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Reg. No. : 21BEC1851

Final Assessment Test(FAT) - Nov/Dec 2024

Programme	**B.Tech.**	Semester	**Fall Semester 2024-25**
Course Code	**BECE409E**	Faculty Name	**Prof. Manimaran P**
Course Title	**Sensors Technology**	Slot	**A1**
		Class Nbr	**CH2024250100166**
Time	**3 hours**	Max. Marks	**100**

General Instructions
- Write only Register Number in the Question Paper where space is provided (right-side at the top) & do not write any other details.

Course Outcomes
1. Understand the sensors, sensor materials and sensor technologies.
2. Utilize various RLC and self-generating sensors for measuring physical quantities
3. Design appropriate signal conditioning and compensating circuits for RLC sensors
4. Fabricate various sensors using different fabrication techniques
5. Explore advanced sensing mechanisms.
6. Explore smart sensors and IOT for various sensor applications
7. Integrate the various sensors, work with them and interpret the data obtained from various applications.

Section - I
Answer all Questions (10 × 10 Marks)

*M - Marks

Q.No	Question	*M	CO	BL
01.	Considering the principles behind capacitive and piezoelectric sensing, how would you approach selecting a suitable sensor for measuring pressure in a high-temperature environment? Discuss the factors that influence your decision, including the sensor materials and properties	10	1	2
02.	In a multi-sensor system involving capacitive, inductive, and Hall effect sensors, how could the system be optimized for detecting various physical parameters in a dynamic environment? What role do sensor technology advancements, such as MEMS or nanotechnology, play in enhancing the performance and integration of these sensors within such a system?	10	1	2
03.	A compressive force is applied to a structural member. The strain is 7 micro-strain: Two separate strain gauges are attached to the structural member, one is a nickel wire strain gauge having a gauge factor of -13.2 and the other is nichrome wire strain gauge having a gauge factor of 3. Calculate the value of resistance of the gauges after they are strained. The resistance of strain gauges before being strained is 150 Ohms.	10	2	5
04.	Given the different operational principles of thermoelectric and photovoltaic sensors, evaluate their suitability for remote environmental monitoring applications, such as weather stations. What key characteristics of each sensor type would influence your decision, and how would you justify selecting one over the other for optimal performance and durability in outdoor conditions?	10	2	4

05. An inductance of 0.34 H and 30 Ohms resistance is measured by comparison with a fixed standard inductance of 0.1 H and 60 Ohms resistance. They are connected as shown in Fig 1. The unknown inductance is in arm ab and the standard inductance in arm bc, a resistance of 950 Ohms is connected in arm cd and a resistance whose amount is not known is in arm da.   10 3 3

i) Find the resistance of arm da (6 Marks)

ii) Show any necessary and practical additions required to achieve both resistive and inductive balance.(4 Marks)
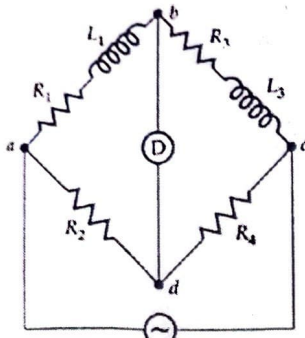

Fig 1

06. Wheatstone bridge has ratio arms of 5000 Ohms and 170 Ohms and is being used to measure an unknown resistance of 70 Ohms. Two galvanometers are available. Galvanometer 'A' has a resistance of 65 Ohms and a sensitivity of 400 mm/μA and galvanometer 'B' has values of 600 Ohms and 900 mm/μA.   10 3 3

i) Calculate is the ratio of sensitivities? (6Marks)

ii) The galvanometer is connected from the junction of the ratio arms to the opposite corners. Comment upon the results. (4 Marks)

07. Operational amplifiers (op-amps) fabricated using thin film technology is being used as a differentiator where the input to the differentiator circuit of Fig 2 is a sinusoidal voltage of peak value of 7 mV and frequency 2 kHz.   10 4 3

Find out the output if R =2000K Ohms and C = 2μF (5 marks)

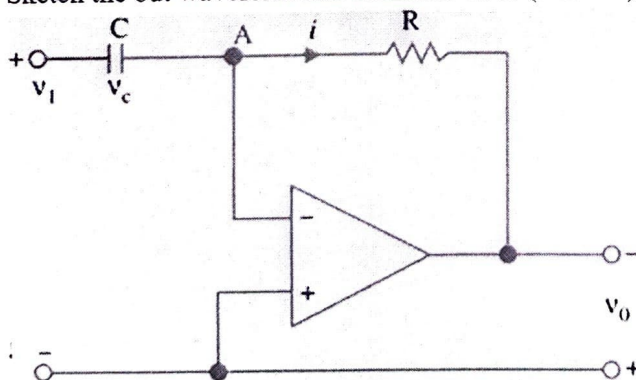Sketch the out waveform and comment on it. (5 marks)

Fig 2

08. i) In an Optical sensor a light ray is incident from medium-1 to medium-2. If the refractive indices of medium-1 and medium-2 are 1.7 and 1.26 respectively then determine the angle of refraction for an angle of incidence of 40°. (5 marks)   10 5 5

ii) Calculate the numerical aperture (NA), acceptance angle and critical angle of the fiber having (Core refractive index) = 1.40 and refractive index of cladding = 1.35.(5 marks)

09. Assume you are developing a wearable health monitoring device that uses a network of smart   10 6 4
sensors to track various physiological parameters (e.g., heart rate, temperature, and blood
oxygen levels).

i)Create a comprehensive plan detailing how you would employ the architecture of smart
sensors to ensure continuous, real-time data acquisition and analysis. (5 Marks)

ii) Explain how you would address challenges such as power efficiency, data transmission, and
adaptability to individual user needs while ensuring data privacy and accuracy in various
environmental conditions.(5 Marks)

10. Imagine you are tasked with designing a sensor-cloud solution for a smart agriculture system   10 7 4
aimed at optimizing water usage, monitoring soil health, and predicting crop diseases.

i) How would you integrate fog computing to manage data processing locally and reduce
latency?(5 Marks)

ii) What novel methods would you propose for real-time decision-making to enhance crop
productivity? (5 Marks)

BL-Bloom's Taxonomy Levels - (1.Remembering, 2.Understanding, 3.Applying, 4.Analysing, 5.Evaluating, 6.Creating)

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