REG.NO.: 23BCT0133

SLOT: D2

VIT

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

SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
WINTER SEMESTER 2025-2026

Programme Name & Branch	: B. Tech. BCT
Course Code and Course Name	: BCSE311L - Sensors and Actuator Devices
Faculty Name(s)	: Dr. M. Manimozhi, Dr. V. Bagyaveereswaran
Class Number(s)	: 3467, 3466
Date of Examination	: 18 – 03 – 26
Exam Duration	: 90 minutes

Maximum Marks: 50

General instruction(s):

- Answer All Questions
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes
  2. Analyze the working principles of thermal, optical & electric sensors and actuators to interpret their mathematical model
  3. Interpret the functional principles of magnetic, thermal & Chemical sensors and actuators to interpret their mathematical model

Q. No	Question	Module	Marks	CO
1.	A compressive force is applied to a structural member. The strain is 5 micro-strain: Two separate strain gauges are attached to the structural member, one is a nickel wire strain gauge having a gauge factor of -12.1 and the other is nichrome wire strain gauge having a gauge factor of 2. Calculate the value of resistance of the gauges after they are strained. The resistance of strain gauges before being strained is 120 Ω. [Note: The tensile strain taken as positive while the compressive strain is taken as negative and 1 micro-strain = 1 μm / m)]	5	10	3
2.	Describe the construction and working of a Thermopile PIR sensor used for motion detection. Why AFIR devices are used for low-contrast radiation measurements where PIRs are not suitable?	3	10	2
3.	a) A capacitive transducer is made up of two concentric cylindrical electrodes. The outer diameter of the inner cylindrical electrode is 3 mm and the dielectric medium is air. The inner diameter of the outer electrode is 3.1 mm. The length of electrodes is 20 mm. Calculate the change in capacitance if the inner electrode is moved through a distance of 2 mm. [Note: $C = 2\pi\varepsilon l/\ln(D_2/D_1)$]	4	5	3
	b) A capacitive transducer uses two quartz diaphragms of area 750 mm^2 separated by a distance of 3.5 mm. A pressure of 900 kN/m^2 when applied to the top diaphragm, causes a deflection of 0.6 mm. The capacitance is 370 pF when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of 900 kN/m^2.		5	3
4.	With the help of neat sketch, explain the working principle of a BLDC motor. Name the main parts and their functions. Why does the absence of brushes and commutators improve the efficiency and reliability of the BLDC motor? What is the role of Hall Effect sensors in a BLDC motor?	4	10	2

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5.	a) What is a voice coil actuator? Discuss the different types of voice coil actuator with necessary diagram.	4	5	3	2
	b) How Magnetic pick-up sensors are used to detect the speed of a rotating ferrous target? Explain with suitable sketch.		5	3	2