GANPAT UNIVERSITY

B. Tech. Semester: VI Mechatronics Engineering

CBCS Regular Examination April – June 2015

2MC605 SENSOR SYSTEMS

Time: 3 Hours   Total Marks: 70

Instruction: 1). All questions are **compulsory**.
2). Figures to the **right** indicate full marks.
3). Answers to the two sections must be written in **separate** answer books.
4). Assume all necessary data.

Section - I

Que. – 1   Attempt All

(a)   Explain threshold, sensitivity, selectivity and hysteresis.   [04]

(b)   Enlist various sensors classify them and note down their applications   [04]

(c)   Compare various temperature sensors from the perspective of Their range and applications.   [04]

OR

Que. – 1   (a)   What is FSR? Explain with interface circuit and principle.   [04]

(b)   Explain basic terms in PCB design.   [04]

(c)   What are the advantages of flash ADC ? Explain working with figure.   [04]

Que. – 2   Attempt All

(a)   Derive the equation for sensitivity of strain gauge.   [04]

(b)   Differentiate incremental and absolute encoders from interfacing point of view.   [04]

(c)   Enlist various automotive sensors and their applications.   [03]

OR

Que. – 2   Attempt All

(a)   Explain working of absolute encoders with figure.   [03]

(b)   Design Band pass filter for the system that uses frequency variation from 300Hz to 800Hz to carry measurement information and draw circuit(Pass band gain is 3.9).   [04]

(c)   What is the difference between transistor, FET, MSFET, TRIAC, Thyristor . Explain their range and capabilities?   [04]

Que. – 3   Attempt All

(a)   Explain working of successive approximation ADC with figure.   [04]

(b)   Explain working of incremental encoders with figure.   [04]

(c)   Which principle is used in O_2 sensors ? Explain O_2 sensor in detail with figure.   [04]

Section – II

Que. – 4 **(a)** Explain the characteristic unit step response for the first order system [04] equation

$$\tau.\dot{y} + y(t) = u_s(t) \text{ where } u_s(t) = 0, t<0$$
$$= 1, t>=0$$

Also give the total response of the unit step function.

(b) A disk flywheel J of mass 8 kg. and radius 0.5m is driven by an electric [04] motor that produces a constant torque T_{in}=10 N-m. The shaft bearings may be modelled as viscous rotary dampers with a damping coefficient of B_R=0.1N-m-s/rad. If the flywheel is at rest at t=0 and the power is suddenly applied to the motor, compute the variation in speed of the flywheel, and also find the maximum angular velocity of the flywheel.

(c) Explain the dynamic calibration of pressure sensors. [04]

OR

Que. – 4 **Attempt All**

(a) Explain the characteristic impulse response for the first order system [04] equation

$$\tau.\dot{y} + y(t) = u_\delta(t).$$ Also give the total response of the impulse function.

(b) Capacitive sensor consists of two concentric cylinders with diameter [04] 40mm and 8mm. The storage tank is also cylindrical and having 50mm diameter and 1.2m in height. The stored liquid has (ϵ_r=2.1). Calculate minimal and maximum capacitance for sensor and sensitivity when used in storage tank.

(c) Explain the dynamic calibration done with the help of thermistor and [04] explain the methods used for it.

Que. – 5 **Attempt All**

(a) Draw a flowchart showing the sequence of operations when doing [04] Automatic Parking of a car in Multi-storey building.

(b) Explain Inductive proximity sensors with figure. [04]

(c) For the capacitor plates arranged in parallel, derive the expression for the [03] total capacitance as well as sensitivity.

OR

Que. – 5 **Attempt All**

(a) Draw a flowchart for Banking security system. [04]

(b) Explain Infrared proximity sensors with figure. [04]

(c) For the capacitor plates arranged in series, derive the expression for the [03] total capacitance as well as sensitivity.

Que. – 6 **Attempt All**

(a) Discuss about any two sensors used in medical diagnostics. [04]

(b) Differentiate various active and passive sensors? Enlist various active and [04] passive sensors.

(c) Explain zeroth order and first order sensor systems with examples. [04]

END OF PAPER