

III B. Tech I Semester Regular/Supplementary Examinations, October/November - 2016
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. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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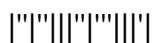
**PART -A**

- 1 a) How errors are classified? Enumerate the various sources of errors. [3M]
- b) Describe the constructional details, theory and application of different types of Diaphragm pressure gauges [4M]
- c) Write explanatory notes on Hot-wire anemometers [4M]
- d) Define strain Rosette. How it is used for strain measurement? [4M]
- e) Explain the working of proving ring with a neat sketch [4M]
- f) Differentiate Open and closed loop control systems with a suitable examples. [3M]

**PART -B**

- 2 a) Sketch and explain with a block diagram generalized measurement system and its elements with an example. [6M]
- b) Explain the following terms. **i)** Range and span **ii)** Resolution **iii)** Calibration **iv)** Sensitivity [4M]
- c) Explain the basic principle of working of piezo-electric transducers [6M]
- 3 a) What do you mean by low pressures? List out various indirect methods for measurement of low pressure and explain any two methods. [8M]
- b) Explain the disappearing filament pyrometers setup and explain its operation [4M]
- c) Explain any two temperature measurement equipments with neat sketches [4M]
- 4 a) Write short notes on cryogenic fuel level indicator [4M]
- b) Why rotameter is called variable area flow meter? Describe its construction and working with a neat sketch. [6M]
- c) Explain the construction, principle of working and advantages of Capacitive vibration sensor. [6M]
- 5 a) Derive, from the first principles, the relationship for gauge factor of a strain gauge. [8M]
- b) Describe the tension measurement using strain gauge with neat sketch. [8M]
- 6 a) With a neat sketch, explain the working of fluid friction dynamometer. [8M]
- b) Explain construction and working of hydraulic load cell. [8M]
- 7 a) Explain in detail about different types of control actions and their effect on system performance? [8M]
- b) Draw a block diagram of closed loop control system. Describe its working for motor speed control. [8M]

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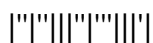
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PART -A

- 1 a) Explain the following terms i) Speed of response ii) Measuring lag iii) Fidelity [3M]
 iv) Dynamic error
- b) Classify temperature measuring instruments. Write short notes on solid expansion thermometers [4M]
- c) Explain any with a neat sketch any of the constant head variable area flow meter. [4M]
- d) List various strain gauge circuitry used for the measurement of strain with neat sketches [4M]
- e) Define the following terms i) Humidity ii) Absolute humidity iii) Relative Humidity [4M]
 iv) Specific humidity
- f) Differentiate a feed back and non-feed back control system [3M]

PART -B

- 2 a) How errors are classified? Explain how errors can be reduced. [4M]
- b) Sketch and explain Linear Variable Differential Transformer with a neat sketch [6M]
- c) Sketch and explain Photo electric transducer. [6M]
- 3 a) Explain working principle of thermocouples [4M]
- b) Explain the working principle of McLeod pressure gauge. State advantages and disadvantages of McLeod pressure gauge [8M]
- c) Classify pressure measurement techniques [4M]
- 4 a) Write short notes on non contact type tachometers [3M]
- b) With the help of hot wire bridge circuit explain the working of hot wire anemometer in constant current mode and constant temperature mode. [7M]
- c) Explain the construction, principle of working and advantages of Strain gauge accelerometer. [6M]
- 5 a) Explain any two methods of compensating temperatures for electrical resistance strain gauge. [8M]
- b) Derive, from the first principles, the relationship for gauge factor of a strain gauge. [8M]
- 6 a) Explain the following i) Hydraulic load cell ii) Strain gauge load cell [8M]
- b) Explain any two torque measuring techniques with neat sketches [8M]
- 7 a) Summarize the essential features of open-loop and closed-loop control systems. Illustrate your answer by referring to a particular example of each type of system, and sketch its relevant block diagram. Point out the disadvantages of open-loop systems. [8M]
- b) How feedback control system is applied for temperature control of air conditioned system [8M]



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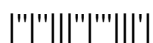
**PART -A**

- 1 a) Explain the following terms. **i)** Accuracy **ii)** Precision **iii)** Threshold **iv)** Standards [4M]
- b) Explain with a neat sketch how pressure can be measured with bourdon tube pressure gauge. [4M]
- c) Define vibration. Explain how it is characterized, and list some of its harmful effects. [3M]
- d) What are the requirements of materials for strain gauges? [3M]
- e) Explain with a neat sketch Electrical torsion meter [4M]
- f) How feedback control system is applied for temperature control of boiler [4M]

**PART -B**

- 2 a) Sketch and explain with a block diagram generalized measurement system and its elements with an example. [6M]
- b) Sketch and explain variable capacitive transducer elements with applications. [6M]
- c) Write short notes on calibration procedures for transducers [4M]
- 3 a) Explain the working of liquid in glass thermometers by means of neat sketch. List their advantages and disadvantages. [6M]
- b) Explain **i)** Gauge pressure **ii)** Absolute pressure [2M]
- c) Explain the following vacuum gauges **i)** Thermocouple type thermal conductivity gauge and **ii)** Pirani gauge [8M]
- 4 a) Write short notes on bubbler level indicators [3M]
- b) Why rotameter is called variable area flow meter? Describe its construction and working with a neat sketch. [8M]
- c) Explain the construction, principle of working and advantages of Seismic instruments. [5M]
- 5 a) With the help of suitable diagrams, derive the expressions for quarter bridge and half bridge circuits of Wheatstone bridge used for strain measurement. Give applications of each. [8M]
- b) Define Strain Rosette. How it is used for strain measurement? [4M]
- c) Name the various types of strain gauges for different applications [4M]
- 6 a) Explain resistive hygrometer for the measurement of humidity with a neat sketch [4M]
- b) Explain with a neat sketch Strain gauge load cell for measurement of force [6M]
- c) Explain water vortex dynamometer with a neat sketch [6M]
- 7 a) What is a 'control system'? Enumerate and define the elements of a control system. [8M]
- b) Differentiate Open and closed loop control systems with a suitable examples. [8M]

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PART -A

- 1 a) Explain with a block diagram generalized measurement system and its elements with an example. [4M]
- b) Explain with a neat sketch working of Thermocouple type thermal conductivity gauge. [4M]
- c) Write short notes on mechanical and electrical tachometers [3M]
- d) Define strain Rosette. How it is used for strain measurement? [4M]
- e) Explain resistive hygrometer for the measurement of humidity with a neat sketch [4M]
- f) Explain the basic features of an open loop control system with a block diagram [3M]

PART -B

- 2 a) Explain the following terms. **i)** Accuracy **ii)** Precision **iii)** Calibration **iv)** Standards [4M]
- b) Explain in brief the various sources of errors and how can they be reduced [6M]
- c) Explain the working principle of Ionization gauge with a neat sketch. State its advantages and disadvantages [6M]
- 3 a) Explain the disappearing filament pyrometers setup and explain its operation [8M]
- b) What are the advantages of thermistors for temperature measurement? [3M]
- c) Explain with a neat sketch working of Bourdon tube pressure gauge. List its advantages and disadvantages. [5M]
- 4 a) With the help of hot wire bridge circuit explain the working of hot wire anemometer in constant current mode and constant temperature mode. [8M]
- b) Name the different vibration sensing system used in practice. Explain any one such system for the measurement of vibration. [8M]
- 5 a) Derive, from the first principles, the relationship for gauge factor of a strain gauge. [8M]
- b) What is temperature compensation and how it is achieved when using bonded strain gauge for the measurement of axial thrust, bending loads and torque? [8M]
- 6 a) Define the following terms **i)** Humidity **ii)** Absolute humidity **iii)** Relative Humidity **iv)** Specific humidity [4M]
- b) Explain the working of optical torsion meter for the measurement of torque with a neat sketch. [6M]
- c) Sketch and explain any two shaft power measuring devices. [6M]
- 7 a) Describe a control system to fill a tank with water after it is emptied through an output at the bottom. This system automatically stops the inflow of water when the tank is filled. Draw the block diagram of the system. [8M]
- b) Explain in detail about different types of control actions and their effect on system performance? [8M]

