



# MANUFACTURING OF COMPOSITES

## PROF. J RAMKUMAR

Department of Mechanical Engineering  
IIT Kanpur

**TYPE OF COURSE** : Rerun | Core/Elective | UG/PG

**COURSE DURATION** : 8 weeks (26 Aug'19 - 18 Oct'19)

**EXAM DATE** : 17 Nov 2019

**INTENDED AUDIENCE** : Students of all Engineering and Science disciplines.

**PRE-REQUISITES** : The student should have completed two semesters of UG Engineering or Science program.

**INDUSTRIES APPLICABLE TO** : HAL, NAL, SAIL, ISRO

## COURSE OUTLINE

Selecting manufacturing technique has emerged as one the paramount challenge in the field of composites. Composites are now being used in almost every field of industry, and students working in the area of the composites need to learn the basics, and progressive techniques of composites manufacturing. This course covers the important aspects of composites manufacturing: process selection guidelines, thermoset and thermoplastic Composites manufacturing processes, process parameters and characterizations. Applications and use of each manufacturing process is focused and this is represented separately.

## ABOUT INSTRUCTOR

Prof. Janakranjan .Ramkumar is currently a Professor of Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers.

## COURSE PLAN

**Week 1:** Introduction to Composites; Introduction to Composites; Function of the Matrix and Reinforcement in Composites  
Matrices: Thermosets and Thermoplastic; Fiber Reinforcement

**Week 2:** Properties and testing composites; Properties of Composites; Composites testing; Composites design: Laminate theory, Rule of mixtures, symmetry and balance

**Week 3:** Thermoset Composites manufacturing processes; Material selection process cont.; Material selection process cont. Design for manufacturing.

**Week 4:** Thermoset composite manufacturing processes; Thermoset Composite manufacturing:Lay-up processes,Spray up process;Thermoset Composite manufacturing:Fiber placement process;Thermoset Composite manufacturing:Resin transfer moulding

**Week 5:** Thermoplastic composite manufacturing processes; Thermoset Composite manufacturing:Vacuum assisted resin transfer moulding; Thermoset Composite manufacturing:Compression molding process; Thermoset composites manufacturing:Filament winding

**Week 6:** Thermoplastic composite manufacturing processes; Thermoplastic Composite manufacturing:Sheet moulding  
Thermoplastic Composite manufacturing: Injection moulding, sheet moulding, Calendaring; Thermoplastic Composite manufacturing:Extrusion, Blow molding, rotational molding, Thermoforming

**Week 7:** Metal and ceramic matrix composites; Metal Matrix Composites: Metal matrix and reinforcement; Manufacturing processes for Metal Matrix Composites:Dispersion hardened and particle composite; Manufacturing processes for Metal matrix composites:Layer composites and infiltration method

**Week 8:** Prevention of Damage, repair of Composites and selection of processes; Ceramic matrix composites: Hot isostatic processing ; Non – destructive testing of Composites; Manufacturing process selection: Cost, performance, size shape, rate of production. Steps for process selection