Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEM B.TECH (BME) DEGREE MAKE UP EXAMINATIONS DEC/JAN 2015-16

SUBJECT: BIOMATERIALS & ARTIFICIAL ORGANS [BME303]

REVISED CREDIT SYSTEM

Thursday, 31st December 2015: 2 pm to 5 pm

Time: 3 Hours **MAX.**

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions and use separate answer books for Part A and Part B
- Draw labeled diagrams wherever necessary.

Part-A (Biomaterials)

1A. 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.

1B. Compare between the "pitting corrosion" and "stress corrosion cracking". How would the corrosion of metallic implants affect host tissues? Explain. **3+3**

1C. Discuss the steps involved in the fixation of endosteal dental implant. Compare endosteal and sub-periosteal dental implants. **5+3**

2A. A fracture plate is designed by a fiber reinforced composite using carbon fiber and resin. The modulus of carbon fiber and resin are 250 GPa and 25GPa respectively. What volume of carbon fiber will be required to make the modulus of the composite plate 100 GPa. Assume that the fibers are aligned in the direction of the test and $V_{resin} + V_{fibers} = 1$ **6**

2B. 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**

2C. Compare surface and bulk erosion. Explain the mechanism involved in the degradation of degradable polymer. **3+3**

3A. 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**

3B. Explain the role of following factors on the mechanical properties of polymer **8**
(i) Tacticity (ii) crystallinity (iii) glass transition temperature (iv) molecular weight.

3C. Differentiate "isostress" and "isostrain" condition of fiber reinforced composites. **4**

Part-B (Artificial Organ)

4A. In open heart surgery, the surgery is done on the heart. This being the case why is 'heart-lung bypass' used. Why not bypass only the heart? Lung is the best gas transfer device one can have. Why not use the natural lung for oxygenation? **4**

4B. A vascular graft is nothing but a conduit for blood flow. So any tubular structure should be adequate. However, every synthetic graft sold in the market is corrugated. Why? What type of graft is normally used in Coronary artery bypass? **6**

4C. With a diagram, clearly explain the parts and function of a heart-lung bypass circuit used in open heart surgery. (Be specific about the function and role of each major component of the circuit. Generalised answers are not acceptable.) **10**

5A. Explain the parts and function of a Charnley Hip Prosthesis. **6**

5B. What is Type I and Type II diabetes? What is the role of insulin in treating diabetes? **4**

5C. Describe the parts and function of a basic insulin pump. What are the pros and cons of an external pump? Explain the basic functional requirements for a fully implantable pump. **10**

6A. Using a block diagram, describe the working of a standard hemodialysis circuit. **8**

6B. What are the basic causes of kidney failure? Compare 'peritoneal dialysis' with 'hemodialysis'. **8**

6C. What is ultrafiltration and how is it different from hemodialysis? For what specific purpose do we use ultrafiltration? **4**