

The University of Queensland - IIT Delhi Academy of Research (UQIDAR)

Joint PhD Project Proposal Template

1. Project details

Project title

Project ID

2. Supervision team

Please visit the IITD website www.iitd.ac.in and UQ website <http://researchers.uq.edu.au/> to highlight potential collaborators that would be best suited for the proposed project. Complete where possible – advise if you’d like assistance establishing contacts.

	University of Queensland	IIT Delhi	External/Industry (if applicable)
Supervisor name and title	<i>Dr Sangeeta Prakash & Professor Bhesh Bhandari</i>	<i>Asst Professor Jatindra Kumar Sahu & Professor S.N. Naik</i>	
School or department (or company, if applicable)	<i>School of Agriculture & Food Sciences</i>	<i>Centre for Rural Development and Technology, Indian Institute of Technology Delhi</i>	
Phone number	<i>+61 7 33469187/33469192</i>	<i>+91 11 26596349/26591162</i>	
Email-ID	<i>s.prakash@uq.edu.au/b.bhandari@uq.edu.au</i>	<i>jksahu@iitd.ac.in/snn@iitd.ac.in</i>	
URL for more info	https://researchers.uq.edu.au/researcher/1129 https://researchers.uq.edu.au/researcher/370	https://scholar.google.com/citations?user=Yv9OtrYAAAAJ&hl=en https://scholar.google.co.in/citations?user=5j9LWQ8AAAAJ&hl=en	

3. Other supervisors

Please provide information about other associate supervisors below.

Full name and title(s):

School/department/company details:

Phone:

Email:

URL:

2. Field Of Research (FOR) codes

Specify up to four four-digit FOR codes for your project – see [here](#) for more detail on FOR codes.

1. 0912 Materials Engineering	3. 0908 Food Sciences
2. 0910 Manufacturing Engineering	4. 0999 Other Engineering

3. Keywords

Please choose up to 4 keywords for your project. E.g. Nanotechnology, data science, novel batteries, etc. Keywords will assist in classifying project and presenting projects to students on the applications portal.

1. 3 dimensional printing	3. Extrusion
2. Dairy	4. Desiccated milk solids

1 Discipline background of candidate

Please outline the preferred background of your student. E.g. Organic chemistry, physiology, topology, CFD, etc. This will assist in presenting projects to applicants on the apps portal.

1 Food Engineering

3. Food Science & Technology

2 Chemical Engineering

4. Physical Chemistry

2 Project description

India is the largest producer of milk in the world with milk and milk products being an integral part of Indian diet and culture. About 50–55% of milk produced in India is converted into a variety of milk products through processes such as heat-desiccation, heat-acid coagulation and fermentation. Heat desiccated milk-based semi-solids are very popular starting material for many Indian confections, which have characteristic sweet taste, caramelized flavour and soft-grainy texture. They are produced in various forms and sizes. This semi-solids would form an ideal building material for extrusion based 3D food printing. 3D food printing is an emerging technology providing engineering solution for personalised food design by combining and merging knowledge of mechatronics, 3D industrial printing and specialized food knowledge in the areas of ingredients, formulae, texture and structure. The layer-by-layer deposition in 3D food printing will enable substantial reduction of sugar and fat and incorporation of functional ingredients into the final 3D printed sweetmeat. This will allow consumers' to indulge in their favourite sweetmeat with lower risk to diseases associated with high sugar and fat such as obesity, type-2 diabetes and coronary heart disease. This study proposes to investigate the material characteristics of the heat desiccated milk-based semi-solids such as flow behaviour, melting and crystallisation characteristics of fat and sugar and other functional ingredients like vitamins, fibres, antioxidants that can be incorporated to the building material and design healthy 3D printed sweetmeats with unique structure and texture. Both single and dual nozzle 3D printers will be used in the design of sweetmeats. Further, this study will investigate the sensory perception and shelf-stability of the 3D printed sweetmeats. The developed technology and formulations have potential for commercialisation in hospitality and dairy manufacturing sectors. The protection of joint IP will be discussed when the student will commence the project.

3 Project deliverables/outcomes

- The project aims to utilise the novel technology of 3D food printing to create reduced fat and sugar sweetmeats with unique texture and design.
- The effectiveness of the healthy sweetmeats will be confirmed through a human sensory panel and shelf-life study.

4 Research impact themes

Highlight the research impact theme(s) this project will address. Feel free to nominate more than one. For more information, see <http://www.uq.edu.au/research/impact>

1. Healthy Ageing
2. Feeding the World
3. Resilient Environment
4. **Technology for Tomorrow ✓**
5. **Transforming Societies ✓**

5 Type of student

This project is best suited for an:

i-student	<input checked="" type="checkbox"/>
a-student	<input type="checkbox"/>
i- or a-student	<input type="checkbox"/>

Please note that:

- an i-student will be expected to spend year-1 at IIT-D, year-2 at UQ and the remaining time at IIT-D.
- an a-student will spend year-1 at UQ, year-2 at IIT-D and the remaining time at UQ.
- All students will be required to complete some amount of coursework in their first year.

6 Student capabilities and qualifications

Essential Capabilities:

Food Engineering and physical chemistry with a good understanding of food material properties.

Desirable Capabilities:

Practical experience of rheology, understanding the working principle of Differential Scanning Calorimeter (DSC), X-ray diffractometry, Gas chromatography and other associated instruments required for studying crystallisation.

Expected qualifications (Courses/Degrees etc):

Honours or Master's degree in Food Engineering/Food Science & Technology/Chemical Engineering/Physical Chemistry