

FALL SEMESTER 2024-2025

Programme Name & Branch : B. Tech Computer Science and Engineering
Course Code and Course Name : BCSE311L, Sensors and Actuator Devices
Faculty Name(s) : NARESH K, ADRIJA BHATTACHARYA
Class Number(s) : VL2024250101489, VL2024250101494
Date of Examination : 19/10/2024
Exam Duration : 90 minutes **Maximum Marks:50**

General instruction(s):

Answer All Questions

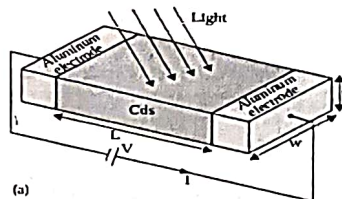
M- Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Course Outcomes (Type the CO statements covered in this question paper. Use the CO number as per the syllabus copy)

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	M	CO	BL
1.	a) A variable reluctance stepper motor is proposed with eight poles in the stator and 6 teeth in each pole and 38 teeth in the rotor (usually the number of teeth in the rotor is less than in the stator because its diameter is smaller, but this is not a requirement, and in variable reluctance motors the opposite is just as practical). a. Calculate the angle per step and number of steps per revolution.	4	3	L3
	b) With various configuration diagrams and stepping sequence demonstrate the functioning of variable reluctance linear stepping motor.	6	3	L3
2.	With necessary design diagram and capacitance property, show a parallel plate capacitor used as fluid level sensor.	10	2	L3
3.	Properties of many semiconductors are determined experimentally primarily because of the variability of constituents of the semiconductors and the difficulties of obtaining reliable data. Nevertheless, especially for cadmium sulfide (CdS) sensors, some reliable data are available. To see what the properties of a photoresistor are, consider a simple CdS structure as in Figure (a) of length 2mm, width 1mm, and thickness 0.1mm.	10	2	L4



The mobility of electrons in CdS is approximately $210 \text{ cm}^2/\text{Vs}$ and that of holes is $20 \text{ cm}^2/\text{Vs}$. The dark concentration of carriers is approximately 10^{16} carriers/cm³ (for both electrons and holes). At a light density of 1 W/m^2 the



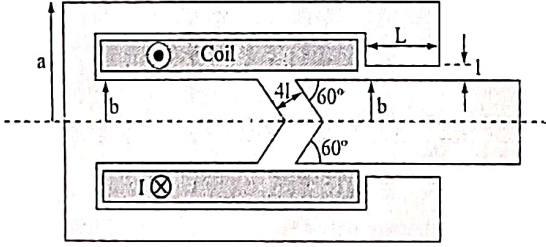
VIT

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

REG.NO.:

SLOT: G2

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	carrier density increases by 14%: - Calculate the conductivity of the material and the resistance of the sensor under dark conditions and under the given illumination. - Assuming a rate of carrier generation due to light of 10^{15} carriers/cm³, estimate the sensitivity of the sensor to radiation at a wavelength of 300nm.			
4.	- With necessary circuit show the operation of photodiodes as an extension of phototransistor along with its associated characteristics and sensitivity. - Hall effect in conductors. To see what the order of magnitudes of the Hall coefficient and Hall voltage are, consider a Hall sensor made by deposition of gold on a substrate. The sensor itself is 1 mm 1 mm and is 0.2 mm thick. The free charge density of gold is 1.5×10^{15} electrons/m³. Calculate the Hall coefficient.	4	2	L3
		6		
5.	- Calculate the force on the movable part in the configuration shown in Figure below. Edge effects in the air gaps are neglected and the flux density is assumed to be constant and perpendicular to the surfaces of the gaps. The permeability of the core may be assumed to be very large, number of turns $N=300$, $I=1A$, $a=25$ mm, $b=10$ mm, $l=2$ mm, and $L=20$ mm. - What is the force if the gap is reduced to 4 mm? - Create the table of quantities and their SI units associated with this problem		3	L4
		10		
