Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

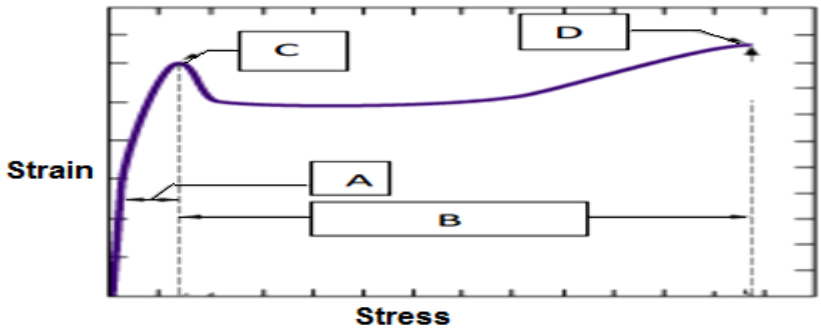
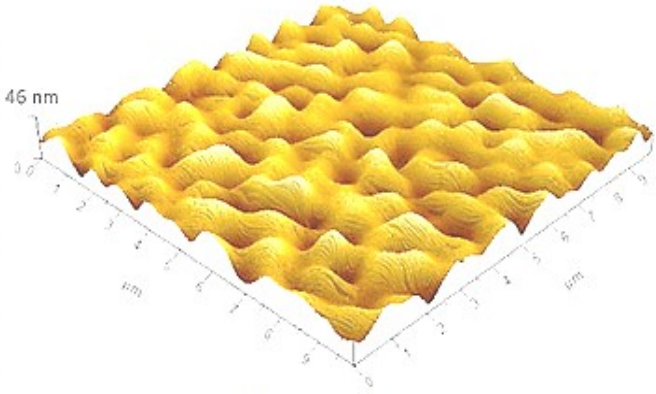
VI SEMESTER B.TECH. (BIOTECHNOLOGY)
END SEMESTER EXAMINATIONS, APRIL 2017

SUBJECT: BIOMATERIALS [BIO 4009]
REVISED CREDIT SYSTEM
(29/4/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

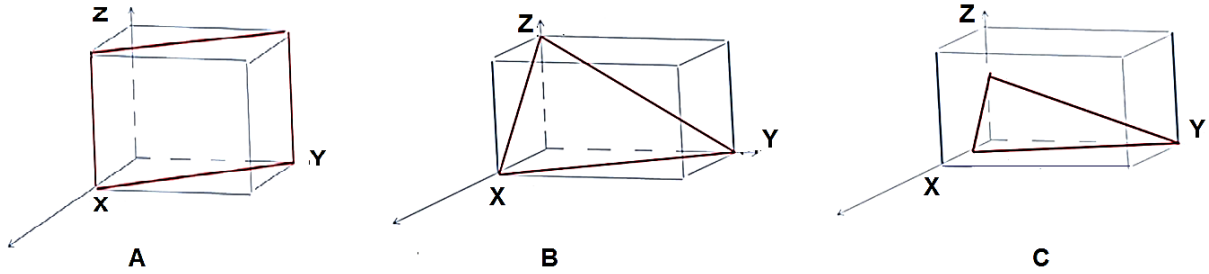
1A.	The Stress-Strain Curve is given below mark and discuss the (A,B,C,D) regions. 	**1**
1B.	The images below are from various corrosive effects of HA and amine fluoride on dental titanium implants. ***I.*** Indicate what surface testing method produced each image; brief each technique including the source of energy and what is detected? ***II.*** Describe the surface characterization method which provides chemical surface interaction of material.  Image 1  Image 2	**3**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

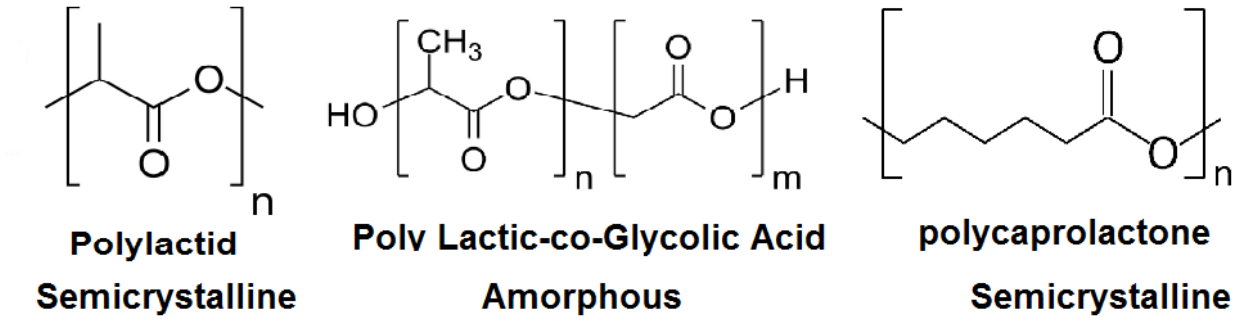
1C.	Determine the ASTEM grain size number n and grain diameter for the given photomicrograph. Micrograph dimensions: 4/3 in, Magnification 500 X.	**1**
1D.	Define bi … dical materials … gical list?	**3**
1E.	State hov …	**2**
2A.	How is it … me signaling molecule …	**2**
2B.	How is ui …	**3**
2C.	In apoptc … contents into the e … l cell death were not achieved in so neat orderly a fashion?	**2**
2D.	Brief on comet assay to understanding DNA fragmentation during apoptosis	**3**
3A.	Explain the procedure for measuring miller indices. What is the miller indices for the following planes? 	**1**
3B.	A Bi metallic SS+Ti material of dia 2 mm and length 20 mm is placed inside which undergoes a tensile force of 100 N. Estimate the change in length of material. Explain the materials suitable for biological application. (SS Modulus = 200 Gpa=200000 N/mm^2. Ti Modulus = 100 Gpa=100000 N/mm^2)	**2**
3C.	Calculate the number of Co ions released in a year from the head (28 mm dia) of a hip joint prosthesis made of CoCrMo alloy. The wear rate of the head is 0.14mm/yr and all the atoms become ionized. Density of Co=8.83gm/cc, atomic weight=58.93, the alloy contains 65% Co.	**3**
3D.	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.	**2**
3E.	Comment on the following: ***I.*** Widmanstatten Microstructures ***II.*** Interstitial effect.	**2**
4A.	What causes thermal expansion in materials, and why do ceramic materials have small coefficients of expansion? List the parts of your body that are ceramic materials.	**2**
4B.	What are piezoelectric ceramics? Mention the design considerations required for the piezoelectric implant that has to be used for bone gap spacers?	**2**
4C.	10 mm dia SS (Young's module =200 Gpa, strength =300 Mpa (yield), density=7.9 gm/cc) is coated with 1mmm thick Bioglass (Young's module = 300 Gpa, Strength = 300	**4**

Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

	Mpa (fracture), density = 4.5 gm/cc. Calculate youngs modulus, average density of composite, maximum strain the composite can carry and maximum load the composite can carry.	
4D.	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-$m^{1/2}$)	**2**
5A.	A biodegradable polymer when implanted in a rat loses 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?	**2**
5B.	UHMWPE is used in knee or hip joint prosthesis. Its molecular weight= $2x10^6$ gm/mol. Monomer repeat unit=-(CH2-CH2-). ***I.*** Calculate the number of repeat units ***II.*** Calculate M_n 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.	**3**
5C.	Chemical structures of poly(L-lactide) and its derivatives are listed below.  **Polylactid** **Polv Lactic-co-Glycolic Acid** **polycaprolactone** **Semicrystalline** **Amorphous** **Semicrystalline** Using physicochemical criteria, predict the hierarchy of degradation rates for these materials. Justify your choices.	**2**
5D.	Describe radiation grafting method for producing hydrogel Also mention its specific advantages over chemical grafting.	**3**