San Jose State University
Mechanical Engineering Department

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Principles and design of Resistive, Capacitive, Inductive, and Magnetic (RCIM) sensors that comprise more than 70% of sensor market today. Their applications in automobiles/aviation, bioengineering research, disease diagnoses, environmental monitoring, quality control, home automation, and homeland security. Sensor circuitry and signal conditioning. Case studies to explore state-of-the-art sensor technologies. Invited speakers to share their first-hand experience in sensor design and manufacturing. Term projects to apply the knowledge gained from this class to design practical and functional sensors.

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Homework	15 %
Midterm Exam	25 %
Case Study and Presentation	15 %
Journal Paper	15 %
Final Exam	30 %

A	93-100	A-	90-92.9		
B+	87-89.9	B	83-86.9	B-	80-82.9
C+	77-79.9	C	73-76.9	C-	70-72.9
D+	67-69.9	D	63-69.9	D-	60-62.9

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- Turn off iPhones during the lecture
- Be in the classroom on time.
- Attend every scheduled lecture, case study presentation and exam.
- Turn in homework at the beginning of the class on the due day (usually Wednesday). No late HW will be accepted. Each student is allowed to miss only one homework for whatever reasons.

- Food is not allowed during lectures.

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To ensure students

- master the most important RCIM sensor principles in measuring variety of physical or chemical quantities or obtaining biological information (e.g., temperature, displacement, velocity, acceleration, force, pressure, concentration, flowrate, sound level, light density, radiation level, magnetic field strength, concentration on oxygen, CO, CO_2, glucose, acetone).
- understand the primary properties/characteristics of RCIM sensing elements and transducers, their operating requirements, and suitable applications
- know the role of the bridge circuits and signal conditioning circuits in sensor design and function
- be familiar with RCIM sensor design and fabrication
- apply the RCIM sensing principles in solving health related problems.

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Upon successful completion of the course, the student should be able to

- know how to read sensor manufacturing data sheet and how to choose a right sensor
- explain the principles, design, and applications typical RCIM sensors
- perform basic calculation and mathematical analysis of RCIM sensors
- state the basic structure, performance, and operation requirements of primary RCIM sensors
- describe elementary electronic components and their functions in sensor circuitry
- interpret sensor signal conditioning (noise attenuation, amplification, filtering)
- know how to integrate a sensor with other devices (microcontrollers, actuators, and other sensors)
- design and build an RCIM sensor
- state major sensor materials, their characteristics, and measurement ranges
- understand the MEMS sensors, their fabrication techniques and major processes.
- learn how to conduct research
- know how to write a journal paper

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Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The University's Academic Integrity policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at www.sjsu.edu/studentconduct/. Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another

Computer labs for student use are available in the Academic Success Center (the 1st floor of Clark Hall) and on the 2nd floor of the Student Union. Additional computer labs in Mechanical Engineering Department are located in E213/215. Computers are also available in the Martin Luther King Library. A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include digital and VHS camcorders, VHS and Beta video players, 16 mm, slide, overhead, DVD, CD, and audiotape players, sound systems, wireless microphones, projection screens and monitors.

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The Learning Assistance Resource Center (LARC) is located in Room 600 in the Student Services Center. It is designed to assist students in the development of their full academic potential and to inspire them to become independent learners. The Center's tutors are trained and nationally certified by the College Reading and Learning Association (CRLA). They provide content-based tutoring in many lower division courses (some upper division) as well as writing and study skills assistance. Small group, individual, and drop-in tutoring are available. Please visit the LARC website for more information at https://peerconnections.sjsu.edu/.

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The SJSU Writing Center is located in Room 126 in Clark Hall. It is staffed by professional instructors and upper-division or graduate-level writing specialists from each of the seven SJSU colleges. Our writing specialists have met a rigorous GPA requirement, and they are well trained to assist all students at all levels within all disciplines to become better writers. The Writing Center website is located at http://www.sjsu.edu/writingcenter/.

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The Peer Mentor Center is located on the 1st floor of Clark Hall in the Academic Success Center. The Peer Mentor Center is staffed with Peer Mentors who excel in helping students manage university life, tackling problems that range from academic challenges to interpersonal struggles. On the road to graduation, Peer Mentors are navigators, offering “roadside assistance” to peers who feel a bit lost or simply need help mapping out the locations of campus resources. Peer Mentor services are free and available on a drop –in basis, no reservation required. The Peer Mentor Center website is located at https://peerconnections.sjsu.edu/

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Attending to your wellness is critical to your success at SJSU. I strongly encourage you to take advantage of the workshops and programs offered through various Student Affairs Departments on campus such as Counseling Services, the SJSU Student Health Center/ Wellness

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WEEK #	723,&6
Week #1 01/27, 01/29	Course syllabus, pre-requisites, permit codes; course overview and structure Ch.1 (1.3.2-1.3.7) TF, sensitivity, linearity
Week #2 02/03, 02/05	Ch.1 (1.3.8-1.3.14) SNR, precision, calibration, bandwidth Ch.2 (2.2-2.4) potentiometric, temperature sensors
Week #3 02/10, 2/12	Ch.2 (2.4 and 2.5) photoresistive, piezoresistive sensors; BJT transistor control circuits Ch. 2 (2.7) chemoresistive, bioresistance/impedance sensors
² Ŝ Ŝ ļ I n 02/17, 02/19	Ch.3 (3.2-3.4) capacitive sensor related physical laws/effects; parallel capacitive sensors Ch.3 (3.5-3.7) cylindrical & spherical capacitive sensors; capacitive sensor arrays
Week #5 02/24, 02/26	Case Study progress checking Ch.4 (4.3-4.5) inductance related physical laws/effects, sensor types and materials
Week #6 03/02, 03/04	Ch.4 (4.6) air coil, ferromagnetic cores, transformers.
Week #7 03/09, 03/11	Ch.5 (5.2-5.4) Hall, AMR/GMR, and magnetostrictive sensors
Week #8 03/16, 03/18	Review for midterm 0LGWHUP ([DP &K
Week #9 03/23, 03/25	Chemical sensors – Invited Speaker: Biosensors -- Invited Speaker:
Week #10 03/30, 04/01	Spring Break
Week #11 04/06, 04/08	Ch.5 (5.5-5.6) NMR, Barkhausen sensors
Week #12 04/13, 04/15	Ch.5 (5.7-5.8) Wiegand, magneto-optical sensors
Week #13 04/20, 04/22	Ch.6 (6.3-6.5) sensor noise, circuitry, grounding & shielding Ó A 02/ʼHU MŮ Ƒ2