III SEMESTER
HARD CORE COURSES

BSH551BIOTECHNOLOGY

52hrs

Course Outcomes:

After successful completion of the course, students will be able to:

CO 1. Understand how organisms and biological processes are used in biotechnology.
CO 2. Gain in-depth knowledge of useful microorganism,bioreactors and fermentationtechnologies.
CO 3. Learn about production of bioplastics, biofertilizers andbiopesticides.
CO 4. Learn about the application of plant tissueculture and production of various hybridplants.
CO 5. Become familiar with animal cell culture, production of transgenicanimals and assisted reproductive techniques
CO 6. Understand rDNA technology, principles and applications of PCR, RT-PCR and DNAfingerprinting.

UNIT I (13 hrs)

Aims and scope of biotechnology, basic concepts of biotechnology, traditional and modern biotechnology. Microbial Biotechnology: Fermentation techniques: Fermenters and bioreactors. Batch, submerged (SmF), solid substrate (SSF) and continuous fermentation. Fermented foods, oriental foods, silage, probiotics, single cell proteins, production of hormones and growth factors. Microbial polysaccharides, bioplastics, cell immobilization and its applications. Biopesticides (fungi, bacteria and viruses). Biofertilizers, plant-growth promoting microorganisms, biocontrol agents and bioprotectants. Transgenic microbes and theirapplications.

UNIT II (13hrs)

Plant Biotechnology: Plant tissue culture laboratory and aseptic techniques, culture media, callus induction, organogenesis, somatic embryogenesis, micropropagation, production of secondary metabolites, selective markers, somaclonal variation, synthetic seeds and cryopreservation. Haploid production: pollen, anther and ovule cultures. Cell suspension culture, protoplast culture, protoplast fusion and hybridoma technology. Transgenic plants, production of disease-, salinity-, pest-, herbicide-, drought-resistant and high yielding varieties of plants. Production of improved varieties using Ti plasmids. Application of rhizobia and mycorrhizas in plant tissue culture. Plant-derived vaccines andantibodies.

UNIT III (13 hrs)

Animal Biotechnology: Animal cell culture techniques, culture media, primary and secondary cell cultures, cell lines and cell strains and growth factors. Stem cells, gene expression in cell culture, organ culture, histotypic culture; Natural and synthetic cell culture media composition; cytotoxicity and cell viability assays; Transgenic animals and their uses. Animals as bioreactors. Assisted Reproductive Techniques: *In-vitro* fertilization, embryo transfer, super ovulation and cloning.

UNIT IV (13 hrs)

Molecular Biotechnology: Gene manipulation, restriction enzymes, DNA insertion through vectors, clone selection and expression of cloned genes. Expression systems and their applications: Escherichia coli, Streptomyces, yeast, baculovirus and animal cells as cloning

hosts. Analysis of DNA-DNA sequences, mutagenesis and gene expression, DNA extraction methods and amplification using PCR and RT PCR techniques; DNA fingerprinting. Overview of next generation sequencing and digital PCR highlights.

References:

1. Moo-Young, M. (2011) Comprehensive Biotechnology, Vol. 1, 2, 3 & 4, PergamonPress
2. Cruger, W.&Cruger, A. (1990) A textbook ofIndustrial Biotechnology
3. Glazer, A. G. (1994) Microbial Biotechnology, WH Freeman andCo.
4. Peppler, H. J. (1979) Microbial Technology., Vol. 1 &2, Academic Press
5. Bajaj, Y. P. S.(2007) Biotechnology in Agriculture and Forestry, Springer VerlagPubl.
6. Russell, G. E. (1988)Biotechnology of Higher Plants, Intercept Publ.
7. Reinert J., Yeoman, M. M. (1982)Plant Cell and Tissue Culture. A Lab manual. NarosaPubl.
8. Mantell, S. H. and Smith H. (1983) Plant Biotechnology. Cambridge Univ.Press.
9. Houdebine, L.-M. (2003) Animal Transgenesis and Cloning by John Wiley &Sons.
10. Butler, M.(2004) Animal Cell Culture and Technology, BIOS ScientificPublishers.
11. Davis, J. M. (2002) Basic Cell Culture: A Practical Approach (Practical Approach Series), Oxford university press, Oxford