Sant Gahira Guru Vishwavidyalaya, Sarguja, Ambikapur (C.G.)

M.Sc. (BOTANY) Syllabus (Choice Based Credit System)

(To be implemented from the Academic Year 2022-23)

SEMESTER-I

Course Code	Course Type	Course Title	Marks	Credits
MBT-101	CCC	MICROBIOLOGY	100	6
MBT-102	CCC	PHYCOLOGY	100	6
MBT-103	CCC	MYCOLOGY	100	6
MBT-104	OSC	RESEARCHMETHODOLOGY & COMPUTER APPLICATION : BACICS	100	6
MBT-105 (ELECTIVE PAPER)	ECC/CB	A 01- BRYOPHYTES AND PTERIDOPHYTES	100	6
	ECC/CB	A 02- ADVANCES IN ARCHEGONIATAE		
LBT-111	CCC	Based on papers MBT101 and MBT102	50	4
LBT-112	CCC & ECC	Based on papers MBT103 and MBT105	50	4

SEMESTER-II

Course Code	Course Type	Course Title	Marks	Credits
MBT-201	CCC	GYMNOSPERMS AND PALAEOBOTANY	100	6
MBT-202	CCC	ANGIOSPERMS: Taxonomy and Embryology	100	6
MBT-203	CCC	PLANT PHYSIOLOGY	100	6
MBT-204	PRJ/FST/EST	SOCIAL OUTREACH AND SKILL DEVELOPMENT	100	6
MBT-205 (ELECTIVE PAPER)	ECC/CB	B01- ENVIRONMENTAL BIOLOGY AND CONSERVATION	100	6
	ECC/CB	B02- ECOLOGY AND PHYTOGEOGRAPHY		
LBT-211	CCC	Based on papers MBT201 and MBT202	50	4
LBT-212	CCC & ECC	Based on papers MBT203 and MBT205	50	4

SEMESTER-III

Course Code	Course Type	Course Title	Marks	Credits
MBT-301	CCC	CELL BIOLOGY	100	6
MBT-302	CCC	GENETICS AND PLANT BREEDING	100	6
MBT-303	CCC	PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING	100	6
MBT-304	OSC	INTELLECTUAL PROPERTY, HUMAN RIGHTS & ENVIRONMENT : BASICS	100	6
MBT-305 (ELECTIVE PAPER)	ECC/CB	C01 - PLANT ANATOMY AND ECONOMIC BOTANY	100	6
	ECC/CB	C02 - DEVELOPMENTAL BIOLOGY		
	ECC/CB	C03 - BIOSTATISTICS		
LBT-311	CCC	Based on papers MBT301 and MBT302	50	4
LBT-312	CCC & ECC	Based on papers MBT303 and MBT305	50	4

SEMESTER-IV

Course Code	Course Type	Course Title	Marks	Credits
MBT-401	CCC	PLANT PHYSIOLOGY	100	6
MBT-402	CCC	PLANT PATHOLOGY	100	6
MBT-403	CCC	INSTRUMENTATION, MOLECULAR TECHNIQUES AND BIOINFORMATICS	100	6
MBT-404	SSC/PRJ	DISSERTATION	100	6
MBT-405 (ELECTIVE PAPER)	ECC/CB	D01 - ETHNOBOTANYAND CONSERVATION OF TRADITIONAL KNOWLEDGE	100	6
	ECC/CB	D02 - PLANT RESOURCE UTILIZATION AND CONSERVATION		
	ECC/CB	D03 -PLANT QUARANTINE		
LBT-411	CCC	Based on papers MBT401 and MBT402	50	4
LBT-412	CCC & ECC	Based on papers MBT403 and MBT405	50	4

SEMESTER-I

Course Code	Course Type	Course Title	Marks	Credits
MBT-101	CCC	MICROBIOLOGY	100	6
MBT-102	CCC	PHYCOLOGY	100	6
MBT-103	CCC	MYCOLOGY	100	6
MBT-104	OSC	RESEARCHMETHODOLOGY & COMPUTER APPLICATION : BACICS	100	6
MBT-105 (ELECTIVE PAPER)	ECC/CB	A 01- BRYOPHYTES AND PTERIDOPHYTES	100	6
	ECC/CB	A 02- ADVANCES IN ARCHEGONIATAE		
LBT-111	CCC	Based on papers MBT101 and MBT102	50	4
LBT-112	CCC & ECC	Based on papers MBT103 and MBT105	50	4

M.Sc. BOTANY			First Semester
COURSE CODE: MBT-101			COURSE TYPE: CCC
COURSE TITLE: MICROBIOLOGY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Microbes.			
UNIT – 1	A brief idea of microbial diversity; Principle of bacterial taxonomy, Bergey's manual. General account of Archaea, Actinomycetes and Mycoplasma		
UNIT – 2	Types of microorganisms on the basis of mode of nutrition, symbiotic and non-symbiotic nitrogen fixation, *Rhizobium*-Legume symbiosis, Mycorrhiza		
UNIT – 3	Genetics of Bacteria: Mechanism of Transformation, Conjugation and Transduction in bacteria. Role of microorganisms in agriculture and medicines		
UNIT – 4	Viruses: General characters and classification; T even phages: Lytic cycle and its regulation; Lysogeny and its reglation in Lambda phage; Viroids and Prions		
UNIT – 5	Different types of culture media; sterilization methods; Batch culture, Synchronous culture and Continuous culture methods. Bacterial growth curve and factors affecting growth rates		

Suggested readings:

1. Madigan, M.T., Martinko, J.M., Dunlap, P.V., Clark, D.P., 2011. Brock Biology of Microorganiss. 13th edition, Pearson Education Inc.

2. Stanier, R.Y., Ingraham, J.L., Wheelis, M.L., Painter, P.R., 1987. General Microbiology. Fifth edition. MacMillan.

3. Atlas, RM. 1995. Principles of Microbiology. Mobsy.

4. Lim, DV. 2003. Microbiology. Kendall/Hunt.

5. Boundless.2013. Microbiology. Boundless Learning, Incorporated.

6. Comelissen, CN, Harvey, RA and Fisher, BD. 2012. Microbiology. Lippincott Williams & Wilkins.

7. Talaro, K.P., Chess, B. 2011, Foundations in Microbiology. 8th edition. McGraw-Hill.

8. Willey, J.M., Sherwood, L., Woolverton, C.J., 2010. Prescott's Microbiology. 8th edition, McGraw-Hill.

9. Agrios, G. N., 1988. Plant Pathology, Academic Press.

10. John A Lucas, 1998. Plant Pathology and Plant Pathogens, Wiley-Blackwell, CRC Press.

11. Dickinson, C. M., 2003. Molecular Plant Pathology, Bios Scientific Publisher

12. Robert, N., Trigiano, Windham, M. T. and Windham, A.S., 2003. Plant Pathology: Concepts and Laboratory Exercises, CRC Press.

13. Bridge, P.D and Clarkson, J.M., 1998. Molecular Variability of Fungal Pathogens, CAB, International

14. Singh, R. S., 2008. Plant Diseases, Oxford and IBH Publishing Co. Pvt Ltd

15. Pelczar, JM, Chan, ECS and Krieg, MR. 1993. Microbiology. Tata McGraw Hill.

16.Prescott, Harley and Kleins. 2001. Microbiology, McGraw-Hill Education. USA.

M.Sc. BOTANY			First Semester
COURSE CODE: MBT-102			COURSE TYPE: CCC
COURSE TITLE: PHYCOLOGY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Algae.			

UNIT – 1	General characters and classification of Algae; distribution and range of thallus organization, Cell ultra-structure,Pigment constitution, reproduction and life cycle patterns
UNIT – 2	Algae of diverse habitats, algal blooms, phycoviruses and algae in human welfare(algal biofertilizers, algae as food and feed, industrial uses of algae),Techniques of algal culture,
UNIT – 3	Cyanophyta: Thallus organization and reproduction, cell structure, heterocyst and akinete development, chromatic adaptation
UNIT – 4	Thallus organization and reproduction in Chlorophyta, Phaeophyta and Rhodophyta
UNIT – 5	A brief account of Prochlorophyta, Euglenophyta, Eustigmatophyta, Prasinophyta, Xanthophyta, Chrysophyta, Bacillariophyta and Pyrrophyta

Suggested Readings:

1. Hoek, CVD & Chapman, DG (1995). Algae: An Introduction to Phycology, Cambridge University Press, Cambridge
2. Fritsch, FE (1935, 1948). The Structure and Reproduction in Algae, Vol I & II, Cambridge University Press, Cambridge
3. Round, FE (1986). The Biology of Algae, Cambridge University Press, U.K.
4. Bold, HC & Wynne, J (1985). Introduction to Algae: Structure and Reproduction, , 2nd Edition, Prentice-Hall Inc.
5. Lee, RE (2008). Phycology, Fourth edition, Cambridge University Press
6. South, GR & Whittick, A (1998). Introduction to Phyclogy, Blackwell Scientific Publication
7. Vashistha, BR, Sinha, AK & Singh, NP (2013). Algae, Botany for Degree Students, S. Chand, New Delhi.
8. Round, FE (1984). The Ecology of algae, Cambridge University Press, New Delhi.

9. Sharma, OP (2006). Textbook of Algae, Tata McGraw Hill, New Delhi

<table>
<tr><td colspan="3">M.Sc. BOTANY</td><td>First Semester</td></tr>
<tr><td colspan="3">COURSE CODE: MBT-103</td><td>COURSE TYPE: CCC</td></tr>
<tr><td colspan="4">COURSE TITLE: MYCOLOGY</td></tr>
<tr><td colspan="2">CREDIT: 8</td><td colspan="2">HOURSE: 135</td></tr>
<tr><td>THEORY: 6</td><td>PRACTICAL: 2</td><td>THEORY: 90</td><td>PRACTICAL: 45</td></tr>
<tr><td colspan="4">MARKS</td></tr>
<tr><td colspan="2">THEORY: 100 (30+70)</td><td colspan="2">PRACTICAL: 25</td></tr>
<tr><td colspan="4">OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Fungi.</td></tr>
<tr><td>UNIT – 1</td><td colspan="3">General characteristics of Fungi; Principles of classification and mode of nutrition; Distribution and economic importance of fungi. Heterothallism and Parasexuality in fungi</td></tr>
<tr><td>UNIT – 2</td><td colspan="3">General account of Myxomycotina. Mastigomycotina: A brief description of Chytridiales, Blastocladiales, Saprolegniales and Peronosporales</td></tr>
<tr><td>UNIT – 3</td><td colspan="3">Zygomycotina: Mucorales and Entomophthroles; Ascomycotina: Endomycetales, Protomycetales, Taphrinales, Eurotiales, Erysiphales, Spaeriales and Pezizales</td></tr>
<tr><td>UNIT – 4</td><td colspan="3">Basidiomycotina: Uredinales, Ustilaginales, Lycoperdales, Nidulariales, Sclerodermatales, Phallales and Agaricales</td></tr>
<tr><td>UNIT – 5</td><td colspan="3">Deuteromycotina: Sphaeropsidales, Melanconiales and Mycelia sterilia
Lichens: General characteristics, thallus structure, reproduction and economic importance,</td></tr>
</table>

Suggested Readings:

1. Alexopoulos, CJ, Mims, CW & Blackwell, M (1996). Introductory Mycology, John Wiley Publications, UK.
2. Mehrotra, RS & Aneja KR, An Introduction to Myocology. New Age InternationalPublishers. New Delhi.
3. Webster, J. 2007. An Introduction to Fungi. Cambridge Univ. Press. New Delhi.
4. Hale, M.E. (1983), The biology of lichens (3rd ed.). Edward Arnold.
5. Hawksworth, DL & Hill, DJ 1984: The Lichen-Forming Fungi. - Blackie, Glasgow and London. 158 pp
6. Galun, M. (ed.) (1988) CRC Handbook of Lichenology. Volume III. - CRC Press, Inc., Boca Raton
7. Brown D. H., Hawksworth D. L. & Bailey R. H. 1976, Lichenology: Progress & problems, Academic Press. London.

M.Sc. BOTANY			First Semester
COURSE CODE: MBT-104			COURSE TYPE: OSC
COURSE TITLE: RESEARCH METHODOLOGY & COMPUTER APPLICATION: BASICS			
CREDIT: 6		HOURSE: 90	
THEORY: 6		THEORY: 90	
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 00	

OBJECTIVES:

-Understands the concept and place of research in concern subject.

-Gets acquainted with various resources for research.

-Becomes familiar with various tools research.

-Gets conversant with sampling techniques, methods of research and techniques of analysis of data.

-Achieves skills in various research writings.

-Gets acquainted with computer fundamentals and office software package.

UNIT – 1	CONCEPT OF RESEARCH: Meaning and characteristics of research, Steps in research process, Types of research; i) Basic, applied and action research ii)Quantitative and qualitative research, area of research in concern discipline. SELECTION OF PROBLEM FOR RESEARCH: Sources and criteria of the selection of the problem, Drafting of research proposal, Meaning and types of variables, Meaning and types of hypothesis.
UNIT – 2	TOOLS OF RESEARCH: Construction procedure of (i) Questionnair, (ii) Interview, (iii) Psychological test, (iv) Observation, (v) Rating scale, (vi) Attitute scale, (vii) Check list, Advantages and disadvantages of above tools. SAMPLING: Meaning of population and sample, Importance and characteristics of sample, Sampling techniques- i) Probability sampling; random sampling, stratified random sampling, systematic sampling, cluster sampling, ii) Non – probability sampling; incidental sampling, purposive sampling, quata sampling.
UNIT – 3	METHODS OF RESEARCH: Meaning and conducting procedure of following methods of research : Historical method, Survey method, Case study, Casual comparative method, Developmental methods, Experimental methods.
UNIT – 4	TREATMENT OF DATA : Level of measurements of data, Steps in measurement of data; editing, coding, classification, tabulation, analysis and interpretation of results. WRITING RESEARCH REPORT : Sections of report; preliminary section, Content section; various chapters, Supplimentary section; appendices,references, abstract, abbreviations, format and style.

UNIT – 5	COMPUTER FUNDAMENTALS : Computer system; Features, generations and basic applications of computers. Parts of computer system: block diagram, central processing unit (CPU); Concepts and types of Hardware & software, Input devices: Mouse, Keyboard, Scanner, Bar code reader, Trac ball; Output devices: Monitor, Printer, Plotter, Speaker; Computer memory – primary and secondary memory, magnetic and optical storage devices. Operating Systems – MS Windows: basics of window OS; Components of windows – icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders; Control Panel: display properties, adding and removing software and hardware, setting date and time, screensaver and appearance; Windows Accessories: Calculator, Notepad, Wordpad, Paint Brush, Commond prompt, windows explorer.
UNIT - 6	Office Software Package : - Word Processing- MS Word : Creating, Saving, Opening, Editing, Formatting, Page setup and Printing documents; Using tables, pictures and charts in documents; Using Mail Merge sending a document to a group of people and creating form, letters and lable. Spreadsheet – MS Excel : Opening a blank or new workbook, entering data/function/formula into worksheet cell, saving, editing, formatting, Page setup and printing workbooks. Presentation Software – MS Power point : Creating and enhancing a presentation, modifying a presentation, working with visual elements, adding animations & transitions and delivering a presentation.

SUGGESTED READINGS:

Agrawal, Y. P. (1988). Better Sampling : Concepts, Techniques and Evaluation. New Delhi: Sterling publishers Private Limited .

Best, J. W. (1993) Research in education (6th ed.) New Delhi : Prentice-Hall of India Pvt.Ltd.

Broota K. D. (1992) Experimental Design in Behavioral Research (2nd ed.) New Delhi : Wiley Eastern Limited.

Dasgupta A. K. (1968) Methodology of Economic research. Bombay – Asia Publishing House.

Edwards, A. L. (1957) Techniques of Attitude scale Construction. New York : Appleton-Contury.

Kothari, C.R. (3rd ed.) Research Methodology : Methods and Techniques, New Age International Publishers.

Singh Y.K. (2021), Fundamental of Research Methodology and Statistics, New Age International Publishers.

Dr. P. Mohan, Fundamentals of Computers, Himalaya Publishing House.

M.Sc. BOTANY			First Semester
COURSE CODE: MBT-105 : A01			COURSE TYPE: ECC/CB
COURSE TITLE: BRYOPHYTES AND PTERIDOPHYTES			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of BRYOPHYTES AND PTERIDOPHYTES			

UNIT – 1	Bryophyta: General account, classification and origin of Bryophytes; evolution of sporophyte; fossil Bryophytes, Affinities of Bryophytes with Algae and Pteridophytes,
UNIT – 2	Comparative account of the gametophytes and sporophytes of Hepaticopsida, Anthocerotopsida and Bryopsida. Peristome structure and its significance in the classification of Mosses.
UNIT – 3	General characters and classification of Pteridophytes and their economic importance. Evolution of vascular system in plants, Stellar system, Telome theory, Apogamy and Apospory, Heterospory and seed habit, Affinities of Pteridophytes with Gymnosperms,
UNIT – 4	Study of Early vascular plants: Rhyniophyta, Trimerophytophyta, Zosterophylophyta, *Lepidodendron, Lyginopteris.*
UNIT – 5	Comparative morphology and anatomy of gametophytes and sporophytes of Psilopsida, Lycopsida, Sphenopsida and Filicopsida.

Suggested Readings :

1. Gangulee, H.C. and Kar, A.K., 2011, College Botany Vol. II (Algae+Fungi+Brophyta+Pteridophyta) , New Central Book Agency, Kolkata
2. Singh, Pande, Jain, 2010, A Text Book of Botany (Algae+Fungi+Brophyta+Pteridophyta) , Pub. Rastogi Publication, Meerut
3. Parihar N. S. 1965, An Introduction to Embyophyta- Bryophyta. Central Book Depot. Allahabad.
4. Kashyap S. R. 1972, Liverworts of the Western Himalayas & the Punjab Plains. Part 1 & 2.
5. Richardson D. H. S, The Biology of Mosses.
6. Janice. M. Glime, 2006, Bryophyte Ecology.
7. Goffinet B. & Shaw. A. J. 2008, Bryophyte Biology.
8. Rashid, A, 2011, An Introduction to Pteridopyta, 2nd edition, (Reprint), Pub. Vikas Publishing House Pvt. Ltd., Noida.

9. Gifford, Ernest, M., Foster, Adriance.S., 1989, Morphology and Evolution of vascular plant. W. H. Freeman; Third Edition.
10. Ogura, Yuzuru., 1972, Comparative Anatomy of Vegetative Organs of The Pteridophytes. Gebr. Borntraeger; 2nd edition.
11. Rashid, A.1999, An Introduction to Pteridophta: Diversity,Development,Differentiation. Vikas Publishing House Pvt Ltd.
12. Parihar, Narayan Singh., 1977, The Biology and Morphology of The Pteridophyte. Central Book Depot.

M.Sc. BOTANY			First Semester
COURSE CODE: MBT-105 : A02			COURSE TYPE: ECC/CB
COURSE TITLE: ADVANCES IN ARCHEGONIATAE			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Bryophytes & Pteridophytes.			
UNIT – 1	Bryophytes : Vegetative and reproductive innovations of earlyland plants, Role of bryophytes in ecosystem dynamics and in the global carbon budget, bryophytes association with microorganism and animals, Symbiotic fungal associations in early land plants.		
UNIT – 2	Poikelohydry, Desication tolerance. Bryogeography and conservation. Hormonal regulation of gametophyte developmentin bryophytes. Breeding system, population ecology and population genetics, Anisospory and sexual dimorphism. Biologically active compounds in Bryophytes. Cytogenetics of bryophytes, Molecular genetics studies of moss species.		
UNIT – 3	Pteridophytes : Morphological diversity and evolution of vegetative organs in Pteridophytes, Diversity of ferns- an ecological perspective, Genetics and reproductive biology of ferns, Culture of fern gametophyte for experimental investigation, Photomorphogenesis, Model System in Ceratopteris, Osmunda, Marsilea.		
UNIT – 4	Gymnosperms : Evolution of pollination mechanisms and embryogeny of gymnosperms, Propagation of conifers using plant tissue culture approaches, advances in synthetic seeds technology of conifers, somatic embryogenesis and plantlet regeneration;		
UNIT – 5	Diversity of non living gymnosperms, morphological diversity and reproductive variations in cycadales, ginkgoales, coniferales and gnetales. Origin of vascular system in coniferales. Conifer plantation, uses and impact of coniferous forest on human life.		

Suggested Readings :

1. Shaw A.J. and B. Goffinet (2000) Bryophyte Biology, Cambridge University Press.
2. Geissler and Greene SW (1982) Bryophyte Taxonomy, Methods, Practices and floristic exploration, J Cramer, Germany.
3. Dyer AF (Ed) (1979) The experimental biology of ferns. Academic London.
4. Richardson DHS (1981) The Biology of mosses. John Wiley & Sons, Inc New York.
5. Bhatnagar SP and Moitra A (1996) Gymnosperms. New Age International (P) Limited, Publishers, New Delhi.
6. Singh Hardev (1978) Embryology of Gymnosperms. Encyclopedia of Plant Anatomy. Vol. X Gebruder Borntraegrl, Berlin, Stuttgart.

LBT111: Based on papers MBT101 and MBT102
LBT112: Based on papers MBT103 and MBT105

SEMESTER-II

Course Code	Course Type	Course Title	Marks	Credits
MBT-201	CCC	GYMNOSPERMS AND PALAEOBOTANY	100	6
MBT-202	CCC	ANGIOSPERMS: Taxonomy and Embryology	100	6
MBT-203	CCC	PLANT PHYSIOLOGY	100	6
MBT-204	PRJ/FST/EST	SOCIAL OUTREACH AND SKILL DEVELOPMENT	100	6
MBT-205 (ELECTIVE PAPER)	ECC/CB	B01- ENVIRONMENTAL BIOLOGY AND CONSERVATION	100	6
	ECC/CB	B02- ECOLOGY AND PHYTOGEOGRAPHY		
LBT-211	CCC	Based on papers MBT201 and MBT202	50	4
LBT-212	CCC & ECC	Based on papers MBT203 and MBT205	50	4

M.Sc. BOTANY			**Second Semester**
COURSE CODE: MBT-201			COURSE TYPE: CCC
COURSE TITLE: **GYMNOSPERMS AND PALAEOBOTANY**			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Gymnosperms and Fossil Plants.			
UNIT – 1	General introduction of gymnosperms with special reference to its salient features, similarities and dissimilarities with other groups like pteridophytes and angiosperms. Classifications of gymnosperms. Origin and Evolution of gymnosperms with special reference to Progymnosperms, Devonien pre ovules and origin of seed.		
UNIT – 2	Comparative morphology, anatomy, reproductive biology and phylogenetic studies of the following groups: Pteridospermopsida-Lyginopteridales, Medullosales, Callistophytales, Glossopteridales, Peltaspermales Corystospermales and Caytoniales. Cycadopsida, Pentoxylopsida, Bennettiopsida, Ginkgopsida Coniferopsida and Gnetopsida.		
UNIT – 3	Global distribution of gymnosperms with special reference to Indian plants. Endangered gymnosperms, their conservation and present status. Cytogenetics of Gymnosperms; Economic importance and biotechnology of gymnosperms.		
UNIT – 4	Basic geological information – structure of Earth, Types of rocks, stratigraphy,		

	basic concepts of continental drift and plate tectonics. Dating the past, Geological time scale. Fossilization process, Types of fossils, including chemical fossils and fossil techniques to study fossils, reconstruction and nomenclature of fossil, concepts of Parataxa and Eutaxa, objectives of palaeobotany. Prebiotic Environment, chemical evolution and origin of life, Pre-Cambrian life. Indian Pre-cambrain stratigraphy and life forms.
UNIT – 5	Applied Palaeobotany Life as fuel maker, sources of natural fossil fuels, Peat, coal and its varieties, constitution of coal, Coal Palynology, coal maceral, Petroleum – its origin, Palynology in oil exploration. Fundamentals of Paleofloristics, Palaeogeography and Palaeoclimatology. Applicaion of Palaeopalynology .Plant and animal interactions correlation Archaeobotany with special reference to phytoliths and palynological studies.

Suggested readings:

1. Eames, A.J. (1936) Morphology of Vascular plant-lower group. Tata Mc Graw Hill, New Delhi.
2. Chamberlain, Charles Joseph, b.(1863), Gymnosperm; Structure and Evolution. Chicago, III., The University of Chicago Press
3. Chhaya Biswas and B.M.Johri. The Gymnosperm. Springer; 1997, edition (16 April 2014)
4. Bhatnagar, S.P. Moitra, Alok. (1996). Gymnosperms. New Age International.
5. Pant DD. (2002), An Introduction to Gymnosperms, Cycas, and Cycadales, Birbal Sahni Institute of Palaeobotany.
6. Steward W.N., Palaeobotany and evolution of plant. Cambridge University Press, New York.405 p.(1)
7. Stewart,W.N.,and G.W.Rothwell.(1993) Palaeobotany and the evolution of plant. 2nd ed. Cambridge University Press, New York.521 p.(1)
8. Andrews ,H.N.,jr.1974 Palaeobotany (1947-1972) Annals of the Missouri Botanical Garden 61:179-202.(8) Page **7** of **21**
9. Thomas N.Taylor.Edith L. Tailor.Michael Krings (2009) Palaeobotany: The biology and Evolution of Fossil Plants Amsterdam ; Boston, Mass. : Academic Press, c2009
10. Wilson N Stewart and Gar W. Rothwell - 1993. Palaeobotany and the evolution of plants. Cambridge university press.
11. Edith L. Taylor, Thomas N. Taylor, Michael Krings – 2009. Palaeobotany: The Biology and Evolution of Fossil Plants. Academic Press.

M.Sc. BOTANY			Second Semester
COURSE CODE: MBT-202			COURSE TYPE: CCC
COURSE TITLE: **ANGIOSPERMS: Taxonomy and Embryology**			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of identification, importance and applications of Higher Plants .			
UNIT – 1	Taxonomic Principles, Botanical nomenclature: Binomial system, ICBN rules and recommendations, Priority, Typification, rules of effective and valid publications. Outline of classification proposed by Bentham and Hooker and Hutchinson, Takhtajan, Cronquist,		
UNIT – 2	Taxonomic features and economic importance of following families: Magnoliaceae, Ranunculaceae, Papaveraceae, Capparidaceae, Brassicaceae, Caryophyllaceae, Malvaceae, Rutaceae, Meliaceae, Leguminosae, Rosaceae, Combretaceae, Cucurbitaceae, Umbelliferae, Rubiaceae, Asteraceae, Asclepiadaceae, Apocyanaceae, Convolvulaceae, Solanaceae, Scrophulariaceae, Acanthaceae, Lamiaceae, Verbenaceae, Polygonaceae, Euphorbiaceae, Orchidaceae, Zingiberaceae, Araceae, Liliaceae, Cyperaceae and Poaceae		
UNIT – 3	Numerical Taxonomy: Aims and objectives, merits and demerits; Chemotaxonomy: Role of phytochemicals in taxonomy; Morphology, Anatomy, Embryology and Cytology in relation to taxonomy;		
UNIT – 4	Structure of a typical flower; Anther and Microsporangium, Microsporogenesis, pollen wall features, development of male gametophyte; Megasporangium: Types of ovules, structure of ovule, Megasporogenesis, development of female gametophyte, types of embryo sacs. Pollination: Definition, types and agencies of pollination; Pollen - pistil interaction, fertilization and Double fertilization; Endosperm: types and development; Embryogeny; Sexual incompatibility		
UNIT – 5	Experimental Embryology: Tissue culture, Apomixis, haploid production, Androgenesis, Gynogenesis, Embryo culture, Ovule and seed culture, Parthenocarpy, Synthetic seed production		

Suggested readings:

1. Sambamurty, A.V. S. S. 2005. *Taxonomy of Angiosperms*. I. K. International Pvt. Ltd., New Delhi.

2. APG III 2009. An update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG III. *Bot. J. Linn. Soc.* 161: 105-121.

3. Bhattacharyya, B. and B. M. Johri. 1998. Flowering Plants - Taxonomy and Phylogeny. Narosa Publishing House, New Delhi.

4. Heywood, V. H. and Moore, D. M. 1984. Current Concepts in Plant Taxonomy. Oxford University Press.

5. Duthie, J. F. "*Flora of upper gangetic plain and of the adjacent siwalik & sub-himalayan tracts*," Calcutta, Vol. 3, No. 1, 1915.

6. Jain, S.K. and Rao, R.R. 1977. *A Handbook of Field and Herbarium Methods*. Today and Tomorrow's Printers and Publishers, New Delhi-

7. Rao, R. R. 1994. *Biodiversity in India* (Plant Aspects), Bishan Singh Mahandrapal Singh, Dehradun.

8. Sharma, O. P. 1993. *Plant Taxonomy*. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

9. Singh, V. & Jain, D.K. 2006. Taxonomy of Angiosperms. : Rastogi Publications, Meerut.

10. Singh, Gurcharan 2012. Plant Systematics: An Integrated Approach- Science Publishers, Enfield, (3rd edn.)

11. Stace, C. A. 1989. Plant Taxonomy and Biosystematics. University Park Place, Baltimore (2nd edn.)

12. Takhtajan A. 2009. *Diversity and classification of flowering plants*, 2nd edn. Berlin: Springer.

13. Verma, B. K. 2010. *An introduction to Taxonomy of Angiosperms*. PHI Learning Pvt. Ltd. New Delhi.

14. Jones, SB Jr. and Luchsinger, AE. 1986. Plant Systematics (2nd edition). McGraw Hill Book Co., New York.

15. Pandey, A. K., J.V.V. Dogra & Wen, J. 2006. Plant Taxonomy: Advances and Relevance. CBS Publishers & Distributors Pvt. Ltd.

16. Subrahmanyam, N. S. Taxonomy of Angiosperm, Vikas publishing house Pvt Ltd.

17. Pullaih, T. 2007. Taxonomy of angiosperm. Regency publications, New Delhi.

18. Bhojwani, S.S. and Bhatnagar, S.P.(1985), Embryology of Angiosperms, Vikash Publishing House, New Delhi

19. Johri, B.M (1984) Embryology of Angiosperms.Springer-Verlog Berlin Heidelberg.

20. Maheshwari, P. (1950) An Introduction to the Embryology of Angiosperms.Tata McGraw Hill.

21. Pandey, B.P., Angiosperms-Taxonomy, Emrbyology and Anatomy, S. Chand and Co., New Delhi

22. Bhojwani, S.S. and Bhatnagar, S.P., Embryology of Angiosperms, Vikash Publishing House, New Delhi

23. Butenko RG (2000) Plant Cell Culture, University Press of Pacific.

24. Davies PJ (2004) Plant Hormones, Kluwer Academic Publishers, Netherlands.

25. Halford N (2006) Plant Biotechnology - Current and future applications of genetically modified crops, John Wiley and Sons, England.

M.Sc. BOTANY			Second Semester
COURSE CODE: MBT-203			COURSE TYPE: CCC
COURSE TITLE: PLANT PHYSIOLOGY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Life Processes of Plants.			
UNIT – 1	Water relations: Properties of water, Water potential, Osmosis, Diffusion, Osmotic Pressure, Diffusion Pressure Deficit (DPD), Absorption of water and minerals, Mechanism of water and mineral absorption Phloem transport: Loading and unloading of photosynthate, theories of phloem transport		
UNIT – 2	Photosynthesis: Photosynthetic pigments, absorption of light, absorption spectra, Light harvesting Complex (LHC), Z- Scheme, Photo-oxidation of water, carbon assimilation pathways-C3, C4 and CAM, Photorespiration		
UNIT – 3	Respiration: Glycolysis, TCA cycle, ETS, ATP synthesis, Pentose phosphate pathway, alternative oxidase system		
UNIT – 4	Plant Growth Regulators: Physiological effects and mechanism of action of plant growth hormones (Auxin, Gibberellins, Cytokinins, ABA, Ethylene and Brassinosteroids), hormone receptors, signal transduction and gene expression		
UNIT – 5	Sensory Photobiology: Structure and function of Phytochrome Cryptochrome and Phototropins; Molecular mechanism of phytochrome action. The Flowering Process: Photoperiodism and its significance, endogenous clock and its regulation, flowering stimulus, florigen concept and vernalization		

Suggested readings:

1. Taiz and Zeiger, 2010, Plant Physiology, 5th Edition , Sinurer Associates
2. Hopkins, W.G. and Huner N.P.A., 2009, Introduction to Plant Physiology, 4th Edition Wiley International Edition, John Wiley & Sons, USA
3. Jones, Russell L. Buchanan, Bob B. Guissem, Wilhelm., 2002, Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists.
4. Peter Scott, Physiology and Behaviour of Plants. Wiley-Blackwell.
5. Frank Boyer Salisbury and Cleon Ross, 1991, Plant Physiology, CA

MBT-204	PRJ/FST/EST	SOCIAL OUTREACH AND SKILL DEVELOPMENT

M.Sc. BOTANY			Fourth Semester
COURSE CODE: MBT-205: B01			COURSE TYPE: ECC/CB
COURSE TITLE: ENVIRONMENTAL BIOLOGY AND CONSERVATION			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Microbes.			
UNIT – 1	Gaseous and particulate pollutants, indoor air pollution, Effects of important air pollutants on plants, human health and ecosystems.		
UNIT – 2	Photochemical smog, stratospheric ozone depletion; effects of enhanced UV-B on plants, microbes and human health. Acid rain: Formation, dispersion and deposition; consequences on soil fertility, rivers, lakes and plants,		
UNIT – 3	Greenhouse effects: consequences, global warming, sea level rise, albedo, oceanic influences; effects of increased CO2 on plants; human implications. Surface cooling		
UNIT – 4	Sources of water pollution, Physico-chemical and biological properties of sewage, industrial effluents produced from textile, leather, thermal power, chemical, and mining industries and their effects on water quality, bio-indicators of water pollution.		
UNIT – 5	Biodiversity: Definition, magnitude and global pattern of Biodiversity, Hypothesis related to global patterns of biodiversity, regional pattern of biodiversity; Biodiversity of Hot Spots, Threats to Biodiversity; Extinction of species, IUCN Red list categories; Conservation Strategies: ex situ and in situ conservation; India's biodiversity and its conservation		

Suggested Readings:

1. Adger, W. N. 2005. Adapting to climate change**.** Wiley Publication. UK.
2. Arthur, C. Stern. 1997. Fundamentals of air pollution, Wiley Publishers, UK.
3. Arya Arun. 2009. Eco-degradation due to air pollution. Narosa Publishers. New Delhi
4. Bell and Treshow 2002. Air Pollution and Plant Life. Willey Publication. UK.
5. Kenneth, Wark. 1997. Air Pollution its origin and control, Prentice Hall publication.UK
6. Pepper, Ian. 2003. Environmental chemistry. Wiley Publication. UK.
7. Sharma, P. D. 2006. Ecology and Environment. Rastogi Publication, Meerut.

8. Singh, J.S. Singh, S.P. and Gupta, S.R. 2008. Ecology Environment and Resource Conservation. Anamaya Publishers. New Delhi.
9. Agrawal S.K., 2009. Water Pollution. APH Publishing House. New Delhi.
10. Goel P.K., 2006. Water Pollution. New Age International. New Delhi.
11. Henze M., Harremoës P., Jansen, and Arvin, E., 2002. Wastewater Treatment: Biological and Chemical processes, Springer Publication. Germany.
12. Marcos von Sperling, 2007. Basic Principles of Wastewater Treatment: IWA Publishing Company. UK.
13. Wang Lawrence. 2009. Handbook of advanced industrial and hazardous wastes treatment. CRC Press. UK.
14. Wun Jern Ng. 2006. Industrial Waste water Treatment. Imperial College Press. UK.

M.Sc. BOTANY			Second Semester
COURSE CODE: MBT-205 : B02			COURSE TYPE: ECC/CB
COURSE TITLE: ECOLOGY AND PHYTOGEOGRAPHY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance, distribution and applications of Plants for healthy environment.			
UNIT – 1	Introduction to ecology, and environmental terminology, population dynamics, population characteristics, population growth forms, density dependent and density independent controls, population structure (distribution, aggregation, isolation territoriality) energy partitioning , r - and k-selection, concept of carrying capacity; Wild life sanctuaries, botanical gardens		
UNIT – 2	Vegetation organization and characteristics: Concepts of Community and Continuum; Community coefficients, interspecific associations, ordination, Ecological Niches, Species diversity (alpha, beta and gama).		
UNIT – 3	Ecosystem: Structure and function, Primary productivity, Trophic organization, Energy flow pathways, Ecological coefficients; Mechanism of Decomposition and its control; Nutrient cycling in ecosystem, Eutorphication, BOD		
UNIT – 4	Ecosystem stability (resistance and resilience), ecological perturbation (natural and anthropogenic) and their impact on plants and ecosystems; Plant invasion Ecological Succession: Modes and mechanism; Xerarch and Hydrarch		
UNIT – 5	Phytogeography: Definition and scope, Endemism, factors governing distribution of plants, phytogeographical regions of India, plants endemic to Indian subcontinent, Major biomes.		

Suggested reading:

1. Odum, E. P. and Barret G.W. 2005. Fundamentals of Ecology. Cengage publication
2. Singh, J.S., Singh S.P. and Gupta S.R. 2006. Ecology Environment and Resource Conservation. Anamaya Publishers
3. Kormondy E. J., 2000. Concept of Ecology. 4th Edition. Benzamin Cummings. UK
4. Odum E.P., 1996. Fundamentals of Ecology, Natraj Publishers, Dehradun.
5. Patrick L. 2000. Tropical Ecosystems and Ecological Concepts. Cambridge University Press. UK.
6. Sharma P.D. 2007. Ecology and Environment. Rastogi Publication, Meerut.
7. Singh J.S., S.P. Singh and S.R. Gupta 2006. Ecology, Environment and Resource Conservation, S. Chand Publication, New Delhi.

LBT211: Based on papers MBT201 and MBT202

LBT212: Based on papers MBT203 and MBT205

SEMESTER-III

Course Code	Course Type	Course Title	Marks	Credits
MBT-301	CCC	CELL BIOLOGY	100	6
MBT-302	CCC	GENETICS AND PLANT BREEDING	100	6
MBT-303	CCC	PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING	100	6
MBT-304	OSC	INTELLECTUAL PROPERTY, HUMAN RIGHTS & ENVIRONMENT : BASICS	100	6
MBT-305 (ELECTIVE PAPER)	ECC/CB	C01 - PLANT ANATOMY AND ECONOMIC BOTANY	100	6
	ECC/CB	C02 - DEVELOPMENTAL BIOLOGY		
	ECC/CB	C03 - BIOSTATISTICS		
LBT-311	CCC	Based on papers MBT301 and MBT302	50	4
LBT-312	CCC & ECC	Based on papers MBT303 and MBT305	50	4

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-301			COURSE TYPE: CCC
COURSE TITLE: CELL BIOLOGY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Cells and Plant Science.			
UNIT – 1	Structural organization of typical plant cell; Structure of cell wall and its biogenesis; Plasma membrane; Cell organelles: Structure and function, nuclear envelope, Nuclear pore complex (NPC), Nucleolus: structure and function		
UNIT – 2	Cell cycle: control mechanism, role of cyclins and cyclin dependent kinesis. Study of different types of cell divisions; Cell-cell interaction and signaling: signaling molecules and mechanism of signaling, secondary messenger, Ca+, c-AMP, MAP kinase		
UNIT – 3	Chromatin organization and replication: Chromosome structure and types, Nucleosome organization, assembly and disassembly of histones during replication; Karyotype analysis, chromosome banding patterns: types of chromosome banding, uses of chromosome banding in cytogenetics; Special types of chromosomes,		
UNIT – 4	RNA structure and types,DNA structure and types Replication of DNA, semiconservative mode of replication, DNA polymerases, Centarl dogma, Genetic codes, transcription and translation in prokaryotes and eukaryotes; Regulation of gene expression in prokaryotes and eukaryotes.		
UNIT – 5	Cellular differentiation and specialization, Molecular mechanisms of cellular differentiation, Cell senescence and death; Programmed cell death-necessity, classes, signals; Cell apoptosis		

Suggested Readings:

1. Alberts B. Johnson, A. Lewis, J. Raff, M. Roberts, K. Walter, P. 2008. Molecular Biology of the Cell. Garland Science Publisher. USA.
2. Berg, J M; Stryer L. 2010. Biochemistry, W. H. Freeman; Seventh Edition edition
3.De Robertis and De Robertis. 2010. Cell and Molecular Biology: Saunders College Publisher. UK.
4. Lewin Benzamin 2011. Gene X: Jones and Bartlett Learning Publisher. USA.
5. Lodish and Baltimore.2005. Molecular Cell Biology: WH Freeman Publisher. UK.
6. Nelson and Cox. 2002. Lehninger Principle of Biochemistry: 3rd Edition: WH Freeman Publisher. UK.

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-302			COURSE TYPE: CCC
COURSE TITLE: GENETICS AND PLANT BREEDING			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Genetics of Plants & Breeding in Plants.			

UNIT – 1	Mendelian Inheritance: Segregation and Independent assortment; Incomplete dominance, Co-dominance, Gene interactions, Epistasis, Chromosomal theory of inheritance, Sex chromosomes and determination, Dosage compensation, Extra nuclear inheritance
UNIT – 2	Linkage and recombination, Crossing over, Chromosome mapping, Structure of genetic material, Chromosomal aberrations: Structure and numerical changes in chromosomes- Deletion, Duplication, Translocation, Aneuploidy and Euploidy, Gene mutation
UNIT – 3	Population Genetics: Population models, probability and distributions, Genotypic and phenotypic variations, Hardy- Weinberg measures of genetic variation, Gene frequencies and equilibrium, Optimum phenotype and selection pressure, kinds of selection, Fischer's fundamental theorem of natural selection
UNIT – 4	Genomics and Molecular Genetics: Maps of chromosomes, Map position- based cloning of genes, Chromosome walks, Chromosome jumps, Expressed sequences, Comparative genomics: Mitochondrial and Chloroplast genomes
UNIT – 5	Plant Breeding: Objective and scope, Hybridization in self pollinated and cross pollinated crops, Inbreeding depression and Heterosis, Polyploid breeding, Breeding for disease resistance plants, Molecular Markers and plant breeding

Suggested reading:

1. Clark, M.S. and Wall, W.J. 1996, Chromosomes : The Complex Code. Chapman & Hall, London.

2. Stebbins, G.L.1950, Variation and Evolution in Plants. Columbia Univ. Press, New York.

3. Swanson, C. P., Mertz, T.F. and Young, W.J. Cytogenetics : The Chromosomes in Division, Inheritance and Evolution (2nd Edn). Englewood Cliff, Prentice-Hall, New Jersey.

4. Sharma, A.K. and Sharma, Archana. 1985. Advances in Chromosome and Cell Genetics. Oxford & IBH Publishing Co., Calcutta.

5. Schnedl, W.. Banding patterns in chromosomes. In: International Review of Cytology (Suppl.4).

6. Lewine, Benjamin, Jones and Bartlet, Genes X, Sudburry, Masschusetts

7. Gupta, P.K., Cytogenetics, Rastogi Publication, Meerut

8. Peter, D, Snustand and Simmons, M.J., John Wiley and Sons Inc.

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-303			COURSE TYPE: CCC
COURSE TITLE: PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Plant Biotechnology & GMOs.			
UNIT – 1	Basic concepts of Biotechnology, biotechnology and its components, need of R and D and pilot scale production using biotechnology, current global scenario, fermentation technology, environmental biotechnologies, biosensors, phytoremediation, biotechnology and information technology (BT and IT) interdependence, management of biotech related industries		
UNIT – 2	Introduction of plant tissue culture and cell suspension culture, physic chemical conditions for propagation of plant cells and tissues, composition of media nutrient and hormone requirement, single cell culture, somaclonal variation, protoplast isolation and hybridization; concept of artificial seeds.		
UNIT – 3	Methods for the plant genetic transformation, particle bombardment method,electroporation, microinjection, mechanism of Agrobacterium mediated gene transformation		
UNIT – 4	Promoters and genetic markers, transgenic plant analysis, biosafety related issues to transgenics, field trials and risk management, intellectual property rights.		
UNIT – 5	GMO case study, GM crops, Transgenics plant resistant to biotic and abiotic stresses, molecular techniques for marker free transgenics.		

Suggested Readings:

1. Brown T.A. 2007. Genomes 3. Garland Science Publication. USA.
2. Brown.T.A.2011. Gene Cloning and DNA Analysis. Taylor and Francis. UK.
3. Karp, G. 2009. Cell and Molecular Biology Concepts and Experiments. Willey Publication. UK.
4. Primrose and Twyman, 2009. Principles of Gene manipulation and Genomics, Wiley Blackwell. UK.
5. Sambrook and Russell. 2001. Molecular Cloning. 3rd Edn. CSHL Press. USA.
6. Senger, Gupta and Sharma. 2010. Laboratory manual on Biotechnology. WH Publishers. USA.
7. Singh, B.D. 2008. Biotechnology. Narosa Publishing House. New Delhi

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-304			COURSE TYPE: OSC
COURSE TITLE: INTELLECTUAL PROPERTY, HUMAN RIGHTS & ENVIRONMENT : BASICS			
CREDIT: 6		HOURSE: 90	
THEORY: 6	PRACTICAL: 00	THEORY: 90	PRACTICAL: 00
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 00	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of Intellectual property, Patenting, Human rights and importance of laws.			
UNIT – 1	Patent :- Introduction and concepts, Historical overview. Subject matter of patent, Kinds of patents. Development of Law of Patents through international treaties and conventions including TRIPS. Agreements. Procedure for grantof patents and term of patent. Surrender, revocation and restoration of patent. Rights and obligationsof Patentee. Grant of compulsory licenses. Infringment of patent and legal remedies. Offences and penalties. Discussionon leading cases.		
UNIT – 2	Meaning of Copyright, Historical Evolution. Subject matter of copyright.Literary works, Dramatic works & Musical works. Computer Programme, Cinematographic films. Registration of Copyrights. Term of Copyright and Ownership of Copyrights. Neighboring Rights. Rights of Performers & Broadcasters. Assignment of Copyright. Author's Special Rights (Moral Rights). Infringment of Copyrights and defenses. Remedies against infringement (Jurisdictionof Courts and penalties). International conventions including TRIPS. Agreement WIPO, UCC, Paris Union, Beme convention, UNESCO. Discussion on leading cases.		
UNIT – 3	Rights: Meaning Human Rights – Meaning and Essentials Kinds of Human Rights Rights related to Life, Liberty, Equals & Disable		
UNIT – 4	National Human Rights Commission. State Human Rights Commission. High Court. Regional Court Procedure & Functions of High & Regional Court.		
UNIT – 5	Right to Environment as Human Right. International Humanitarian Law and Environment Environment and Conflict Management Nature and Origin of International Environmental Organisations (IEOs) Introduction to Sustainable Development and Environment		

	Sustainable Development and Environmental Governance.

Suggested Readings :-

1. **G.B. Reddy, Intellectual Property Rights and Law, Gogia Law Agency, Hyderabad.**
2. **S.R. Myneni, Intellectual Property Law, Eastern Law House, Calcutta.**
3. **P. Narayanan, Intellectual Property Rights and Law (1999), Eastern Law House, Calcutta.**
4. **Vikas vashistha, Law and Practice of Intellectual Property, (1999), Bharat Law House, New Delhi.**
5. **Comish W.R. Intellectual Property, 3rd,ed. (1996), Sweet and Maxwell**
6. **P.S. Sangal and Kishor Singh, Indian Patent System and Paris Convention.**
7. **Comish W.R. Intellectual Property, Patents, Copyrights and Allied Rights, (2005)**
8. **Bibeck Debroy,Intellectual Property Rights, (1998), Rajiv Gandhi Foundation.**

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-305 : C01			COURSE TYPE: ECC/CB
COURSE TITLE: PLANT ANATOMY AND ECONOMIC BOTANY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Plants for society.			
UNIT – 1	Shoot apical meristem, Root apical meristem, Control of cell and tissue differentiation especially xylem and phloem, secretory ducts and laticifers, wood development in relation to environmental factors.		
UNIT – 2	Types and phylogeny of stomata, types of nodal anatomy, phylogenetic and evolutionary consideration of nodal anatomy, types of cambium, factors influencing the growth of cambium, experimental control of cambial activity.		
UNIT – 3	Seed anatomy of Monocotyledonous and Dicotyledonous, special features of seeds or seed appendages, seed germination seedling growth, hormonal control of seedling growth.		
UNIT – 4	Origin of Cultivated Plants, Cereals, Millets, Pulses, Oil yielding plants, Spices and condiments, Beverage plants		
UNIT – 5	Plants of medicinal importance, Fumitories and Masticatories, Fibres, Wood, Energy Plantation: Petrocrops and Firewood		

Suggested Readings:

1. Carlquist, S.C. (1961),Comparative Plant Anatomy Holt, Rinehart and Winston, New York Press.
2. Carlquist S. (2001), Comparative Wood Anatomy Systematic, Ecological and Evolutionary Aspects of Dicotyledon Wood.
3. Cutter, Elizabeth (1969), Plant Anatomy part –I Cells and Tissues IInd edition,Edward Arnold,London
4. Cutter, Elizabeth (1971), Plant Anatomy Part- II Organs ,Edward Arnold London
5. Dickison W.C. (2000), Integrative Plant Anatomy. Academic Press
6. Eames, Arthur J. & Mac Daniels Laurence H. (1951), An Introduction To Plant Anatomy, McGraw Hill.
7. Esau, Katherine, (1965), Plant Anatomy, , John Wiley and Sons. Inc, New York.

8. Esau, Katherine, (1960), Anatomy of seed Plants. Wiley, New York.
9. Evert, Ray. F. (1960), Esau's Plant Anatomy. John Wiley & Sons.
10. Fahn, A. (1982), Plant Anatomy Vol I and Vol II Pergamon Press. Oxford New York.
11. Jane F.W (1934)-Aspects of the Study of Wood Anatomy. Science Reviews2000 Ltd.
12. J. Mauseth, James D. (1988) Plant Anatomy. Benjamin/Cummings.

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-305 : C02			COURSE TYPE: ECC/CB
COURSE TITLE: DEVELOPMENTAL BIOLOGY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of internal tissue system of plants and development of stem, root, flower and embryo.			
UNIT – 1	Archegoniatae : Comparative morphology and developmental anatomy of Hepaticae, Anthocerotae and Musci. Comparative anatomy of vegetative organs of Pteridophytes. Study of stem apex, leaf initiation and early leaf ontogeny in ferns. Development of long and short shoots. Origin and pattern of development of cortex, pith and procambium in conifers.		
UNIT – 2	Vascular Plants : Meristems; patterns of cell fate, determination and lineage in root and shoot. Leaf growth and differentiation. Secondary growth. Wood development and its diversity. Cambial variants. Ultrastructure and control of xylem and phloem differentiation. Secretory ducts and laticifers. Flower, seed and fruit anatomy. Patterns of evolution in seed. Anatomical adaptationsfor special habitates, biotic and abiotic stresses.		
UNIT – 3	Development of Flower : Transition to flowering-vegetative to reproductive evocation. Floral homeotic mutations in Arabidopsis, Antirrhinum and Petunia. Axis development in flower. Gender expression in monoecious and dioecious plants. Develpmental biology of male and female gametophytes: Regulation of anther and ovule development. Microsporogenesis and microgametogenesis. Megasoprogenesis and megagametogenesis. Male sterility- mechanism and applications. Pollen embryogenesis.		
UNIT – 4	Pollen-Pistil Interaction: In vivo and in vitro pollen germination. Pollen tube growth and guidance. Double fertilization. Self-compatibility mechanisms, incongruity.		
UNIT – 5	Embryogenesis and seed development: Polarity during embryogenesis, Pattern mutants. In vitro fertilization, Endosperm development, Apomixis, Polyembryony, Somatic embryogenesis.		

Suggested Readings:-

1. Bhatnagar S.P. and Moitra A.(2005) Gymnosperms, New Age Interactive(P) Ltd. Publishers, New Delhi.
2. Carlquist S.(2001). Comparative Wood Anatomy, Springer-Verlag, Germany.
3. Culter D.F.(1978). Applied Plant Anatomy, Longman, United Kingdom.
4. Howell S.H.(1998), Molecular Genetics of Plant development, Cambridge University Press.
5. Leyser O. and Day S.(2003), Mechanism of Plant Development, Blackwell Press.
6. Parihar N.S.(1993), An Introduction to Embryophyta: Vol. I- Bryophyta, Vol. II- Pteridophyta, Central Book Dept. Allahabad.
7. Raghavan V. (2000) Developmental Biology of Flowering Plants, Cambridge University Press.
8. Richards A.J.(1986), Plant Breeding System, George Allen and Unwin.
9. Shivanna K.R.(2003), Pollen biology and Biotechnology, Science Publishers.

M.Sc. BOTANY			Third Semester
COURSE CODE: MBT-305 : C03			COURSE TYPE: ECC/CB
COURSE TITLE: BIOSTATISTICS			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Biostatistics in Plant Sciences.			
UNIT – 1	Unit-1 Scope of Biostatistics, variables in biology, collection, classification, tabulation of data. Frequency distribution, Diagrammatic and graphical presentation of statistical data, Sampling techniques. Measures of central location and dispersion,Simple measure of skewness and Kurtosi, Probability, conditional probability.		
UNIT – 2	Unit-2 Binomial, Poisson and Normal Distribution Correlation and Regression, Least Square method of fitting, Standard error of estimate, Correlation and regression coefficient. Basic idea of significance testing, level of significance, students,'t'test, χ^2 (chi-square) test and F-test, Analysis of variance.		
UNIT – 3	Unit-3 Biological databases, EMBL, DDBJ, TAIR, KEGG, Swis-prot, Optimal Pairwise Alignment- Biological Sequences and the Exact String Matching Problem-Fast Alignments: Genome Comparisons and Database Searches		
UNIT – 4	Unit-4 Multiple Sequence Alignment-Sequence Profiles and Hidden Markov Models.- Gene Prediction-Phylogeny-Sequence Variation and Molecular Evolution		
UNIT – 5	Unit-5 Testing Evolutionary Hypotheses, In silico analysis of phylogeny, construction of phylogenetic tree, dendrogram, Computational phylogenetics, Construction of QTL mapping, Microarray data analysis.		

Suggested Readings:

1. Bernard, A. Rosner, 2006. Fundamentals of Biostatics. Thompson Publication. Canada.
2. Khan and Khanam. 2003. Fundamental of Biostatistics. Ukaaz Publications. Hyderabad.
3. Krawetz. 2003. Introduction to Bioinformatics: A theoretical and Practical Approach. Humana Press. USA.
4. Miguel and Rade. 2003. Bioinformatics and Genome. Horizon Scientific Press.Utah. USA.

LBT311: Based on papers MBT301, MBT302 and MBT303
LBT312: Based on papers MBT304 and MBT305

SEMESTER-IV

Course Code	Course Type	Course Title	Marks	Credits
MBT-401	CCC	PLANT BIOCHEMISTRY	100	6
MBT-402	CCC	PLANT PATHOLOGY	100	6
MBT-403	CCC	INSTRUMENTATION, MOLECULAR TECHNIQUES AND BIOINFORMATICS	100	6
MBT-404	SSC/PRJ	DISSERTATION	100	6
MBT-405 (ELECTIVE PAPER)	ECC/CB	D01 - ETHNOBOTANYAND CONSERVATION OF TRADITIONAL KNOWLEDGE	100	6
	ECC/CB	D02 - PLANT RESOURCE UTILIZATION AND CONSERVATION		
	ECC/CB	D03 -PLANT QUARANTINE		
LBT-411	CCC	Based on papers MBT401 and MBT402	50	4
LBT-412	CCC & ECC	Based on papers MBT403 and MBT405	50	4

M.Sc. BOTANY			FOURTH Semester
COURSE CODE: MBT-401 :			COURSE TYPE: CCC
COURSE TITLE: PLANT BIOCHEMISTRY			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Biochemical Compounds of Plants.			

UNIT – 1	Law of mass action, dissociation of water and its ion product (Kw), pH, ionization of weak acids and weak bases, the Henderson-Hasselbalch equation, physiological buffers. Biochemical energetics: General concept, laws of thermodynamics, entropy, enthalpy, free energy, redox potential, energy rich phosphorus compounds
UNIT – 2	Biosynthesis and degradation of carbohydrates in higher plants Structure of protein, Ramchandran plot Biosynthesis of fatty acids, ß oxidation of fatty acids, glyoxylate cycle
UNIT – 3	Enzymology: General aspects, prosthetic groups and coenzymes, mechanism of action, kinetics, Michaelis- Menton equation, factors affecting enzyme catalysis, enzyme inhibition, regulatory enzymes, isoenzymes, ribozymes
UNIT – 4	Biological Nitrogen Fixation: Nitrogenase enzyme, substrate for nitrogenase, reaction mechanism, strategies to exclude oxygen and need to control hydrogen evolution Inorganic nitrogen metabolism: Introduction, nitrate transport, nitrate and nitrite reductases, inhibitors, localization and regulation of nitrate and nitrite reductases, pathways of ammonia assimilation, regulation of nitrogen assimilation
UNIT – 5	Sulphur and phosphorus metabolism: Sulphate uptake, activation and transfer, assimilatory pathways of sulphate reduction, transport and assimilation of phosphate

Suggested readings:

1. Wilson, K. and Walker, J., 2000, Practical Biochemistry: principles & techniques. Cambridge University Press. ISBN 0521799651.

2. Buchanan, B., Gruissem, W., & Jones, R.L., 2002, Biochemistry and Molecular Biology of Plants. American Society of PlantBiologists, USA.

3. Watson, JD, Baker, TA, Bell, SP, Gann, A, Levine, M and Richard, L. 2008. Molecular Biology of the Gene. Pearson Education Inc.

4. Nelson, D .L. and Cox, M.M., 2008, Lehninger Principles of Biochemistry, W. H. Freeman & Co, New York, USA

5. Murray, R, Murray, RK, Bender, D, Gotham, KM, Kennelly, PJ, Rodwell, V and Weil, PA. 2012. Harper's Illustrated Biochemistry McGraw Hill

6. Wilhelm Gruissem, Russell L.Jones, 2000, Biochemistry and molecular biology of plants. American Society of Plant Physiologists,

7. .Berg, J.M., Tymoczko, J.L. & Stryer, L. 2011, Biochemistry, Freeman & Co., New York, USA.

8. Weil, J.H., 1990, General Biochemistry, Wiley Eastern Limited, New Age International Limited. New Delhi.

9. Lea P.J. and Leegood R.C., 1999, Plant Biochemistry & Molecular Biology, John Wiley & Sons, NewYork

M.Sc. BOTANY			Fourth Semester
COURSE CODE: MBT-402			COURSE TYPE: CCC
COURSE TITLE: **PLANT PATHOLOGY**			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of Plant diseases and their control.			
UNIT – 1	History of plant pathology, identification of symptoms and signs, observation of symptoms, isolation, growth and identification of causal agents, losses caused by plant diseases, basic procedure in diagnosis of plant diseases.		
UNIT – 2	Parasitism and pathogenecity, development of plant diseases, inoculations, penetration, infection, dissemination of pathogen, oxidative burst, PR proteins, SAR, phytoalexins, factors affecting distribution of disease.		
UNIT – 3	Pathogenesis, Chemical weapons of pathogens, microbial toxins, growth regulators and detoxification of antimicrobial molecules in disease development Pre-existing defense structures, pre-existing chemical defense, induced structural and biochemical defense.		
UNIT – 4	Nature and properties of pathogenic bacteria, viruses, mycoplasma and nematodes, symptoms, transmission, characterization. Study of plant disease caused by Bacteria, Viruses, Mycoplasma and Nematodes and their control		

	measures.
UNIT – 5	Study of fungal diseases, symptoms caused by fungi on plants, mechanisms of infection, penetration, colonization and their control measures. General account of some important fungal diseases of economically important crops of central India and their control measures.

Suggested Readings:

1. Aggrawal Ashok and Mehrotra R S. 2002. Plant Pathology. Tata Mcgraw Hill, 2nd edition. Mumbai.
2. Agrios George N. 2005. Plant Pathology, Academic Press, 5th Edition. UK.
3. Robert B. 2008. Plant Pathology: Techniques and Protocols (Methods in Molecular Biology), Humana Press. USA.
4. Gail L. Schumann and Cleora J. D'Arcy 2009. Essential Plant Pathology, 2nd Edition. American Phytopathological Society. USA.
5. Sharma P. 2006. Plant Pathology, Alpha Science International Ltd. New Delhi.
6. Trigiano Robert N. 2007. Plant Pathology Concepts and Laboratory Exercises. 2nd Edition, CRC Press. U.K

M.Sc. BOTANY			Fourth Semester
COURSE CODE: MBT-403			COURSE TYPE: CCC
COURSE TITLE: INSTRUMENTATION, MOLECULAR TECHNIQUES AND BIOINFORMATICS			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Modern techniques in Plant Science.			
UNIT – 1	**Microscopy:** Bright-field microscope, Dark-field, Phase-contrast, Differential interference contrast, Fluorescence, Transmission and scanning electron microscopy, confocal microscopy; Staining of different cells, cell organelles and tissues.		
UNIT – 2	**Chromatography:** Thin layer, ion exchange, gel filtration, affinity chromatography, GLC, HPLC. Spectroscopy: Beer-Lambert's law, molar extinction coefficient and calculation, Absorption spectrum, Colorimeter and UV-Vis Spectrophotometer, Nuclear Magnetic Resonance (NMR). ESI MS, MALDI-TOF Application of tracer techniques in biology, radioactive isotopes, autoradiography		
UNIT – 3	**Electrophoresis:** Polyacrylamide Gel Electrophoresis (PAGE), Agarose Gel Electrophoresis (AGE), native-Page, SDS-PAGE, Isoelectric focusing (IEF), 2D-		

	electrophoresis Isolation and purification of genomic and plasmid DNA, RNA and proteins Blotting Technique: Southern, Northern and Western blotting
UNIT – 4	**DNA Amplification:** PCR, RT-PCR, genome mapping and expression analysis, RFLP, RAPD, AFLP, *In situ* hybridization, FISH, EST, Microarray
UNIT – 5	Bioinformatics: Bioinformatics in genome sequencing and annotation; Databases - NCBI, EMBL, DDBJ, Genbank, Pubmed, Patent databases, TAIR, PDB, ATIDB. Online tools - BLAST, ORF finder, Primer3, protein motif and structure prediction tools.

Suggested Readings:

1. Becker, JM, Caldwell, GA & Zachgo, EA (1996). Biotechnology: A Laboratory Course, Academic Press, Inc, San Diego,California
2. Wilson, K, Walker, J (1997). Principles and Techniques of Biochemistry and Molecular Biology,
Cambridge University Press, Cambridge
3. Sambrook, J, Fritsch EF, Maiatis,T (2000). Molecular Cloning: A Laboratory Manual Cold Spring
Harbor Laboratory Press, New York
4. Primrose, SB (1994). Molecular Biotechnology, Blackwell Scientific Pub, Oxford.
5. Reece, RJ (2004). Analysis of Genes and Genomes, Wiley
6. Arthur, M. 2002. Introduction to Bioinformatics. Oxford University Press. New
Delhi.
7. Krawetz. 2003. Introduction to Bioinformatics: A theoretical and Practical Approach. Humana Press. USA.
8. Miguel and Rade. 2003. Bioinformatics and Genome. Horizon Scientific Press.Utah. USA.

MBT-404	SSC/PRJ	DISSERTATION	100	6

M.Sc. BOTANY			Fourth Semester
COURSE CODE: MBT-405 : D01			COURSE TYPE: ECC/CB
COURSE TITLE: ETHNOBOTANY AND CONSERVATION OF TRADITIONAL KNOWLEDGE			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Local Plants and Traditional Knowladge.			
UNIT – 1	Ethnobotany: Knowledge of culture and belief, Introduction and relevance in the modern context, documentation of Ethnobotanical wisdom		
UNIT – 2	The centres of Ethnobotanical studies in the world, Ethnobotanical Hot Spots, Scope of Ethnobotanical research in Chhattisgarh, Plants in magico-religious beliefs, social customs and beliefs		
UNIT – 3	Tribal societies of Chhattisgarh: origin, customs and beliefs		
UNIT – 4	Plants in Traditional medical practices, Ethnoveterinary medicines, Important ethnobotanical drugs of India, WHO and Ethno-directed drug discovery		
UNIT – 5	Conservation of Traditional Knowledge, IPR, Convention on Biodiversity, Conservation of Biodiversity, Conservation strategies, IUCN Red list categories		

Suggested Readings:

1.Brain K.R, and Turner T.D. 1976. The Practical evaluation of Phytopharmaceuticals. Bristol Wright-Scientehnica. Italy.

2.Chopra, R.N., Nayar S.L. and Chopara I.C. 1956. Glossary of Indian Medicinal plants. CSIR. New Delhi.

3.Das, A.P. and Pandey, A.K. 2007. Advances in Ethnobotany. Bishen Singh and Mahendra Pal Singh, Dehradun.

4. Jain and Mudgal. 1996. Dictionary of Ethnobotany. Deep Publication, Delhi.

5. Jain, S.K. 1990. Contributions of Indian Ethnobotany. Scientific publishers, Jodhpur.
6. Jain, S.K. 1995. Manual of Ethnobotany, Scientific Publishers, Jodhpur.
7.Kokate C. K., Purohit A. P. and Gokhale S. B. 2003. Pharmacognosy 22nd Edition, Nirali Prakashan. Pune.
8.Mukherjee P.K. 2002. Quality control of Herbal Drugs – An approach to Evaluation of Botanicals, Business Horizons, New Delhi, 1st Edition.
9.Trease G. E. and Evans, W. C. 2006. Pharmacognosy. 10th Edition, Williams and Wilkins, Baltimore. USA.

M.Sc. BOTANY			Fourth Semester
COURSE CODE: MBT-405 : D02			COURSE TYPE: ECC/CB
COURSE TITLE: **Plant Resource Utilization and Conservation**			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Microbes.			
UNIT – 1	General aspects on resource types: Renewable resources, non-renewable resources, Resource degradation, Resource conservation; Natural resources, biological resources, plants as natural resources		
UNIT – 2	Utilization of plant resources, Bio-control- soruces and advantages, Bio-control as agribusiness, Untapped potential plant resources, seaweeds as potential resources– food, fodder and biofertilizer; Plant resources used in cosmetics, aromatics and pharmaceuticals, fibres; forest as potential resources: vegetable oil yielding plants, bioenergy		
UNIT – 3	Biodiversity, Levels and types of biodiversity, uses of biodiversity, Distribution of biodiversity, Regional pattern of biodiversity, Hot spots of biodiversity, Threats to biodiversity – Habitat loss and fragmentation, Alien invasive species, disturbance and pollution, harvesting and overexploitaion.		
UNIT – 4	An overview of Indian biodiversity; Biogeographic regions (zone) of India; Hot spots of Indian biodiversity; Status of biodiversity conservation in India; Protected area network of India; The Biological Diversity Act 2002; Bio-prospecting – Biochemical resources from plants.		

UNIT – 5	Conservation of Biodiversity; IUCN red list categories, In situ conservation strategies – Protected areas, Biosphere reserves; Ex-situ conservation strategies – Restoration of endangered species, Sustainable use and public participation; International efforts for conserving biodiversity

Suggested Readings:

1. Chandel K. P. S. Shukla G. and Sharma Neelam.1996. .Biodiversity in Medicinal and Aromatic Plants in India – Conservation and Utilization, Indian Bureau of Plant Genetic Resources, New Delhi,
2. Kaufman Peter B. et al. 1999. Natural Products from Plants, CRC Press. UK.
3. Primack R.B. 2000. A Primer of Conservation Biology, Sinauer Asso. Publ., Massachusetts. USA.
4. Sahoo S. 2002. Plant Resource Utilization. Allied Publishers. Nagpur.
5. Singh J.S. Singh S.P. and Gupta S.R., 2006, Ecology, Environment and Resource Conservation, S. Chand Publication, New Delhi,
6. Trivedi P.C. and Sharma N. 2010. Plant Resource Utilization and Conservation, Pointer Publishers. Jaipur.

M.Sc. BOTANY			Fourth Semester
COURSE CODE: MBT-405 : D03			COURSE TYPE: ECC/CB
COURSE TITLE: **PLANT QUARANTINE**			
CREDIT: 8		HOURSE: 135	
THEORY: 6	PRACTICAL: 2	THEORY: 90	PRACTICAL: 45
MARKS			
THEORY: 100 (30+70)		PRACTICAL: 25	
OBJECTIVES: This course is aimed towords generating fundamental knowledge, concepts and dimensions of importance and applications of Rules of Plant Quarentine.			
UNIT – 1	Definition of pest, pesticides and transgenics as per Govt. notification; relative importance; Quarantine – domestic and International Quarantine restrictions in the movement of agricultural produce, seeds and planting materials.		
UNIT – 2	Case histories of exotic pests/diseases and their status. Plant protection organization in India. Acts related to registration of pesticides and transgenics.		
UNIT – 3	History of quarantine legislation, PQ Order 2003. Environmental acts, Industrial registration; APEDA, Import and Export of bio-control agents.		
UNIT – 4	Identification of pest/disease free areas; contamination of food with toxigens, microorganisms and their elimination; Symptomatic diagnosis and their techniques to detect pest/pathogen infestation; VHT and other safer techniques of disinfestation/ salvaging of infected material.		
UNIT – 5	WTO regulations; non-tariff barriers; Pest risk analysis, good laboratory practices for pesticide laboratories; Pesticide industry; Sanitary and Phytosanitary measures.		

Suggested Readings:

1 Rajeev K & Mukherjee RC.1996.Role of Plant Quarantine in IPM. Aditya Books.

2 Rhower GG. 1991. Regulatory Plant Pest Management. In; Hand book of Pest Management in Agriculture. 2nd Ed. Vol. II (Ed. David Pimental). CRC Press.

LBT411: Based on papers MBT401 and MBT402
LBT412: Based on papers MBT403 and MBT405