – 1996. Microbiology (Essential & Appliances) – 2<sup>nd</sup> Edition –

Pelezar, Michael J. 4<sup>th</sup> ed.- New Delhi; Tata Mograw Hill 1983 copy (2)

Powar & Daginawater, General Microbiology – vol- eight edition – 1992 (Reprint – 2000)

Purohit S.S., Microbiology, fundamentals & applications (1991) – 4 ed.

Stanier Roger Y, - 1993. General Microbiology – 5<sup>th</sup> ed.

Thomas D. Brock, Michael T. Madigan, 2000. Biology of Microorganisms – 6<sup>th</sup> edition.

Volk, Wesley. A. – 1984 Basic microbiology – 5 ed.



### Paper III (V) Seed Technology

Importance of Agriculture and development of seed biology, seed industry, seed quality testing, seed viability

Seed Production: Procedures in important representative crops

Seed certification, Biotechnology and seed improvement, cleaning and grading

Seed processing- seed drying, cleaning and grading

Common pesticides used for seed treatment

Seed marketing and management of policy

Seed law and seed law enforcement

#### References:

Agarwal R.L. (1998) Seed Technology, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

Black M., Bewley J.D. & Halmer P. (2006). The encyclopedia of seeds science Technology and uses.

A. Chakarbooty et.al 2003. Handbook of Postharvest Technology: cereals, Fruits, vegetables, tea and species.  
International Books & Periodicals supply services, Delhi.

Khare D. Seed Technology Scientific Publishers, Jodhpur

Paul Neergaard (1988). Seed Pathology Vols. I & II. Published by the Macmillan Press Ltd. Houndmills. Basingstoke, Hampshire RG 21 2XS pp 1191.

Ramamoorthy K. (2006) Seed Legislation in India. International books and periodicals supply services, New Delhi

Singh T. and Agarwal K. 2001 Seed Technology and Seed Pathology. International Books and periodicals supply services.

Umarani R. (2006) Experimental seed science and Technology

## Paper III (VI) Plant Pathology

Classification of plant diseases

Study of plant diseases

Disease – host parasite interactions, Immunology, resistance

Rhizosphere microorganisms

Epidemiology and forecasting

Transmission of plant diseases

Plant disease control – exclusion, eradication and direct protection

Pesticides- their applications and mode of action

Pest control Technology

Pesticide metabolites, terminal residues, toxicity, detoxification, degradation and safety regulations

Diseases and pests of Important Crops

Plant Pathology Institutions



### References:

Agnihotri, V.P., Sarbhay, A.K., Singh, D.V., 1997. Management of threatening plant diseases of National Importance.

Agrios, N. 1997. Plant Pathology, Academic Press, New York.

Ainsworth, G.C. 1981. Introduction to the history of Plant Pathology

Callow, J.A., (Ed.) 1983. Biochemical plant pathology. John Wiley & Sons

Chester, Starr, K., 1994. Arihant Plant diseases - Jaipur,

Dhingra, D. 1993. Basic Plant Pathology methods - Delhi CBS.

Dordrecht; 1995. Induced resistance to disease in plants -

Fungal pathogenesis in plants and crops. John A. Lucas - 3rd Ed. 1998. Plant Pathology & Plant Pathogens

John A. Lucas. 1998. Plant Pathology & Plant Pathogens. 3rd ed. Blackwell Science Ltd.

Mahadevan. A. Post infectious defence mechanisms - New Delhi (Today & Tomorrow, 1991)

Rangaswami, Mahadevan, A. 2001. Diseases of crop plants in India. Prentice Hall of India, Pvt. Ltd., New Delhi.

Singh, R.S. 1990. Plant diseases - 6th ed. New Delhi. Oxford & IBM.

Vidhyasekaran, P. 1997. Fungal Pathogenesis in plants and crops. (Molecular Biology and host Defense mechanisms), Marcel Dekker Inc.

Vidhyasekaran, P. - 1990. Basic research for crop diseases Management - Delhi : Daya Publ.



### Paper III (VII) Tissue culture and Plant Biotechnology

Pant tissue Culture: Principles and methodology

Histological and photographic techniques for plant tissue culture

Spices and condiments improvement through Biotechnology

Synthetic seed technology

Applications of genetic engineering in agriculture

Important enzymes in genetic engineering

#### **References:**

Bansal P.B. (2006) Biotechnology and its application in Agricultural science. International books and periodicals supply services New Delhi.

Bhojwani S.S. Plant tissue culture, Theory & practice. Agrosiences books centre.

Dwivedi (2003) Plant tissue culture Book circle, Darya Gani, New Delhi.

Grierson. Don. 2007. Plant genetic engineering, Springer international (India) Private Ltd., New Delhi.

Khan I.A. Fundamentals of Molecular Biology. Genetic engineering Biotechnology CAB publication

Nirmala C.D. (2006) Plant Biotechnology, MJP Publishers.

Purohit S.S. (2005). Agricultural Biotechnology, Agrobotanical Publ. Bikaner.

Smith R.M. 2000. Plant tissue culture, Techniques and experiments, Academic press, Newyork.

### Paper III (VIII) Ecology, Environment and Plant Conservation

Population – Structure, Density, frequency, Dominance, Diversity indices

Autecology – Methods of study

Genecology – Ecological amplitude, Ecades, Ecotypes

Synecology: Methods of study of communities

Global warming- causes and consequences

Pollution and major pollutants

*In-situ* and *Ex-situ* conservation

Endemism, IUCN- threatened categories

Hotspots, Biogeographic regions, vegetation types of India

#### References:

Ahmedullah, M. and M.P. Nayar, 1986. Endemic plants of the Indian region. Vol 1. Botanical Survey of India.

Champion, H.G. and S.K. Seth, 1968. A revised survey of the forest types of India.

Krishnamurthy K.V. 2003. An advanced textbook on Biodiversity – Principles and Practice Oxford & IBH Publishing Co. New Delhi. Pp 260.

Ludwig, J.A. and Reynold, J.F. 1988. Statistical Ecology. Wiley, New York.

Michael L. Mckinney and Robert M. Schoch 1997. Environmental Science – Systems and Solutions Jones and Bartlett publishers. Inc. pp 639

Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.

Pascal J.P. 1988. Wet evergreen forests of the Western Ghats of India. Institut Francais de Pandichery.

Peter D. Stiling 1992. Introductory Ecology Prentice Hall.

Peter stiling 1999. Ecology – Theories and Applications. Prentice – Hall. Int. Ltd., London pp 638

Puri G.S., V.M. Meher-Homji, R.K. Gupta and S. Puri 1980. Forest ecology (2nd edn.) Vol. 1. Phytogeography and forest conservation. Oxford and IBH.

Puri G.S., V.M. Meher-Homji, R.K. Gupta and S. Puri 1989. Forest ecology (2nd edn.) Vol.2 - Plant form, diversity, communities and succession. Oxford and IBH.

Smith, R.L. 1996. Ecology and Field Biology. Harper Collins, New York.