

Name of the Programme: M.Sc. Biotechnology

Course Code: GBT-606

Title of the Course: SYNTHETIC BIOLOGY

Number of Credits: 2

Effective from AY: 2022-23

Pre-requisites for the Course:	None	
Course Objectives:	The objective of the course is to <ol style="list-style-type: none">1. redesign organisms for useful purposes by engineering them to have new abilities.2. harness the power of nature to solve problems in medicine, manufacturing and agriculture.	
Content:	<p style="text-align: center;"><u>MODULE I</u></p> <ul style="list-style-type: none">● Synthetic biology: Introduction, History, Top down and Bottom up approach.● Enabling technologies<ol style="list-style-type: none">1. Emerging tools for DNA synthesis: artificial DNA synthesis, synthetic genomics.2. Genome modularity concepts: Biobricks, Assembly method: 3 Antibiotic (3A) Assembly, Amplified Insert Assembly, Gibson Scarless Assembly, Methylase-assisted (4R/2M) AssemblyGolden gate cloning3. Synthetic biological circuits: oscillators, bistable switches, logical operators, analog tuners4. Circuit design5. Modeling6. Microfluidics7. Synthetic transcription factors	<p style="text-align: center;">No. of hours</p> <p style="text-align: center;">15</p>
	<p style="text-align: center;"><u>MODULE II</u></p> <ul style="list-style-type: none">● Genome editing: CRISPR technologies, gene	15

	<p>therapy, synthetic immunology</p> <ul style="list-style-type: none"> ● Artificial cells, Synthetic genomics, Mycoplasma laboratory, Protocell ● Computational method for protein engineering, pathway engineering, circuit designs using biological parts for creating synthetic biological constructs and strain design ● Xenobiology using nucleic acid analogues, xenonucleic acids, unnatural base pairs and expanded genetic code ● Applications of synthetic biology in biosensors, biological computers, organoids, bio-printed organs, space explorations. ● Ethics on creation of life and ethical support for synthetic biology 	
Pedagogy:	Lectures, tutorials, assignments	
References/ Readings:	<ol style="list-style-type: none"> 1. M. M. Andrea, Introduction to Synthetic Biology, Springer Verlag, 2018. 2. M. W. Covert, Fundamentals of Systems Biology From Synthetic Circuits To Whole-Cell Models Taylor & Francis, 2018. 3. J. A. Davies, Synthetic Biology: A Very Short Introduction, Oxford, 2018. 4. G. E. Kaebnick, T. H. Murray , A. Lustig and J. Boldt, Synthetic Biology and Morality Artificial Life and the Bounds of Nature MIT Press Ltd, 2013. 5. M. A. Marchisio, Computational Methods in Synthetic Biology Springer, 2021. 6. V. Singh and P.K. Dhar, Systems and Synthetic Biology, Springer, 2015. 	
Course Outcomes:	<p>The students will be able to</p> <ol style="list-style-type: none"> 1. apply the concepts of synthetic biology for the design of biological systems. 2. understand how the limits of existing technology be overcome by DNA synthesis technology 3. identify the biological problems that have limitations for industrial use and to analyze how synthetic biology can be applied as a solution. 4. Apply the concepts in creating various applications 	