

CBCS SCHEME

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15EE662

Sixth Semester B.E. Degree Examination, June/July 2019

Sensors and Transducers

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is transducer? How are they classified? (06 Marks)
- b. What are the advantages of electrical transducers? (05 Marks)
- c. Explain variable reluctance transducer. (05 Marks)

OR

- 2 a. Explain the working of Piezoelectric accelerometer. List the advantages, disadvantages and application of Piezoelectric transducers. (06 Marks)
- b. Explain the working of LVDT with advantages, disadvantages and its applications. (06 Marks)
- c. Explain the displacement measurement using Hall effect transducers. (04 Marks)

Module-2

- 3 a. Explain the working of semi conductor strain gauges with advantages and disadvantages. (06 Marks)
- b. Explain: i) Pneumatic Sensors ii) Eddy current proximity sensors. (06 Marks)
- c. What are digital transducers? What are the advantages of them? (04 Marks)

OR

- 4 a. Explain the working of synchros and Resolvers, mentioning their advantages. (08 Marks)
- b. Explain MEMS accelerometer with its applications and advantages. (04 Marks)
- c. What are the factors need to be considered for selecting a sensor for a particular application? (04 Marks)

Module-3

- 5 a. What are the functions of signal conditioning equipment? (05 Marks)
- b. What is an op-amp? State the characteristics of an op-Amp. (05 Marks)
- c. What you mean by filter and filtering? How are the filters classified? (06 Marks)

OR

- 6 a. Draw the block diagram of a generalised Data Acquisition system and explain it briefly. (06 Marks)
- b. Explain the working of a multi channel analog multiplexed data acquisition system. (05 Marks)
- c. Explain briefly the R-2R Ladder D/A converter and PWM. (05 Marks)

Module-4

- 7 a. With the help of a block diagram, explain the working of telemetering system. (05 Marks)
- b. Explain briefly the amplitude modulation and frequency modulation. (06 Marks)
- c. What is a modem? Explain with interfacing block diagram. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 8 a. Explain inductance type pressure transducers. (04 Marks)
- b. Define :
- i) Atmospheric pressure
 - ii) Gauge pressure
 - iii) Absolute pressure
 - iv) Static pressure
 - v) Total pressure, with the help of schematic diagram. (06 Marks)
- c. Give the construction and working of a hot filament congaion gauge. List its advantages and disadvantages. (06 Marks)

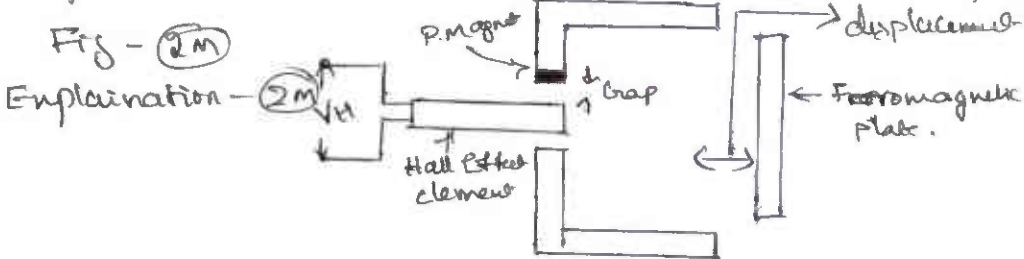
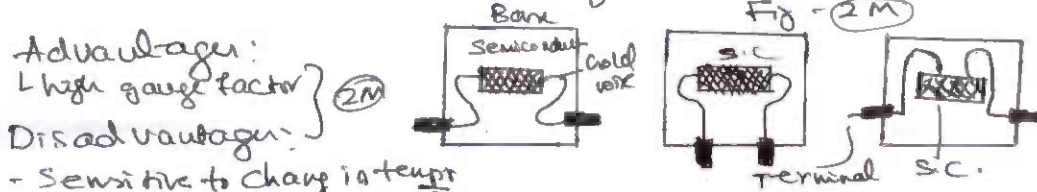
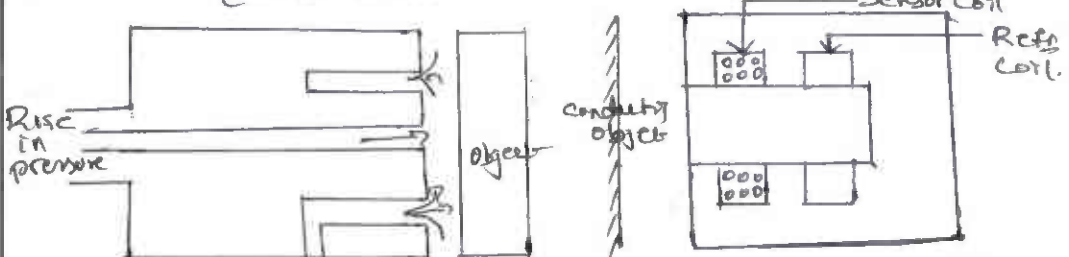
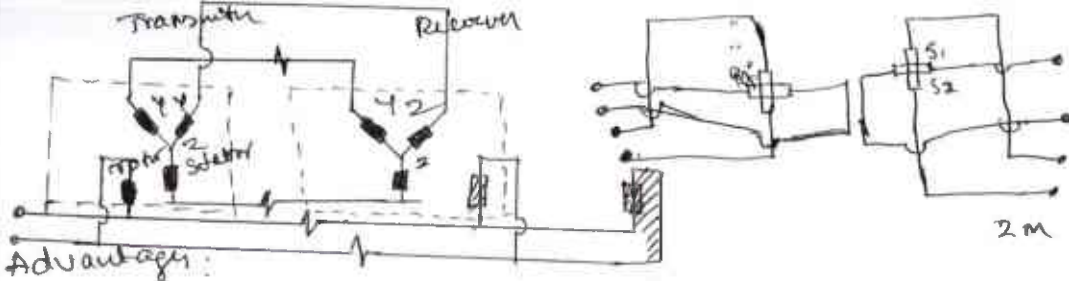
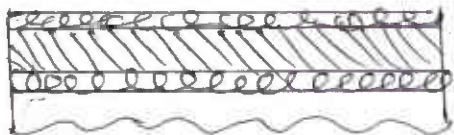
Module-5

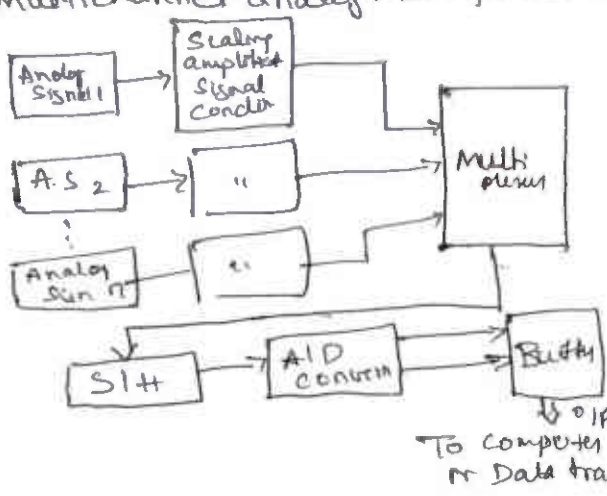
- 9 a. What is "Seebeck effect"? explain with a neat diagram the construction and working of a thermoelectric pyrometer. (08 Marks)
- b. Briefly explain: i) Rotometer ii) ELbow menter. (08 Marks)

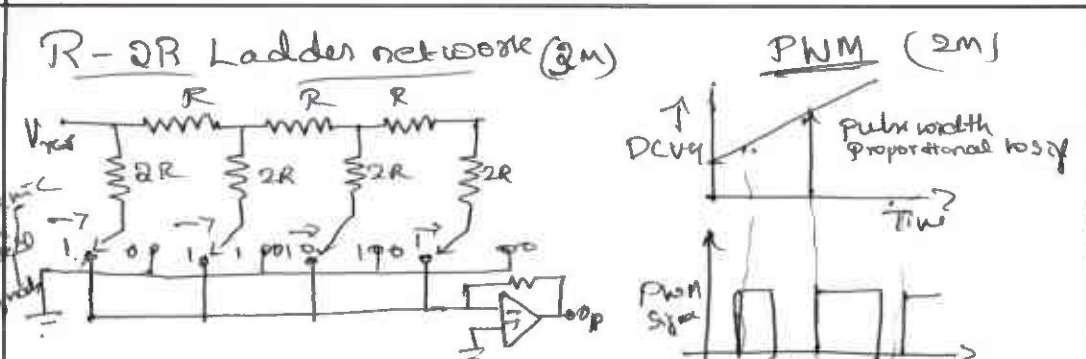
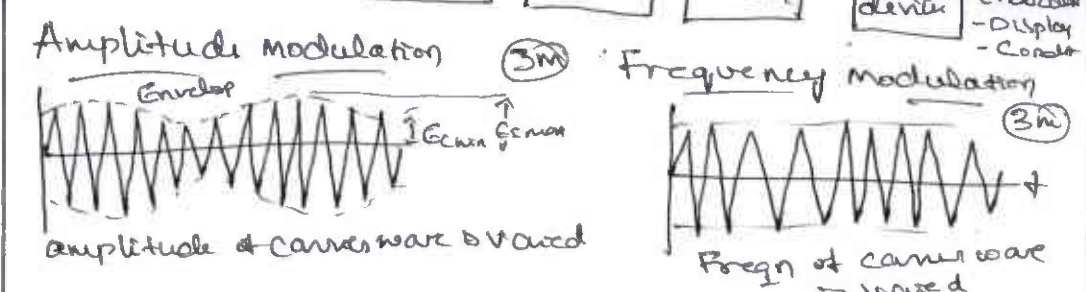
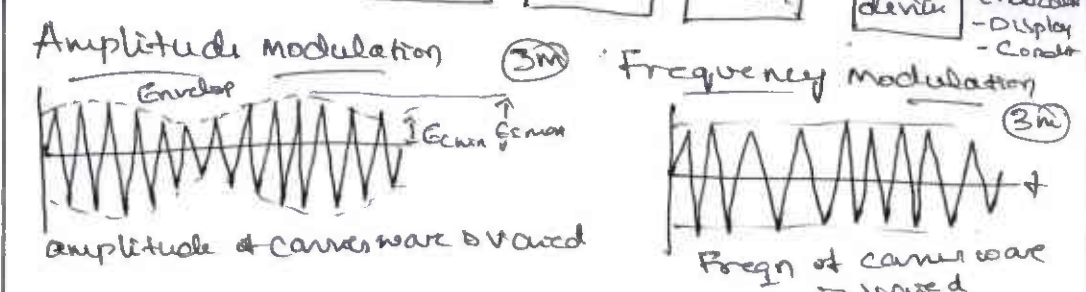
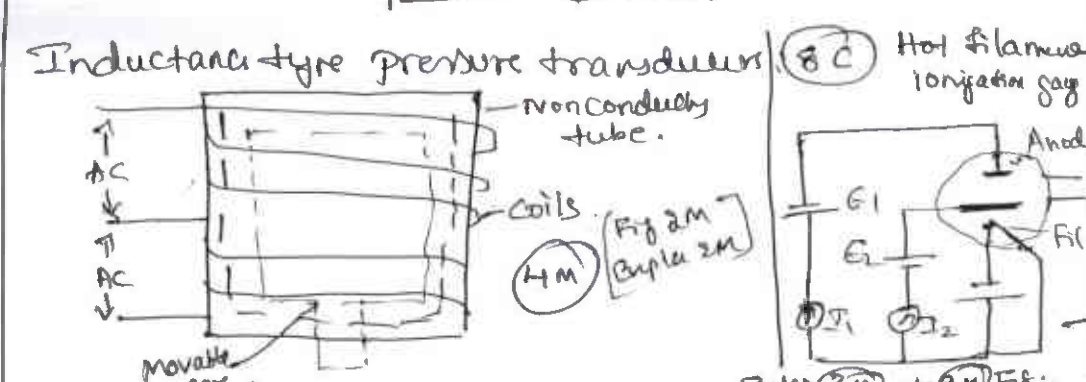
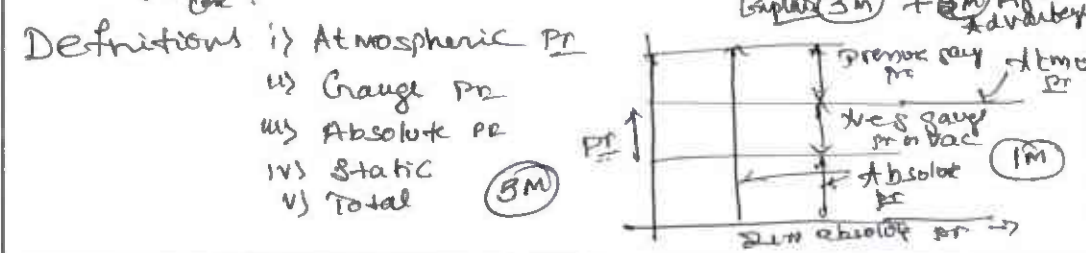
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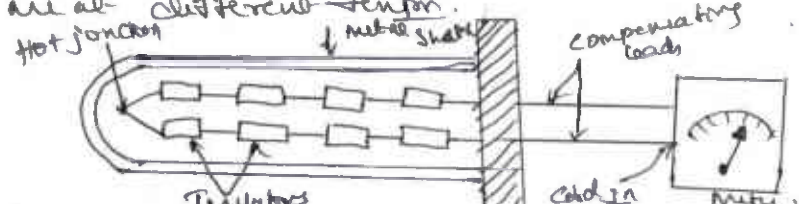
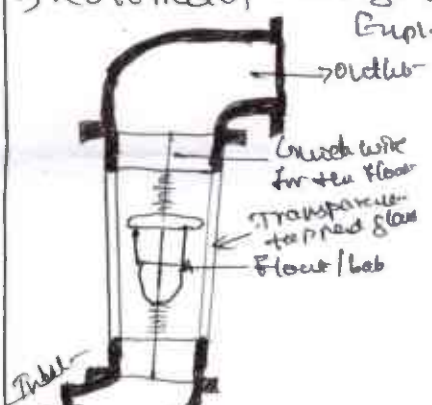
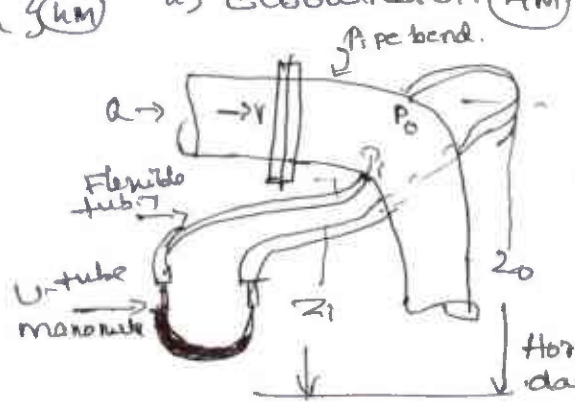
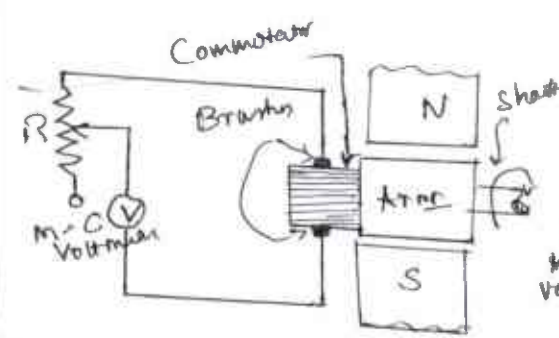
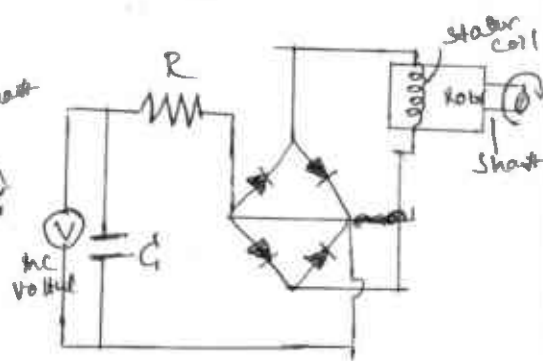
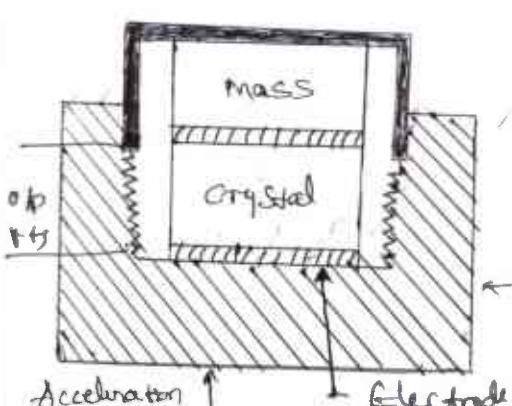
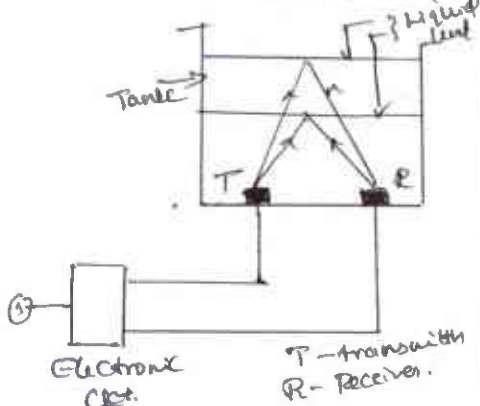
- 10 a. Explain briefly : i) DC tachometer generator ii) AC tachometer generator (08 Marks)
- b. Explain : i) Piezo electric accelerometer ii) Ultra sonic Liquid level gauge. (08 Marks)

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Question Number	Solution	Marks Allocated
2 c	<p>Displacement-measurement using Hall-Effect <u>trans</u></p> <p>Fig - (2M) Explanation - (2M)</p> 	4M
3 a.	<p>semiconductor strain gauge: working - (2M)</p> <p>Advantages: - High gauge factor } (2M) Disadvantages: - Sensitive to change in temp</p> 	6M
b.	<p>1) Pneumatic Sensors: (1 1/2 + 1 1/2) (3M)</p> <p>ii) Eddy current proximity [1 1/2 + 1 1/2] (3M)</p> 	6M
c.	<p>Digital transducers - DIP is discrete & may give freq type DIP or digitally coded DIP. - (2M)</p> <p>Advantages: Accuracy, easy for data manipulation, etc. - (2M)</p>	4M.
4 a.	<p>Synchros (3M) Resolvers (3M)</p>  <p>Advantages:</p>	8M
b.	<p>MEMS accelerometers. (2M)</p>  <p>Advantages: (2M) - Fast response - Better stability - High freq B.W - High charge sensitivity</p> <p>Apr) - Vibration level - Check noise.</p>	4M

Question Number	Solution	Marks Allocated
A.C.	Factors: 1. Nature of measurement required L.V available, accuracy, speed, reliability 2. Requirement of signal conditions.	4M
5a.	Functions of signal conditioning equipment: 1. Amplification, 2. modification/modulation (1M) each 3. Impedance matching 4. Data processing 5. Data transmission	5M
b.	An Op-Amp is a linear IC that has a very high voltage gain, a high i_{ip} input and a low i_{op} output. Specification: i) i_{ip} offset voltage (1M) ii) i_{ip} offset current } (4M) iii) i_{op} offset current iv) slew rate v) unity gain frequency vi) CMRR.	5M
c.	Filter - an electronic circuit which can pass or stop a particular band of frequency through it. Filtering: process of attenuating unwanted components of a measurement while permitting the desired i_{op} to pass. Classification: 1. Low pass 2. High pass 3. Band pass 4. Band stop [Band on frequency] (3M) 1. constant filter 2. m-derived [Band on shape frequency curve]	6M
6a.	Generalized Data Acquisition system block diagram. main parts: i) transducers (3M) ii) Digital recorder (3M) iii) Digital printer	6M
b.	Multichannel analog multiplexed system using A/D converter. Explanation (3M) 	5M.

Question Number	Solution	Marks Allocated
6.C.	<p><u>R-2R Ladder network (2M)</u></p>  <p><u>PWM (2M)</u></p>	5M
7 a.	<p><u>General telemetry system: Explanation - (3M)</u></p> <p>← DIP stage → ← Intermediate stage → → DIP stage. (2M)</p> <pre> graph LR A[measurand] --> B[Primary detector] B --> C[Telemetry transmitter] C --> D[Telemetry Channel] D --> E[Telemetry receiver] E --> F[End device] F --- G[Recorder, Indicator, Display, Console] </pre>	5M
b.	<p><u>Amplitude modulation (3M)</u></p>  <p><u>Frequency modulation (3M)</u></p> 	6M
c.	<p><u>Modem - is device that functions as both modulator & Demodulator.</u></p> <pre> graph TD Mod[Modulator] --> IC1[Interface Ckt] IC1 --> MC[Modulator ckt] MC --> FA[Filter & Dip Amplifier] FA --> Out[Output] Dem[Demodulator] --> FIA[Filter & Dip Amplifier] FIA --> DC[Demodulator ckt] DC --> IC2[Interface Ckt] IC2 --> In[Input] PS[Power Supply] --> IC1 PS --> MC PS --> FIA PS --> DC CT[Control & Timing] --> MC CT --> DC </pre>	5M
8 a.	<p><u>Inductance type pressure transducers (8C)</u></p>  <p><u>Hot filament ionization gage (4M)</u></p>	4M
b.	<p><u>Definitions</u></p> <ol style="list-style-type: none"> i) Atmospheric Pr ii) Gauge Pr iii) Absolute Pr iv) Static v) Total <p>(5M)</p> 	6M

Question Number	Solution	Marks Allocated
9. a.	<p>Seebeck effect - thermocouple - two dissimilar metals or alloys which develop emf when the refer & measure junction are at different temp.</p>  <p>Hot junction, Metal sheath, Compensating leads, Cold junction, Meter.</p> <p>Fig - 2M Expln - 4M</p>	8M
b.	<p>1) Rotometer Fig - 2M Expl - 2M (4M)</p>  <p>Outlet, Check valve for the float, Transparent tapered glass, Float/bob, Inlet.</p> <p>2) Globe valve Fig - 2M Expl - 2M (4M)</p>  <p>Pipe bend, Flexible tubing, U-tube manometer, Horizontal datum.</p>	8M
10 a.	<p>1) DC tachogenerator Fig - 2M Expl - 2M</p>  <p>Commutator, Brushes, N, S, Shaft, R, m.c. Voltmeter.</p> <p>2) AC tachogenerator Fig - 2M Expl - 2M</p>  <p>R, ac voltmeter, Bridge rectifier, Shunt coil, Shaft.</p>	8M
b.	<p>1) Piezo electric accelerometer 2+2=4M</p>  <p>Mass, Crystal, Electrode, Acceleration.</p> <p>2) Ultrasonic liquid level gauge. 2+2=4M</p>  <p>Tank, T - Transmitter, R - Receiver, Electronic Ckt.</p>	8M