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**DESIGN, MANUFACTURE AND IMPLANTATION OF CUSTOM-  
MADE ORTHOPEDIC BIOPROSTHESES FOR NEEDY  
PATIENTS: NANO-RANGE HYDROXYAPATITE COATING ON  
ROUGHENED STAINLESS STEEL SURFACES.**

A PROJECT REPORT PRESENTED BY  
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To the board of study in Chemical Sciences of the  
**POSTGRADUATE INSTITUTE OF SCIENCE**

*in partial fulfillment of the requirement  
for the award of the degree of*

**MASTER OF SCIENCE IN NANOSCIENCE AND NANOTECHNOLOGY**

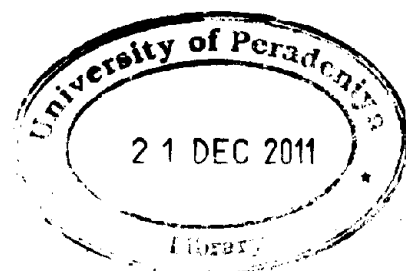
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## ABSTRACT

**DESIGN, MANUFACTURE AND IMPLANTATION OF CUSTOM-  
MADE ORTHOPEDIC BIOPROSTHESES FOR NEEDY  
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Recent world trend in bioengineering is work in interdisciplinary manner in order to sort out the problems faced in the field of Medicine. Especially in orthopedics, this scenario is obviously identified. The use of nanotechnology in orthopedics is an evolving trend since the basic hierarchical structure of a bone is exactly in the range of nanometer scale. Custom-made orthopedic implantation systems are such systems, on which orthopedic surgeons, engineers, chemists, biological specialists are worked together. We have organized a system to design, manufacture, and implantation of tailor-made orthopedic prostheses for needy patients.

The process starts from consultation of orthopedic surgeon and ends at implantation of a custom made orthopedic prosthesis for the benefit of the patient in view that more compatibility with patient's anatomy gives best acceptance and less post implant complications. This study focused on organizing this process from beginning to end by having continuous coordination among professionals in different discipline giving special attention to implication of Nanotechnology for the orthopedics with the application of nano-range Hydroxyapatite coating of the custom-made orthopedic bio prostheses to make them more osteoconductive. The process includes proper evaluation of patients, identifying the need for a custom made implants, transferring all the necessary information to the design team, continuous coordination with the design and manufacturing team in arriving at final design, acquiring biomaterials, machining, and

finally the implantation of the prosthesis to the patient. Nano-structured hydroxyapatite coating was done over roughened biocompatible stainless steel sample series as a preliminary study. The follow up studies and making necessary plans to get the full mobility of the patient was also coordinated. The case study presented shows ability to successfully carrying out design, manufacturing and implantation of customized bioprostheses locally. The present study was aimed at facilitating the necessary coordination for the functioning of the Biomedical Engineering Research Group while paying more attention to use Nanotechnology for the sustained development of the field of Orthopedics with the preliminary study with novel coating technique.