Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

5th SEMESTER B.Tech. (BME) DEGREE MAKE UP EXAMINATIONS, DECEMBER 2017

SUBJECT: BIOMATERIALS AND PROSTHETICS (BME 3103)
(REVISED CREDIT SYSTEM)
Thursday, 21st December 2017: 2 PM to 5 PM

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates:

1 Answer all the questions.
2 Use separate answer book for Biomaterials (Q.1-3) and Prosthetics (Q.4-5)

1A.	What is relaxation in the context of viscoelastic model of a material? Using a spring and Newtonian dashpot, derive an expression for the viscoelastic behavior of bone applies to Voight model.	**8**
1B.	Explain the role of the following factors on the mechanical properties of polymer (i) Tacticity, (ii) crystallinity, (iii)glass transition temperature, (iv) molecular weight	**8**
1C.	Compare surface and bulk erosion.	**4**
2A.	Mention the causes for heart valve replacement? Analyze the pros and cons of mechanical and bioprosthetic heart valves.	**3+3**
2B.	Compare the rule of mixture and inverse rule of mixture apply to fiber reinforced composites.	**8**
2C.	Classify different types of stainless steel. Type 316L stainless steel has a maximum carbon content of 0.03% than that of 316 i.e. 0.7%. Explain how you would expect their modulus to differ from each other.	**3+3**
3A.	Compare 'pitting corrosion' and 'stress corrosion cracking'. Classify composites.	**4+4**
3B.	What do you mean by endosteal dental implants? Discuss the steps involved in the fixation of dental implants.	**8**

3C.	A stress of 1MPa was required to stretch a 2cm aorta strip to 2.3 cm. After an hour in the stretched position, the strip exerted a stress of 0.75 MPa. Assume the mechanical property of the aorta did not vary appreciably during the experiment. What is the relaxation time as per simple exponential decay model?	**4**
4A.	With a clear and neat diagram, explain the working of a wear tester. Label all parts and explain the function of each part clearly. Generalized statements are not acceptable.	**10**
4B.	In pulse duplicator testing, a new leaflet valve under development, showed very low opening pressure and practically zero forward resistance. However, it was very slow to close compared to a disc valve. What is your inference about the performance of this valve?	**5**
4C.	What will be the clinical implication if the valve is approved for mitral or aortic replacement? (In other worlds, how will it affect the patients?)	**5**
5A.	A bovine aortic valve and a St. Jude's bi-leaflet valve were tested in a standard pulse duplicator. Identify standard performance parameters of heart valves and compare the two valves referred above.	**6**
5B.	Describe the function of a bubble oxygenator. How can you control the level of oxygenation in such a system? What are its shortcomings? How does it compare in performance with a membrane oxygenator?	**8**
5C.	Explain the role of 'bi-carbonate' and 'citric acid' in a dialysate solution?	**6**