INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**INSTRUMENTATION AND CONTROL SYSTEMS**
Course Code	:	**AME019**
Program	:	B.Tech
Semester	:	SEVEN
Branch	:	Mechanical Engineering
Academic Year	:	2020 - 2021
Course Faculty	:	Dr. GVR Seshagiri Rao, Associate Professor

COURSE OBJECTIVES:

The students will try to learn:	
I	The fundamental knowledge of measuring principles, configuration and functional description of instruments with static, dynamic inputs and error control.
II	The concepts and working of instrumentation devices for displacement, flow, dynamic and other mechanical measurement applications.
III	Instrumentation practices and automatic control system for monitoring industrial real time processes within limits of parameter specifications.

COURSE OUTCOMES:

At the end of the course students are able to:		
Course Outcomes		**Knowledge Level (Bloom's Taxonomy)**
CO 1	**Recognize** the importance of basic principles, configuration and functional description of measuring instruments.	Remember
CO 2	**Describe** performance characteristics of an instrument when the device is exposed to measure dynamic inputs and error control.	Understand
CO 3	**Categorize** the measuring instruments based on the principle of working with the physical parameters such as displacement, temperature and pressure.	Understand
CO 4	**Explain** calibration of instruments for measurement of all types of mechanical parameters.	Understand
CO 5	**Demonstrate** working principle of level measuring devices for ascertaining liquid level and choose appropriate device for controlling fluid level in industrial applications.	Understand

CO 6	**Discuss** the theory, phenomena and working principle of flow measuring instruments and calibration.	Understand
CO 7	**Make use of** appropriate instrument for measuring Speed, Acceleration and Vibration by considering different aspects.	Apply
CO 8	**Demonstrate** the concepts for measurement of Stress, Strain, Humidity and their application for finding stress, strain, and humidity.	Understand
CO 9	**Describe** the principles of measurement of force, torque and power and their application in industries for finding force, torque and power.	Understand
CO 10	**Apply** relevant control systems for speed, position and control processes in practical applications.	Apply

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S No	QUESTION	ANSWER	Blooms Taxonomy Level	Course Outcome
		UNIT-I		
1	Define Instrumentation.	The division of e engineering science which deals with measuring techniques, devices and their associated problems is called Instrumentation.	Remember	CO 1
2	What is Measurement?	Measurement is the act, or result of a quantitative comparison between a	Remember	CO 1
3	Define secondary Measurement.	The indirect measurements involving one translation are called secondary measurement.	Remember	CO 1
4	Explain function of a sensor.	The function of sensor element is to sense the measured i.e. physical parameter to be measured.	Understand	CO 1
5	List the functions of measuring systems.	The main functions of measuring system are Indicating Function. Recording Function. Controlling Function.	Remember	CO 1
6	What is manipulator?	Manipulator is an element is used to manipulate (modify) the output of Variable conversion element such that it can be accepted by other element. For example; electrical amplifier which is a manipulator and it amplifies the signal applied to it. It increases its electrical signal of low magnitude to high magnitude signal. It also operates like addition, subtraction, integration, differentiation etc.	Remember	CO 1
7	Explain transmitter.	Transmitter is a data transmission element used to transmit the measured signal from one place to other.	Understand	CO 1
8	Explain static characteristics.	The characteristics which describe the performance of measuring instruments when subjected to low frequency inputs or DC inputs are referred to as static characteristics	Understand	CO 1
9	What is accuracy?	Accuracy is defined as the TLO senses with which the reading of the instrument approaches true value.	Remember	CO 1
10	Define static error.	Static error is defined as the difference between the best measured value and the true value of the quantity.	Remember	CO 1

		Static Error = Measured value – True value.		
11	Define reproducibility.	Represents the degree of TLO senses with which a given value of a quantity (variable) may be repeatedly measured with in a TLO sense range.	Remember	CO 1
12	What is drift?	It is characteristic which indicates the change in the output of the instrument (transducer) for a zero input.	Remember	CO 2
13	Define Sensitivity.	Sensitivity can be defined as the ratio of magnitude of the output to the magnitude of input signal being measured. Sensitivity = Change in output signal / Change in input K = qo / qi where K = sensitivity qo = Value of output signal qi = Value of input signal	Remember	CO 2
14	Define and zone.	Dead zone (Dead band) can be defined as the largest variation in the value of input for which the instrument cannot respond and produces no output.	Remember	CO 2
15	Define time constant.	Time constant is defined as the time required for the output of the system to reach 63.2% of the final output value.	Remember	CO 2
16	Define Precision.	Precision can be defined As the ability of the measuring system to reproduce the same output among several independent measurement sunder specified conditions or within a given accuracy is referred to as precision and is expressed in terms of deviation in measurement.	Remember	CO 2
17	Define Linearity.	Linearity can be d e f i n e d as the TLO senses of actual calibration curve of the instrument to the idealized straight line with in a given range of full scale output.	Remember	CO 2
18	Define threshold.	Threshold of an instrument can be defined as the smallest quantity of input below which the output will not be detected. It can be specified as percentage of maximum scale deflection or an absolute value in terms of units of input.	Remember	CO 2
19	Define hysteresis.	Hysteresis can be defined as maximum differences in output at any measured value within the specified range when approaching the point with increasing and then decreasing input.	Remember	CO 2
20	State resolution.	Resolution of a measurement can be stated as any smallest i n c r e m e n t in the measured variable that can be noticed or detected by that instrument with certainty.	Remember	CO 2
21	Define stability.	Stability can be defined as the ability of the instrument to have the same standard of performance over a prolonged period of time.	Remember	CO 2
22	What is range and span?	The region between which the instrument is to operate is called range. Range = Lc to Hc where Lc= Lower calibration value, Hc=higher calibration value Span is the	Remember	CO 2

		difference between Upper and Lower limits of the instrument.		
23	Define speed of response.	Speed of response can be defined as the rapidity with which an instrument responds to sudden changes in the measured quantity.	Remember	CO 2
24	Define Measurement lag.	Measurement lag is the retardation or delay in the response of an instrument to changes in the measured quantity.	Remember	CO 2
25	Define fidelity.	The instrument reading follows the measured variable. i.e. It is the degree to which an instrument indicates the changes in measured variable without dynamic error.	Remember	CO 2
UNIT-II				
1	Define transducer.	A transducer is a device Which senses the physical variable to be measured and converts into a suitable signal (voltage or current).	Remember	CO 3
2	List transducers used for measurement of displacement.	Linear Variable Differential Transformer Capacitive transducer Piezo-electric transducer Ionization transducer Hall effect displacement Transducer Light Dependent Transducer	Remember	CO 3
3	Explain active transducer.	The transducer which do not require any external excitation energy to provide their output are known as active transducer. Example: • Piezoelectric transducer • Photo voltaic cell • Thermocouple • Moving coil generator	Understand	CO 3
4	Explain primary transducer.	A transducer which is used as the first element in a measurement system and it senses the physical parameters (like temperature, pressure, displacement, force etc.) and converts them into a mechanical parameter (usually displacement)	Understand	CO 3
5	Explain secondary transducer.	A transducer which is used as the second element of a measurement system, to convert the mechanical output of primary transducer into an electrical quantity is known as secondary transducer. Generally these are electrical type transducers. Example: -Strain gauge, LVDT	Understand	CO 3
6	Explain analog transducer.	Analog transducer is a transducer which produces an output in analog form or a form which is a continuous function of time. Example: Thermistor , Thermocouple, Strain gauge, LVDT	Understand	CO 3
7	Explain digital transducer.	Digital transducer: It is a transducer which produces an output in digital form or in the form of pulses. Example: Turbine flow meter.	Understand	CO 3
8	Explain inverse transducer.	A measuring device which measures and converts non- electrical quantity into electrical quantity is known as transducer. Such transducers are usually used in the input stage of a system.	Understand	CO 3

9	Explain principle of variable resistance transducer.	This device is a variable resistor whose resistance is varied by movement of a slider over its resistance element. The slider is connected to an arm which is moved by the component whose linear motion is to be sensed. When the component moves to the right, the resistance of the potentiometer is increased and the amount of increase is a function of the amount of linear motion of the component. The resistance can be measured by employing a Wheatstone bridge circuit.	Understand	CO 3
10	What is LVDT and Mention usage of it?	Linear variable differential transformer. It is used to measure linear displacement.	Remember	CO 3
11	Explain the principle of LVDT.	It consists of a primary winding (PW) and two identical secondary windings (SW1, SW2) and a soft iron core which is connected by means of an arm to the moving component and moves with it. When the core is placed centrally, equal but opposite emf are induced in the secondary windings and zero output is recorded. A variation in the position of the core from its null position produces an unbalance in the resistance of the secondary windings to the primary windings, thus upon displacement of the core, the result will be a voltage rise in one secondary and a decrease in the other.	Understand	CO 3
12	List the use of rotary variable differential transformer.	RVDT is used to find angular displacement of rotating element.	Remember	CO 3
13	Explain the principle of capacitive transducer.	Capacitive transducer operates on the principle of capacitance of a parallel plate capacitor which is given by $C = \epsilon . A/d$ Where C = Capacitance of a capacitor (in Farads) A= over lapping area of Capacitor plates d= distance between capacitor plates. ϵ = Permittivity of medium (F/m)	Understand	CO 3
14	Define temperature	A condition of a body by virtue of which heat is transferred to or from other bodies" and a quantity whose difference is proportional to the work from a carnot engine operating between a hot source and a cold receiver	Remember	CO 3
15	Explain physical properties of matter used for measurement of temperature.	Change in physical state Change in chemical state or properties. Change in dimensions Change in electrical properties.	Understand	CO 3
16	What is the Operating principle of resistance thermometer?	The operating principle of resistance thermometer is that the resistance of conductor changes with the change in temperature.	Remember	CO 4
17	Define the operating principle of gas thermometer.	The operating principle of gas thermometer is that the change in pressure of a gas corresponding to change in temperature.	Remember	CO 4
18	Define the principle of liquid-in-glass thermometer.	The operating principle of liquid-in-glass thermometer is that differential expansion of liquid and glass on heating is used to indicate temperature.	Remember	CO 4

19	Explain how bimetallic sensor is formed.	When two different materials which have different thermal expansion coefficient are joined together, then bimetallic thermometer or bimetallic sensor is formed.	Remember	CO 4
20	List the applications of bimetallic thermometers.	Bimetallic thermometers are used in Control devices in a process oil burners Refineries. AC thermostats	Remember	CO 4
21	Define Calibration.	Operation that, under specified conditions, in a first step, establishes a relation between the quantity values with measurement uncertainties provided by measurement Standards and corresponding indications with associated measurement uncertainties (of the calibrated instrument or secondary standard) and, in a second step, uses this information to establish a relation for obtaining a measurement result from an indication.	Remember	CO 4
22	Define principle of solidrod thermometer.	The principle of solid rod thermometer is linear expansion of the metals due to changes in temperature.	Remember	CO 4
23	What is the principle of thermistor.	The principle of thermistor is that the resistance is inversely proportional to temperature. As temperature increases resistance also increases and as temperature decreases the resistance increases.	Remember	CO 4
24	Define Peltier effect.	The electromotive force results from contacts of the two dissimilar metals and junction temperature.	Remember	CO 4
25	What is thermocouple?	Thermocouple is a temperature sensor used to measure temperature. It is firmed by joining two dissimilar metals. Hot or measuring junction is used to sense temperature to be measured and cold junction is kept at reference temperature.	Remember	CO 4
26	List the law of intermediate metals.	Insertion of an intermediate metals into a thermocouple circuit will not affect the net emf, provided the two junctions introduced by the third metal are at identical temperature	Remember	CO 4
27	Define law of intermediate temperature.	If a simple thermocouple circuit develops an emf e_{12} when its junctions are at temperatures $T1$ and $T2$, and an emf e_{23} when its junctions are temperatures $T2$ and $T3$. It develops an emf e13 considering junctions 1, 3. $e13 = e12 + e23$ it will develop an emf ($e_{12} + e_{23}$)	Remember	CO 4
28	What is phyrometer?	pyrometer is a instrument used to measure temperature	Remember	CO 4
29	What is phyrometry.	The term pyrometer means temperature measurement technique.	Remember	CO 4
30	Define transducer.	A transducer is a device which senses the physical variable to be measured and converts into a suitable signal (voltage or current).	Remember	CO 4

UNIT-III				
1	Define the principle of direct method of measuring level.	Direct method uses the varying level of the liquid as a means of obtaining the measurement. The response of the device indicates the changes in liquid level directly.	Remember	CO 5
2	Explain indirect method of level measurement method.	In indirect methods of level measurement methods, uses a variable (resistance, capacitance, inductance, buoyancy force, hydrostatic pressure) that changes with the liquid level to actuate measuring mechanism.	Understand	CO 5
3	Explain the working principle of displacer type liquid level measuring method.	The working principle of displacer type liquid level measuring instruments depends on Archimedes's principle. According it this, an object or mass when dipped in a liquid is buoyancy up by an amount of force which is equal to the weight of the displaced liquid. The object dipped in the water is referred as displacer	Understand	CO 5
4	Explain the working principle of capacitive level indicator.	Capacitive level indicator operates on the principle of parallel plate capacitor, which can be stated as the capacitance of two parallel plate capacitor varies or changes, if the over lapping area or dielectric constant changes.	Understand	CO 5
5	Explain the operating principle of radioactive measurement of level.	The Radioactive method is based on the principle of dependence of absorption of radioactive radiation upon the height of the liquid level. In this method, radioactive isotopes are used as the source of the radioactive emission.	Remember	CO 5
6	Explain the principle of float operated potentiometer level indicator.	The float position changes with a change in the level of the liquid in the tank. The float displacement then actuates an arm which causes a slider to move over the resistance element of a rheostat. The circuit resistance changes and this resistance change is inversely proportional to the liquid level in the tank	Understand	CO 5
7	Define the principle of ultrasonic level measuring instrument.	This method works based upon the utilization of the law of the reflection of ultrasonic oscillations from the air-liquid boundary. The principle of operation is based on the application to the medium, the level of which it is required to measure, the sharply directed impulses of elastic oscillations at an ultrasonic frequency.	Remember	CO 5
8	List the use of Magnetic type level indicator	Magnetic type level indicator is used to measure level of liquids containing corrosive and toxic materials.	Remember	CO 5
9	Explain the working principle of bubbler type level indicator.	The working principle o bubbler level indicator is that, the air pressure in the pneumatic pipe line is adjusted and maintained greater than the hydrostatic pressure at the lower end of the bubbler tube. The bubbler tube is dipped in the tank such that its end is at zero level then the supply of air through the bubbler tube regulator is	Understand	CO 5

		adjusted accomplished until bubbles are seen leaving the lower end of the bubbler tube.		
10	What is cryogenic fuel.?	A gas which changes its state (gaseous state into liquid state), when cooled to very low temperature is known as cryogenic fuel. A cryogenic fluid exists in liquid state at very low temperatures, which are usually less than the temperature levels at which as super conductor exhibits zero resistance characteristic.	Remember	CO 5
11	Define the principle of rotometer.	The working principle of a rotometer is that for a given rate of flow, the float assumes a position in the tube, where the forces acting on it are in equilibrium. The position of float is dependent on flow rate and annual area between float and tube.	Remember	CO 5
12	Explain the principle involved in electromagnetic flow meter.	The measurement of flow rate using an electromagnetic flow meter depends on Faraday's law of electromagnetic induction. The induced voltage is expressed by the relation e = B l V * 10-8 where e = the induced voltage in volts l= the length of the conductor in cm V=velocity of the conductor in cm/sec	Understand	CO 5
13	Explain about principle of turbine flow meter.	The measurement of flow rate using an electromagnetic flow meter depends on Faraday's law of electromagnetic induction. The induced voltage is expressed by the relation e = B l V * 10-8 where e = the induced voltage in volts l = the length of the conductor in cm V = velocity of the conductor in cm/sec	Understand	CO 5
14	Explain the principle of hot wire anemometer.	When a fluid (gas or liquid) flow over an electrically heated surface or heated wire, heat transfer takes place from the surface of wire to the fluid. Hence the temperature of the heated wire decreases, which causes variations in its resistance. The change that occurred in the resistance of the wire is related to the flow rate.	Understand	CO 5
15	Explain about basic principle of laser Doppler anemometer works.	Laser Doppler Anemometer works on the principle of Doppler effect. It states that whenever a laser beam passes through the moving fluid, frequency shift takes place in the light scattered by the small particles present in that fluid. This shift in the frequency of beam is directly proportional to the velocity of the fluid flow.	Remember	CO 5
16	List the methods of determining flow rate with ultrasonic flow meter.	Methods for determining flow rate Travel time difference method Frequency difference method.	Understand	CO 6
17	Define linear speed.	Linear speed : Rate of changes of linear displacement expressed in meters/sec (m/s)	Remember	CO 6
18	Define angular speed.	Angular speed is rate of change of angular displacement (rotational speed) expressed	Remember	CO 6

		in radians/second (radians/sec) or revolutions per minute (rpm).		
19	What is a tachometer.?	An instrument used to measure angular velocity of shaft by registering, the number of rotations during the period of contact, or by indicating directly the number of rotations per minute.	Remember	CO 6
20	Explain the principle of mechanical tachometer.	Mechanical tachometers operate on the principle of movement of mechanical parts for speed measurement. The mechanical movements give rise to the revolutions of the shaft, which is counted by a counter. These evolutions made by shaft are directly proportional to the speed.	Understand	CO 6
21	Explain operating principle of centrifugal tachometer.	Centrifugal tachometer operates on the principle that centrifugal force is directly proportional to the speed of rotation.	Understand	CO 6
22	What is the principle of vibration reed tachometer?	The basic principle of vibration reed tachometer is that vibration and speed of a body are interrelated.	Remember	CO 6
23	Explain the operating principle of Eddy current tachometer.	Operating principle of eddy current tachometer is that the relative perpendicular motion between a magnetic field and conductor results in voltage generation in the conductor. Magnitude of this voltage is a direct function of the strength of the magnetic field and the speed with which the conductor moves perpendicular to it.	Understand	CO 6
24	Explain the operating principle of commutated capacitor tachometer.	The operation of this tachometer is based on alternately charging and discharging of a capacitor. These operations are controlled by the speed of the machine under test.	Understand	CO 6
25	Explain the basic principle of photo electric type tachometer.	When a beam of light hits the reflecting surface on the rotating shaft, light pulses are obtained and the reflected light is focused on to the photoelectric cell. The frequency of light pulses is proportional to the shaft speed and so will be the frequency of electrical output pulses from the photo electric cell.	Understand	CO 6
26	Explain the principle involved in measurement of speed with stroboscope.	The principle involved in measurement of speed through stroboscope is to make the moving objects visible only at specific interval of time by adjusting flashing frequency under this condition the speed rotation is equal to the flashing frequency.	Understand	CO 6
27	Define vibration.	The displacement –time variation is of a generally continuous form with some degree of repetitive nature is called vibration.	Remember	CO 6
28	Define Jerk.	The rate of change of acceleration is called as jerk.	Remember	CO 6
29	List the t causes of vibrations.	Imbalance of machine Resonance Misalignment. Mechanical asymmetry electrical asymmetry Use of wrong ball bearing	Remember	CO 6
30	What is a vibrometer?	A device used for measurement of vibrations is called as vibrometer.	Remember	CO 6

UNIT-IV				
1	Define stress.	Pressure or tension exerted on a material object.	Remember	CO 7
2	What is axial strain.?	Axial Strain = ξ a = change in length / original length = (L 2 -L1)/L1 = ΔL/L1 Where ξ a = axial strain L1 = Linear dimension or gauge length	Remember	CO 7
3	What is a strain gauge?	A strain gauge is a strain transducer, i.e., device for measuring dimensional changes on the surface of a structural member under test.	Remember	CO 7
4	List the requirements of strain gauge.	i.Extremely small size and negligible mass ii.Simple and easy attachment to the specimen under test iii.High speed of response. iv.High sensitivity in the direction of measured strain. v.Capability to indicate static, dynamic strain. vi.In sensitive to ambient conditions (temp, humidity, vibration) vii.Inexpensive. viii.Availability in various types & size	Remember	CO 7
5	List the strain measuring techniques.	-Mechanical strain gauges -Electrical strain gauges - Photo-elastic strain gauges	Remember	CO 7
6	List the requirements of strain gauges.	Extremely small size and negligible mass Simple and easy attachment to the specimen under test High speed of response. High sensitivity in the direction of measured strain. Capability to indicate static, dynamic strain. In sensitive to ambient conditions Inexpensive. Availability in various types & size	Remember	CO 7
7	List different forms of bonded resistance type gauges.	Grid type strain gauge Foil type strain gauge Semiconductor gauge	Understand	CO 7
8	What is bonding material.?	The form of cement or adhesives that are used to attach strain gauge to the test specimen is called bonding material.	Remember	CO 7
9	Explain need for gauge protection.	The strain gauge has to be protected from ambient conditions. Protection from moisture, oil, dust and dirt.	Understand	CO 7
10	What is Strain gauge rosette?	a group of gauges bonded to the same supporting material in definite relative positions is called strain gauge rosette. Depending on the arrangement of grids, we have the rectangular, delta and T-delta rosettes.	Remember	CO 7
11	List number of strain gauges used in half bridge setup of strain measurement.	Two stain gauges are used in half bridge circuit for measurement of strain.	Understand	CO 7

12	List various strain gauges are used in full bridge setup of strain measurement.	Four stain gauges are used in half bridge circuit for measurement of strain.	Remember	CO 7
13	What is humidity.?	Humidity refers to dampness, i.e., water vapour content of air	Remember	CO 7
14	Explain dry air.	When there is absence of water vapor in the atmosphere, it is called dry air.	Understand	CO 7
15	Explain saturated air.	Saturated air is the moist air wherein the partial pressure of water vapour equals the saturation pressure of stream corresponding to the temperature of air.	Understand	CO 7
16	Explain absolute humidity.	Absolute humidity represents the amount of water-vapour actually present in the air. Expressed as gm per cubic meter of air.	Understand	CO 8
17	What is specific humidity.	This is the ratio of the mass of water-vapour to the mass of dry air in a given volume of air-water vapour mixture.	Remember	CO 8
18	What is relative humidity.	Relative humidity compares the humidity of air with the humidity of saturated air at the same temperature and pressure. For a saturated air, relative humidity equals 100%,	Remember	CO 8
19	Explain due point temperature.	When the temperature of air is reduced by continuous cooling at constant pressure, the water vapour in the air starts condensing at a particular temperature which is referred to as the dew point temperature.	Understand	CO 8
20	what is dry bulb temperature.	Dry-bulb temperature refers to the temperature of air- water vapour mixture as indicated or recorded by a thermometer whose bulb is exposed to temperature.	Remember	CO 8
21	Explain wet bulb temperature.	Wet-bulb temperature refers to the temperature of air- water vapour mixture as registered by a thermometer whose bulb is covered by a wick maintained continuously wet. When the air passes over the wet wick, the moisture contained in the wick tends to evaporate and a cooling effect is produced at the bulb	Understand	CO 8
22	List the use of psychometric chart.	A chart used in humidity calculations is called psychrometric chart.	Remember	CO 8
23	Explain the operating principle of Absorption hygrometer.	The operating principle of absorption hygrometer involves the change of liner dimension of some hygroscopic materials like wood, paper, human air, animal membrane etc.., when they absorb moisture from the atmosphere.. This absorption is dependent on the temperature and partial pressure of atmosphere, and hence its humidity.	Understand	CO 8
24	Explain the operating principle of electrical humidity sensing hygrometer.	The operating principle of electrical humidity sensing hygrometer depends on the variation of resistance with variation in humidity.	Understand	CO 8
25	Explain the operating principle of electrical method for moisture measurement.	The operating principle of electrical moisture determination is based on the variation in electrical resistance or capacitance of the material due to change in the moisture content.	Understand	CO 8

26	Explain the principle of dew point meter.	Dew point measuring instrument depend on the appearance of moisture on a polished metal plate as the dew point is reached. The air sample to be analyzed is made to impinge upon a polished metal target which is cooled either by a water- ice mixture or by the evaporation of volatile substance like ether. The temperature at which the first droplet appears on the surface is taken as the dew point.	Understand	CO 8
27	What is a torque?.	Torque represents the amount of twisting effort and numerically it equals to the product of force and the momentum arm or the perpendicular distance from the point of rotation (fulcrum) to the point of application of force. Consider a wheel rotated by the fore F applied at radius 'r'. Torque or twisting movement is given by T = F. r	Remember	CO 8
28	Explain the principle of hydraulic load cell.	The principle of operation of hydraulic load cell is, when the force is applied in a liquid medium, the pressure of the liquid increases. This increase in pressure is a measure of the applied force when calibrated.	Understand	CO 8
29	Explain the principle of hydraulic load cell.	The principle of operation of hydraulic load cell is, when the force is applied in a liquid medium, the pressure of the liquid increases. This increase in pressure is a measure of the applied force when calibrated.	Understand	CO 8
30	Define power.	Power is the rate of doing work and is obtained by dividing the work done by time. Power = work done per unit time	Remember	CO 8
UNIT-V				
1	Define a system.	A system is an assemblage of devices and components connected or related by some form of regular interaction or interdependence to form an organized whole and perform specified tasks. The system produces an output corresponding to a given input.	Remember	CO 9
2	List the requirements of control system.	Three main requirements of a control system. They are Accuracy Speed of response	Understand	CO 9
3	what is stability of a system	System said to be stable if it produces bounded output for a bounded input also the output reaches to zero state in the absence of the input, independent of initial conditions.	Remember	CO 9
4	Define open loop system.	A system in which the output has no effect on the input is called as open loop control system. Unmonitored control system is called open loop system.	Remember	CO 9
5	Define closed loop system.	A system in which the output has an effect on the input is called as closed loop system. Feedback controlled system is called as closed loop system.	Remember	CO 9
6	List the examples for open loop system.	An electrical on-off system Washing machine An automatic toaster.	Remember	CO 9

7	List the examples for closed loop system.	Control of thermal system. An automobile steering system. Biological control system.	Remember	CO 9
8	Explain manual Closed loop system.	The closed loop systems listed above involve a continuous manual control by human operators and are classified as manual feed back or manual closed-loop systems.	Understand	CO 9
9	Define automatic control system.	A close-loop system operating without human is called as automatic control system.	Remember	CO 9
10	List the example for manual control system.	Manual control of thermal system.	Remember	CO 9
11	List the example for automatic control system.	Water level control system is an automatic control system.	Remember	CO 9
12	Pressure control system is example for which type of system.	Pressure control system is an automated control system.	Remember	CO 9
13	Which type of system consists feedback loop.	A closed loop system or automated system contains feedback loop.	Remember	CO 9
14	Define controlled variable.	Quality or condition of characterizing a process whose value is held constant by controller or changed according to certain law.	Remember	CO 9
15	Define controlled medium.	The process material in the controlled system or flowing through it in which the variable is to be controlled.	Remember	CO 9
16	Define command in a system.	An input that is established or varied by some means external to and independent of the feedback control system.	Remember	CO 10
17	What is manipulated variable.?	The quality or condition that is varies as a function of the actuating signal so as to change the value of the control element (g1).	Remember	CO 10
18	What is actuating signal.?	An algebraic sum of the reference input ‘r’ and the primary feedback ‘b’. The actuating signal is also called the error or control action.	Remember	CO 10
19	What is primary feedback signal (b).	A function f the controlled output ‘c’, which is compared with the reference input to obtain the actuating signal.	Remember	CO 10
20	Explain error detector.	An element that detects the feedback of the system.	Understand	CO 10
21	Explain negative feedback.	Negative feedback occurs when the feedback signal subtracts from the reference signal e = r - b Negative feedback tries to reduce the error	Understand	CO 10
22	Explain positive feedback signal.	If the feedback signal adds to the reference signal, the feedback is said to be positive e = r + b positive feedback makes the error large.	Understand	CO 10
23	Explain disturbance.	An undesirable variable applied to the system which tends affect adversely the value of the variable being controlled. The process disturbance may be due to changes in set point, supply, demand, environmental and other associated variables.	Understand	CO 10
24	Explain feedback element.	An element of the feed-back control system that establishes a functional relationship	Understand	CO 10

		between the controlled variable ‘c’ and the feedback signal ‘b’.		
25	Explain control element	An element that is required to generate the appropriate control signal (manipulated variable) ‘m’ applied to the plant.	Understand	CO 10
26	Define Servo mechanism.	Servo mechanism is an automatic feedback control system whose function is to make the output of the system to follow/track the continuously varying input variable or desired variable	Remember	CO 10
27	Define Regulator.	A Regulator: is a feed-back control system in which the output (controlled variable) is maintained at a preset value irrespective of external load on the plant.	Remember	CO 10
28	Explain process Control.	Process control is a feedback control system which operates in order to maintain the value of a certain parameter of the process to the desired value, irrespective of the external disturbances acting on the process	Understand	CO 10
29	Explain position control system.	Position control is a plant With zero integration between the control input and plant input. It indicates the proportionality between the input or displacement of the control and the plant output. It controls the position directly with the help of a human operator control.	Understand	CO 10
30	Explain acceleration control.	Acceleration control is a plant with two integrations between the control input and plant output. It indicates the proportionality between input or displacement of the control and the acceleration of the plant output. It is a high order control which provides high-order gains to the algorithms of position control. It operates on high order derivatives of the controlled parameter i.e., position or displacement.	Understand	CO 10

Prepared by:
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