Question 1

a) Define an Encoder.

b) With the use of an illustrative diagram, briefly describe one type of angular encoder.

c) A linear encoder has 400 ferromagnets encoded on a strip of metal which is 200 mm long. If the metallic strip is displaced through a distance of 0.8 cm, how many pulses are generated by the coil ?

d) By considering each pulse to be binary digit 1, give a binary representation of the pulses generated in (c) above.

Question 2

A feedback system is described by the differential equation

$$\frac{d^2 y}{dt^2} + 4\frac{dy}{dt} + 100y = 100r(t)$$

Calculate:

a) The Transfer Function of the system

b) The output y(t) when the input r(t)=1

Question 3

A variety of transduction principles and sensing elements are used in the design of sensors.

a) Fill in the last two columns of the table below.

Variable (measurand)	Transduction principles	Sensing elements
Linear displacement		
Angular speed		
Flow rate		
Liquid level (continuous variable)		
Liquid Level (discrete variable)		
Temperature		
Pressure		

b) An Electromagnetic sensor incorporates a rotating disk with 90 electromagnets imprinted at uniform intervals around the circumference of the disk. The sensor is used to measure an Angular Speed of 4π radians/s.

Calculate the number of pulses generated by the pickup coil in an interval 0f 0.3 second.