Name of the Program: M.Sc. Marine Microbiology
Course Code: MMI-606
Title of the Course: Genetic Engineering
Number of credits: 03
Effective from AY: 2022 - 23

Prerequisites for the course:	Students should have undergone M.Sc. Marine Microbiology/Marine Biotechnology Part I Courses.	
Objective:	This course aims to introduce the tools and techniques in molecular cloning, DNA editing and protein expression in wide variety of hosts and their applications in genetic engineering.	
Content:	**Module I** Introduction to genetic engineering. Tools and techniques involved in genetic manipulation – I: restriction endonucleases, exonucleases, DNA ligases, terminal DNA transferase, DNA polymerases, reverse transcriptase, T4 polynucleotide kinases, alkaline phosphatase, S-1 nuclease, mung bean nuclease, RNases. Gene cloning systems/Hosts: Gene cloning in *E. coli* and other organisms such as *Bacillus subtilis*, *Saccharomyces cerevisiae*. Retroviruses and retroposons. **Module II** Tools and techniques involved in genetic manipulation – II: Expression vectors – Prokaryotic (pET, pGEX-2T). Characteristics of expression vectors – strong bacterial and viral promoters (lac, trp, tac, SV 40, T7, T3) for induction of gene expression. Cloning vectors – plasmid (pUC19, pBR 322), λ phage-based vectors (M-13, 2µ plasmid), cosmid vectors, phasmid vectors, shuttle vectors, high capacity cloning vectors (BAC and YACs), Ti plasmid. Construction of cDNA, cloning, its expression and techniques – transformation, electroporation, transfection, gene gun. Other recombinant DNA techniques – use of radioactive and non- radioactive nucleotides for DNA probe preparation and detection of hybrids, restriction mapping, RFLP, PCR, RT-PCR, Real time PCR. Microarray. DNA sequencing methods. Chromosome walking. CRISPR-Cas. **Module III** Application of genetic engineering in diagnostics, agriculture, medicine, pharmaceuticals, industries and allied areas. Genetically modified foods/crops, recombinant drugs, vaccines, interferons and hormones. Recombinant proteins and drugs, enzymes, biomolecules and fermentation products, bioremediation and	15 hrs. 15 hrs. 15 hrs.

	biomonitoring (biosensors) of toxic environmental pollutants. Ethics in genetic engineering.	
Pedagogy:	Lectures/assignments/self-study.	
References/Readings:	1. Old, R. W., & Primrose, S. B. (1980). *Principles of gene manipulation: An introduction to genetic engineering.* University of California Press. 2. Glick, B. R., Pasternak, J. J., & Patten, C. L. (1994). *Molecular biotechnology: Principles and applications of recombinant DNA*. ASM Press. 3. Brown, T. A. (2010). *Gene cloning & DNA analysis*. Wiley-Blackwell. 4. Glover, D. M. (1984*). Gene cloning: The mechanics of DNA manipulation.* Springer-Science+Business Media. 5. Green, M. R., & Sambrook, J. (2001). *Molecular cloning: A laboratory manual*. New York: Cold Spring Harbor Laboratory. 6. Davis, L. G., Dibner, M. D., & Battey, J. F. (1986). *Basic methods in molecular biology*. Elsevier.	
Course Outcomes:	1. Understand and analyze the techniques involved in gene manipulation and molecular cloning. 2. Recognize **t**he applications of genetic engineering in agriculture, medicine, pharmaceuticals and allied areas. 3. Understand and apply the knowledge of genetic engineering in developing industrially important microbial products. 4. Use the principles of genetic manipulations for addressing bioremediation and biomonitoring. 5. Practice the basis of ethics involved in genetic engineering.	