

VI SEMESTER B.TECH. EXTERNAL EXAMINATIONS APRIL 2019

SUBJECT: BIOMATERIALS [BIO 4009]

Date of Exam: 03/05/2019 Time of Exam: 2.00 PM – 5.00 PM Max. Marks: 50

Instructions to Candidates:

♦ Answer ALL the questions & missing data may be suitable assumed



2D.	 GPCRs activate G proteins by reducing the strength of GDP binding, allowing GDP to dissociate and GTP, which is present at much higher concentrations, to bind. How do you suppose the activity of a G protein would be affected by a mutation that caused its affinity for GDP to be reduced without significantly changing its affinity for GTP? 			
3A.	recommend alloying with aluminum (it is known that there is a very strong atomic bonding between AI and Material A) or alloying with cobalt (changes the overall phase from a cubic structure to hexagonal close packed). Which approach would be better to create Material B?			
3B.	Draw the plane defined by the intercepts and determine the Miller Indices.	2		
3C.	Collar bone made of iron was implanted for a patient. Calculate the volume change when Fe (ρ = 7.787 gm/cc) is oxidized to FeO (ρ =5.95 gm/cc). Molecular weight of Fe = 55.85 gm/mol.			
3D.	Explain the composition of Stainless streel.			
4A.	Estimate the area size responsible for the failure of a bone implant made from partially stabilized HA metal composite that fractures at a stress level of 300 MPa. (K_{IC} =9 MPa-m ^{1/2})			
4B.	Ceramic materials do not normally induce tissue reaction when implanted in bulk form. However, when ceramics implanted in powder form, they become non- biocompatible. Explain.			
4C.	 From the list of ceramics choose the most appropriate one: A. Al2O3 B. Hydroxyapatite C. Tricalcium phosphate D. Carbon D. Glass-ceramic a. Resorbable in vivo. b. Has best blood compatibility c. A large single crystal can be made and sometimes is called ruby or sapphire d. Has a direct bone-bonding ability e. Bone mineral has the similar structure 			
4D.	Three different types of bioactive glass (M1, M2 and M2) was incubated in a body and looked at mineralization on each material over time. At 120 minutes, 180 minutes and 1200 minutes. The samples are removed and analysed for IR spectrum, which is shown below,	4		

	Groups W	Vavenumber Range(cm-1)	<i>i)</i> Which material begins to form mineralized hydroxyapatite first? <i>(1)</i>		
	Si-O-Si Si-OH P-O	1175-860 549-470 600-560	 <i>ii)</i> Which material undergoes the most significant amount of mineralization by 1200 minutes?. (1) <i>iii)</i> A linear relationship between time and mineralization is required for osteogenic differentiation of stem cells during the first day. Which material would you select for your studies and why? (2) 		
5A.	 UHMWPE is used in knee or hip joint prosthesis. Its molecular weight= 2x10⁶ gm/mol. Monomer repeat unit=-(CH2-CH2-). I. Calculate the number of repeat units II. Calculate Mn if polydispersity III. Calculate the length of a stretched chain. Since the tetrahedral structure of the carbon leads to a C-C-C bond length of =0.126 nm. 				
5B.	A biodegradable polymer when implanted in a rat losses 40% of its tensile strength in 10 days and 50% of its tensile strength in 20 days. How many days will it take to loose 60% of its strength?				
5C.	Discuss the equilibrium swelling behaviour of ionic hydrogels?				
5D.	The chemica each polyme	al structu er, identif	ures of polystyrene and polyethylene is given below. For y if they are amorphous, semi-crystalline, crystalline? H H H H -C-C-C-C-C- H H H H -C-C-C-C-C- H H H -C-C-C-C-C- H H H -C-C-C-C- H H H H -C-C-C-C- H H H H -C $-C$ $-C-H$ H -C $-C$ $-C-H$ H -C $-C$ $-C-H$ H -C $-C$ $-C$ $-C$ $-C$ $-C$ $-C$ $-C$	2	