METABOLIC ENGINEERING

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PRE-REQUISITES : Basics of Microbiology, Biochemistry, Genetics
INTENDED AUDIENCE : B Tech (Biotechnology/Bioengineering); B Sc. (Microbiology, Biotechnology,Botany); M Sc. (Biotechnology / Life Sciences)

COURSE OUTLINE :
Metabolic engineering is an emerging field of biotechnology/bioprocess engineering which aims towards purposeful modification of cellular (metabolic, gene regulatory, and signalling) processes/networks to achieve desirable goals such as enhanced production of metabolites including pharmaceuticals, biofuels and biochemicals and other biotechnology products. This course aims to provide fundamental and advanced knowledge in the development of microbial strain for bio production through metabolic engineering.

ABOUT INSTRUCTOR :
Prof. Pinaki Sar, Professor, Department of Biotechnology IIT Kharagpur has been engaged in teaching and research on Microbiology and related biotechnology aspects for the past 18 years. His major area of interest lies in the exploration of microbial communities and their catabolic repertoire; and application in environmental sustainability. He uses genomics and metagenomics approaches to understand community/species function. He has been engaged in teaching the subject Metabolic Engineering for over 10 years to the undergraduate (B Tech. Biotechnology and Biochemical Engineering) students of IIT Kharagpur.

Prof. Amit Ghosh received his Ph.D. from IISc Bangalore and thereafter did his postdoctoral research for seven years in Metabolic Engineering from Lawrence Berkeley National Laboratory (LBNL) and University of Illinois at Urbana Champaign (UIUC), USA. He has been engaged in research on metabolic engineering, systems and synthetic biology for the last 12 years. He got involved in teaching subjects: Metabolic Engineering, Metabolic Systems Biology to UG & PG students of IIT Kharagpur for the last 4 years.

COURSE PLAN :

Week 1: Introduction to Metabolic Engineering, Basic concepts; Scopes and Applications; Metabolism overview _1 (Cellular Transport processes, Fueling Reactions)

Week 2: Cellular Metabolism Overview_2 (Biosynthetic reactions, Polymerization, Growth Energetics); Regulation of Metabolic Pathways

Week 3: Reconstruction of Genome-scale metabolic network

Week 4: Examples of pathway manipulations by metabolic engineering : Ethanol, Aminoacids, antibiotics, vitamines, biopolymers, etc.

Week 5: Examples of pathway manipulations by metabolic engineering : Improvements of cellular properties, Biodegradation

Week 6: Metabolic Flux Analysis: Flux Balance Analysis (FBA), Flux Variability Analysis, Flux Map

Week 7: Experimental determination of Metabolic Fluxes: Isotope labeled substrate, Isotope mapping Mapping Matrix, Isotope Distribution Vector

Week 8: Application of metabolic Flux Analysis