Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER M.TECH (BIOMEDICAL ENGINEERING)

MAKE UP EXAMINATIONS, June/July 2016

SUBJECT: BIOMATERIALS & ARTIFICIAL ORGANS [BME 520]

REVISED CREDIT SYSTEM

THURSDAY, JUNE 30TH, 2016: 9.00 AM-12.00 NOON

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Draw labeled diagrams wherever necessary.
- Use separate answer book for Biomaterials and Artificial Organ

Part A: Biomaterials

1A. What is relaxation w.r.t viscoelastic property of a material? Using a spring and Newtonian dashpot, derive an expression for viscoelastic property of bone using Voigt Model. **8**

1B. Explain the role of following factors on the mechanical properties of polymer (i) Tacticity, (ii) crystallinity, (iii) glass transition temperature and (iv) molecular weight **8**

1C. Differentiate "isostress" and "isostrain" condition of fiber reinforced composites. **4**

2A. Mention the causes for heart valve replacement? Analyze the pros and cons of mechanical and bio-prosthetic heart valves. Does "central blood flow" have any impact on the long term stability of artificial heart valves? Explain. **8**

2B. Compare surface and bulk erosion. Explain the mechanism involved in the degradation of degradable polymer. **8**

2C. Classify Composites. **4**

3A. Classify different types of stainless steel. **3+3**
Type 316LSS has a maximum carbon content of 0.03% than that of Type 316 i.e. 0.07%. Explain how you would expect their mechanical properties to differ from each other.

3B. Compare between the "pitting corrosion" and "stress corrosion cracking". Highlight the impact of corrosion of metallic implants over host tissues. **4+3**

3C. Discuss the steps involved in the fixation of total hip replacement. **7**

Part B: Artificial Organ

4A. Explain the components of Charnley prosthesis. What are the benefits and complications associated with Charnley Prosthesis? **4**

4B. What is external counter pulsation? Explain in detail the method of external counter pulsation. Compare and contrast this with IABP. **8**

4C. (i) Discuss in detail, different types of prosthetic valves. **4 + 4**

(ii) Explain, with necessary diagrams, the construction of a stent mounted tissue valve. Label all the parts clearly and explain step by step how the valve is constructed.

5A. (i) What factors do you control in Hemodialysis for ultrafiltration? **2+3**

(ii) Can the membrane used for hemodialysis be used for membrane lung? Why or Why not?

5B. Explain the basic causes of liver failure. **5**

5C. Discuss in detail the challenges in designing a Wearable Artificial Kidney and how these challenges are being overcome. Discuss the design of any Wearable kidney system under development. **10**

6A. Give a basic explanation of what a *Cardioplegia* solution is and why, where and how it is used. **4**

6B. Discuss the parts of an extracorporeal circulation system used in open heart surgery? **6**

6C. With a block diagram, discuss a pulse duplicator used for testing heart valves. **10**