**IV Year B.Tech. Bioinformatics  II - Semester**    **L   T   P   To   C**

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## BI 406 METABOLIC ENGINEERING (ELECTIVE - V)

**Course Description and Objectives :**

*This course deals with the basic and applications of metabolic engineering. This course helps the student for understanding purposeful modification of metabolic pathways to achieve desired goals such as enhanced production of metabolites, creation of novel metabolites and utilization of new carbon substrates*

**UNIT I : Introduction & Applications of Metabolic Engineering :**

Identification of metabolic regulation is a key point in metabolic engineering. Basic concepts of Metabolic Engineering – Overview of cellular metabolism – Different models for cellular reactions, induction – Jacob Monod model and its regulation, Differential regulation by isoenzymes, Feed back regulation. Application in pharmaceuticals, chemical bioprocess, food technology, agriculture, environmental bioremediation and biomass conversion.

**UNIT II : Synthesis of Primary & Secondary Metabolities :**

Amino acid synthesis pathways and its regulation at enzyme level and whole cell level, Alteration of feed back regulation, Limiting accumulation of endproducts. Regulation of secondary metabolite pathways, precursor effects, prophase, idiophase relationship, Catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites, applications of secondary metabolites.

**UNIT III : Bioconversions & Regulation of Enzyme Production :**

Applications of Bioconversions, Factors affecting bioconversions, Specificity, Yields, Co metabolism, Product inhibition, mixed or sequential bioconversions, Conversion of insoluble substances. Strain selection, Genetic improvement of strains, Gene dosage, metabolic pathway manipulations to improve fermentation, Feed back repression, Catabolite Repression, optimization and control of metabolic activities. The modification of existing - or the introduction of entirely new - metabolic pathways.

**UNIT IV : Metabolic Flux :**

Integration of anabolism and catabolism, metabolic flux distribution analysisbioprocess, material balance, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, Metabolic flux analysis and its applications, Thermodynamics of cellular processes.

**UNIT V : Metabolic Engineering with Bioinformatoics :**

Metabolic pathway modeling, Analysis of metabolic control and the structure metabolic networks, Metabolic pathway synthesis algorithms.

**TEXT BOOKS:**

1. Stanbury P.F., and Whitaker A., Principles of Fermentation Technology, Pergamon Press, 1984 - ELSEVIER, 2nd Edition, 2008.

2. Zubay G., Biochemistry, Macmillan Publishers, 1989 - 3rd Edition, WMC Brown Publisher, 1990.

**REFERENCE BOOKS:**

1. Metabolic engineering principles and methodologies-Gregory N.Stephanopoulos, Aristos et al-Elsevier, First Edition, 2006.

2. http://ocw.osaka-u.ac.jp/contents/19/ME040512.pdf

3. http://ocw.osaka-u.ac.jp/contents/19/ME040421.pdf

4. http://ocw.osaka-u.ac.jp/contents/19/ME040526.pdf

5. http://ocw.osaka-u.ac.jp/contents/19/ME040602.pdf