GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VII

METALLURGY ENGINEERING

Subject Name: **Process Modeling (Department Elective-I)**
Subject Code: **172105**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
3	1	0	4	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	Introduction and scope of the subject, Basic principles and classification, General modeling of processes involving phase transformation e.g. solidification and heat treatment, deformation e.g. extrusion, forging etc. and joining welding etc.	8
2.	Physical modeling and Simulation - cold and hot models, Physical simulation, Similarity criteria, Transport and reaction simulation, Dimensional analysis, Case studies of water models	8
3.	Mathematical modeling, Advantages and limitations, Process control, Instrumentation and data acquisition systems.	8
4.	Review of transport phenomena, differential equations and numerical methods, Concept of physical domain and computational domain, Assumptions and limitations in numerical solutions, Introduction to FEM and CFD.	10
5.	Introduction to software packages like MATLAB, ANSYS etc, Useful websites and generic information about different products, Introduction to expert systems and artificial intelligence, Demonstration/practical training in some software packages, Use of computers for the construction of phase diagrams, phase transformations and thermo-chemical calculations.	10
6.	Modeling of Metallurgical processes: Solidification / heat transfer, Liquid metal treatment, Vacuum degassing, Continuous casting, Sand mold casting, Blast furnace, LD process, and Case studies from literature pertaining to modeling of metal forming and joining processes.	10

Text Books:

1. Rate Phenomena in Process Metallurgy- J. Szekely and N.J. Themelis, Wiley Publication.
2. Computer Simulation of Flow and Heat Transfer - P.S. Ghosh Dastidar, Tata McGraw Hill.

References Books:

1. Proc of the conference on Mathematical process models in Iron & Steel Making, (1975) London, The metals Society.
2. Proc. of Conf. on: Application of Mathematical and Physical models in the iron & steel industry (1982) , USA, ISS-AIME.
3. Proc. of Conf. on: Mathematical models for metals and materials (1987), Suffon Coldfield, UK, The Inst. of Metals.
4. Ed. J. Szekely et. al (1987), Mathematical modeling of materials processing operation, Warrandale, AIME.