REG.NO.: 24BHT0014

VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF HEALTHCARE SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST -II
FALL SEMESTER 2025-2026

SLOT: C1+TC1

Programme Name & Branch	**: B.Tech in Health Sciences and Technology**
Course Code	**: BHST302L**
Course Name	**: Materials in healthcare**
Faculty Name(s)	**: Prof. Geetha Manivasagam**
Class Number(s)	**: VL2025260100965**
Date of Examination	**: 07-OCT-2025**
Exam Duration	**: 90 minutes**

Maximum Marks: 50

General instruction(s):

1. All questions are compulsory.
2. Read all the questions carefully before answering.
3. Draw neat and properly labelled diagrams/tables/figures wherever necessary.
4. Mobile phones, smart watches, or any electronic gadgets are strictly prohibited.

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	The success of an implant is dictated by the cell material interactions happening on the surface of the implant. Nanoscale surfaces enhance cell attachment, differentiation, and proliferation. (a) Explain how cell signalling changes based on material stiffness and surface properties. (b) How can you engineer the nano surface to promote better cell spreading? Explain using a schematic labelled diagram.	10	CO4: Identify the host's response to these biomaterials.	BL1, BL2, BL3
2.	A 35-year-old male, who is diabetic, sustained deep partial-thickness burns on his right forearm and hand in a kitchen accident. On examination, there was extensive blistering, necrotic skin, and risk of contracture. (a) Suggest a suitable biomaterial that can be used to cover the wound and explain why it is preferred in this situation. (b) Describe the general steps involved in preparing and applying this biomaterial to the wound. (c) List the post-operative care measures and possible complications associated with its use.	10	CO5: Recognize the various applications of biomaterials in tissue engineering, drug delivery and biosensing fields. CO2: Recognize the bulk and surface properties of the biomaterials for the selection of healthcare applications.	BL3

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3.	Design a vascular graft with an internal diameter of less than 5 mm. Describe its structural features, materials, and biological strategies. Justify your design choices with respect to thrombosis resistance, mechanical compatibility, and clinical performance.	10	CO5: Recognize the various applications of biomaterials in tissue engineering, drug delivery and biosensing fields	BL3,BL5
4.	Imagine you are tasked with designing a next-generation spinal implant for long-term stability and biocompatibility. Discuss the possible materials you would select, justify why they are suitable for spinal applications, and outline how you would evaluate their interaction with cells in terms of adhesion, viability, and differentiation.	10	CO2: Recognize the bulk and surface properties of the biomaterials for the selection of healthcare applications. CO5: Recognize the various applications of biomaterials in tissue engineering, drug delivery and bio sensing fields.	BL1
5.	(a) A clinical laboratory uses UV–visible spectroscopy to monitor the concentration of an antibiotic in a patient's serum. The antibiotic has a maximum absorbance at 260 nm with a molar absorptivity (ε) of 20,000 $L \cdot mol^{-1} \cdot cm^{-1}$. A 1 cm path length cuvette is used, and the measured absorbance (A) is 0.600. Calculate the concentration of the antibiotic in the sample in micromoles per litre. (b)A bio-ink is tested using a rheometer. • The ink behaves as a **Newtonian fluid** with viscosity μ=0.04 Pa · s • During extrusion, the nozzle applies a shear rate ($\dot{\gamma}$) of **150 s^{-1}.** 1. Calculate the **shear stress (τ)** on the fluid. If the viscosity of the same ink decreased to **0.02 Pa·s** at high shear rate (shear-thinning behaviour), calculate the new shear stress. 2. Briefly explain why shear-thinning is advantageous in **3D bio printing.**	10	CO4: Identify the characterization techniques of the biomaterials	BL3

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