SEMESTER – II			
ELECTIVE – II RURAL BIOTECHNOLOGY			
17PMIE21	**Hrs/ Week: 6**	**Hrs/ Sem: 4**	**Credit: 4**

Objectives:

- To impart knowledge on various biotechnological commercial processes and its usefulness.
- To provide hands on exposure to various biotechnological commercial processes such as biogas production, composting methods, mushroom production, spirulina cultivation and ornamental fish cultivation.

Unit-I: Biogas technology.

Introduction and binary – anaerobic digestion – microbes involved – factors influencing methane – production – stages of methane generation – waste used in methanogensis – various bioreactors used for methane generation – advantages and disadvantages. Visit in biogas production units with field demonstration.

Unit-II: Composting technology.

Historical background – waste availability- factors influencing – methods – biomaturity – encrichments of compost and crop productivity. Vermiculture technologies: History – species – life cycles – methods – different types of waste suitable for vermicomposting. Utilization of vermicompost for crop production. Visit to vermicompost industries with field demonstration.

Unit-III: Mushroom technology.

Bioconversion of organic wastes into protein – oyster mushroom technology, paddy mushroom, milky mushroom and button mushroom technology, post harvest technology. Mushroom farming and prospects. Visit to mushroom farms with field demonstration.

Unit- IV:*Spirulina* cultivation technology.

Biology of *spirulina* – cultivated methods, post harvest technology and single cell protein formulation. Visit to *Spirulina* industries with field demonstration.

Unit-V: Ornamental fish culture.

Present status and importance- popular varieties – artificial and live feeds – breeding techniques of egg layers- gold fish, angel fish, fighter and barbs – live bearers – guppy, molly, platy and sword tail – economics . Visit to ornamental fish farms with field demonstration.

Text books:

1) Vonshak, A.2004. Spirulina plantensis – physiology, cell biology and biotechnology. Taylor and frencis, London.
2) Kawl, T.N. 1999. Introduction to mushroom science, oxford and IBM co., Pvt. Ltd., New Delhi.
3) Philip G. Miles, Shu- ting chang, 1997. Mushroom biology , world scientific, Singapore.
4) Bahl, N .1988. Hand book on mushroom. Oxford and IBH publishing Co.,Pvt Ltd., New Delhi.
5) Tripati. G. 2003. Vermiresources technology, 1st Ed., Discovering Publication House, New Delhi.
6) Gaur, A.C., 1999. Microbial technology for composting of Agricultural Residues by Improved Methods, 1st Print, ICAR, New Delhi.
7) Subba Rao, N.S., 1999. Soil Microbiology, 4th Ed, oxford IBH publishing Co. Pvt. Ltd., New Delhi.
8) Chawla O.P. 1986. Advances in Biogas Technology, ICAR, New Delhi.
9) Martin Alexander 1976. Introduction to soil Microbiology, Wiley eastern Ltd., New Delhi.
10) Anita Saxena, 2003. Aquarium management Daya Pub. House , New Delhi.
11) Srivastava, C.B.I., 2002. Aquarium fish keeping. Kitab Mahal, Allahabad.

References:

1. Kumar , H.D., 1991. A textbook on Biotechnology , II Edition , East- west press Pvt Ltd., New Delhi.
2. Chatwal, G.R., 1995. Textbook of Biotechnology, Anmol Publications Pvt. Ltd., New Delhi.
3. Jarsa , O.P., 2002 . Environmental Biochemistry, I Ed., Sarup& Sons, New Delhi, India.

SEMESTER – II			
ELECTIVE – II VERMI TECHNOLOGY			
17PMIE21	**Hrs/ Week: 6**	**Hrs/ Sem: 4**	**Credit: 4**

OBJECTIVES:

To impart advanced level knowledge in vermicomposting

UNIT-I:

Earth worm classification – Morphology and anatomy. Biology of *Lampitomaruitii.* Vermicomposting - Definition, introduction and scope- The nature of earthworms-soil environment-basic environmental requirements.

UNIT-II:

Vermicomposting materials and their classification. Physical, chemical and biological changes brought by earth worm in soil structure-carbon,nitrogen and phosphorous transformations

UNIT-III:

Veermicomposting methods - Optimal conditions for Vermiculture - temperature, moisture, pH, soil type, organic matter,

UNIT-IV:

Vermicomposting in Homes, Maintenance of vermicomposting beds. Harvesting the worms. Earth worm predators, parasites and pathogens. - Vermi wash.

UNIT-V:

Composting - Vermicomposting - Required conditions - Advantages - Application of vermicomposting, Field sampling- passive methods.

REFERENCES:

1. Edwards, C.A. and Bohlen, P.J. 1996, Ecology of earthworms-3rd Edition, Chapman and hall.

2. Jsmail, S.A., 1970, Vermicology. The biology of earthworms. Orient Longman, London.

3. Lee, K.E., 1985. Earthworms - Their ecology and relationship with soil and land use, Academic Press, Sydney.

4. Ranganathan L.S. 2006. Vermibiotechnology from soil health to human health. Agrobios India.

5. Gupta P.K. 2008. Vermicomposting for sustainable agriculture. Agrobios. India.

SEMESTER – II			
ELECTIVE – II MUSHROOM TECHNOLOGY			
17PMIE21	**Hrs/ Week: 6**	**Hrs/ Sem: 4**	**Credit: 4**

UNIT I:

Mushroom Technology - Introduction, History and Scope –Morphology of mushroom -Vegetative characters - Formation and development of Basidiocarp, structure of basidiocarp - *Agaricus*.Edible and Poisonous Mushrooms.Medicinal and nutritive value of edible mushrooms.Food preparation- soup, cutlet, vegetable curry, samosa, omlette and pickle. Mushroom research centres in India.

UNIT II:

Cultivation of button mushroom (*Agaricusbisporus*), milky mushroom (*Calocybeindica*), oyster mushroom (*Pleurotussajor-caju*) and paddy straw mushroom (*Volvariellavolvcea*).Preparation of Pure Culture and spawn cultivation methods.

UNIT III:

Cultivation technology - Substrates, bed, polythene bag preparation, spawning - casing - Cropping - Mushroom production - Harvest - Storage methods and marketing. Post harvest technology: Storage-Freezing, dry Freezing, drying, canning,.

UNIT IV:

Structure and construction of Mushroom House- Layout of traditional and green house method. Methods of Mushroom cultivation: Bed Method, Polythene Bag Method. Methods of Composting-Long method of composting (LMC) & Short method of composting (SMC).

UNIT V:

Diseases: Common pest, microbes (Bacteria, Fungus and Virus). Diseases of Mushrooms: Brown black disease,yellowing of oyster mushrooms,Bacterial soft rot, fungal brown blotch, wet bubble,dry bubble, cob web, green blotch. Principles of insect pest control: Principles and methods of pest management -chemical control.