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MANIPAL INSTITUTE OF TECHNOLOGY MANIPAL A Constituent Institution of Manipal University													
5 th SEN	AESTER B.Tech. (BME) DE	GREE MAH	KE U	P EX	XAM	IINA	TIO	NS,	DEC	JAI	N 201	16-17	7
SUBJECT: BIOMATERIALS AND ARTIFICIAL ORGANS (BME 303) (REVISED CREDIT SYSTEM) Thursday, 29 th December 2016: 2 PM to 5 PM													
TIME: 3 HOURS MAX. MARKS: 100													
Instructions to Candidates:													
1 Answer any FIVE full the questions. 2 Use separate answer book for Biomaterials (Q.1-3) and Artificial Organs (Q.4-6)													
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.										g e	8	
1 B .	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.											f 3	3+3
2B.	Compare the rule of mixture and inverse rule of mixture apply to fiber reinforced composites.										d	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 6	3+3	
3A.	Compare 'pitting corrosion' and 'stress corrosion cracking'. How would you isolate soluble collagen? Explain all the steps.											4	l+4
3B.	What do you mean by Total Hip Arthoplasty (THA)? Discuss the steps involved in the fixation of THA.										n	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?
- 4A. With a clear and neat diagram, explain the working of a pulse duplicator. Label all parts and explain the function of each part clearly. Generalized statements are not acceptable.
- 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?
- **4C.** What will be the clinical implication if the valve is approved for mitral or aortic **5** replacement? (In other worlds, how will it affect the patients?)
- 5A. A porcine 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.
- 5B. Describe the function of a disc 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?
- **5C.** Why do you have to add 'bi-carbonate' or 'citric acid' in a dialysate solution? **6**
- 6A. You know that, in a hemodialyser, concentration gradient results in the removal of various solutes (for example urea). Draw a diagram showing the inlet and outlet concentrations of urea and flow rate of blood and dialysate and derive a simple equation for the amount of urea removed from the blood.
- **6B.** What are Type 1 and Type 2 diabetes? Why are they caused? **4**
- 6C. With a clear block diagram, explain the functioning of a pulsatile system that can temporarily support a failing heart. Clearly identify the device and explain the function relating to that device.