VTU B.E ELECTRICAL AND ELECTRONICS ENGINEERING (EEE)
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER – VI

SENSORS AND TRANSDUCERS 15EE662 (Open Elective)

Module 1 Question Bank

1. Define Transducer. What is its role in instrumentation? (5 Marks)
2. Broadly explain the classification of transducers. (6 Marks)
3. What are the factors influencing the choice of transducer? – Explain. (5 Marks)
4. Explain the construction and working of thermistors. What are its applications? (8 Marks)
5. Distinguish between primary and secondary transducers. (4 Marks)
6. Distinguish between: (i) sensors and transducers (ii) Analog transducers and digital transducers (iii) Transducer and Inverse Transducer (iv) Passive Transducers and active Transducers. (8 Marks)
7. Explain basic principle of the following transducers: (i) Resistive Transducer (ii) inductive Transducer (iii) Capacitive Transducer (iv) Piezoelectric transducers. (8 Marks)
8. Define the following (i) scale errors (ii) Dynamic errors (iii) drift errors. (6 Marks)
9. Explain how Linear and Angular Motion Potentiometers are used in displacement measurement. (6 Marks)
10. A linear resistance potentiometer is 50mm long and is uniformly wound with a wire having a resistance of 10,000 Ω. Under normal conditions, the slider is at the center of the potentiometer. (i) Find the linear displacement when the resistance of the potentiometer is measured by a wheatstone bridge for a resistance of 3850 Ω. (ii) If it is possible to measure a minimum value of 10Ω resistance with the above arrangement, find the resolution of the potentiometer in mm. (8 Marks)
11. What are the advantages and disadvantages of resistive transducers? (4 Marks)
12. A thermistor has a resistance temperature, coefficient of —5% over a temperature range of 25^0C to 50^0C. If the resistance of the thermistor is $10^0\Omega$ at 25^0 C (a) what is the resistance at 35^0C? (a) Suggest a complete instrumentation scheme in block diagram form to measure the temperature in a closed oven with the help of thermistor. (6 Marks)
13. Explain the construction and working of eddy current (drag cup) tachometer. (6 Marks)
14. Give the working principle of (i) Variable reluctance transducer (ii) Mutual inductance transducer. (6 Marks)
15. With a neat sketch, explain how the magnitude and the direction of the core of a LVDT can be detected. (8 Marks)
16. Draw the schematic diagram of LVDT and explain the electromehanical transfer characteristics. (8 Marks)
17. What are the advantages and disadvantages of LVDT? (4 Marks)
18. The output of a LVDT is connected to a 4 V voltmeter through an amplifier whose amplification factor is 500. An output of 1.8 mV appears across the terminals of LVDT when the core moves

through a distance of 0.6 mm. If the millivoltmeter scale has 100 divisions and the scale can be read to —of a division, calculate: (i) The sensitivity of LVDT. (ii) The resolution of the instrument in mm. (8 Marks)

19. The output of an LVDT is connected to a 5V voltmeter through an amplifier whose amplification factor is 250. An output of 2mV appears across the terminals when the core moves through a distance of 0.5 mm. calculate the sensitivity of LVDT. The milli voltmeter scale has 100 divisions The scale can be read to 1/5 of a division. Calculate the resolution of the instrument in mm. (8 Marks)
20. With a neat diagram explain the working principle of capacitive transducer. In a differential capacitor system, show that the difference voltage is a a linear function of the central plate. (8 Marks)
21. List the Advantages and disadvantages of capacitive transducers. (4 Marks)
22. A parallel plate capacitive transducer uses plates of area 300 mm^2 which are separated by a distance 0.2 mm. (i) Determine the value of capacitance when the dielectric is air having a permittivity of 8.85 x 10^{-12} F/m (ii) Determine the change in capacitance if a linear displacement reduces the distance between the plates to 0.18 mm. Also determine the ratio of per unit change of capacitance to per unit change of displacement. (iii) If a mica sheet 0.01 mm thick is inserted in the gap, calculate the value of original capacitance and change in capacitance for the same displacement. Also calculate the ratio of per unit change in displacement. The dielectric constant of mica is 8. (8 Marks)
23. Explain the working principle of of piezoelectric transducer. State its advantages and disadvantages. (8 Marks)
24. With a neat diagram, explain the working of piezoelectric accelerometer. (5 Marks)
25. A 2.5 mm thick quartz piezoelectric crystal having a voltage intensity of 0.055Vm/N is subjected to a pressure of of 1.4 MN/m^2. If the permittivity of quartz is 40.6 ×10 F/m. Calculate : (i) Voltage output (ii) Charge sensitivity of the crystal. (8 Marks)
26. A quartz piezoelectric crystal having a thickness of 2mm and a voltage sensitivity of 0.055 V-m/N is subjected to a pressure of 200 psi. Calculate the voltage output of this transducer. [Ans. 151.8V] (5 Marks)
27. A piezoelectric crystal has the dimensions of 5mm x 5mm x 1.5mm and having voltage sensitivity = 0.055 V-m/N. It is used for force measurement and gave an output voltage of 100V. What force did it measure? (6 Marks)
28. What is Hall effect? Explain the applications Hall effect transducer in the measurement of (i) displacement (ii) current (iii) magnetic flux (iv) fluid level. (8 Marks)
29. The resistivity of semiconductors material was known to be 0.00912 Ohm meter at room temperature. The flux density in the hall model was 0.48 wb/m^2. Calculate the hall angle for a Hall co-efficient of 3.55 x 10^{-4} m^3/coloumb. (8 Marks)
30. Explain the following transducers (i) photoemissive cell (ii) photovoltaic cell (iii) photoconductive cell. (9 Marks)
31. Explain the working principle of photoelectric tachometer. (5 Marks)