Q) The solution to an optimal control problem may not exist if the system considered is not -------- --> **Controllable**

Q) Although most physical systems are controllable, the corresponding mathematical models may not possess the property of -------- --> **Controllability**

Q) The concept of observability is useful in solving the problem of reconstructing unmeasurable -------- --> **State**

Q) If any state variable is independent of control signal of the control signal, then it is impossible to control this state variable and therefore the system is -------- --> **Uncontrollable**

Q) Complete -------- is neither necessary nor sufficient for controlling the output of the systems --> **State controllability**

Q) -------- is concerned with the problem of whether it is possible to steer a system from a given initial state to an arbitrary state --> **Controllability**

Q) A system is said to be -------- if it is possible by means of an unbounded control vector to transfer the system from an initial state to another state in a finite number of sampling periods --> **Controllable**

Q) -------- is concerned with the problem of determining the state of a dynamic system from observations of the output and control vectors in a finite number of sampling periods. --> **Observability**

Q) A system is said to be -------- if, with the system in state \( x(0) \), it is possible to determine this state from the observations of the output and control vectors over a finite number of sampling periods --> **Observable**

Q) A control system is said to be completely --------, if it is possible to transfer the system from any arbitrary initial state to any desired state in a finite time period --> **State controllable**

Q) If the state controllability matrix for a system is \[
\begin{bmatrix}
1 & 0.8 \\
0 & 0.64
\end{bmatrix}
\]
then the system is --> **Not completely state controllable**

Q) If the state controllability matrix for a system is \[
\begin{bmatrix}
2 & -2 \\
3 & 6
\end{bmatrix}
\]
then the system is --> **State controllable**

Q) If the observability matrix for a system is \[
\begin{bmatrix}
1 & -1 \\
5 & 2
\end{bmatrix}
\]
then the system is completely --> **Observable**

Q) If the observability matrix for a system is \[
\begin{bmatrix}
0 & 1 \\
1 & 2
\end{bmatrix}
\]
then the system is completely --> **Observable**

Q) If a discrete - time control system is defined by where \( G = n \times n \) matrix, \( H \) is \( n \times 1 \) matrix, then for complete state controllability rank of controllability matrix should be -------- --> **n**

Q) If a system is defined by the equations \[
\dot{x}(k+1) = Ax(k) + Bu(kT) \quad \text{and} \quad y(kT) = Cx(kT)
\]
where \( G = n \times n \) matrix, \( C = m \times n \) matrix then for complete observability, the rank of observability matrix should be --> **n**
Q) If the observability matrix for a system is
\[
\begin{bmatrix}
0 & 0 \\
1 & -2
\end{bmatrix}
\]
then the system is completely \(\rightarrow\) **Not observable**

Q) If the output controllability matrix for a system is
\[
\begin{bmatrix}
2 & 3 \\
2 & 5
\end{bmatrix}
\]
then the system is completely \(\rightarrow\) **Output controllable**

Q) If the output controllability matrix for a system is
\[
\begin{bmatrix}
1 & 2 \\
2 & 4
\end{bmatrix}
\]
then the system is completely \(\rightarrow\) **Not output controllable**

Q) If a system \(s_1\) with
\[
X((k+1)T) = Cx(kT) + Hu(kT)
\]
has a dual part \(s_2\), then state matrix of \(s_2\) is \(\rightarrow\) **\(G^*\)**

Q) If a system \(s_1\) with
\[
X((k+1)T) = Cx(kT) + Hu(kT)
\]
and \(y(kT) = Cx(kT)\) has a dual part of \(s_2\),
then input matrix of \(s_2\) is \(\rightarrow\) **\(C^*\)**

Q) If a system \(s_1\) with
\[
X((k+1)T) = Cx(kT) + Hu(kT)
\]
and \(y(kT) = Cx(kT)\) has a dual part of \(s_2\),
then output matrix of \(s_2\) is \(\rightarrow\) **\(H^*\)**

Q) By using the principle of duality, observability of a given system can be checked by testing the \(\rightarrow\) **State controllability**
\[
y(x) = \frac{(x + 3)}{(x + 2)(x + 3)}
\]
then the system is completely \(\rightarrow\) **State controllable & Observable**

Q) If two systems \(s_1\) & \(s_2\) are dual, and if system \(s_1\) is completely state controllable, then system \(s_2\) is completely \(\rightarrow\) **Observable**

Q) If two systems \(s_1\) & \(s_2\) are dual and if system \(s_1\) is completely observable, then system \(s_2\) is completely \(\rightarrow\) **State controllable**

Q) If rank of state controllability matrix of a system \(s_1\) is 'n', then rank of observability matrix of its dual system \(s_2\) is \(\rightarrow\) **n**

Q) If rank of observability matrix of a system \(s_1\) which is completely observable is 'n', then rank of state controllability matrix of its dual system \(s_2\) is \(\rightarrow\) **n**

Q) The pulse transfer function has no cancellation if and only if the system is completely \(\rightarrow\) **State controllable and observable**

Q) Location 1 in fig 2 corresponds to \(\rightarrow\) in fig 1
Q) Location 2 in fig 2 corresponds to ________ in fig 1

Q) Location 3 in fig 2 corresponds to ________ in fig 1

Q) Location 4 in fig 2 corresponds to ________ in fig 1
Q) Location 5 in fig 2 corresponds to _________ in fig 1

Q) Location 1 in fig 1 corresponds to _________ in fig 2
Q) Location 2 in fig 1 corresponds to ________ in fig 2

![Figure 1](image1)

![Figure 2](image2)

Q) Location 3 in fig 1 corresponds to ________ in fig 2

![Figure 1](image1)

![Figure 2](image2)

Q) Location 4 in fig 1 corresponds to ________ in fig 2

![Figure 1](image1)

![Figure 2](image2)
Q) Location 5 in fig 1 corresponds to ------- in fig 2

![Figure 1](image1.png)  ![Figure 2](image2.png)

Q) The relationship between the S - plane and the Z - plane is given by $Z = \ldots \rightarrow e^{TS}$

Q) Complementary strip in S - plane extends, from $\omega = \ldots$ for negative frequencies $\rightarrow -\omega_0 / 2$ to $-3\omega_0 / 2$

Q) Complementary strip in S - plane extends, from $\omega = \ldots$ for +ve frequencies $\rightarrow \omega_0 / 2$ to $3\omega_0 / 2$

Q) All the points on the unit circle in the Z - plane correspond to points ------- of S - plane $\rightarrow$ On jw axis

Q) All the points in the left half of S - plane correspond to points ------- the unit circle in Z - plane $\rightarrow$ Inside

Q) All the points in the right half of S - plane correspond to points ------- the unit circle in Z - plane $\rightarrow$ Outside

Q) Points on the jw axis in the S - plane correspond to points ------- the unit circle in the Z - plane $\rightarrow$ On

Q) All the points inside the unit circle in Z - plane correspond to points in the ------- of S - plane $\rightarrow$ Left - half

Q) All the points outside the unit circle in the Z - plane correspond to the points in the ------- of S - plane $\rightarrow$ Right half

Q) The damping factor is the ------ part of a ----- of the transfer function in S - plane $\rightarrow$ Real, pole

Q) The constant damping loci in the right half of S - plane indicates that the system is --- $\rightarrow$ Unstable

Q) With negative damping, the system will be ------------ $\rightarrow$ Unstable

Q) Constant - damping loci in the Z - plane are described by $Z = \ldots \rightarrow e^{Tz}$

Q) The centre for constant - damping loci circles in Z - plane is at $Z = \ldots \rightarrow 0$

Q) Constant damping loci in S - plane are ------------ $\rightarrow$ Vertical lines parallel to imaginary axis

Q) Constant damping loci in Z - plane are ------------ $\rightarrow$ Circles with origin as centre

Q) The constant damping loci in the left half of S - plane indicates that the system is --- $\rightarrow$ Stable

Q) The constant damping loci inside the unit circle in Z - plane indicates that the system is -------
4-2 2nd mid of Digital Control Systems (Common to ECE & EIE)

---- --> Stable
Q) The constant damping loci outside the unit circle in Z-plane indicates that the system is -------
------- --> Unstable
Q) Poles located in the first and fourth quadrants in the Z-plane will have ------- frequencies
compared to those in second & third quadrants --> Lower
Q) The portion of constant - damping ratio locus that corresponds to the frequency range from \( \omega = \text{-----} \) to \( \omega = \text{--------} \) in S-plane is of importance --> \( 0, \omega_s / 2 \)
Q) For practical purposes, only the portion of the constant - damping ratio locus that corresponds to the frequency range from \( \omega = \text{-----} \) to \( \omega = \text{-----} \) is of importance --> \( 0, \omega_s / 2 \)
Q) Constant frequency locus at \( \omega = \omega_1 \) in Z-plane is a -------- --> Straight line emanating
from the origin at an angle \( \theta = \omega_1 \tau_{rad} \)
Q) For a given damping ratio '&zeta', the constant - damping ratio locus is a -------- in z-plane,
except for \( \zeta = 0 \) and \( \zeta = 1 \). --> Logarithmic spiral
Q) For any given frequency \( \omega = \omega_1 \) in the S-domain, the constant - frequency locus in the S-
plane is a -------- --> Horizontal line
Q) Constant frequency locus in Z-plane corresponding to \( S = j\omega_1 \) is represented by \( Z = \text{----} \rightarrow e^{j\omega_1t} \)
Q) Constant - damping ratio loci in S-plane is described by \( S = \omega \tan \beta + \text{--------} (\beta = \tan^{-1} z \text{-measured from } j\omega \text{ axis}) \rightarrow jw \)
Q) Constant - damping ratio loci in S-plane is described by \( S = \text{--------} + j\omega (\beta = \tan^{-1} z \text{-measured from } j\omega \text{ axis}) \rightarrow -\omega \tan \beta \)
Q) 'Beta' in the constant - damping ratio locus equation in the s-plane \( s = -\omega \tan \beta + j\omega \text{ is -------} \rightarrow \sin^{-1} \zeta \)
Q) For a polynomial \( F(z) = a_2z^2 + a_1z + a_0 \) one of the necessary & sufficient conditions is
pertaining to Jury's stability test is ------- \( < a_2 \rightarrow |a_3| \)
Q) For a polynomial \( F(z) = a_2z^2 + a_1z + a_0 \) one of the necessary & sufficient conditions is
pertaining to Jury's stability test is \( |a_3| \) \rightarrow \( < a_2 \)
Q) For an nth order equation in 'Z' \( F(z) = a_n z^n + \text{--------} + \text{--------} a_1z + a_0 = 0 \), the third element
breaking to \( z^2 \) in row 1 is \( \rightarrow a_2 \)
Q) For an nth order equation in 'Z' \( F(z) = a_n z^n + \text{--------} + \text{--------} a_1z + a_0 = 0 \), the second
element corresponding to \( z \) in row 2 is \( \rightarrow a_{n-1} \)
Q) For an nth order equation in 'Z' \( F(z) = a_n z^n + \text{--------} + a_1z + a_0 = 0 \), the first element
corresponding to \( z^0 \) in row 1 is \( \rightarrow a_n \)
Q) For an nth order equation in 'Z' \( F(z) = a_n z^n + \text{--------} + a_1z + a_0 = 0 \), the first element
corresponding to \( z \) in row 2 is \( \rightarrow a_{n-1} \)
Q) In Jury's stability test, one of the necessary & sufficient conditions for the polynomial \( F(z) \) is
\( F(1) \) is \( \rightarrow > 0 \)
Q) In Jury's stability test, one of the necessary & sufficient conditions for the polynomial \( F(z) \) is
\( F(-1) \) \( \text{-(order of equation is even)} \rightarrow > 0 \)
Q) In Jury's stability test, one of the necessary & sufficient conditions for the polynomial \( F(z) \) is
\( F(-1) \) \( \text{-(order of equation is odd)} \rightarrow < 0 \)
Q) For an nth order equation in 'Z' \( F(z) = a_n z^n + \text{--------} + \text{--------} a_1z + a_0 = 0 \), the second
element corresponding to \( z^1 \) in row 1 is \( \rightarrow a_1 \)
Q) Transformations that are algebraic and transform circles in the Z-plane onto vertical lines in a
complex variable plane (say s - plane) are of the form $Z = \frac{(ar + b)}{(cr + d)}$ (a, b, c and d are real constants) $\Rightarrow \frac{(r + 1)}{(r - 1)}$

Q) The equation pertaining to r - transform is $Z = \frac{(r + 1)}{(r - 1)}$.

Q) Location 2 in fig2 corresponds to ______ in fig1.

Q) Location 3 in fig2 corresponds to ______ in fig1.

Q) Location 4 in fig2 corresponds to ______ in fig1.
Q) Location 1 in fig1 corresponds to _________ in fig2.

Q) Location 2 in fig1 corresponds to _________ in fig2.
Q) Location 3 in fig1 corresponds to --------- in fig2

Q) Location 4 in fig1 corresponds to ------- in fig2
Q) Location 1 in fig 2 corresponds to ------- in fig 1.

Q) The delay time $T_d$ in transient response of a discrete-time system is defined as the time required for the unit-step response to reach ------- percent of its final value --> 50

Q) The transient response refers to that portion of the response due to ------- of the system --> Closed-loop poles

Q) For ------- system, the peak-time, and maximum overshoot terms do not apply --> Over
damped
Q) If $C_{\text{max}}$ is the maximum value of the output $c(t)$ and its steady state value is $C_{ss}$, then maximum overshoot of a discrete time control system is $\longrightarrow C_{\text{max}} - C_{ss}$

Q) If the desired value is 1, and maximum value of the transient response is 1.5, then, percent max overshoot is $\longrightarrow 50$

Q) The rise time $T_r$, in transient response of a discrete time system, is the time required for the unit step response to rise from 10 percent to $\longrightarrow$ percent of its final value $\longrightarrow 90$

Q) The rise time $T_r$, in transient response of a discrete time system, is the time required for the unit step response to rise from $\longrightarrow$ percent to 90 percent of its final value $\longrightarrow 10$

Q) Settling time is defined as the time required for the unit step response to decrease and stay within $\pm \longrightarrow \%$ of its final value $\longrightarrow 5$

Q) In a digital control system, output of the controller is fed to $\longrightarrow \text{Hold}$

Q) In a digital control system, input to the plant is from $\longrightarrow \text{Hold}$

Q) Discrete ramp error constant for type 1 system is $\longrightarrow K$

Q) For type 1 continuous time system, with ramp input, ramp error constant is $K_v \longrightarrow K$

Q) For type 2 continuous time system, with parabolic input, parabolic error constant $K_a$ is $\longrightarrow K$

Q) For type 0, continuous time system with ramp input, ramp error constant $K_v$ is $\longrightarrow 0$

Q) Parabolic error constant for a discrete time system of type 0, $K_v^*$ is $(K = \text{Amplifier gain})$ $\longrightarrow \frac{1}{K}$

Q) If $e(t)$ is the error of a continuous data control system, then steady state error of the system is defined as $e_{ss} = \lim_{t \to \infty} e(t)$

Q) If $G_p(s)$ is the gain of forward path and $H(s)$ is the gain of feedback path of a closed loop continuous time system, then step error constant $K_p = \lim_{s \to 0} G_p(s)H(s)$

Q) If $G_p(s)$ is the gain of forward path and $H(s)$ is the gain of feedback path of a closed loop continuous time system, then ramp error constant $K_v = \lim_{s \to 0} sG_p(s)H(s)$

Q) If $G_p(s)$ is the gain of forward path and $H(s)$ is the gain of feedback path of a closed loop continuous time system, then parabolic error constant $K_a = \lim_{s \to 0} s^2 G_p(s)H(s)$

Q) The function $G(e^{-s})$ is commonly called the transfer function $\longrightarrow \text{Sinusoidal pulse}$

Q) Input to the system $G(z)$ before sampling for frequency response method of design, is $u(t) = \longrightarrow \text{Sin}$

Q) The sampled signal $u(kT)$ which is input to the system $G(z)$ for frequency response method of design is $u(kT) = \longrightarrow \sin koT$

Q) 'A' in the figure is $u(kT) = \longrightarrow \sin koT$

Q) In frequency response method, the description of the performance of a linear time invariant system is given in terms of its steady state response to varying input signals $\longrightarrow$
Sinusoidal
Q) In the frequency response method of design, ---- and ---- are to be considered -->

Amplitude, Phase
Q) Frequency response of \( G(z) \) can be obtained by substituting \( Z = \) ---- into \( G(z) \) --> \( e^{j\omega T} \)
Q) Steady state response \( x_{ss}(kT) \) of a system \( G(z) \) in frequency - response analysis is \( x_{ss}(kT) = M(----) \) --> \( \sin (k\omega T + \theta) \)
Q) In the equation for steady state response \( x_{ss}(kT) = M \sin (k\omega T + \theta) \) in frequency response analysis for a system \( G(z) \), \( M = ---- \) --> \( \mathcal{G}(e^{j\omega T}) \)
Q) In the equation for steady state response \( x_{ss}(kT) = M \sin (k\omega T + \theta) \) in frequency response analysis for a system \( G(z) \), \( \theta = ---- \) --> \( \angle \mathcal{G}(e^{j\omega T}) \)
Q) The transformation of pulse transfer function in \( z \)-plane into \( w \)-plane is defined by \( Z = ---- \)
\[ \frac{1 + \left( \frac{Z}{2} \right)^{\omega_0}}{1 - \left( \frac{Z}{2} \right)^{\omega_0}} \]
Q) The relation between \( w \)-plane and \( Z \)-plane for converting a given pulse transfer function in \( Z \)-plane is given by \( w = ---- (T = \text{Sampling Period}) \) --> \( \frac{Z}{T} \) \( (Z + 1) \)
Q) \( a' \) in Fig1 corresponds to ---- in Fig 2
Q) \( b' \) in Fig1 corresponds to ---- in Fig 2
Q'c' in Fig 1 corresponds to ------ in Fig 2

Q'd' in Fig 1 corresponds to ------ in Fig 2

Q)1 in Fig 2 corresponds to --------- in Fig 2
Q2 in Fig 2 corresponds to \[ \text{-----} \] in Fig 1

Q3 in Fig 2 corresponds to \[ \text{-----} \] in Fig 1

Q4 in Fig 2 corresponds to \[ \text{-----} \] in Fig 1

[Diagram with labeled points]
Q) The relationship between the fictitious frequency 'V' and the actual frequency 'ω', in the design procedure in ω-plane is $V = \frac{2}{T} \tan \frac{ωT}{2}$.

Q) In the control system design in ω-plane, $G(\omega)$ is a _______ transfer function $\rightarrow$ Non-minimum phase

Q) First step in design procedure in the w-plane is to obtain Z-transform of _______ $\rightarrow$ Plant preceded by a hold

Q) In the control system design in ω-plane, _______ is read from Bode diagram $\rightarrow$ Static Error Constant

Q) In the control system design in w-plane, _______ is read from Bode diagram $\rightarrow$ Phase margin

Q) 'X' in the figure of Digital Control system is _______

Q) In the design procedure in w-plane, _______ diagrams are drawn $\rightarrow$ Bode

Q) In the design procedure in ω-plane, Bode diagram is plotted for _______ $\rightarrow$ G(V)

Q) In the control system design in w-plane, _______ is read from Bode diagram $\rightarrow$ Gain margin

Q) In the figure for Digital control system shown, 'Y' is _______

Q) _______ controller is a special case of a phase - lag lead controller $\rightarrow$ PID

Q) _______ controller behaves in much the same way as a phase lead compensator $\rightarrow$ PD

Q) _______ controller acts as a phase lag compensator $\rightarrow$ PI
Q) If a digital controller is described by \( D(z) = K_c \frac{(z - z_1)}{(z - p_i)} \) and if the controller is not to affect the steady-state performance of the system, then generally \( \lim_{z \to 1} D(z) \) is set as \( \lim_{z \to 1} D(z) \) \( \Rightarrow 1 \)

Q) The phase lead compensation --- the system \( \Rightarrow \text{Increases bandwidth} \)
Q) Phase lag compensation --- the system gain at higher frequencies \( \Rightarrow \text{Reduces} \)
Q) With phase lag compensation, the system bandwidth is \( \Rightarrow \text{Reduced} \)
Q) Phase lead compensation is commonly used for improving \( \Rightarrow \text{Stability margins} \)
Q) A system with a phase lead compensation will have a \( \Rightarrow \text{faster} \) speed to respond
Q) With phase lag compensation the \( \Rightarrow \text{accuracy can be improved} \)
Q) Backward - rectangular integration is given by \( D_1(Z) = \frac{K_p T}{(Z - 1)} \) \( \Rightarrow \)

Q) Forward - rectangular integration is given by \( D_1(Z) = \frac{K_p T Z}{(Z - 1)} \)
Q) Bilinear transformation integration is given by \( D_1(Z) = \frac{K_p T (Z + 1)}{2 (Z - 1)} \)
Q) Transfer function of the digital derivative controller is \( D_0(Z) = \frac{K_p}{T Z (Z - 1)} \) \( \Rightarrow \)

Q) The function of \( \Rightarrow \text{PID controller is to provide a reduction of the steady-state error} \)
Q) The \( \Rightarrow \text{Integral} \) control of PID controller provides an anticipatory action to reduce overshoots and oscillations in the time response \( \Rightarrow \text{Derivative} \)
Q) The \( \Rightarrow \text{control of PID controller simply multiples error signal by a constant} \)

**Proportional**

Q) Figure shows a block diagram of a digital PID controller. 'A' in the figure is \( \Rightarrow \text{sampling period} \)

\( X((k + 1)T) = C_x(kT) + H_1(kT) \Rightarrow K_p \)

Q) Figure shows a block diagram of a digital PID controller. 'B' in the figure is \( \Rightarrow \text{d_1 (Z)} \)

Q) Figure shows a block diagram of a digital PID controller. 'C' in the figure is \( \Rightarrow \text{sampling period} \)
Q) In choosing the sampling period of a digital control system, care must be exercised so that the desired system will not require unusually ----------- control signals --> Large

Q) In the design via pole placement for a system \( X(k + 1) = G x(k) + H u(k) \), the state feedback gain matrix \( k \) is so chosen that eigen values of \( -------- \) are the closed - loop poles \( \mu_1, \mu_2, ..., \mu_n \) --> \( G - HK \).

Q) If a system is described by \( X(k + 1) = G x(k) + H u(k) \), then the characteristic equation for the state feedback control system is \( |Z I --------| = 0 \) --> \(-G + HK\).

Q) If the desired eigen values \( \mu_1, \mu_2, ..., \mu_n \) are distinct, then the desired state feedback gain matrix \( 'k' \) \( k = [--------] [\&x_1, \&x_2, ..., \&x_n]\) \(^{-1}\) --> \([1 1 ... 1]\).

Q) In figure, B is ------------------

Q) In figure, C is ------------------

Q) A necessary and sufficient condition for arbitrary pole placement is that the system be completely -------- --> **State controllable**

Q) A necessary and sufficient condition for arbitrary pole placement is that the system be completely -------- --> **State controllable**

Q) The desired state feedback gain matrix \( 'K' = [--------] H G \) \( ||G^{n-1} H\)\(^{-1}\) \( x f(G) \) (Ackermann's formula) --> \([0 0 ... 0 1]\)

Q) A -------- is a subsystem in the control system that performs an estimation of the state variables based on the measurement of the output and control variables --> **State observer**

Q) State observers can be designed if and only if the -------- condition is satisfied --> **Observability**

Q) Output of state observer is ----------- --> \( \hat{X}(k) \)

Q) A' in figure is ------------------

Q) B' in figure is ------------------
Q)'C' in figure is ...

---> State observer

Q) One of the inputs to state observer is ... --> y(k)
Q) One of the inputs to state observer is ... --> U(k)
Q) The state observer based on estimation $\hat{X}(K+1)$ in one sampling period ahead of measurement of y(k) is called ... observer --> Prediction
Q) If a system is represented by $X(K+1) = GX(K) + HU(k), y(k) = CX(K)$, then eigen values of (G - KcC), where Kc is the observer feedback gain matrix, are commonly called ... --> Observer poles
Q) If the state X(k) is to be estimated, it is desirable that ... be as close to the actual state X(k) as possible --> Estimated state
Q) If the ... is to be estimated, it is desirable that the observed state be as close to the actual state $\hat{X}(K)$ as possible --> State X(k)
Q) If the state X(k) is not available for direct measurement, state estimation can be done by observing ... --> Both Input U(k) and Output y(k)
Q) ... order observer means that all 'm' state variables, regardless of whether some state variables are available for direct measurement, are estimated --> Full
Q) Necessary and sufficient condition for state observation is that the system be completely ... --> Observable
Q) Although the ... may not be measurable, the output Y(k) is measurable --> State X(k)
Q) Although the state X(k) may not be measurable, ... is measurable --> Output y(k)
Q) If the measurement of output variables involves significant noises, then the use of ... order observer may result in a better system performance --> Full
Q) With the partitioning of state vector X(k) into two parts directly measurable and unmeasurable portions, the input matrix H is partitioned as ... $\begin{bmatrix} H_a \\ H_b \end{bmatrix}$
Q) If state vector X(k) is an n - vector and output vector Y(k) is an m - vector that can be measured then only ... state variables are to be estimated --> n - m
Q) Minimum order observer is designed by first partitioning ... into two parts, directly measurable and unmeasurable --> State vector X(k)
Q) With the partitioning of state vector $X(k)$ into two parts, directly measurable and unmeasurable portions, the state matrix $G$ is partitioned as $\begin{bmatrix} G_{aa} & G_{ab} \\ G_{ba} & G_{bb} \end{bmatrix}$.

Q) With the partitioning of state vector $X(k)$ into two parts directly measurable and unmeasurable portions, the output matrix $H$ is partitioned as $\begin{bmatrix} I & 0 \end{bmatrix}$.

Q) An observer that estimates fewer than $n$ state variables, where $n$ is the dimension of state vector, is called a $\text{Reduced - order}$ observer.

Q) If the order of the reduced-order is the minimum possible, the observer is called a $\text{Minimum - order}$ observer.

Q) If the order of the $\text{Reduced - order}$ observer is the minimum possible, the observer is called a minimum order observer.

Q) If the state vector $X(k)$ is an $n$-vector and the output vector $y(k)$ is an $m$-vector that can be measured, then the reduced-order observer becomes an $n - m$ th-order observer. 

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