EXAMINATIONS * ADDITIONAL CONTROLLER OF
AU
CHENNAI
600 025

RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech(Full Time) - END SEMESTER EXAMINATIONS, April / May 2025

Materials Science and Engineering
VI Semester

ML5001 & Bio and Smart Materials
(Regulation2019)

Time : 3hrs Max.Marks: 100

CO1 To study different concepts in selecting bio and smart materials
CO2 To import knowledge on different electro-rheological and piezoelectric materials
CO3 To import knowledge on different shape memory materials and their applications of materials in biomedical engineering and special materials for actuators, sensors, etc.
CO4 To import knowledge on Materials for oral and maxillofacial surgery
CO5 To import knowledge on materials for cardiovascular ophthalmology and skin regeneration

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Classify the biomaterials based on chemical nature	2	1	2
2	Differentiate hydrophobic and hydrophilic	2	1	3
3	Differentiate between active, passive and reactive smart material	2	2	3
4	Write the principle of electro restrictive material? Give example.	2	2	1
5	Write the Working Principle of SMA Blood Clot Filter.	2	3	2
6	Draw and label the stress-strain curve for an SMA.	2	3	3
7	Name the three layers of an artery and mention their functions.	2	4	2
8	Differentiate the terms bioresorbable, bio-inert, and bioactive in the context of biocompatible materials.	2	4	3
9	List the different materials used for stent applications	2	5	3
10	Name any two natural and synthetic biomaterials used in skin regeneration	2	5	3

PART- B(5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	What is meant by biocompatibility? Discuss the properties of biocompatible materials.	13	1	2
	OR			
11 (b)	What are the various biological properties that can be evaluated by In-vivo and In -vitro Testing methods? Explain any two testing procedures in each one of them	13	1	2

12 (a)	Discuss the factors that influence the efficiency of charge migration in electro-rheological (ER) fluids, and explain how these factors impact the overall performance of ER fluids in practical applications.	**13**	2	3
	OR			
12 (b)	What is Piezoelectric Material? Explain its principle, working and applications.	**13**	2	3
13 (a)	What is the phase transformation that occurs in Nitinol, and how does it contribute to its shape memory effect and super-elasticity? Discuss the various applications of Nitinol.	**13**	3	2
	OR			
13 (b)	Explain how temperature and stress influence the transformation between the Martensite and austenite phases in SMAs. Discuss the role of transformation temperatures in the performance of SMAs.	**13**	3	2
14 (a)	Explain the composition, properties and formation of teeth. Write the materials used in dental applications with its properties and advantages	**13**	4	3
	OR			
14 (b)	Explain the composition, properties and formation of Bones. write any synthetic bone graft materials with advantages.	**13**	4	3
15 (a)	Write short notes on Cardiovascular Devices, their applications, and the materials used.	**13**	5	3
	OR			
15 (b)	What is the use of scaffold in tissue engineering? Discuss the scaffold materials processing and its properties.	**13**	5	3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Discuss two engineering applications of Shape Memory Alloys (SMAs), explaining how their unique properties (e.g., shape recovery, superelasticity) are utilized in these applications.	**15**	1	4

CONTROLLER OF EXAMINATIONS ★ ADDITIONAL
AU
CHENNAI
600 025