

III B. Tech II Semester Regular Examinations, April/May - 2019
INSTRUMENTATION & CONTROL SYSTEMS

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. Answer **ALL** the question in **Part-A**
 3. Answer any **FOUR** Questions from **Part-B**

PART -A

1. a) Define measurement and explain its significance in our day-to-day life and in various fields of engineering. [3M]
- b) Liquid column manometers are treated as standards for pressure and differential pressure measurements. Why? [2M]
- c) Discuss the importance of level measurements in industrial processes. [2M]
- d) Name the various types of strain gauges for different applications. [3M]
- e) Explain dew point. [2M]
- f) Discuss the function of servomotor in a control system? [2M]

PART -B

2. a) Explain instrumental, environmental and observational errors by citing suitable examples. Explain the measures taken to minimize these errors. [6M]
- b) Explain how displacement can be measured with the help of an inductive transducer and a capacitive transducer. Give the essential features of construction of these two types of electrical transducers. [8M]
3. a) Describe the classification of temperature devices based upon the nature of change produced. Indicate the approximate temperature range of each category. [6M]
- b) Describe the construction, working and theory of McLeod gauge for measurement of vacuum. List its advantages and disadvantages. [8M]
4. a) Describe the functioning of stroboscope and explain how speed of a rotating shaft can be measured using a single pattern and multi-pattern disc? [8M]
- b) Classify the methods for level measurements into direct and inferential methods giving suitable examples. [6M]
5. a) Explain in detail, the working of Rectangular strain gauge rosettes. [6M]
- b) Explain the method of usage of resistance strain gauges for bending, compressive and tensile strains. [8M]
6. a) Explain the construction and working of d.c. dynamometers. Describe their advantages and disadvantages. [7M]
- b) Describe the theory and working of an absorption psychrometer used for the measurement of relative humidity. [7M]
7. a) Compare between open loop and close loop control systems. [6M]
- b) With the help of a neat sketch, explain the functions of each component of generalized feedback control system. [8M]

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PART -A

1. a) Describe with an example, the applications of measurement systems. [2M]
- b) Does the accuracy of an optical pyrometer depend on its distance from the object? If so, why? [3M]
- c) What are the different factors which influence the choice of method used for measurement of flow? [3M]
- d) List some practical situations where strain measurement becomes essential. [2M]
- e) Discuss the limitations of sling psychrometer. [2M]
- f) In what respects, the a.c. servomotor differs from d.c. servomotor? [2M]

PART -B

2. a) Explain gross, systematic and random errors by citing suitable examples. Explain the measures taken to minimize these errors. [6M]
- b) Describe the principle of operation of Piezo-electric transducer. Discuss why it is desirable that Piezo-electric transducers should be used for the measurement of dynamic quantities only. [8M]
3. a) Describe the construction and working of thermocouples. Describe the thermo-electric laws and their applications. [7M]
- b) Describe the principle of working of ionization gauges. Describe how vacuum can be measured by using them? [7M]
4. a) Explain the construction, working, advantages and disadvantages of a photoelectric tachometer. [7M]
- b) Describe the working of ultrasonic flow meters. Explain the different techniques used for measurement of flow velocity. [7M]
5. a) Explain, in detail the working of Delta type strain gauge rosettes. [7M]
- b) Mention different techniques available for the measurement of strain and explain the principle on which the operation of an electrical resistance strain gauge is based. [7M]
6. a) Explain the construction and principle of working of Piezo-electric load cells. Discuss their advantages in details. [7M]
- b) Explain the working of a servo-controlled dynamometer which automatically adjusts the speed and torque of the engine of the automobile to the desired values. [7M]
7. a) What is a control system? What are the basic components? Give two examples of control systems. [7M]
- b) Explain a closed loop control system used to control the temperature of water heated by steam. [7M]

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PART -A

1. a) Discuss the differences between limiting and known errors. [2M]
- b) Discuss the salient features of resistance thermometers. [2M]
- c) Discuss the advantages and disadvantages of Ultrasonic flow meters? [2M]
- d) Explain the function of Rosettes. [3M]
- e) Discuss the limitations of absorption psychrometer. [3M]
- f) Discuss the main applications of servomotors? [2M]

PART -B

2. a) What are primary, secondary and tertiary measurements? Explain with examples. [7M]
- b) Give the essential features of inductive and capacitive transducers when used for the measurement of displacement. [7M]
3. a) Explain the theory of radiation pyrometers. Describe the different receiving elements. [7M]
- b) Describe the applications of piezoelectric transducers for measurement of pressure. List their advantages and disadvantages. [7M]
4. a) What are mechanical tachometers? Explain with examples. Describe the disadvantages of mechanical tachometers. [7M]
- b) What is a hot wire anemometer? Describe its construction and principle of working. [7M]
5. a) Discuss the various types of strain gauges for different applications. [6M]
- b) What do you mean by resistance strain gauges? Give a detailed discussion on the subject covering the basic principle, gauge and binding materials, and application of the method. [8M]
6. a) Explain the construction and working of Elastic force meters for force measurement. [7M]
- b) Describe how relative humidity can be measured by measuring dew point temperature. [7M]
7. a) Describe open loop system with suitable examples. State the advantages and limitations. [7M]
- b) Describe servo mechanism. Draw block diagram of a servo mechanism. [7M]

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PART -A

1. a) Define (i) Static error and (ii) Relative error. [2M]
- b) List the advantages and disadvantages of Ionization gauges. [2M]
- c) Discuss the difference between vibrometers and accelerometers. [2M]
- d) Define the gauge factor of a resistance strain gauge. [2M]
- e) Discuss the differences between transmission and driving dynamometers. [3M]
- f) State the utility of following components in a control system: [3M]
 (i) Potentiometer (ii) Tacho-generator (iii) Servomotor

PART -B

2. a) Draw the block diagram representation of a generalized measurement system. Identify the various elements and point out the function performed by each element. [7M]
- b) Define displacement. Suggest a suitable transducer for the measurement of a small linear motion. Give reasons to justify your choice. [7M]
3. a) Explain the method of measurement of temperature with resistance thermometers. Describe their construction. [7M]
- b) Explain with the help of suitable sketches, the difference between a bellows gauge and a diaphragm gauge for pressure measurement. [7M]
4. a) Describe the inductive methods for measurement of level of liquids. [7M]
- b) Describe the construction and working of a rotameter. Derive the expression for the volume flow rate. Explain its advantages and disadvantages. [7M]
5. a) What is strain? Explain the working of Electric strain gauge and write its applications. [7M]
- b) Explain the different methods used for providing input to and getting output from strain gauge bridges mounted on rotating shafts for measurement of torque. [7M]
6. a) What are load cells? Explain the working of a load cell using strain gauges. [7M]
- b) Describe the theory and working of a sling psychrometer used for the measurement of relative humidity. [7M]
7. a) Describe close loop system with suitable examples. State the advantages and limitations. [7M]
- b) Explain how feedback control system is employed for temperature control of an air-conditioned system. [7M]
