Reg. No.										
----------	--	--	--	--	--	--	--	--	--	--



## MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal 576104)

## II SEMESTER M.Tech (BME) DEGREE MAKE UP EXAMINATIONS, JUNE 2019 SUBJECT: BIOMATERIALS & ARTIFICAL ORGANS (BME 5231) (REVISED CREDIT SYSTEM) Wednesday, 12<sup>th</sup> June 2019: 9 AM to 12 NOON

**Instructions to Candidates:** 

## TIME: 3 HOURS

## MAX. MARKS: 50

- 1. Answer all the questions.
- 2. Draw labelled diagrams wherever necessary. Use separate answer books for Biomaterials and Artificial Organs.
- **3.** Biomaterials questions from 1(a) to 3(a) and Artificial Organs questions from 3(b) to 5(c)
- 1. (a) Discuss the effects of pH and electric potential on the passivation process of metallic 04 implants
  - (b) Elaborate on the systemic toxicity of different metal ions released from metal implants 03
  - (c) Discuss methods to improve blood compatibility of blood contacting biomaterials 03
- (a) Suppose you want to evaluate the cytotoxicity of polymer used in the fabrication of medical device. Elaborate on various cytotoxicity assays used to evaluate the toxicity of polymer
  - (b) Discuss briefly various genotoxicity assays used in testing biomaterials in the lab 03
  - (c) Elaborate on hydrolytic biodegradation process of polymeric biomaterials within the 03 human body
- 3. (a) Categorise and compare the different types of ceramic biomaterials used within the 05 human body
  - (b) As a biomedical engineer, you are asked for your opinion on the design of a new bileaflet disc heart valve made of crystal discs (a material like glass), pure plastic cage and hinges made of Teflon and the normal sewing ring coated with silver (the idea being silver can prevent infection).
    Discuss in detail, the pros and cons of each of these components of the valve. Your discussion should cover both biological and engineering aspects.

BME 5231

- 4. (a) With necessary diagrams, explain, in detail, the function of an implantable LVAD, its 05 parts and where, why and how LVAD will be used.
  - (b) How will you test an ECMO device, in vitro, before putting into clinical trials? 04 Discuss in detail the parameters you will measure
  - (c) What are the potential complications you can envisage during the clinical use of an 01 LVAD device?
- 5. (a) Draw the solute clearance characteristics (molecular mass vs clearance rate) of 03 hemofiltration, Low flux and high flux membranes and compare them with that of a natural kidney. Discuss the shape of each of these curves.
  - (b) (i) With suitable diagrams, explain the basic design of a knee prosthesis, identify the 2+2 parts and the materials used.
    - (ii) Discuss the modes of implant failure as applied to a knee prosthesis.
  - (c) Explain the concept of a mobile bearing knee and its advantages over a fixed bearing 03 knee.