Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

5th SEMESTER B.Tech. (BME) DEGREE END SEM. EXAMINATIONS, NOV/ DEC 2016.

SUBJECT: BIOMATERIALS AND PROSTHETICS (BME 3103)
(REVISED CREDIT SYSTEM)
Saturday, 26th November 2016: 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 creep 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 Maxwell model. **10**

1B. An applied strain of 0.4 produces an immediate stress of 10MPa in a piece of rubber, but after 42 days the stress is only 5 MPa. Calculate the relaxation time (T). **5**

1C. Explain the mechanism involved in the bio-erosion of degradable polymer. **5**

2A. You are asked to design a composite material from carbon fiber and resin for fracture plate. The modulus of carbon fiber and resin are 200 GPa and 20 GPa 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 $V_{resin}+V_{fibers}=1$. **5**

2B. (i) Explain the role of nucleation and crystal size for the fabrication of glass ceramics. **5**
(ii) Highlight the importance of catalyst in the preparation of HDPE and UHMWPE.

2C. Discuss the steps involved in the fixation of dental implant. Compare endosteal and subperiosteal dental implants. **6+4**

3A. Explain how corrosion of metallic implants affects host tissues. **3+3**
Analyze the impact of 'central blood flow' on the stability of mechanical heart valve.

3B.	Compare (i) dendrimer and graft co-polymer, (ii) thermoplastic and thermosetting plastics, (iii) plasticizer and cross linkers.	**6**
3C.	A sample of monomer (-CH2-CH-CH3) is polymerized. The polymer has degree of polymerization (DP) 1. Calculate the molecular weight of the polymer. Can the said polymer exhibit different values of Young moduli? Explain. Highlight the limitations of PMMA in the fixation of hard tissue implants.	**3+2+3**
4A.	With a diagram, explain the working of an accelerated wear tester for heart valves, the need for such testing and how accelerated testing is achieved in the wear tester.	**6+2+4**
4B.	A new heart valve under development has high opening pressure and high forward flow resistance but has very low regurgitation in a pulse duplicator. 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**
4C.	Explain the causes of liver failure.	**3**
5A.	Explain the role of a Bio-reactor in a liver assist device.	**6**
5B.	Explain the need for ultrafiltration in hemodialysis? How is it achieved during hemodialysis? How is the problem solved in peritoneal dialysis?	**2+2+4**
5C.	Discuss the causes and the process of loosening of knee / hip prostheses.	**6**