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Description generated with very high confidence

**Course Plan**

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| **Department :** | Instrumentation and Control Engineering |
| **Course Name & code :** | Sensors and Transducers&ICE 2155 |
| **Semester & branch :** | III&EI |
| **Name of the faculty :** | Dr. C Gurudas Nayak and Dr. Kapil Sadani |
| **No of contact hours/week:** | |  |  |  |  | | --- | --- | --- | --- | | **L** | **T** | **P** | **C** | | 3 | 0 | 0 | 3 | |

**ASSESSMENT PLAN**

**Course Outcomes (COs)**

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|  | ***At the end of this course, the student should be able to:*** | **No. of Contact Hours** | **Marks** |
| CO1: | Classify and understand the characteristics of sensors. | 4 | 10 |
| CO2: | Categorize and describe the working of electrical transducers | 5 | 20 |
| CO3: | Understand, identify and design a sensor for measuring physical parameters. | 7 | 20 |
| CO4: | Understand, identify and design piezo-electric transducers and electrochemical sensors for analytical and industrial measurements. | 12 | 25 |
| CO5: | Understand, choose and design optical sensors for analytical and industrial measurements | 8 | 25 |
|  | **Total** | 36 | 100 |

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| **Components** | **Quizzes** | **Sessional Tests** | **End Semester/**  **Make-up Examination** |
| **Duration** | 20 to 30 minutes | 60 minutes | 180 minutes |
| **Weightage** | 20 % (4 X 5 marks) | 30 % (2 X 15 Marks) | 50 % (1 X 50 Marks) |
| **Typology of Questions** | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation | Knowledge/ Recall; Understanding/ Comprehension; Application | Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation |
| **Pattern** | Answer one randomly selected question from the problem sheet (Students can refer their class notes) | MCQ: 10 questions (0.5 marks)  Short Answers: 5 questions (2 marks) | Answer all 5 full questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks |
| **Schedule** | 4, 7, 10, and 13th week of academic calendar | Calendared activity | Calendared activity |
| **Topics Covered** | Quiz 1 (L1-10& T**y1-y2**) **(CO1,2)** | Test 1  (L1-13&T**b1-b2**)  **(CO1,2)** | Comprehensive examination covering full syllabus. Students are expected to answer all questions **(CO1-5)** |
| Quiz 2 (L**11-17**& T**y3-y4**)**(CO2,3)** |
| Quiz 3 (L18-25& T**y5-y6**)**(CO3,4)** | Test 2  (L14-27&T**b3-b4**)  **(CO3,4)** |
| Quiz 4 (L26-33& T**y7-y8**)**(CO5)** |

**Course Plan**

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| **L. No./ T. No.** | **Topics** | **Course Outcome Addressed** |
| **L0** | Introduction to the course | 1 |
| **L1** | Functional elements of an Instrument, Types of transducers, Comparison, Analog and Digital Modes of Operation | C01 |
| **L2** | Null and Deflection methods, Input/output configurations | C01 |
| **L3** | Characteristics of transducers | CO1 |
| **L4** | Selection of Transducers | CO2 |
| **L5** | Classification of resistive transducer | CO2 |
| **L6** | Potentiometric transducer, Characterstics | CO2 |
| **L7** | Strain gauge design and circuits | CO2 |
| **L8** | Load Cell and associated calibration | CO2 |
| **L9** | Capacitive Sensors and their Characterstics | CO2 |
| **L10** | Variable Distance and Variable Permittivity type capacitive sensors | CO3 |
| **L11** | Inductive Transducers and their characterstics | CO3 |
| **L12** | LVDT and displacement measurement | CO3 |
| **L13** | Eddy Current and Hall Effect based transducers | CO3 |
| **L14** | Magneto-elastic transducers and solid state sensors | CO3 |
| **L15** | Tachometer, Stroboscope, Encoders | CO3 |
| **L16** | Shaft Encoders, Optical Encoders | CO3 |
| **L17** | Piezo Electric Transducers, elements and properties | CO4 |
| **L18** | Equivalent circuit and frequency response of piezo devices | CO4 |
| **L19** | Quartz crystal microbalance and Surface acoustic wave based sensors | CO4 |
| **L20** | Design of QCM sensors | CO4 |
| **L21** | Nerst Equation, Ph sensing | CO4 |
| **L22** | Understanding electrochemical systems, Double layer | CO4 |
| **L23** | The standard reference electrode | CO4 |
| **L24** | 2,3 and 4 electrode systems | CO4 |
| **L25** | Cyclic Voltametry-1 | CO4 |
| **L26** | Cyclic Voltametry-2 | CO4 |
| **L27** | Frequency response analysis, Bioimpedance analysis | CO4 |
| **L28** | Electrochemical sensor design considerations: Case Studies | CO4 |
| **L29** | Electrochemical Sensor Design for biological applications | CO4 |
| **L30** | Introduction to optical sensors, Natural optical phenomenon | CO5 |
| **L31** | Sources and detectors in optics | CO5 |
| **L32** | Plasmonics, Surface enhanced raman effect based sensors | CO5 |
| **L33** | Surface Plasmon Resonance and Localised Surface Plasmon resonance based sensors | CO5 |
| **L34** | Optic fiber based sensors and optical sensor design | CO5 |
| **L35** | Viscosity, moisture and humidity measurement | CO3 |
| **L36** | Gas Sensors | CO3 |
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**References:**

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| 1. | A.K. Sawhney, A course on electrical and electronic measurements, Dhanpat Rai and Co., 2008 |
| 2. | DVS Murthy, Transducers & Instrumentation, PHI, (2e), 1999. |
| 3. | B.G. Liptak, Process Measurement & Analysis, Chilton Book Company, (4e), 2003. |
| 4. | E.O. Doeblin, Measurement Systems: Application and Design, McGraw Hill, (5e), 2004. |
| 5. | Douglas Skooj, Principles of Instrumental Analysis, (6e), 2008 |
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| **Submitted by:** | Dr. C Gurudas Nayak andDr. Kapil Sadani |

**(Signature of the faculty)**

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| **Date:** | 20-09-2021 |

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| **Approved by:** | Dr. Shreesha C |

**(Signature of HOD)**

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| **Date:** | 20-09-2021 |

**Faculty members teaching the course (IF MULTIPLE sections EXIST):**

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| --- | --- | --- | --- |
| **FACULTY** | **Section** | **FACULTY** | **Section** |
| Dr. C Gurudas Nayak | B |  |  |
| Dr Kapil Sadani | A |  |  |
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