Name of Proposer:	Chinmay Ghoroi
Email	chinmayg@iitgn.ac.in
Proposed Areas of research for PhD candidates:	1. Reactions among particulate solids: In spite of importance of solid-solid reactions in many materials, chemical and metallurgical process industries, the mechanisms and kinetics that govern this class of reactions is not well understood. The reactions among several oxides in the formation of cement clinker in the rotary kiln are a prime example of the genre. The mechanistic aspects of these reactions play an important role in determining energy efficiency, composition and nature of the phases that are formed inside the reactor. A particular lacuna concerns the interplay of diffusion and intrinsic kinetics in multiple reactions occurring in series. Recently we have formulated a model for reactions in series among solid phases. The model shows that depending on the relative rates of the processes involved, there exist one or two moving fronts in the reacting particle. The model is shown to reduce to the well known single reaction models at the appropriate limits and validated using the data obtained on the calcia-alumina system (in a static furnace). Reaction model developed so far have few assumptions like uniformity of the particle size and contacts. We are interested to introduce the effect of particle size, contacts and initial mole ratio of reacting particles into the particle level reaction model. Proposed research will be focused on the inclusion of these parameters in the model and validation of the developed model into any solid phase reaction system. 2. Flow improvement of cohesive pharmaceutical powders In general larger the particles, better is the flow of powder. As particle size falls under 100 microns, powder becomes more cohesive and fine particle smaller than 30 microns is generic industrial problem. It is well established that fine powders are not able to flow easily due to very strong inter-particle forces namely the van der Waals, capillary and electrostatic forces. As Active Pharmaceutical Ingredient (API) or pharmaceutical drug particles are normally smaller than 100 microns, they are mostly cohesive powders and gives rise to poor flowability, low bulk density and increased electrostatic tendency. These typical characteristics affect the powder flow through different processing equipments in pharmaceutical operation and creates problem in blending, die-filling, tableting etc. This leads to non-uniformity of drug content in the final solid dosage form (tablets, capsules etc.) and causes significant loss of revenue. In spite of their enormous relevance in pharmaceutical industry, extensive study on cohesive powders and improving their flow properties begin only in the recent past. Surface modification or dry powder coating is an efficient technique to prepare engineered particles having desired properties. It helps to reduce the cohesive force among very fine powders and improve their flowability, fluidizability, compactability by creating nano-scale asperities on the surface of drug particles. But technology is still in research lab. Any effort to take the technology to manufacturing industry is a considerable contribution to the pharmaceutical

	industry including other powder handling industries. The objective of this research work is to design and develop an innovative continuous device for surface modification of API and characterize the powder flow properties. Study is also intended for establishing proper correlation between particle scale and bulk scale properties and proposing a predictive tool for powder property from particle characteristics.
Required qualification of applicants	Prospective students having Masters in Chemical Engineering or equivalent with good GATE score are encouraged to apply for the same. Both the projects will have modeling and experimental work. Motivated students having strong programming skill and keen interest to perform finest experiments are most desirable.

Name of Proposer:	Sameer Dalvi
Email	sameervd@iitgn.ac.in
Proposed Areas of research for PhD candidates:	My research work focuses on precipitation and stabilization of nanoparticles in aqueous suspensions mainly for the pharmaceutical applications. The newly developed, “Precipitation by Pressure Reduction of Gas-Expanded Liquids (PPRGEL)” process, will be used for precipitation of ultrafine particles. The process uses subcritical CO_2 and obviates the requirements of high pressure pumps, specially designed nozzles and accurate control of process parameters (which are generally needed for processes which use supercritical CO2). Thus, the PPRGEL process is a promising candidate for an easy scale-up to a commercial manufacturing level process Aqueous suspensions of nanoparticles can be used in a wide spectrum of products for medical and pharmaceutical applications and also in novel diagnostic tools and targeted therapeutics.
Required qualification of applicants	A candidate should hold a Master’s degree in Chemical Engineering/Pharmacy/Material Science. However, bright and motivated candidates with Bachelor’s degree in the same area with good GATE score can also apply. It will be an added advantage if candidate posses programming skills in Matlab/C/C++. However, it is not a MUST. Good communication skills in terms of speaking and technical writing are desirable.

Name of Proposer:	Mukta Tripathy
Email	tripathy@iitgn.ac.in
Proposed Areas of research for PhD candidates:	1) Determining the conditions for thermodynamic stability of Pickering emulsions, using statistical mechanics. The work will be theoretical and involve both paper-and-pencil analysis, as well as computational solutions to integral equations. 2) Miscibility of nanotubes and nanosheets in polymeric media. We will be using mostly liquid state theory approaches to solve this problem."
Required qualification of applicants	MSc in Physics or B. Tech/M. Tech in Chemical Engineering with good GATE/CSIR score. An interest in theoretical work. Some programming experience would be preferred.

Name of Proposer:	Supreet Saini
Email	saini@iitgn.ac.in
Proposed Areas of research for PhD candidates:	1. Impact of Inter-specie communication among bacteria on the gene expression profiles in the human gut. 2. Engineering bacterial species for organophosphate and metal ions remediation from groundwater. (Expectations, for both projects: basic understanding of fundamentals of biology, DNA Cloning techniques - typically these candidates might not have had exposure to mathematics after 10th, wondering if we can make an exception for an exceptional candidate, if any)"
Required qualification of applicants	"MSc/BTech/MTech or equivalent" in: 1. Microbiology 2. Biotechnology 3. Zoology 4. Chemical Engineering

Name of Proposer:	Suchira Sen
Email	suchira@iitgn.ac.in
Proposed Areas of research for PhD candidates:	Project area: Structure-property studies of polymer nanocomposites using molecular simulations. Required: Programming proficiency in Fortran and/or C. Parallel programing experience a plus. Programming in Unix environment preferred. Good numerical computation experience such as solving systems of ODE, PDEs. Preferred course background: Exposure to soft materials, polymer physics, statistical mechanics, molecular modeling, algorithm development.
Required qualification of applicants	MTech in Chemical Engineering, Mechanical Engineering, Materials Science with good GATE/CSIR score.

Name of Proposer:	Nitin Padhiyar
Email	nitin@iitgn.ac.in
Proposed Areas of research for PhD candidates:	Ph.D. Topic: Kinetic study, process modeling and control strategies for wheat straw pulping process using caustic soda DESCRIPTION: Wheat straw is a cheap source of fiber used for manufacturing pulp suitable for making paper in India. Usually caustic soda is used for delignification process in a continuous horizontal pulp digester called Pandiya Digester. This work will include delignification kinetic study using caustic soda. The kinetic model will be utilized in process model of a batch/continuous pulp digester. Off-line control strategies will then be attempted for maximizing delignification and minimizing batch time for the digestion process using simulations as well as experiments. The

	research scholar may have to visit industry and/or a research laboratory for collecting kinetic/process data.
Required qualification of applicants	BTech/MTech in Chemical Engineering with good GATE/CSIR score. The candidate should have strong willingness to carry out experimental work and willingness to attempt simulation work.