INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	**RADAR SYSTEMS**
Course Code	:	**AEC521**
Program	:	**B.Tech.**
Semester	:	**VI**
Branch	:	**Electronics and Communication Engineering**
Section	:	**III-B**
Course Faculty	:	**Dr. M V Krishna Rao, Professor**

OBJECTIVES:

I	To help students to consider in depth the terminology and nomenclature used in the syllabus.
II	To focus on the meaning of new words / terminology/nomenclature

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
UNIT-I						
1	What is the basic purpose of radar?	Radar stands for RAdio Detection And Ranging. Radar can detect the distant objects beyond the limits of human senses. It broadcasts EM energy and senses the reflections from the Objects to detect them.	Remember	CO 1	CLO 1	AEC521.01
2	What are the basic parameters of a pulse radar waveform?	Pulse width (τ), Pulse Repetition Frequency (f_p) and Carrier Frequency (f_c)	Remember	CO 1	CLO 1	AEC521.01
3	What is PRF?	The Pulse Repetition Frequency (PRF) is the reciprocal of the Pulse Repetition Period (T) $$f_p = \frac{1}{T}$$	Remember	CO 1	CLO 1	AEC521.01
4	What is the shortest range that a pulse radar can measure?	When the Radar transmitter is active, the receiver input is blanked to avoid the damage of amplifiers. Thus the pulse width of the transmitted signal determines the dead zone. $$R_{min} = \frac{c\tau}{2}$$	Understand	CO 1	CLO 1	AEC521.01

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
5	What is the maximum unambiguous range that a pulse radar can measure?	It is the target range that a radar can measure unambiguously. Range ambiguity occurs when the time taken for an echo to return from a target is greater than the pulse repetition period (T) $$R_{unamb} = \frac{cT}{2}$$	Remember	CO 1	CLO 1	AEC521.04
6	What is the significance of radar equation?	The radar equation gives the relation between the radar parameters and the target range, R and is given by $$R = \left[\frac{P_t G \sigma A_e}{(4\pi)^2 S}\right]^{1/4}$$ where the variables in equation have the known meanings.	Understand	CO 1	CLO 1	AEC521.04
7	If the detection range of a radar is to be doubled, then how the transmitter power, P_t is to be adjusted?	If the detection range of a radar is to be doubled, then the transmitter power , P_t is to be increased by a factor of $2^4 = 16$.	Application	CO 1	CLO 1	AEC521.01
8	How is the maximum radar range is determined?	The maximum radar range is the distance beyond which the radar cannot detect the targets. It occurs when the received echo signal power (S) is equals the minimum detectable signal (S_{min}), which in turn is determined by the sensitivity of the radar receiver. The maximum radar range is given by $$R_{max} = \left[\frac{P_t G \sigma A_e}{(4\pi)^2 S_{min}}\right]^{\frac{1}{4}}$$	Application	CO 1	CLO 1	AEC521.04
9	What is the significance of the Pulse width in a pulsed radar ?	Pulse Width is the duration of the radar pulse. It is expressed in milliseconds. The pulse width influences the total pulse energy. It determines minimum range and range resolution of the radar. In, fact it represents the transmitter 'ON' time.	Understand	CO 1	CLO 1	AEC521.01
10	What is the target resolution of a radar?	It is the radar's ability to separate and detect multiple targets. In other words, it is the ability of radar to distinguish targets that are very close in either range or bearing. The targets can be resolved in four dimensions range, horizontal cross- range, vertical cross-range and Doppler shift.	Understand	CO 1	CLO 1	AEC521.01
11	What is the Pulsed Radar?	It is radar which transmits high power and frequency pulse. After transmitting one pulse, it receives echoes and then transmits another pulse. It determines direction, distance and altitude of an object.	Remember	CO 1	CLO 1	AEC521.01

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
12	What is OTH Radar:	It represents Over-The-Horizon radar. It is radar which can look beyond the radio horizon. It uses ground wave and sky wave propagation modes between 2MHz and 30MHz.	Remember	CO 1	CLO 1	AEC521.01
13	Discriminate between Monostatic and Bistatic Radars.	Monostatic Radar: It is radar which contains transmitter and receiver at the same location with common antenna. Bistatic Radar: In this radar transmitting and receiving antennas are located at different locations. The receiver receives the signals both from the transmitter and the target.	Remember	CO 1	CLO 1	AEC521.01
14	What is Remote Sensing Radar?	It provides the data about the remote places and uses the shaped beam antenna. The angle subtended at the radar antenna is much smaller than the angular width of the antenna beam. LIDAR: It represents Light Detection and Ranging. it is sometimes called as LADAR or Laser Radar.	Remember	CO 1	CLO 1	AEC521.01
15	What is the Laser Radar?	It is radar which uses laser beam instead of microwave beam. Its frequency of operation is in between 30 THz and 300 THz.	Remember	CO 1	CLO 1	AEC521.01
16	Define the Radar Signature.	It is the identification of patterns in a target radar cross-section.	Remember	CO 1	CLO 1	AEC521.02
17	What is a False Alarm ?	A false alarm is an erroneous radar target detection decision caused by noise or other interfering signals exceeding the detection threshold". In general, it is an indication of the presence of a radar target when there is no valid target.	Remember	CO 1	CLO 3	AEC521.03
18	How are False alarms generated?	False alarms are generated when thermal noise exceeds a pre-set threshold level, by the presence of spurious signals (either internal to the radar receiver or from sources external to the radar), or by equipment malfunction. A false alarm may be manifested as a momentary blip on a cathode ray tube (CRT) display, or an audio signal	Understand	CO 1	CLO 1	AEC521.01
19	How is the detection threshold effects the false alarms?	If the detection threshold is set too high, there will be very few false alarms, but the signal-to-noise ratio required will inhibit detection of valid targets. If the threshold is set too low, the large number of false alarms will mask detection of valid	Understand	CO 1	CLO 3	AEC521.03

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		targets.				
20	How is receiver thermal noise computed?	Thermal noise generated in the radar receiver is given by $Ni = kTB_n$ where k is Boltzmann's constant =1.38 x 10^{-23} J/deg, T is degrees Kelvin and B_n is the noise bandwidth of the receiver.	Remember	CO 1	CLO 3	AEC521.03
21	What are different PDFs used to describe the radar cross section (RCS) of targets?	The Log Normal distribution has been suggested for describing the cross sections of some satellites, ships, cylinders, plates, arrays. The Rice distribution is a better description of the cross section fluctuations of a target dominated by a single scatter than the Chi-square distribution with m=2.	Remember	CO 1	CLO 2	AEC521.02
22	What is the false alarm time?	The false alarm time: It is the average time interval between crossings of the threshold by noise alone is the false alarm time $T_{fa.}$	Remember	CO 1	CLO 1	AEC521.01
23	Wha is The false alarm probability?	It is also given by the ratio of the time that the envelope is above the threshold to the total time.	Remember	CO 1	CLO 1	AEC521.01
24	What is the significance of The Chi-square distribution in radars?	The Chi-square distribution also describes the cross section of shapes such as cylinders, cylinders with fins (e.g. some satellites). Here m varies between 0.2 and 2 depending on the aspect angle.	Remember	CO 1	CLO 1	AEC521.02
25	What is a point target in case of radars?	A radar target that is small compared with the pulse volume, which is the cross-sectional area of the radar beam multiplied by half the length of the radar pulse.	Remember	CO 1	CLO 2	AEC521.02
26	What do you mean by radar cross section of a target?	The radar cross section of a target is the (fictional) area intercepting that amount of power which. when scattered equally in all directions, produces an echo at the radar equal to that from the target.	Remember	CO 1	CLO 2	AEC521.02
27	Where is a scintillating echo is observed radars?	A complex target may be considered as comprising a large number of independent objects that scatter energy in all directions. If the separation between the individual scattering objects is large compared with the wavelength, as is usually true for most radar applications, the phases of the individual signals at the radar receiver will vary as the viewing aspect is changed and cause a scintillating echo.	Understand	CO 1	CLO 2	AEC521.03
28	What is Collapsing loss?	If the radar were to integrate additional noise samples along with the wanted signal-to-noise pulses, the added noise results in a degradation called the collapsing loss.	Remember	CO 1	CLO 1	AEC521.03

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
	UNIT-II					
1	What is Doppler Shift in radars?	Is the change in the frequency of a signal that occurs when the source and the observer are in relative motion, or when the signal is reflected by a moving object, there is an increase in frequency as the source and the observer (or the reflecting object) approach, and a decrease in frequency as they separate. It is given by $f_d = 2v_r/\lambda$ Where v_r = relative velocity or radial velocity of target with respect to radar.	Remember	CO 2	CLO 1	AEC521.05
2	What is CW Radar?	It is radar which transmits a constant amplitude RF sinewave signal continuously. The echoed sinewave is processed to obtain the target speed.	Remember	CO 2	CLO 1	AEC521.05
3	Distinguish between Primary and Secondary Radars.	Primary Radar: It is radar which receives all types of echoes including clouds and aircrafts. It receives its own signals as echoes. Secondary Radar: It transmits the pulses and receives digital data coming from aircraft transponder. The data like altitude, call signs in terms of codes are transmitted by the transponders. In military applications, these transponders are used to establish flight identity etc. Example of secondary radar is IFF radar.	Understand	CO 2	CLO 1	AEC521.05
4	State the difference between the unmodulated and modulated CW Radar.	It is radar in which the transmitted signal has and frequency. It useful to measure velocity of the object but not the speed. Modulated CW Radar: It is radar in which the transmitted signal has constant amplitude with modulated frequency.	Remember	CO 2	CLO 1	AEC521.05
5	What is Doppler Resolution of a radar?	Doppler Resolution is the ability to distinguish targets at the same range, but moving at Different radial velocities. The Doppler resolution Δf_d is given by, $\Delta f_d = 1/T_d$ in Hz, where T_d = The look time in seconds. The Doppler resolution is possible if Doppler frequencies differ by at least one cycle over the time of observation. It depends on the time over which signal is gathered for processing.	Understand	CO 2	CLO 1	AEC521.05
6	What does Radar Altimeter means?	It is radar which is used to determine the height of the aircraft from the ground.	Remember	CO 2	CLO 1	AEC521.05
7	What is the MST Radar?	It represents Mesosphere, Stratosphere and Troposphere radar. Mesosphere exists between 50km and 100km above the earth. Stratosphere exits between 10km and 50 km above the earth. Troposphere exists between 0 and 10km above the earth. MST Radar is used to observe wind velocity, turbulence etc.	Remember	CO 2	CLO 1	AEC521.05

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
8	How doppler Filter Bank is useful in CW Radar receiver?	A relative wide band of frequencies called as bank of narrow band filters are used to measure the frequency of echo signal. These are also used to improve the signal to noise ratio of the receiver.	Understand	CO 2	CLO 1	AEC521.06
9	How to select center frequencies of the doppler filter bank?	The center frequencies of the filters are staggered to cover the entire range of Doppler frequencies. If the filters are spaced with their half power points overlapped, the maximum reduction in signal to noise ratio of a signal which lies midway between adjacent channels compared with the signal to noise ratio at midband is 3 dB. By using the large number of filters, the maximum loss will be reduced but it increases the probability of false alarm.	Application	CO 2	CLO 1	AEC521.06
10	Where the doppler filter bank is implemented in a radar?	A bank of narrow band filters may be used after the detector in the video stage or in the the IF stage.	Remember	CO 2	CLO 1	AEC521.05
11	What are the uses of CW Radar?	Simple CW Radar can be used to find the relative velocity of a moving target without any physical constant with the target. For example: in police speed monitors, in rate of climb-meter for vertical-take-off aircraft, measurement of turbine- blade vibration, the peripheral speed of grinding wheels and the monitoring of vibrations in the cables of suspension bridges. It is also employed for monitoring the docking speed of large ships.	Remember	CO 2	CLO 1	AEC521.05
12	How are the CW Radars useful for traffic police and in railways?	CW radars are also used for the control of traffic lights, regulation of toll booths, speed monitors and vehicle counting. In railways CW Radars can use as a speed meter to replace the conventional axle- driven tachometer.	Remember	CO 2	CLO 1	AEC521.05
13	What is FMCW radar? What is its Principle of the operation?	It is the Frequency-Modulated Continuous-Wave Radar. CW radars have the disadvantage that they cannot measure distance. In FMCW radar, the frequency is generally changed in a linear fashion, so that there is an up-and-down or a sawtooth-like alternation in frequency. If the frequency is continually changed with time, the frequency of the echo signal will differ from that transmitted and the difference Δf will be proportional to round trip time Δt and so to the range R of the target too.	Understand	CO 2	CLO 1	AEC521.05
14	Characteristic Feature of FMCW radar	The distance measurement is done by comparing the actual frequency of the received signal to the reference transmitted signal. The duration of the transmitted signal is much larger than the time required for measuring the installed	Remember	CO 2	CLO 1	AEC521.05

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
		maximum range of the radar				
15	What is the frequency band of radio altimeters? What type receiver is used in altimeters?	The band from 4.2 to 4.4 G Hz is reserved for radio altimeters. The altimeter can employ a simple homodyne receiver, but for better sensitivity and stability.	Remember	CO 2	CLO 1	AEC521.05
S.No	**QUESTION**	**ANSWER**	**Blooms Level**	CO 2	**CLO**	**CLO Code**
		UNIT-III				
1	What is MTI Radar?	It is the Moving Target Indication radar. It is a pulsed radar which uses the Doppler frequency shift for discriminating moving targets from fixed ones, appearing as clutter.	Remember	CO 3	CLO 4	AEC521.07
2	What is a Blind Range?	It is a range corresponding to the time delay of an integral multiple of the inter pulse period plus a time less than or equal to the transmitted pulse length. Radar usually cannot detect targets at a blind range because of interference by subsequent transmitted pulses.	Remember	CO 3	CLO 4	AEC521.07
3	How the problem of Blind Range is solved?	The problem of blind ranges can be solved or largely mitigated by employing multiple PRFs.	Understand	CO 3	CLO 4	AEC521.07
4	What is a Pulse Doppler radar?	It is a radar that uses a series of pulses to obtain velocity content. It can also measure the target range along with velocity.	Remember	CO 3	CLO 4	AEC521.07
5	What is a Delay Line Canceller (DLC)?	The delay-line canceler acts as a filter to eliminate the d-c component of fixed targets and to pass the a-c components of moving targets. The video portion of the receiver is divided into two channels. One is a normal video channel. In the other, the video signal experiences a time delay equal to one pulse-repetition. The two outputs are subtracted from one another. The fixed targets with unchanging amplitudes from pulse to pulse are canceled on subtraction	Remember	CO 3	CLO 4	AEC521.07
6	Describe the frequency response of the DLCs.	DLC acts as a filter to reject DC clutter but because of its periodic nature it also rejects energy near the PRF and its harmonics. The frequency response of the single delay-line canceller is $H(f) = 2k \sin(\pi f_d T)$. The response of the single delay line canceller will be zero when the argument $\pi f_d T$ is $0, \pi, 2\pi\ldots$ etc.	Understand	CO 3	CLO 4	AEC521.07
7	How is the acoustic delay-line canceller useful in radars?	In MTI radars, the time domain delay-line canceller capability depends on the quality of the medium used as the delay line. The delay required is equal to	Understand	CO 3	CLO 4	AEC521.07

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
		the A A PRI of several milliseconds cannot be achieved with electromagnetic transmission lines. Converting the electromagnetic signal to an acoustic signal allows the design of delay lines with reasonable physical length. The signal at the output of the acoustic delay device is then converted back to an electromagnetic wave				
8	What is the advantage of the TD delay line canceller compared to the FD cancellers?	An advantage of the time domain delay line canceller as compared with the frequency domain filter is that a single network operates at all ranges and does not need a separate filter for each range resolution cell.	Remember	CO 3	CLO 4	AEC521.07
9	What is the Blind speed in radars?	Blind speed is defined as the radial velocity of the target at which the MTI response is zero. It is also defined as the radial velocity of the target which results in a phase difference of exactly 2π radians between successive pulses.	Understand	CO 3	CLO 4	AEC521.07
10	How the effect of blind speeds are mitigated?	The blind speed is dependent on the transmitted frequency and on the pulse repetition frequency of the radar unit. Large λ has the disadvantage that antenna beamwidth is wider and is not satisfactory. The effect of blind speeds can be reduced by operating with more than one PRF (staggered PRF MTI). Operating at more than one RF frequency can also reduce effect of blind speeds.	Application	CO 3	CLO 4	AEC521.07
11	What is the purpose of Double Cancellation in MTI radars?	Single delay line cancelers do not always have as broad a clutter reject null at DC as might be desired. The null can be widened by the use of the two single delay line cancellers in cascade.	Understand	CO 3	CLO 4	AEC521.07
12	Why Multiple PRFs are used in some radars?	Multiple PRFs reduce the effect of blind speeds and also allow a sharper low frequency cutoff. The blind speeds of two independent radars will be different if their PRFs are different.	Understand	CO 3	CLO 4	AEC521.07
13	Where staggered PRFs are used in some radars?	The blind speeds of two independent radars will be different if their PRFs are different. This same result can be achieved with one radar which shares its PRFs between 2 or more values. PRF can be switched every other scan, every time the antenna is scanned half a beam width or pulse to pulse (staggered PRF).	Understand	CO 3	CLO 4	AEC521.08
14	What is the disadvantage of staggered PRF?	The disadvantage of staggered PRF is its inability to cancel second time around clutter echoes. Such clutter does not appear at the same range from pulse to pulse and produces uncancelled residue.	Remember	CO 3	CLO 4	AEC521.07
15	What are range gated	The band pass filters are used in MTI	Remember		CLO 4	AEC521.08

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
	Doppler Filters?	radar to sort the Doppler frequency shifted targets. A narrow band filter with a pass band designed to pass the Doppler components of a moving target will ring when excited by a short radar pulse. This smearing destroys the range resolution. So range is to be gated before the applications doppler filterbank.				
16	What is Subclutter Visibility (SCV)?	The ratio by which the target echo may be weaker than the coincident clutter echo power and still be detected with specified Pd and Pfa. All target radial velocities are assumed equally likely. A typical value is 30 dB	Remember	CO 3	CLO 4	AEC521.08
17	What is Interclutter Visibility in MTI radars?	The ability of the MTI to detect moving targets in clear resolution cells between patches of strong clutter. Resolution cells can be range, azimuth or Doppler.	Remember	CO 3	CLO 4	AEC521.08
18	What is the MTI Improvement Factor?	It is the signal to clutter ratio at the output of the MTI system divided by the signal to clutter ratio at the input, averaged over all of the target radial velocities of interest.	Remember	CO 3	CLO 4	AEC521.08
		UNIT-IV				
1	Define Bearing Angle.	Bearing or Azimuth Angle is an angle measured from true north in a horizontal plane. In other words, it is the antenna beams angle on the local horizontal plane from some reference. The reference is usually true north.	Remember	CO 4	CLO 5	AEC521.09
2	Define Elevation Angle.	Elevation Angle is the angle measured between the horizontal plane and line of sight. In other words, it is an angle between the radar beam antenna axis and the local horizontal.	Remember	CO 4	CLO 5	AEC521.09
3	What is Radar antenna beamwidth?	Radar Beam Width is the width of the main beam of radar antenna between two half power points or between two first nulls. It is expressed in degrees.	Remember	CO 4	CLO 5	AEC521.09
4	Define Bearing Resolution in a radar system.	It is the ability of Radar to distinguish objects which are in different bearing but at the same range. It is expressed in degrees	Remember	CO 4	CLO 5	AEC521.09
5	What is Cross-Range Resolution of Radar?	It is the ability of Radar to distinguish multiple targets at the same range but at different vertical or horizontal planes. It has linear dimension perpendicular to the axis of the Radar antenna. It is of two types: Azimuth (Horizontal) cross-range and Elevation (Vertical) cross-range.	Remember	CO 4	CLO 5	AEC521.09
6	Contrast between the Two-dimensional & Three-dimensional Radars.	Two-dimensional Radars can determine the Range and the Bearing of targets. Three-dimensional Radars can determine the Range, the Bearing of targets and	Understand	CO 4	CLO 5	AEC521.09

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
		Altitude				
7	What is a search radar ?	Search Radars are used for searching the targets and they scan the beam a few times per minute. These are used to detect targets and find their range, angular velocity and sometimes velocity.	Remember	CO 4	CLO 5	AEC521.11
8	What are the different types of search radars?	The different types of search radars are: • Surface Search Radar • Air Search Radar • Two-dimensional Search Radar • Three-dimensional Search Radar	Remember	CO 4	CLO 5	AEC521.09
9	How the cross-range resolution in azimuth of a radar is determined?	Narrow beam of radar antennas resolve closed spaced targets. The azimuth cross-range resolution is given by $$d\theta_{az} = \frac{R\lambda}{L_{az}}$$	Understand	CO 4	CLO 5	AEC521.11
10	How the cross-range resolution in elevation of a radar is determined?	The elevation cross-range resolution is given by $$d\theta_{el} = \frac{R\lambda}{L_{el}}$$ where R = Target range in meters. L_x = Effective length of the antenna in the x-direction i.e. azimuth or elevation. λ = Wavelength in meters	Understand	CO 4	CLO 5	AEC521.11
11	Where is Tracking Radar used?	It is radar which tracks the target and it is usually ground borne. It provides range tracking and angle tracking. It follows the motion of a target in azimuth and elevation.	Remember	CO 4	CLO 5	AEC521.09
12	How is the Phased Array Radar useful in radars?	It is radar which uses phased array antenna in which the beam is scanned by changing the phase distribution of array. It is possible to scan the beam with this radar at a fraction of microseconds.	Understand	CO 4	CLO 11	AEC521.11
13	What is Clutter?	The clutter is an unwanted echo from the objects other than the targets. We have sea and land clutters.	Remember	CO 4	CLO 6	AEC521.09
14	What is TWS Radar?	A surveillance radar which develops tracks on targets it has detected is called a “track while scan” (TWS) radar. This radar scans and tracks the targets simultaneously.	Remember	CO 4	CLO 8	AEC521.09
15	What is the Noise bandwidth of a receiver?	B_n is the width of an ideal rectangular filter whose response has the same area as the filter or amplifier in question. For many types of radar B_n is approximately equal to the 3 dB bandwidth (which is easier to determine).	Remember	CO 4	CLO 1	AEC521.10
16	What is a matched filter? What are its advantages?	It has a frequency response which is proportional to the complex conjugate of the signal spectrum. The output of a	Remember	CO 4	CLO 7	AEC521.10

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
		matched filter is the cross correlation between the received waveform and the replica of the transmitted waveform. The shape of the input waveform to the matched filter is not preserved. Maximizing SNR at the output of the IF is equivalent to maximizing the video output.				
17	Why an automatic detection and tracking(ADT) is required ?	A single operator however can not handle more than about 6 target tracks when the radar has a twelve second scan rate. Also an operator's effectiveness in detecting new targets decreases rapidly after 1/2 hour of operation. These problems are avoided by automating the target detection and tracking process. This is called automatic detection and tracking (ADT)	Understand	CO 4	CLO 7	AEC521.11
18	Why adaptive thresholding in radar worsens the range resolution?	The adaptive thresholding of the automatic detector can cause worsening of the range resolution. It would seem that two targets might be resolved if their separation is about 0.8 pulse width. However with automatic detection, the probabilityof resolving targets in range onlye xceeds 0.9 if they are separated by 2.5 pulse widths.	Understand	CO 4	CLO 7	AEC521.11
19	Explain the concept of sequential lobing.	The method of obtaining the direction and the magnitude of the angular error in one coordinate is by alternately switching the antenna beam between two positions, is called lobe switching or sequential lobing. The difference in amplitude between the voltages obtained in the two switched positions is a measure of the angular displacement of the target from the switching axis. The sign of the difference determines the direction the antenna must be moved in order to align the switching axis with the direction of the target.	Understand	CO 4	CLO 5	AEC521.11
20	Explain conical scanning method. What is the squint angle?	The logical extension of the sequential lobing technique is to rotate continuously an offset antenna beam rather than discontinuously step the beam between four discrete positions. This is known as conical scanning (Fig). The angle between the axis of rotation (which is usually, but not always, the axis of the antenna reflector) and the axis of the antenna beam is called the squint angle.	Understand	CO 4	CLO 5	AEC521.11
21	What is the function of the automatic gain control (AGC) in	One of the purposes of AGC in any receiver is to prevent saturation by large signals. The scanning modulation and the error signal would he lost if the receiver	Remember	CO 4	CLO 11	AEC521.11

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
	scanning radars?	were to saturate. In the conical-scan tracking radar an AGC that maintains the d-c level constant results in an error signal that is a true indication of the angular pointing error. The d-c level of the receiver must be maintained constant if the angular error is to be linearly related to the angle-error signal voltage.				
22	Explain Phase-comparison monopulse tracking radar technique.	The measurement of angle of arrival by comparison of the phase relationships in the signals from the separated antennas of a radio interferometer has been widely used for precise measurements of the positions of radio stars. Tracking radar which operates with phase information is similar to an active interferometer. It is called phase-comparison monopulse radar	Understand	CO 4	CLO 8	AEC521.11
S.No	**QUESTION**	**ANSWER**	**Blooms Level**	**CO**	**CLO**	**CLO Code**
UNIT-V						
1	What are the typical IF frequencies used in radar receivers?	IF is typically 300MHz, 140Mz, 60 MHz, 30 MHz with bandwidths of 1 MHz to 10MHz.	Remember	CO 5	CLO 11	AEC521.12
2	What is PPI?	The plan position indicator (PPI) which maps the location of the target in azimuth and range in polar coordinates. It is intensity modulated by the amplitude of the receiver output and the CRT electron beam sweeps outward from the centre corresponding to range.	Remember	CO 5	CLO 11	AEC521.12
3	What is A-Scope?	It is a radar display and represents an oscilloscope. Its horizontal coordinate represents the range and its vertical coordinate represents the target echo amplitude. It is the most popular radar display.	Remember	CO 5	CLO 11	AEC521.12
4	What is B-Scope?	It is a radar display and it is an intensity modulated radar display. Its horizontal axis represents azimuth angle and its vertical axis represents the range of the target. The lower edge of the display represents the radar location.	Remember	CO 5	CLO 11	AEC521.12
5	Define the noise figure of a radar receiver.	The noise figure of a receiver was described as a measure of the noise produced by a practical receiver as compared with the noise of an ideal receiver. The noise figure F_n of a linear network may be defined as $F_n = \frac{S_{in}/N_{in}}{S_{out}/N_{out}} = \frac{N_{out}}{kT_0 B_n G}$ where S_{in} = available input signal power N_{in} = available input noise power (equal to $kT_0 B$ S_{out} = available output signal power	Remember	CO 5	CLO 10	AEC521.13

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S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
6	What is the Noise figure of N- networks in cascade?	The Noise figure of N- networks in cascade is given by $F_o = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1 G_2} + \cdots + \frac{F_N - 1}{G_1 G_2 \cdots G_{N-1}}$	Remember	CO 5	CLO 10	AEC521.13
7	How is J-scope different from A-scope?	A modified A-scope in which the time base is a circle and targets appear as radial deflections from the time base.	Understand	CO 5	CLO 11	AEC521.14
8	How the Beam width of a phased array antenna will vary with steering angle?	The half-power beam width in the plane of scan increases as the beam is scanned off the broadside direction. The beam width is approximately inversely proportional to $\cos\theta_o$, where θ_o is the angle measured from the normal to the antenna.	Understand	CO 5	CLO 11	AEC521.12
9	What is CFAR receiver?	It is Constant False Alarm Rate receiver. Here the detection threshold at the video output is chosen so as to achieve a desired false alarm probability.	Remember	CO 5	CLO 7	AEC521.14
10	What is the advantage balanced mixer in a radar receiver?	A method of eliminating local-oscillator noise without the disadvantage of a narrow-bandwidth filter is the balanced mixer. A balanced mixer uses a hybrid junction, a magic T, or an equivalent. These are four-port junctions	Remember	CO 5	CLO 11	AEC521.14
11	What is Diode burnout in radar receivers?	A crystal diode which is subjected to excessive RF power may burnout. This is a rather loosely defined term which is applied to any irreversible deterioration in the detection or conversion properties of a crystal diode as the result of electrical overload.	Remember	CO 5	CLO 11	AEC521.14
12	What is the advantage of using a low-noise front-end in radar receiver?	The lower the noise figure ofthe radar receiver, the less need be the transmitter power and/or the antenna aperture. Reductions in the size of the transmiuer and the antenna are always desirable ifthere are no concomitant reductions in performance. A few decibels improvement in receiver noise-figure can be obtained at a relatively low cost as compared to the cost and complexity of adding the same few decibels to a high-power transmitter.	Remember	CO 5	CLO 11	AEC521.13
13	What is the role of duplexer in a radar receiver?	The duplexer is the device that allows a single antenna to serve both the transmitter and the receiver. On transmission it must protect the receiver from burnout or damage, and on reception it must channel the echo signal to the receiver. Duplexers, for high-power applications, may ef gas-discharge may employ Solid-state devices are also utilized.	Remember	CO 5	CLO 11	AEC521.14

S.No	QUESTION	ANSWER	Blooms Level		CLO	CLO Code
14	What is Noise temperature?	The noise introduced by a network may also be expressed as an effective noise temperature, It is defined as that (fictional) temperature at the input of the network which would account for the noise at the output.	Remember	CO 5	CLO 10	AEC521.13
15	What is The system noise temperature?	It is defined as the effective noise temperature of the receiver system including the effects of antenna temperature. It is also sometimes called the system operating noise temperature.	Remember	CO 5	CLO 10	AEC521.13

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