

MANGALORE UNIVERSITY
Department of Biosciences

Ph.D. course work in Biosciences

Scheme of Assessment and Examination

Papers	Particulars	Hours of Instruct- ion per week	Duration of Examination (Hrs)	Marks			Credits
				IA	Theory	Total	
Paper 1	Research Methodology	4	3	30	70	100	4
Paper 2	Theoretical Foundations	4	3	30	70	100	4
Paper 3 (one of the papers to be chosen)	Recent Developments: a) Cell Biology and Genetics b) Environmental Biology c) Physiology and Biochemistry d) Microbiology	4	3	30	70	100	4
Paper 4	Review of Literature and Planning of the Proposed Research Work with Tentative Title	16	-	-	-	200	8
	Total					500	20

* Full-time candidates have to complete all the papers in one semester.

* Part-time candidates have to complete Paper 1, 2 & 3 in one semester and Paper 4 in the second Semester.

* Internal Assessment (30 marks) will be based on assignment/seminar.

PAPER I – RESEARCH METHODOLOGY

60 hr (15hr/unit)

Unit 1: Research prerequisites

- a) Testing hypothesis-refinement of experiment
- b) Field/Lab techniques-design, sample size
- c) Collection, compilation, analysis, interpretation of data and drawing conclusions
- d) Literature retrieval, citation methods and bibliography
- e) Format in writing research paper/dissertation.
- f) Laboratory & Personnel safety measures; good laboratory practices
- g) Design of questionnaire

Unit 2: Principles of instrumental analysis

- a) Tissue preparation for cytological and histological analysis
- b) Light microscopy compound, Dark field, Phase contrast, Polarization and stereo microscopy
- c) Fluorescent microscopy
- d) Transmission and scanning electron microscopic techniques (TEM and SEM) – Preparation of samples and their applications.
- e) Autoradiography and X-ray diffraction techniques
- f) IR-analysis

Unit 3: Analytical techniques

- a) Ultra centrifugation (tissue fractionation)
- b) Chromatographic techniques
- c) Electrophoresis
- d) Spectrophotometry and Flame-photometry
- e) NMR and AAS
- f) Staining techniques – cytological and histochemical
- g) Lyophilization
- h) Isolation of cellular and sub-cellular components
- i) Gel documentation
- j) HPLC
- k) GCMS
- l) PCR
- m) ELISA test

Unit 4: Biostatistical and mathematical methods

- a) Standard deviation
- b) Theory of probability
- c) Student-t-test
- d) Analysis of variance
- e) Graphical representation
- f) Computer and its applications in biological sciences
- g) Statistical packages.
- h) Databases
- i) Techniques of remote sensing

References:

1. Baily and Ollis. Biochemical Engineering Fundamentals. McGraw-Hill. .
2. Banwell, C.N. 1972. Fundamentals of Molecular Spectroscopy. McGraw Hill, London.
3. Buerger, M.J. 1942. X-Ray Crystallography, John Wiley, New York.

4. Carr and Casherine, E. 1982. Cell Structure: An Introduction to Biomedical Electron Microscopy. Churchill, Edinburgh.
5. Chaplin, M.F. and Bruke. Enzyme Technology. Cambridge University Press.
6. Da Skooge Holt 1985. Principles of Instrumental Analysis. Saunders.
7. Dennis, P. 1977. Kinetics of Chemical and Energy Catalyzed Reactions. Oxford University Press, New York.
8. Hayet, M.A. 1978. Principles and Techniques of Electron Microscopy. Van Nostrand Reinhold, New York.
9. Ian Freshney, R. 2000. Culture of Animal Cells: A Manual of Basic Technique. IV Edition, Wiley-Liss.
10. Karp, G. 1999. Cell and Molecular Biology – Concepts and Experiments. (Ed. John Harris,D),Wiley & Sons, New York.
11. Khan and Irfan 1994. Fundamentals of Biostatistics, Ukaae Publication, Hyderabad.
12. Khopkar, S.N. 1988. Basic Concepts of Analytical Chemistry. II Edition, New Age Publishers.
13. Newbury Dale, E. 1988. Advanced Electron Microscopy and x-Ray Microanalysis. Plenum Publishers, New York.
14. Rastogi, V.B. 2006. Fundamentals of Biostatistics. Ane Book India, New Delhi

PAPER II – THEORETICAL FOUNDATION

60 hr (15 hr/unit)

Unit 1: Cell Biology and Genetics

An over view of cell organization – Molecular composition of cell organization and functions of cytoplasm and cell organelles and cell membrane.

Experimental approaches for studying cells, cell cycle and cell division.

Regulation of gene expression.

Gene transcription, genetic code and translation.

Genetics – Mendelian and Non-Mendelian inheritance – chromosomal theory of inheritance.

Genetic disorders Theories of evolution : Human genome project.

Hardy-Weinberg equilibrium

Unit 2: Environmental Biology

Concepts of environmental biology; Biotic and a biotic factors; Biogeochemical cycles;

Ecosystems; Phyto & mcrobial remediation; Population and community ecology; Island biogeography; Biodiversity in Western Ghats; Biochemical adaptation, Ecophysiology and chemical ecology.

Unit 3: Physiology and Biochemistry

Plant Physiology: Water Relations, hormones, physiological adaptation, ecotypes photoperiodism.

Endocrine Physiology: Endocrine glands – Pituitary, thyroid, parathyroid adrenals, gonads, pineal and pancreas:

Hormones-Release, transport, mechanism of actions and biological action; Neurohormones of the hypothalamus.

Proteins, carbohydrates, lipids and nucleic acids: Structure, properties and functions. Blotting technique.

Nutrition: Physiological and biochemical perspectives in nutrition, malnutrition, starvation and obesity.

Biochemical basis of diseases – Techniques for diagnosis.

Unit 4: Microbiology

Microbial biodiversity and phylogeny

Microbial nutrition, culture, cultivation of bacteria, actinomycetes, cyanobacteria and fungi.

Microbial metabolism and fermentation.

Factors effecting growth and death of microbes.
Microbial interactions and ecology.
Extremophiles

References:

1. Baily and Ollis. Biochemical Engineering Fundamentals, McGraw-Hill.
2. Bernard, G. and Pasternack, 1998. Molecular biotechnology. ASM Press, Washington
- Brayce, C.F., El-Mansi, E.M.T. 2002. Fermentation Microbiology and Biotechnology. Taylor and Francis, London.
3. Cassida. Industrial microbiology.
4. Charles, E.D. 1973. Outlines of Chemical Technology. Affiliated, New Delhi.
5. Costa, M.S. 1989. Microbiology of External Environments and its Potential for Biotechnology. EAS Publications, London.
6. Coulson, J.M. Chemical Engineering. Pergamon Press.
7. Devlin, T.M. 2005. Text Book of Biochemistry with Clinical Correlation. Wiley Liss Inc., New York.
8. Elgert, J. 1997. Immunology - Understanding the Immune System. Wiley Liss Inc., New York.
9. Faust, Samuel D. 1983. Chemistry of Water Treatment, Butterworths, London.
10. Helm, K. and Adriance, M. 1996. Recombinant DNA and Biotechnology, ASM Publication, Washington.
11. Hudson and others 1986. Practical Immunology. Blackwell scientific.
12. Kindt, T.T.J., Goldsby, R.A., Osborne, B.A. 2007. Immunology. VI Edition, W.H. Freeman and Co., New York.
13. Kuby, J. 1997. Immunology. III edition .W.H. Freeman and Co., New York.
14. Lewin, B. 2000. Genes VII. Oxford University Press, New York.
15. Mathew, S.K. and Purohit, S.S. 1976. Biotechnology: Fundamentals and its Applications. Agro Botanical Publications, Bikaner.
16. Mitchell and Ralph, E. 1978. Water Pollution Microbiology. John Wiley Publishers, New York.
17. Old and Primrose 1994. Principles of Gene Manipulation. Blackwell Scientific Publishers.
18. Page, M.I. and Williams, A. 1993. Enzyme Mechanisms. The Royal Society of Cambridge, Cambridge.
19. Price, C.N and Stevens, L. 2006. Fundamentals of Enzymology. Oxford University Press, New York.
20. Riott, I.M., Brostoff, J. and Male, D.K. 1993. Immunology. Mostby-Year Book Europe Ltd., London.
21. Rosevear, A. and others. Immobilised Enzymes and Cells. IOP Publishers.
22. Stanburry, P.F. and Whitaker. Principles of Fermentation Technology. Pergamon Press.
23. Stryer, L. 1983. Principles of Biochemistry. W.H Freeman and Co., San Francisco Tali and Robert. 1995. Soil Microbiology. John Wiley, New York.
24. Wilson, K. and Walker, J.M. 1995. Principles and the Techniques of Practical Biochemistry. Cambridge University Press.
25. Zuby, G. 1983. Principles of Biochemistry: General Aspects. McGraw Hill Book Co., Kogakusha.
26. Watson, J.D. *et al.* 1992. Recombinant DNA Technology. Scientific American Books, New York.
27. Guyton, A.C. & Hall, J.E. 2000. Text Book of Medical Physiology. 10th Ed. W.B. Saunders Company, Philadelphia.
28. Jenson, D., 1976. Principles of Physiology, Appleton Century Crofts., New York.

PAPER III – RECENT DEVELOPMENTS

Cell Biology and Genetics

60 hr (15 hr/unit)

Unit 1: Mutagenic and carcinogenic substances in human environment with special reference to drugs, pesticides, food additives, pollutants, cosmetics and radiation.

Evaluation of mutagenicity - *in vivo* and *in vitro* assays.

Induced mutations and its significance.

Unit 2:

Mitotic and meiotic Chromosomal observation analysis: Sister chromatid exchanges.

Dominant lethal test,

Micronucleus test.

Heritable translocations: Ames test, sperm abnormality test, FISH and COMET assay.

Flow cytometry

Unit 3: Recombinant DNA technology

Chromosome banding techniques, karyotype studies in plant and animal systems

Survey of genetic disorders and their management.

Unit 4:

Plant and animal tissue culture.

Leucocyte and cell line cultures and their applications.

Cancer biology- Types , causes, oncogenes, tumor suppressor genes and preventions.

Chemical carcinogens.

References

1. C.J. Avers (1986). Molecular Cell Biology. Addison - Wesley Publishing Company, England.
2. J. Brachet (1985). Molecular Cytology. Vol.I &II. The cell cycles. Academic Press, Inc.
3. C.F.A. Culling (1974). Handbook of Histopathological and histochemical Techniques. 3rd Edition. Butterworths.
4. J.H. Darnell, Lodish and D. Baltimore (1995). Molecular Cell Biology. Scientific American Books, New York.
5. C.P. Swanson and P.L. Webster (1989). The Cell. 5th edition. Prentice Hall of India Pvt. Ltd., New Delhi.
6. Sadova, E., 1993. Cell Biology. Jones and Bartlett Publishers, London.
7. Kleinsmith, L.J. and Kish, V.M., 1995. Principles of Cell and Molecular Biology. 2nd Edition. Harper Collins Collge Publishers,
8. Thorpe, N.O., 1984. Cell Biology. John Wiley and Sons, New York.
9. Ladish, H., Baltimore, D., Berk, A., Zipursky, S.W., Matsudaira, P. & Darnell, S., 1995. Molecular Cell Biology. Scientific American Books. Freeman & Company, New York.
10. Lowey, A.G., Siekevitz, P., Mesninger, J.R. and Gallant, J.A.N., 1987. Principles of Cell structure and function.
1. Fraser, F.C. and James J. Nora, 1986. Genetics of Man. Lea and Febiger, Philadelphia.
2. Friefelder, D. 1987. Molecular Biology II Edn. Jones and Bartlett Pub. Inc., Boston.
3. Gardner, E.J., M.J. Simmons & D.P. Snustad, 1991. Principles of Genetics. 8th Ed. John Wiley and Sons, Inc., New York.
4. Hartl, D. L., D. Freifelder and L.A. Snyder, 1988. Basic Genetics. Jones and Bartlett Publishers, Boston.
5. Hollaender A. (Ed). 1971-76. Chemical Mutagens. Priniples and Methods for their Detection. Vols. 1, 2 & 3. Plenum Press, New York.
6. Jha, A.P. 1993. Genes and Evolution. MacMillan India Ltd., New Delhi.
7. Lewin, B. 1997. Genes VI, Oxford University Press, New York
8. Marther, K. and J. L. Jinks, 1977. Introduction to Biometrical Genetics. Chapman and Hall.
9. Peter J. Russell, 1998. Genetics. The Benjamin/Cummings Publishing Company, Inc.

PAPER III – RECENT DEVELOPMENTS
Environmental Biology

60 hr (15 hr/unit)

Unit 1: Principles and concepts of environmental biology

Relevance of environmental biology to human affairs

Ecosystem: Atmosphere, Hydrosphere and Lithosphere, Stratosphere

Hotspots of Biodiversity.

Unit 2: Pollution and environmental health.

Pollution of air, soil and water

Major pollutants with special reference to India, their fate, effects on the ecosystem,

Methods of detection of pollutants.

Unit 3: Management of natural resources:

Waste management (agricultural, industrial and plastics)

Wildlife management and forest reserves

Management of natural resources (forests, minerals, water and mangroves)

Hydrological/Irrigation systems

Freshwater, brackish and marine ecosystems.

Biofertilizers, composting and bioprotectants

Unit 4: Environmental laws and biosafety conservation of natural resources, wildlife resources.

Environmental toxicological studies and bioremediation.

Non-conventional energy sources; Energy from biomass, biofuels and energy plantations

Biological control (weeds, pests and diseases)

Patenting and intellectual property rights (IPR)

Transgenic organisms and Environmental Ethics.

References:

1. Edmondson, W.T., 1965. Freshwater Biology. John Wiley and Sons, New York.
2. Hynes, H.B.N., 1970. Ecology of running waters. Liverpool University Press, U.K.
3. Hutchinson, G.E., 1967. A treatise on Limnology. John Wiley and Sons, New York.
4. John Brown et al., 1989. Sea water: Its composition properties and behaviour. Open University Publications, Pergamon Press, England.
5. Munshi, J.D. and Munshi, J.S.D., 1995. Fundamentals of freshwater biology. Narendra Publishing House, Delhi.
6. Zhang et al., 1988. Marine planktonology. Chinese University Press, Beijing.
7. Qasim, S.Z., 1998. Glimpses of the Indian Ocean. Universities Press, Hyderabad. 206 pp.
8. Reddy, P.A., 2000. Wetland ecology. Cambridge University Press, London. 614 pp.
9. Davis, C.C., 1995. The marine and freshwater plankton. Michigan State University, Michigan. 502 pp.
10. Boudou, A. 1997. Aquatic toxicology. Vol. I and II.
11. Gupta P.K. and Salunke, D.K. 1985. Modern Toxicology. Vol. I, II and III. Metropolitan Publications, Delhi.
12. Jorgensen, S.E., Modelling in Ecotoxicology. Elsevier, Amsterdam.
13. Lewin, S.A. et al., 1989. Ecotoxicology: Problems and approaches. Springer - Verlag, Tokyo, New York.
14. Omkar, 1995. Concepts of Toxicology. Chand & Co., Jalandar.
15. Trivedi, P.R. and Sudarshan, K. 1995. Global environmental issues. Commonwealth Publications, New Delhi.
16. Vernberg et al., 1981. Biological monitoring of marine pollutants. Academic Press, New York.

PAPER III – RECENT DEVELOPMENTS

Physiology and Biochemistry

60 hr (15 hr/unit)

Unit 1: Stress physiology in plants and animals – Definition, kinds of stress factors; Physiological response and adaptations to stress; Biological monitoring systems as indicators of stress; Primary parameters for assessment of the stress response.

Unit 2: Nutrition – Physiological and biochemical perspectives in malnutrition, starvation and obesity. Nutritional and antinutritional evaluation of wild plant species; *in vivo* and *in vitro* protein digestibility. Food toxicants and dietary antioxidants.

Unit 3: Methods for the separation of proteins, nucleic acids, enzymes and lipids from the biological samples. Enzyme and hormone assays using animal models. Analysis of serum and urine samples. Cell fractionation techniques: Cell lysis, differential and density gradient centrifugation. Radioisotopes in biology.

Unit 4: Seed dormancy and physiology of flowering. Plant adaptations to radiations, temperature and salinity. Physiology of some selected ecological groups of plants.

References

1. Berne, R.M. & Levy, M.N. 1991. Physiology. The C.V. Mosby Company, St. Louis.
2. Ganong, W.F. 1999. Review of Medical Physiology (19th Edition) Kotheri Book Depot, Bombay.
3. Wilson, J.A. 1979. Principles of Animal Physiology. MacMillan Pub., New York.
4. Hopkins, W.G. (1995). Introduction to Plant Physiology. John Wiley and Sons, Inc. New York.
5. Guyton, A.C. & Hall, J.E. 1996. Text Book of Medical Physiology. 9th Ed. W.B. Saunders Company, Philadelphia.
6. Jenson, D., 1976. Principles of Physiology, Appleton Century Crafts.
7. Gorbman, A & Bern, H.A. 1974. A text book of Comparative Endocrinology. Wiley Eastern.
8. Prosser, C.L. & Brown, 1983. Comparative Animal Physiology. W.B. Saunders Company.
9. Vander, A.J., Sherman, J.H. and Luciano, D.S., 1994. Human physiology – The mechanisms of body function. International edition (6th ed.). McGraw Hill, Inc. New Delhi.
10. Devlin, R.M. 1983. Plant Physiology. CBS Publications & Distributors, New Delhi.
11. Hopkins, W.G. (1995). Introduction to Plant Physiology. John Wiley and Sons, Inc. New York.
12. Kochhar, P.L. 1978. Plant Physiology. Atmaram, New Delhi.
13. Noggie, Ray G. 1986. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd. New Delhi.
14. Prasad M., 1997. Plant Ecophysiology. John Wiley & Sons, New York.
15. Salisbury, F.B. and C.W. Ross, 1992. Plant Physiology. Wordsworth Publishing Company, California.
16. Verma, V. 1975. Plant Physiology. Embkay, New Delhi.
17. Campbell, P.N. and Smith, A.D. (1982). Biochemistry Illustrated. Churchill Livingstone, New York.
18. Christian, G.D. (1986). Analytical Chemistry. John Wiley and Sons, New York.
19. Conn, E.E., Stumrf, P.F., Bruenning, G. and Doi, R.H. Outlines of Biochemistry. Wiley Eastern Ltd., New Delhi.
20. Cryton - Protein Chemistry
21. Das, D. (1987). Biophysics and Biophysical Chemistry. Academic Publishers, Calcutta.
22. Dasgupta, S.K. (1977). Biochemistry. Vol. 1, 2 and 3. MacMillan Company of India. Delhi.
23. David Rawn. Biochemistry.
24. Devlin, T.M. (1982). Text book of biochemistry with clinical correlations. John Wiley and Sons, New York.
25. Ewing, G.W. (1985). Instrumental methods of chemical analysis. McGraw Hill Book Company, New York.
26. Kaplan, A. and Szabo, L.L. (1983). Clinical Biochemistry. Interpretation and Techniques. Lea and Febiger, Philadelphia.
27. Lehninger, A.L., Nelson, D.L. and Cox, M.M. (1993). Principles of Biochemistry. CBS Publishers and Distributors, New Delhi.
28. Lehninger, L. Biochemistry. Kalyani Publishers, New Delhi.
29. Mahler, H.R. and Cordes, E.H. Basic biological chemistry. A Harper's International Edition.
30. Martin Jr., J. W., Mayes, P.A. and Rodwell V.W. (1981). Harper's Review of Biochemistry. Lange Medical, California.

PAPER III – RECENT DEVELOPMENTS

Microbiology

60 hr (15 hr/unit)

Unit 1: Microbes: Sources, methods of isolation, identification strain improvement preservation. Microbiological assays; Plant-microbe, animal-microbe and microbe-microbe interactions.

Unit 2: Industrial applications of microorganisms. Fermentation technology (solid substrate and batch fermentation). Food microbiology and microbes in food processing. Soil microbiology (biological nitrogen fixation and phosphate solubilizers).

Unit 3: Agricultural microbiology; Microbial degradation of structural components (carbohydrates, proteins and fats). Biofertilizers; Biofuels, Biopesticides, Composting and bioprotectants, Phyto and Microbial remediation.

Unit 4: Microbial metabolites, toxins and their applications (bacteria, cyanobacteria and fungi).

Aquatic microbiology – Fresh brackish and marine waters.

Microbes in waste water and sewage treatment.

Microbes in extremophilic habitats and their applications

References:

1. Alexopoulos, C.J., 1988. Introductory Mycology. Third Edition, Wiley Eastern Limited, New Delhi.
2. Atlas, R.M. and Bartha, R. 2000. Microbial Ecology. 4th Ed., Benjamin/Cummings Sci. Press, USA.
3. Brock, T.D. & Madigan, M.T., 1988. Biology of Microorganisms. Prentice Hall, New Jersey.
4. Cambell, R. 1983. Microbial Ecology. Second edition, Blackwell Scientific Publications, London.
5. Cruickshank, R. *et al.*, 1975. Medical Microbiology, Vol.2, 12th Edition, Churchill Livingstone, London.
6. Doelle, H.W., 1969. Bacterial Metabolism. Academic Press, London.
7. Freifelder, D., 1987. Molecular Biology. Second Edition, Jones and Bartlett Publishers.
8. Kumar, H.D. 1998. Modern Concepts in Biotechnology. Vikas Pub. House, New Delhi.
9. Mishra, A. (Ed.) 1985. Virus Taxonomy and Classification.
10. Niciklin *et al.* 2001. Instant Notes in Microbiology. Via Books Pvt. Ltd., New Delhi.
11. Norris, J.R. (Ed.), Methods in Microbiology, Series, Academic Press, London.
12. Rosenberg, E. and Cohen, I.R., 1983. Microbial Biology. Sanders College Publishing, Philadelphia.
13. Schlegel, H.G., 1988. General Microbiology, Sixth Edition. Cambridge University Press, Cambridge.
14. Stainer, R.Y. *et al.*, 1990. The Microbial World. 5th Edition, Prentice Hall of India, New Delhi.
15. Watson, J.D. *et al.*, 1987. Molecular Biology of Gene. Vol. 2, Benjamin/Cummings Publishing Company, USA.
16. Webster, J., 1980. Introduction to Fungi. Cambridge University Press, Cambridge.

Ph. D Course Work in Biosciences

Question Paper

Time: 3 hrs.

Max. Marks: 70

1. Write short notes on any **Four** of the following (not exceeding 8 pages)

4X4=16

- a.
- b.
- c.
- d.
- e.
- f.

Write brief answers on any **Four** of the following (not exceeding 16 pages)

4X7=28

- 2.
- 3.
- 4.
- 5.
- 6.
- 7.



Answer any **Two** of the following (not exceeding 16 pages)

2X13=26

- 8.
- 9.
- 10.