

International Summer School Manipal University Jaipur [ISSMUJ]-2022

Project Overview

Name of Project: Synthesis and characterisation of high performance bioactive glass-ceramic nano-particulates and their applications in composite bone implants

Name of instructor: Dr. Vijay Shankar Kumawat

Session: June-July 2022

Language of instruction: English

Number of contact hours: 36

Credit awarded: 03

Objective of Project

At the end of this project, participants will be able to:

1. Describe the fundamental idea, principles, and uses of glass and glass-ceramic materials in biomedical applications.
2. Hands-on experience with sophisticated research equipment employed in the synthesis of glasses and glass-ceramics.
3. Hands-on experience with glass melting, fritting, and heat treatment to convert glass to glass ceramics, as well as a top-to-bottom ball milling strategy to manufacture nano particles.
4. Understanding of current R&D initiatives and employment possibilities in the field of bioactive engineered materials, as well as their application in the development of next-generation composite bone implants via 3D printing techniques.
5. Extensive hands-on experience with material characterisation techniques used in nanomaterials and composite bone implants.

Syllabus

- Biomaterials (bioactive glasses and glass-ceramics, biodegradable polymers and bio-nanocomposites) and their applications in tissue engineering applications.
- Bone structure, composition, fractures and healing mechanism.
- Natural bone implants, synthetic bone implants, and the optimal property criteria for each.
- Synthesis, fabrication and characterisation techniques for development of bioactive glasses and glass-ceramics nano-reinforcements.
- Hands-on experience with high temperature glass melting furnaces, heat-treatment tube furnace and cryo-ball milling machine to manufacture glass and glass-ceramic nano particles.
- Conceptualization and practical learning with advanced 3D printers utilised in the manufacture of complex-shaped composite bone implants.

Organization of Project

Total contact hrs 36		
1st week:	10 hrs (theory/research experiments)	2 hrs (self-study/project)
2nd week:	10 hrs (theory/research experiments)	2 hrs (Mid-term presentation/assessment/discussion based on review/experimental research paper writing)
3rd week:	10 hrs (classes)	2 hrs (End term presentation/review/experimental research paper draft submission)

Mode of lectures: online lecture/online videos/ workshop/ hands-on experience

Course/Project Plan

Lecture no.	Topic	Lecture mode	Instructor
L: 1-6	<ul style="list-style-type: none"> Engineering materials Biomaterials and their property correlation in tissue engineering (TE) applications <ul style="list-style-type: none"> Current scope and trend Synthesis, fabrication and characterisation techniques Understanding of current R&D initiatives and employment possibilities in the field of in the field of TE. 	PPT / Video	Dr. Vijay Shankar Kumawat
L: 7-12	<ul style="list-style-type: none"> Live demonstration and hands on experience of glass batch preparation, glass melting/friting and heat-treatment of bulk glass 	PPT/ Live Video	Dr. Vijay Shankar Kumawat
L: 13-18	<ul style="list-style-type: none"> Live demonstration and hands on experience on characterisation of glass frits, nano-structured glass-ceramic particulates Paper writing & progress 	PPT/ Live Video	Dr. Vijay Shankar Kumawat
L: 19-24	<ul style="list-style-type: none"> Live demonstration and hands on experience on FDM, SLA based 3D printers towards development polymeric and composite of bone implants. 	PPT/ Live Video	Dr. Vijay Shankar Kumawat
L: 25-30	<ul style="list-style-type: none"> Live demonstration and hands on experience on characterisation techniques of polymeric and bio-nanocomposite samples. Progress of review/experimental paper writing 	PPT/ Live Video	Dr. Vijay Shankar Kumawat
L: 31-36	<ul style="list-style-type: none"> End term project presentation /review & experimental research paper draft submission 	PPT/ Live Video	Dr. Vijay Shankar Kumawat

Brief profile of the instructor

Dr. Vijay Shankar Kumawat

Assistant Professor | Department of Mechanical Engineering

Research Associate | Engineered Biomedical Materials Research and

Innovation Centre (EnBIOMatRIC) | BIONAC Research Lab

Manipal University Jaipur

Email: vijayshankar.kumawat@jaipur.manipal.edu

Ph: +91-90012-25135

