



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)  
Dundigal, Hyderabad-500043

## MECHANICAL ENGINEERING

### TUTORIAL QUESTION BANK

<b>Course Title</b>	<b>INSTRUMENTATION AND CONTROL SYSTEMS</b>				
<b>Course Code</b>	AME019				
<b>Programme</b>	B. Tech.				
<b>Semester</b>	VII	ME			
<b>Course Type</b>	Core				
<b>Regulation</b>	IARE - R16				
<b>Course Structure</b>	<b>Theory</b>			<b>Practical</b>	
	<b>Lectures</b>	<b>Tutorials</b>	<b>Credits</b>	<b>Laboratory</b>	<b>Credits</b>
	3	1	4	2	1
<b>Chief Coordinator</b>	Mr. M V Aditya Nag, Assistant Professor, ME				
<b>Course Faculty</b>	Dr. Paidi Raghavulu, Professor, ME Mr. M V Aditya Nag, Assistant Professor, ME				

### COURSE OBJECTIVES:

<b>The course should enable the students to:</b>	
I	Visualize the concepts of measurement and dynamic performance characteristics of measuring instruments.
II	Understand the measurement of typical physical quantities like displacement, temperature, pressure.
III	Applying techniques for measurement of Level, Flow, Speed, Acceleration and Vibration.
IV	Visualize the measurement of Stress, Strain, Humidity, Force, Torque and Power.
V	Understand the control systems for instrumentation and develop Temperature, Speed and Position control systems.

### COURSE OUTCOMES (COs):

CO 1	Ability to describe the static and dynamic characteristics, identify functional elements of generalized measuring system and error control.
CO 2	Ability to analyze and design the measuring system for the measurement of displacement, temperature and Pressure
CO 3	Ability to analyze and design the measuring system for the measurement of Flow and liquid level.
CO 4	Ability to analyze and design the measuring system for the measurement of stress, strain, humidity, force and torque.
CO 5	Ability to analyze & design the control system for control of position, temperature, acceleration & process control.

### **COURSE LEARNING OUTCOMES (CLOs):**

AME019.01	Understand the basic principles and measurement system.
AME019.02	Comprehend generalized configuration and functional description of measuring instruments.
AME019.03	Visualize static and dynamic performance characteristics.
AME019.04	Understand the sources of various errors and its elimination.
AME019.05	Apply the working principles and identify the measurands for displacement.
AME019.06	Evaluate temperature measuring methods in various equipments.
AME019.07	Understand the fluid pressure, its importance and measurement techniques.
AME019.08	Comprehend the level measuring devices for ascertaining liquid level.
AME019.09	Visualize the importance of flow measurement and know various flow measuring devices..
AME019.10	Evaluate the measurement of speed in engineering applications and importance of speed measurement in instrumentation.
AME019.11	Comprehend the importance of acceleration and vibration measurement with various techniques.
AME019.12	Visualize the stress and strain experienced by various elements and understand the importance of strain measurement with various techniques.
AME019.13	Understand the concept of humidity in atmosphere as well as the storage applications and maintenance of humidity by measurement.
AME019.14	Apply the basic principles of instrumentation for force measurement in various fields of engineering.
AME019.15	Apply the basic principles and characteristics for torque measurement.
AME019.16	Comprehend the instrumentation techniques in solving the engineering measuring applications of torque and power.
AME019.17	Understand the control systems for instrumentation in various practical applications.
AME019.18	Classify the control systems, advantages, limitations and control system terminology.
AME019.19	Comprehend servo mechanism, process control and regulators for process and position control.
AME019.20	Apply control system for control of position, temperature and acceleration.

## TUTORIAL QUESTION BANK

UNIT- I				
PRINCIPLES OF MEASUREMENT				
Part - A (Short Answer Questions)				
S No	QUESTIONS	Blooms Taxonomy Level	Course Outcomes	Course Learning Outcomes (CLOs)
1	What is meant by measurement?	Remember	CO 1	AME019.01
2	State the two conditions to be satisfied for the result of measurement to be meaningful.	Understand	CO 1	AME019.01
3	Give two examples for primary measurement.	Understand	CO 1	AME019.01
4	What is secondary measurement?	Understand	CO 1	AME019.01
5	What is a primary sensing element?	Understand	CO 1	AME019.01
6	Define the term 'STANDARD'.	Remember	CO 1	AME019.01
7	Define a measuring instrument.	Remember	CO 1	AME019.01
8	What is null type instrument?	Remember	CO 1	AME019.02
9	What are analog and digital instruments?	Remember	CO 1	AME019.02
10	Give examples for automated and manually operated instruments.	Remember	CO 1	AME019.02
11	Give two examples for non-contacting instruments.	Understand	CO 1	AME019.02
12	What are intelligent instruments?	Remember	CO 1	AME019.02
13	Differentiate the terms 'accuracy' and 'precision'.	Remember	CO 1	AME019.02
14	Define the term calibration.	Understand	CO 1	AME019.03
15	Why instruments are to be calibrated?	Remember	CO 1	AME019.03
16	What is meant by primary calibration?	Remember	CO 1	AME019.03
17	What is secondary calibration?	Remember	CO 1	AME019.03
18	What are mechanical instruments?	Remember	CO 1	AME019.03
19	List two deflection type instruments.	Understand	CO 1	AME019.03
20	What is a power operated instrument?	Understand	CO 1	AME019.03
Part - B (Long Answer Questions)				
1	Classify the methods of measurement. Explain each one of them in detail considering their applications and limitations.	Remember	CO 1	AME019.01
2	Draw the block diagram of a generalized measurement system and explain its various elements.	Remember	CO 1	AME019.02
3	With the help of an example, explain the generalized measurement system.	Understand	CO 1	AME019.02
4	Broadly classify the measuring instruments and explain the applications of measuring instruments in detail.	Understand	CO 1	AME019.02
5	List the various types of measuring instruments and explain each one of them.	Understand	CO 1	AME019.02
6	What are the static characteristics of measurement systems? Explain the various static characteristics of a measurement system involving their importance in instrumentation.	Understand	CO 1	AME019.02
7	Explain the various elements of generalized measurement system with a neat sketch.	Understand	CO 1	AME019.02
8	Explain the dynamic performance characteristics of measuring instruments.	Understand	CO 1	AME019.03
9	Why is calibration of instruments needed? Elaborate on the procedure adopted for calibrating instruments.	Remember	CO 1	AME019.03
10	With suitable examples, explain how flow measuring instruments are calibrated by the primary and secondary calibration methods.	Remember	CO 1	AME019.03
11	Briefly discuss on calibration of temperature measuring devices with suitable examples.	Remember	CO 1	AME019.03
12	Discuss the importance and procedure for calibration of strain gauges in various applications.	Remember	CO 1	AME019.03
13	What is the importance of calibration, error and correction curves in instrumentation? Discuss their usage in various applications.	Understand	CO 1	AME019.03
14	a) Define measurement and explain its significance in our day-to-day life. b) What are different sources of errors in measuring instruments? Suggest and	Remember	CO 1	AME019.04

	explain the methods for elimination or minimization of the errors.			
15	What is an error? Classify various errors and explain them in detail considering the importance of them in practical applications.	Understand	CO 1	AME019.04
16	Discuss the following transducers with respect to their construction, working and characteristics: a) Piezo-electric b) Capacitance c) Ionization	Understand	CO 1	AME019.04
17	What is the application of inductive transducer? Explain the calibration procedure for inductive transducer.	Remember	CO 1	AME019.04
18	Explain how a resistance potentiometer is used to measure displacement, with its advantages and limitations.	Understand	CO 1	AME019.04
19	Briefly discuss on a differential transformer being used for measuring displacement.	Understand	CO 1	AME019.04
20	a) List electrical transducers for measurement of linear and angular displacement. b) Explain the construction and working of a photo-electric transducer.	Understand	CO 1	AME019.04

### Part - C (Problem Solving and Critical Thinking Questions)

1	a) Distinguish between direct and indirect methods of measurement with suitable examples. b) Discuss propagation of uncertainties in measurement systems.	Remember	CO 1	AME019.05
2	With the help of a suitable example, explain the functional description of various elements of a generalized measuring system.	Understand	CO 1	AME019.05
3	Classify measuring instruments. Explain them in detail with neat sketches.	Understand	CO 1	AME019.05
4	Explain the dynamic response characteristics of first order instruments to step, ramp and sinusoidal inputs.	Understand	CO 1	AME019.05
5	a) Differentiate between accuracy and precision. b) How do second order instruments respond to ramp input?	Remember	CO 1	AME019.05
6	Elaborate on the procedure adopted for calibrating instruments and its importance.	Understand	CO 1	AME019.06
7	With suitable examples, explain how flow measuring instruments are calibrated by the primary and secondary calibration methods.	Understand	CO 1	AME019.06
8	Briefly discuss on calibration of temperature measuring devices with suitable examples.	Understand	CO 1	AME019.06
9	What is meant by statistical analysis of random errors? Explain the terms involved in it.	Remember	CO 1	AME019.06
10	Discuss about the desired, modifying and interfering inputs for a measurement system? Give examples for each of these quantities. What is the influence of these on the final output?	Understand	CO 1	AME019.06

## UNIT-II

### MEASUREMENT OF DISPLACEMENT, TEMPERATURE, PRESSURE

#### Part – A (Short Answer Questions)

1	Define the term transducer.	Remember	CO 2	AME019.05
2	What is meant by loading?	Remember	CO 2	AME019.05
3	Compare a primary transducer with secondary transducer.	Understand	CO 2	AME019.05
4	Give examples for active and passive transducers.	Remember	CO 2	AME019.05
5	What is an elastic transducer?	Remember	CO 2	AME019.05
6	Differentiate analog and digital transducers.	Remember	CO 2	AME019.05
7	What is an electric transducer?	Remember	CO 2	AME019.05
8	What is a mechanical transducer?	Remember	CO 2	AME019.05
9	What is meant by displacement measurement?	Understand	CO 2	AME019.05
10	List various transducers used for displacement measurement.	Understand	CO 2	AME019.05
11	State the basic principle behind a resistance potentiometer.	Understand	CO 2	AME019.05
12	List three areas where temperature measurement is important.	Understand	CO 2	AME019.06
13	Give the definition of temperature.	Remember	CO 2	AME019.06
14	Explain the basic principle on which the bimetallic thermometer works.	Remember	CO 2	AME019.06
15	List the common metals used in bimetallic strips.	Remember	CO 2	AME019.06
16	What is a pressure thermometer?	Remember	CO 2	AME019.06
17	What are the limitations of thermistor?	Remember	CO 2	AME019.06
18	Write the usage of a thermocouple?	Remember	CO 2	AME019.06
19	Write the characteristics of a thermopile?	Understand	CO 2	AME019.06

20	What are pyrometers?	Understand	CO 2	AME019.06
<b>Part - B (Long Answer Questions)</b>				
1	Design a measurement system for displacement measurement using LDR (Light dependent resistor) as sensor.	Understand	CO 2	AME019.05
2	Explain the principle of working of a pyrometer. With the help of a neat sketch, explain a pyrometer and state its advantages of the same.	Understand	CO 2	AME019.06
3	a) Explain the temperature measurement by thermocouples. b) Explain the temperature measurement by resistance thermometers.	Remember	CO 2	AME019.06
4	Explain the use of thermocouples for the measurement of average temperature of a room.	Remember	CO 2	AME019.06
5	a) Distinguish between RTD and Thermistor. b) State the laws of thermocouples. How are the laws useful in construction of thermocouple thermometers?	Remember	CO 2	AME019.06
6	a) Differentiate between rare metal thermocouples and base metal thermocouples. b) Why protection is needed for a sensing element?	Understand	CO 2	AME019.06
7	What is a bimetallic strip? Explain the working of a helix and spiral bimetallic thermometer.	Remember	CO 2	AME019.06
8	What are RTDs? On what basic principle do they work? Explain with diagram one of the RTDs.	Understand	CO 2	AME019.06
9	What is a thermistor? How is it used for temperature measurement? Give its applications, advantages and limitations.	Understand	CO 2	AME019.06
10	a) Explain the working principle, construction and characteristics of Linear Variable Differential Transformer (LVDT). b) A platinum resistance thermometer has a resistance of $140.5 \Omega$ and $100.0 \Omega$ at $100^\circ$ and $0^\circ$ respectively. If its resistance becomes $305.3 \Omega$ when it is in contact with a hot gas, determine the temperature of gas. Take the temperature coefficient of platinum as $0.0039^\circ\text{C}^{-1}$ .	Understand	CO 2	AME019.06
11	With the help of line diagrams, explain the construction, working and advantages of thermal conductivity gauges.	Remember	CO 2	AME019.07
12	With the help of a suitable diagram, explain the construction, working and principle features of bourdon tube pressure gauge.	Understand	CO 2	AME019.07
13	a) Explain the working principle of diaphragm gauge with a neat diagram. b) State the advantages and disadvantages of diaphragm gauge.	Understand	CO 2	AME019.07
14	a) Explain the working principle of manometers for pressure measurement. b) List out various types of manometers used for pressure measurement and discuss their specific characteristics.	Understand	CO 2	AME019.07
15	How do you measure the pressure with the help of U-tube manometer and micro-manometer?	Understand	CO 2	AME019.07
16	a) What is the basic principle in thermal conductivity gauge? Explain the working principle of thermal couple type conductivity gauge. b) A McLeod gauge having $V = 200 \text{ cm}^3$ and a capillary diameter of 2 mm is used to measure the gas pressure. What will be the pressure of the gas corresponding to a capillary of 4 cm?	Remember	CO 2	AME019.07
17	Explain the construction and working principle of Ionization pressure gauge.	Remember	CO 2	AME019.07
18	a) Explain absolute, gauge and vacuum pressure b) Explain with the help of suitable sketches, the difference between a Bellow gauge and a diaphragm gauge for pressure measurement.	Understand	CO 2	AME019.07
19	Describe the construction, theory and applications of different types of Diaphragm pressure gauges.	Understand	CO 2	AME019.07
20	Explain the construction, working principle and features of Pirani thermal conductivity gauge.	Remember	CO 2	AME019.07
<b>Part - C (Problem Solving and Critical Thinking Questions)</b>				
1	What is the principle of thermocouple? Explain how a thermocouple is used to measure temperature.	Remember	CO 2	AME019.06
2	State the three laws of thermocouples. Discuss their importance and practical applications in engineering.	Remember	CO 2	AME019.06
3	Discuss the working of total radiation pyrometer. Give its applications, advantages and limitations.	Understand	CO 2	AME019.06
4	What are the various pyrometers available for measuring temperature?	Understand	CO 2	AME019.06

	Discuss in detail about optical pyrometer.			
5	What is a dead weight tester? How is a dead weight tester used to calibrate pressure measuring devices?	Understand	CO 2	AME019.07
6	Give the classification of manometers in brief. Explain how a manometer is used to measure pressure.	Understand	CO 2	AME019.07
7	Explain the working of a bourdon tube pressure gauge. What are its advantages and limitations?	Remember	CO 2	AME019.07
8	State the principle of diaphragm gauges. How an elastic diaphragm gauge is used to measure pressure?	Remember	CO 2	AME019.07
9	What are bellows gauges? Explain the bellows gauge used to measure gauge pressure.	Remember	CO 2	AME019.07
10	Explain the bellows arrangement used to measure differential pressure. Give their advantages and limitations.	Remember	CO 2	AME019.07

### UNIT -III

#### MEASUREMENT OF DISPLACEMENT, TEMPERATURE, PRESSURE

##### Part - A (Short Answer Questions)

1	What is liquid level?	Remember	CO 3	AME019.08
2	What is the difference between direct and indirect liquid level measuring devices?	Understand	CO 3	AME019.08
3	Explain the basic principle behind electric liquid level sensors.	Understand	CO 3	AME019.08
4	Why flow measurement is important?	Understand	CO 3	AME019.09
5	What are secondary or rate meters?	Understand	CO 3	AME019.09
6	On what basic principle does an obstruction meter work?	Understand	CO 3	AME019.09
7	Where are magnetic flow meters used?	Remember	CO 3	AME019.09
8	What is an ultrasonic flow meter?	Remember	CO 3	AME019.09
9	Discuss about velocity and its concept.	Understand	CO 3	AME019.10
10	Write the two kinds of velocity	Remember	CO 3	AME019.10

11	State any one linear velocity transducer	Understand	CO 3	AME019.10
12	State any three mechanical tachometers used to measure angular velocity	Understand	CO 3	AME019.10
13	State the basic principle behind tacho-generators	Remember	CO 3	AME019.10
14	Write the list of various contactless electrical tachometers	Understand	CO 3	AME019.10
15	Write about vibration and its characteristics.	Remember	CO 3	AME019.11
16	What is piezo – electric effect?	Remember	CO 3	AME019.11
17	State the basic principle on which a seismic displacement sensing accelerometer works	Remember	CO 3	AME019.11
18	State the basic principle on which a strain gauge accelerometer works	Remember	CO 3	AME019.11
19	Write various instruments which are used for measuring vibrations	Remember	CO 3	AME019.11
20	Write any three measurement devices for measurement of linear velocity	Remember	CO 3	AME019.11

##### Part – B (Long Answer Questions)

1	Describe in detail with neat sketches: a) Hook level indicator b) Float operated potentiometer level indicator c) Cryogenic fuel method	Understand	CO 3	AME019.08
2	Explain in detail with neat sketches: a) Bubbler level indicator b) Ultrasonic level method c) Capacitive level method	Understand	CO 3	AME019.08
3	Distinguish between the direct and indirect modes of level measurement. Discuss in brief about the methods.	Remember	CO 3	AME019.08
4	Give the classification of float gauges in brief. Explain any one float operated liquid level gauge in detail.	Remember	CO 3	AME019.08
5	Discuss about purge system for liquid level measurement. Explain any one purge system to measure liquid level in detail.	Understand	CO 3	AME019.08
6	What is the principle of working of a magnetic flow meter? What are its advantages over other types of flow meters?	Understand	CO 3	AME019.09
7	a) Describe the construction of bubbler level indicator. b) Explain the use of rotameter for flow measurement.	Remember	CO 3	AME019.09
8	a) Explain the working principle of ultrasonic flow meter. b) Explain the construction and working principle of turbine flow meter with a neat sketch. State its advantages and limitations.	Remember	CO 3	AME019.09



9	With the help of a neat diagram, explain the construction, working and special features of Laser Doppler anemometer.	Understand	CO 3	AME019.09
10	a) Enumerate the principle of operation, construction details, advantages and limitations of rotameter. b) List out the advantages and disadvantages, applications of hot wire anemometer.	Understand	CO 3	AME019.09
11	Discuss with neat sketch the working of moving magnet type and moving coil type velocity transducer	Understand	CO 3	AME019.10
12	Explain with neat sketch the working of slipping clutch and centrifugal tachometer	Understand	CO 3	AME019.10
13	Explain with neat sketch the working of vibration measurement using stroboscope	Understand	CO 3	AME019.10
14	Explain with neat sketch the working of commutated capacitor tachometer	Understand	CO 3	AME019.10
15	Explain with neat sketch the working of DC and AC Tachogenerator	Understand	CO 3	AME019.10
16	Discuss with neat sketch the working of Inductive pickup and stroboscope tachometer	Understand	CO 3	AME019.10
17	Explain with neat sketch the working of photo electric and capacitor tachometer	Understand	CO 3	AME019.10
18	Give the applications and with neat sketch the working of vibrating reed and drag cup tachometer	Understand	CO 3	AME019.11
19	Explain with neat sketch the working of piezo-electric accelerometer	Understand	CO 3	AME019.11
20	Explain with neat sketch the working of linear and rotational seismic displacement sensing accelerometer	Understand	CO 3	AME019.11
<b>Part – C (Problem Solving and Critical Thinking)</b>				
1	Give the working principle and explain capacitive liquid level sensor used to measure liquid level.	Remember	CO 3	AME019.08
2	State the principle and describe the working of a rotameter. Enumerate its applications, advantages and limitations.	Remember	CO 3	AME019.09
3	Explain with neat sketch principle and working of Laser Doppler Anemometer mention advantages and disadvantages.	Remember	CO 3	AME019.09
4	Discuss the importance of magnetic flow meter in flow measurement. Explain the working of a magnetic flow meter.	Remember	CO 3	AME019.09
5	What are the various applications of ultrasonic waves in engineering? Explain the ultrasonic flow meter using the travel time difference method.	Understand	CO 3	AME019.09
06	Discuss the speed measurement requirement in engineering. Explain with neat sketch the working of revolution counter and timer	Understand	CO 3	AME019.10
07	Explain with neat sketch the working of Tachoscope. Enumerate its advantages and limitations.	Understand	CO 3	AME019.10
08	What is the importance of speed measurement? Explain with neat sketch the working of hand speed indicator.	Understand	CO 3	AME019.10
09	Give the areas where the measurement of acceleration is important in engineering. Explain with neat sketch the working of variable induction accelerometer.	Understand	CO 3	AME019.11
10	Explain with neat sketch the working of reed type vibrometer. Give its applications, advantages and limitations.	Remember	CO 3	AME019.11
<b>UNIT -IV</b>				
<b>MEASUREMENT OF STRESS–STRAIN, HUMIDITY, FORCE, TORQUE AND POWER</b>				
<b>Part – A (Short Answer Questions)</b>				
1	Write about strain and its concept.	Remember	CO 4	AME019.12
2	Define strain gauge and its importance.	Remember	CO 4	AME019.12
3	What is Poisson's ratio?	Remember	CO 4	AME019.12
4	What is gauge factor?	Remember	CO 4	AME019.12
5	What is bonded strain gauge?	Remember	CO 4	AME019.12
6	What is gauge rosette?	Understand	CO 4	AME019.12
7	What is self-temperature compensation?	Understand	CO 4	AME019.12
8	List the materials used for fine wire strain gauges	Understand	CO 4	AME019.12
9	What is piezo-resistivity?	Understand	CO 4	AME019.12
10	Define humidity and give its engineering concepts.	Remember	CO 4	AME019.13
11	Define dry air and enumerate its importance.	Remember	CO 4	AME019.13

12	What is moist air?	Remember	CO 4	AME019.13
13	Define saturated air	Remember	CO 4	AME019.13
14	What is absolute humidity?	Remember	CO 4	AME019.13
15	What is relative humidity?	Understand	CO 4	AME019.13
16	Define humidity ratio in the concept of instrumentation.	Understand	CO 4	AME019.13
17	What is percentage humidity?	Understand	CO 4	AME019.13
18	What is wet bulb depression?	Understand	CO 4	AME019.13
19	Define dew point temperature.	Understand	CO 4	AME019.13
20	Define force in the concept of instrumentation.	Understand	CO 4	AME019.14

**Part – B (Long Answer Questions)**

1	Discuss briefly on the various bonded strain gauges. Give their classification considering engineering applications.	Understand	CO 4	AME019.12
2	Discuss briefly on the surface preparation and bonding techniques for mounting bonded strain gauges	Understand	CO 4	AME019.12
3	Discuss the essential characteristics required for the backing material of a bonded strain gauge.	Understand	CO 4	AME019.12
4	Discuss the procedure to mount a strain gauge with paper backing on the surface under study.	Understand	CO 4	AME019.12
5	Explain one method of temperature compensation using an adjacent arm compensating gauge	Remember	CO 4	AME019.12
6	Explain how a sling psychrometer is used to determine the dry and wet bulb temperatures	Understand	CO 4	AME019.13
7	Give the classification of hygrometer. Explain the working of any one of the absorption hygrometers.	Understand	CO 4	AME019.13
8	Explain how a dew point meter is used to measure the dew point temperature.	Understand	CO 4	AME019.13
9	With suitable diagram briefly explain the details of a pendulum scale and discuss the applications.	Understand	CO 4	AME019.14
10	What is the practical application of unequal arm balance in engineering? Discuss in detail on an unequal arm balance.	Remember	CO 4	AME019.14
11	Give the various types of pendulum scales for different engineering applications. Explain with a diagram a pendulum scale of multi lever type.	Remember	CO 4	AME019.14
12	Discuss various engineering applications where the measurement of force is important. Explain the method of measuring force using a strain gauge load cell	Remember	CO 4	AME019.14
13	Discuss various engineering applications where the measurement of force is important. Explain how hydraulic load cells are used to measure force	Remember	CO 4	AME019.14
14	Discuss various engineering applications where the measurement of force is important. Explain the method of measuring force using a pneumatic load cell	Understand	CO 4	AME019.14
15	Discuss various engineering applications where the measurement of torque is important. Explain briefly how a stroboscope is used to measure torque	Understand	CO 4	AME019.15
16	Discuss various engineering applications where the measurement of torque is important. Explain the measurement of torque by optical torsion meter	Remember	CO 4	AME019.15
17	Give the applications, advantages and limitations of measurement of torque using slotted discs.	Remember	CO 4	AME019.15
18	Write about strain gauges on rotating shafts. Enumerate their advantages and limitations.	Remember	CO 4	AME019.15
19	Explain with a neat diagram, the working of a Prony brake for estimating power.	Understand	CO 4	AME019.16
20	What are dynamometers? Discuss briefly the working and advantages of fluid friction dynamometers.	Understand	CO 4	AME019.16

**Part – C (Problem Solving and Critical Thinking)**

1	What is strain? Compare and explain the difference between positive strain and negative strain.	Remember	CO 4	AME019.12
2	Define gauge factor. Enumerate what does it indicate if a strain gauge has a low gauge factor?	Understand	CO 4	AME019.12
3	Give the importance of strain measurement. Explain how an unbounded strain gauge is used to measure strain.	Understand	CO 4	AME019.12
4	Briefly give the classification of strain gauges. Discuss the advantages	Understand	CO 4	AME019.12



	and disadvantages of unbounded strain gauges.			
5	Differentiate the n – type and p – type sensing elements of a semi – conductor strain gauge.	Understand	CO 4	AME019.12
6	Give the importance of measurement of humidity in engineering applications. Give various instruments for humidity measurement.	Remember	CO 4	AME019.13
7	Explain the importance of measurement of strain in engineering applications. What is the purpose of providing backing for bonded strain gauges?	Remember	CO 4	AME019.13
8	Explain the importance of measurement of strain in engineering applications. What is temperature compensation with respect to strain gauges?	Remember	CO 4	AME019.13
9	Give the various engineering applications where force is to be measured. What is a proving ring? How is it used to measure force?	Remember	CO 4	AME019.16
10	Give the importance of dynamometers in measuring instruments. Explain driving and transmission dynamometers.	Understand	CO 4	AME019.16

#### UNIT -V

#### ELEMENTS OF CONTROL SYSTEMS

#### Part - A (Short Answer Questions)

1	Define a system and a control system.	Remember	CO 5	AME019.17
2	Write about control system and its uses.	Remember	CO 5	AME019.17
3	Write the elements of a control system.	Remember	CO 5	AME019.18
4	Define actuating signal in the concept of instrumentation.	Remember	CO 5	AME019.18
5	Define disturbance in the concept of instrumentation.	Remember	CO 5	AME019.18
6	Write the classification of control systems	Understand	CO 5	AME019.18
7	Define open-loop control system.	Remember	CO 5	AME019.18
8	Write the elements of open-loop control system	Remember	CO 5	AME019.18
9	Sketch the open-loop control system.	Remember	CO 5	AME019.18
10	Write the advantages of open-loop control system	Understand	CO 5	AME019.18
11	Write the limitations of open-loop control system	Understand	CO 5	AME019.18
12	Write two examples for open-loop control system	Understand	CO 5	AME019.18
13	Define closed-loop control system.	Understand	CO 5	AME019.18
14	Write the elements of closed-loop control system	Remember	CO 5	AME019.18
15	Sketch the closed-loop control system.	Remember	CO 5	AME019.18
16	Write the advantages of closed-loop control system	Remember	CO 5	AME019.18
17	Write the limitations of closed-loop control system	Remember	CO 5	AME019.18
18	Write two examples for closed-loop control system	Remember	CO 5	AME019.18
19	Define a controlled variable.	Remember	CO 5	AME019.19
20	Define an indirectly controlled variable	Remember	CO 5	AME019.19

#### Part - B (Long Answer Questions)

1	What is a control system? Explain the various elements of control system in detail.	Understand	CO 5	AME019.17
2	What is the role of control system in engineering applications? Explain four examples of control system applications.	Remember	CO 5	AME019.17
3	Give the importance and classification of control systems in engineering. Enumerate the applications of control system in various areas of engineering.	Understand	CO 5	AME019.18
4	Explain open-loop control system with neat sketch. Give the applications of open-loop control system.	Understand	CO 5	AME019.18
5	Discuss the advantages and limitations of open-loop control system. Explain briefly two examples of open-loop control systems.	Understand	CO 5	AME019.18
6	Explain closed-loop control system with neat sketch. Give the applications of closed-loop control system.	Understand	CO 5	AME019.18
7	Discuss the advantages and limitations of closed-loop control system. Explain briefly an example of closed-loop control systems	Remember	CO 5	AME019.18
8	Give the major classification of control systems. Explain advantages and disadvantages of open-loop control system	Remember	CO 5	AME019.18
9	Give the classification of control systems in application point of view. Explain advantages and disadvantages of closed-loop control system	Remember	CO 5	AME019.18
10	What is the role of feedback in control systems? Explain the characteristics of feedback.	Remember	CO 5	AME019.19

11	Give the importance of automation in control systems. Explain automatic control system.	Remember	CO 5	AME019.19
12	Explain the advantages and limitations of automatic control system along with its applications.	Understand	CO 5	AME019.19
13	Define block diagram and Explain the steps in developing a block diagram for an engineering problem.	Remember	CO 5	AME019.19
14	Give the comparison for pneumatic and hydraulic control systems. Explain with neat sketch the working of pneumatic control systems	Understand	CO 5	AME019.20
15	Give the comparison for pneumatic and hydraulic control systems. Explain with neat sketch the working of hydraulic control systems.	Remember	CO 5	AME019.20
16	Explain in detail about system error in the concept of instrumentation.	Understand	CO 5	AME019.20
17	Discuss about reference input in the concept of instrumentation.	Remember	CO 5	AME019.20
18	Explain in detail about Block diagram in the concept of instrumentation.	Understand	CO 5	AME019.20
19	Explain in detail about Stability in the concept of instrumentation.	Remember	CO 5	AME019.20
20	Explain in detail about system error in the concept of instrumentation.	Understand	CO 5	AME019.20
<b>Part – C (Problem Solving and Critical Thinking)</b>				
1	Discussing the importance of control systems and briefly explain the advantages and disadvantages of pneumatic control systems	Understand	CO 5	AME019.17
2	Discussing the importance of control systems and briefly explain the advantages and disadvantages of hydraulic control systems	Understand	CO 5	AME019.18
3	Explain the applications of pneumatic control systems in engineering. Enumerate their limitations.	Understand	CO 5	AME019.19
4	Explain the applications of hydraulic control systems in engineering. Enumerate their limitations.	Understand	CO 5	AME019.19
5	Discuss the advantages of control systems in engineering. Explain the requirements of control systems.	Understand	CO 5	AME019.19
6	What are the applications of servo systems in engineering. Explain the features of servo-mechanism.	Remember	CO 5	AME019.19
7	Explain with block diagrams any one position control system.	Remember	CO 5	AME019.19
8	Explain with block diagrams any one temperature control system.	Remember	CO 5	AME019.20
9	Explain with block diagrams any one speed control system.	Remember	CO 5	AME019.20
10	Enumerate the various engineering applications where measuring systems are involved with instruments. Explain the functions of instruments and measuring systems.	Understand	CO 5	AME019.20

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