



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	MICROWAVE ENGINEERING
Course Code	:	AEC015
Program	:	B.Tech
Semester	:	VII
Branch	:	Electronics and Communication Engineering
Section	:	A,B,C,D
Academic Year	:	2019 – 2020
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OBJECTIVES:

I	Develop the knowledge on transmission lines for microwaves, cavity resonators and Wave guide components and applications.
II	Enable the students to understand and analyze the operation of microwave tubes like klystron, magnetron, travelling wave tube, etc.,
III	Familiarize with microwave solid state devices.
IV	Introduce the student the microwave test bench for measure different parameters like attenuation, VSWR, impedance etc.

DEFINITIONS AND TERMINOLOGY QUESTION BANK

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
UNIT-I WAVEGUIDES						
1	Define spectrum?	The electromagnetic spectrum is the range of frequencies of electromagnetic radiation and their respective wavelengths and photon energies.	Understand	CO1	CLO 1	AEC015.01
2	Define Microwaves?	Microwaves are form of electromagnetic radiation with wavelengths ranging from about one meter to one millimeter; with frequencies between 300 MHz and 300 GHz	Understand	CO1	CLO 2	AEC015.02
3	Define wave guide?	A hollow metallic tube of the uniform cross section for transmitting electromagnetic waves by successive reflections from the inner walls of the tube is called as a Waveguide.	Understand	CO1	CLO 3	AEC015.03
4	What is the frequency range of L-Band	1 to 2 GHz	Remember	CO1	CLO 4	AEC015.04

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
5	What is the frequency range of s-Band	2 to 4 GHz	Remember	CO1	CLO 1	AEC015.01
6	What is the frequency range of c-Band	4 to 8 GHz	Remember	CO1	CLO 2	AEC015.02
7	What is the frequency range of x-Band	8 to 12 GHz	Remember	CO1	CLO 3	AEC015.03
8	What is the frequency range of k _u -Band.	12 to 18 GHz	Remember	CO1	CLO 4	AEC015.04
9	What is the frequency range of k _a -Band	26.5 to 40 GHz	Remember	CO1	CLO 1	AEC015.01
10	What is the frequency range of k-Band	18 to 26.5 GHz	Remember	CO1	CLO 2	AEC015.02
11	Define bandwidth?	Bandwidth is defined as a range within a band of frequencies or wavelengths	Understand	CO1	CLO 3	AEC015.03
12	Define directivity?	Directivity is the measure of the concentration of an antennas's radiation pattern in a particular direction.	Understand	CO1	CLO 4	AEC015.04
13	Define fading?	fading definition: a variation in the strength of received radio signals due to variations in the conditions	Understand	CO1	CLO 1	AEC015.01
14	Define rectangular wave guide?	The shape of the waveguide is in the form of rectangle then it is called rectangular waveguide	Understand	CO1	CLO 2	AEC015.02
15	Define circular wave guide?	The shape of the waveguide is in the form of circular then it is called circular waveguide.	Understand	CO1	CLO 1	AEC015.01
16	Define elliptical wave guide?	The shape of the waveguide is in the form of elliptical then it is called elliptical waveguide	Understand	CO1	CLO 2	AEC015.02
17	What is meant by TE Mode?	This waveguide mode is dependent upon the transverse electric waves, also sometimes called H waves, characterised by the fact that the electric vector (E) being always perpendicular to the direction of propagation	Remember	CO1	CLO 3	AEC015.03
18	What is meant by TM Mode?	Transverse magnetic waves, also called E waves are characterised by the fact that the magnetic vector (H vector) is always perpendicular to the direction of propagation.	Remember	CO1	CLO 4	AEC015.04
19	What is meant by TEM Mode?	The TEM wave is characterised by the fact that both the electric vector (E vector) and the magnetic vector (H vector) are perpendicular to the direction of propagation.	Remember	CO1	CLO 1	AEC015.01
20	Define cut off frequency?	The frequency at which γ just becomes zero is defined as the cut-off frequency.	Understand	CO1	CLO 2	AEC015.02
21	Define Guided Wavelength?	It is defined as the distance travelled by the wave in order to undergo a phase shift of 2π radians.	Understand	CO1	CLO 3	AEC015.03
22	Define phase velocity?	wavelength It is defined as the rate at which the wave changes its phase in terms of the guide.	Understand	CO1	CLO 4	AEC015.04
23	Define group velocity?	The rate at which the wave propagates through the waveguide.	Understand	CO1	CLO 1	AEC015.01
24	What is meant by Dominant Mode?	Dominant Mode The mode for which the cut-off wavelength assumes a maximum value.	Remember	CO1	CLO 2	AEC015.02

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
25	What is the dominant mode in rectangular waveguide?	TE ₁₀ mode is the dominant mode in rectangular waveguide	Remember	CO1	CLO 3	AEC015.03
26	What is meant by Degenerate Mode?	Two or more modes having the same cut-off frequency are called 'Degenerate modes'	Remember	CO1	CLO 4	AEC015.04
27	Define Wave impedance?	Wave impedance is defined as the ratio of the strength of electric field in one transverse direction to the strength of the magnetic field along the other transverse direction	Understand	CO1	CLO 1	AEC015.01
28	Define Cavity Resonators?	When both the ends of wave guide section are closed, with in the cavity it produces the resonance so it is called cavity resonator.	Understand	CO1	CLO 2	AEC015.02
29	What are the different types of Cavity resonators are there?	2types. 1.Rectangularcavity resonator 2.circular cavity resonator	Remember	CO1	CLO 3	AEC015.03
30	Define wave length?	Wavelength can be defined as the distance between two successive crests or troughs of a wave.	Understand	CO1	CLO 4	AEC015.04
31	Define quality factor?	The Quality factor of a resonator is defined as the ratio of the amount. of energy stored in the cavity and the amount of energy lost per cycle through the walls of the cavity .	Understand	CO1	CLO 1	AEC015.01
32	Define ridge type of wave guide?	The Ridge waveguide is a uniform rectangular waveguide with one or two (double ridge) rectangular metal insets in the top and/or in the bottom of the rectangular housing.	Understand	CO1	CLO 2	AEC015.02
33	Define wave length?	Wavelength is the distance between corresponding points of two consecutive waves.	Understand	CO1	CLO 3	AEC015.03
34	Define cut-off wave length?	The cutoff wavelength for any mode is defined as the maximum wavelength at which. that mode will propagate.	Understand	CO1	CLO 4	AEC015.04
35	Define gauss law?	The electric flux across a closed surface is proportional to the charge enclosed.	Understand	CO1	CLO 1	AEC015.01
36	Define resonant frequency?	A resonator is a device or system that exhibits resonance or resonant behavior. That is, it naturally oscillates with greater amplitude at some frequency, called resonant frequency.	Understand	CO1	CLO 2	AEC015.02
37	Define Wave equation?	Any differential equation that describes the propagation of waves is Called as a wave equation.	Understand	CO1	CLO 3	AEC015.03
38	What is the degenerate mode in rectangular waveguide?	All higher order modes of TE except m=0 and n=0 are degenerate modes	Remember	CO1	CLO 4	AEC015.04
39	What is meant by attenuation?	Attenuation is a general term that refers to any reduction in the strength of a signal	Remember	CO1	CLO 1	AEC015.01
40	Define resonant frequency?	resonant frequency fr at which energy of resonator becomes maximum	Understand	CO1	CLO 2	AEC015.02
UNIT-II						
WAVEGUIDE COMPONENTS AND APPLICATIONS						
1	Define waveguide coupling?	When waveguide pieces or components are joined together, the Waveguide Coupling is generally by means of some sort of flange.	Understand	CO2	CLO 5	AEC015.05
2	Define Probe coupling?	A probe projecting into a waveguide or cavity resonator, designed to transfer energy to or	Understand	CO2	CLO 6	AEC015.06

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		from an external circuit.				
3	Define loop coupling?	A method of transferring energy between a waveguide and an external circuit, by inserting a conducting loop into the waveguide	Understand	CO2	CLO 7	AEC015.07
4	Define waveguide irises?	Waveguide/Impedance Matching is often necessary to reduce reflections caused by a mismatch between the waveguide and the load. Matching devices called "Irises" are used to introduce either capacitance or inductance (or a combination of both) into a wave guide	Understand	CO2	CLO 8	AEC015.08
5	Define inductive iris?	The iris places a shunt inductive reactance across the waveguide that is directly proportional to the size of the opening	Understand	CO2	CLO 5	AEC015.05
6	Define capacitive iris?	The iris places a shunt Capacitive reactance across the waveguide that is directly proportional to the size of the opening	Understand	CO2	CLO 6	AEC015.06
7	Define series resonant iris?	A combination of both E and H plane waveguide irises can be used to provide both inductive and capacitive reactance. This forms a tuned circuit. At resonance, the iris acts as a high impedance shunt.	Understand	CO2	CLO 7	AEC015.07
8	Define parallel resonant iris?	At the resonant frequency, the iris acts as a high shunt resistance	Understand	CO2	CLO 8	AEC015.08
9	Define waveguide Post?	A post waveguide is a synthetic rectangular electromagnetic waveguide formed in a dielectric substrate by densely arraying metalized posts which connect the upper and lower metal plates of the substrate.	Understand	CO2	CLO 5	AEC015.05
10	Define inductive Post?	When the post extends completely through the waveguide, making contact with the top and bottom walls, it acts as an inductive reactance	Understand	CO2	CLO 6	AEC015.06
11	Define Capacitive Post?	When the post extend part of the way through the waveguide, it acts as capacitive reactance	Understand	CO2	CLO 7	AEC015.07
12	Define Tuning Screws?	Tuning screws are screws inserted into resonant cavities which can be adjusted externally to the waveguide	Understand	CO2	CLO 8	AEC015.08
13	Define capacitive tuning screw?	For screws inserted only a small distance, the equivalent circuit is a shunt capacitor, acts as a capacitive tuning screw	Understand	CO2	CLO 5	AEC015.05
14	Define inductive tuning screw?	Inserting the screw further causes the impedance to change from capacitive to inductive acts as a inductive tuning screw.	Understand	CO2	CLO 6	AEC015.06
15	Define Matched Load?	Matched Load is a device used to terminate a transmission line or waveguide so that all the energy from the signal source will be absorbed.	Understand	CO2	CLO 7	AEC015.07
16	Define waveguide attenuator ?	A waveguide attenuator is an RF device specifically designed to reduce the power of a signal without affecting or reducing the waveform of the signal	Understand	CO2	CLO 8	AEC015.08
17	Define waveguide phase shifters?	waveguide phase shifters are two-port waveguide modules that alter the phase of an output signal in response to an external signal	Understand	CO2	CLO 5	AEC015.05
18	Define Fixed Attenuators?	Fixed Attenuators are waveguide components for introduction of some particular attenuation value in to the waveguide network for signal	Understand	CO2	CLO 6	AEC015.06

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		leveling or reflection compensation				
19	Define variable Attenuators?	The Variable Attenuators are waveguide components for tunable signal leveling or reflection compensation in waveguide networks	Understand	CO2	CLO 7	AEC015.07
20	Define rotary-vane attenuator	A Device designed to introduce attenuation into a waveguide circuit by varying the angular position of a resistive material in the guide.	Understand	CO2	CLO 8	AEC015.08
21	Define microwave junction.	The point of interconnection of two or more microwave devices is called microwave junction.	Understand	CO2	CLO 5	AEC015.05
22	How many microwave junctions are there?	There are 4 microwave junctions.	Understand	CO2	CLO 6	AEC015.06
23	Define E-Plane Tee Junction?	As the axis of the side arm is parallel to the electric field, this junction is called E-Plane Tee junction.	Understand	CO2	CLO 7	AEC015.07
24	Define H-Plane Tee Junction?	As the axis of the side arm is parallel to the magnetic field, this junction is called H-Plane Tee junction	Understand	CO2	CLO 8	AEC015.08
25	Define E-H Plane Tee Junction?	The magic T waveguide junction is effectively a combination of the E-type and H-type waveguide junctions.	Understand	CO2	CLO 5	AEC015.05
26	Define Magic Tee?	When port 1,2 are perfectly match with the junction automatically 3,4 ports also matches with the junction that is called Magic. so it is called magic tee.	Understand	CO2	CLO 6	AEC015.06
27	Define Rat Race Junction?	A normal three-port Tee junction is taken and a fourth port is added to it, to make it a rat race junction. All of these ports are connected in angular ring forms at equal intervals using series or parallel junctions.	Understand	CO2	CLO 7	AEC015.07
28	Define hybrid ring?	A rat-race coupler is also known as a hybrid ring coupler.	Understand	CO2	CLO 8	AEC015.08
29	Define Faraday rotation principle?	Rotation of a beam of polarized microwaves traversing an isotropic medium along the lines of force of a magnetic field.	Understand	CO2	CLO 5	AEC015.05
30	What is the need of twist?	A gradual twist in the waveguide is used to turn the polarization of the waveguide and hence the waveform.	Remember	CO2	CLO 6	AEC015.06
31	What is the need of bend?	Waveguides may be bent in several ways to avoid reflections.	Remember	CO2	CLO 7	AEC015.07
32	Define gyrator?	Gyrator is a phase shifting electronic device, which gives an output 180 degrees out of phase with input.	Understand	CO2	CLO 8	AEC015.08
33	Define circulator?	A circulator is a passive, non reciprocal three- or four-port device, in which a microwave or radio-frequency signal entering any port is transmitted to the next port in rotation (only).	Understand	CO2	CLO 5	AEC015.05
34	Define isolator?	An isolator is a mechanical switching device that, in the open position, allows for isolation of the input and output of a device.	Understand	CO2	CLO 6	AEC015.06
35	What are the Applications of magic tee?	Magic Tee junction is used to measure the impedance Magic Tee is used as a duplexer Magic Tee is used as a Mixer.	Remember	CO2	CLO 7	AEC015.07
36	What are the	Three port circulators are used as duplexers.	Remember	CO2	CLO 8	AEC015.08

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	Applications of circulators?					
37	What are the Applications of isolators?	Isolators are most widely used to protect high power RF sources.	Remember	CO2	CLO 5	AEC015.05
38	What is tee junction?	When the shape of micro wave junction is in the form of English alphabet T then it is called tee junction.	Remember	CO2	CLO 6	AEC015.06
39	What is the need of microwave junction?	To split the energy in to different directions or to combine the energy coming from different directions microwave junctions are used.	Remember	CO2	CLO 7	AEC015.07
40	What is the need of Ferrite?	The unique properties of ferrites provide a variable reactance by which microwave energy can be manipulated to conform to the microwave system	Remember	CO2	CLO 8	AEC015.08

UNIT-III
MICROWAVE LINEAR BEAM AND CROSS FIELD TUBES
(O TYPE AND M TYPE)

1	What are the limitations of conventional tubes?	Inter electrode capacitance and lead inductance effect, Transit time effect and Gain-Bandwidth product limitation	Remember	CO3	CLO 9	AEC015.09
2	Define linear or O- type tubes.	Linear beam or O-type tubes in which the accelerating electric field is in the same direction as the static magnetic field used to focus electron beam.	Understand	CO3	CLO 10	AEC015.10
3	Define M- type tubes.	M-type tubes where the static magnetic field is perpendicular to the electric field.	Understand	CO3	CLO 11	AEC015.11
4	Define transit time.	In a conventional tube electrons emitted by the cathode take a finite (non-zero) time in reaching the anode. This interval, called the transit time	Understand	CO3	CLO 12	AEC015.12
5	Define Drift space.	The region between buncher cavity and catcher cavity is called drift space.	Understand	CO3	CLO 13	AEC015.13
6	Define velocity modulation.	When the electrons pass the buncher gap their velocity will be change according to the input RF signal. This process is known as velocity modulation	Understand	CO3	CLO 14	AEC015.14
7	Define Applegate diagram.	The theory of velocity modulation can be explain by using the diagram known as Applegate diagram.	Understand	CO3	CLO 9	AEC015.09
8	Define current modulation.	The electron beam contains an AC current and variation in current density (often called current modulation)	Understand	CO3	CLO 10	AEC015.10
9	Define de bunching	At the point of bunching the electrostatic force of repulsion between the electrons does not allow electronic collision, but may cause beam spreading or undesirable de bunching.	Understand	CO3	CLO 11	AEC015.11
10	Define Mutual conductance.	Mutual conductance of the klystron amplifier is the ratio of the induced output current to the input voltage.	Understand	CO3	CLO 12	AEC015.12
11	Define synchronous tuning.	A klystron amplifier tube will deliver high gain and a narrow bandwidth if all the cavities are tuned to the same frequency. This method of tuning is called synchronous tuning.	Understand	CO3	CLO 13	AEC015.13
12	Define staggered tuning.	If the cavities are tuned to slightly different frequencies, the gain of the amplifier will be reduced but the bandwidth will be appreciably increased. This method of tuning is called	Understand	CO3	CLO 14	AEC015.14

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		staggered tuning.				
13	Define transit time.	Transit time is the time taken by the electron to travel into the repeller space and back to the gap.	Understand	CO3	CLO 9	AEC015.09
14	Define slow wave structures.	Slow wave structures are special circuits that are used in microwave tubes to reduce the wave velocity in a certain direction so that the electron beam and the signal wave can interact.	Understand	CO3	CLO 10	AEC015.10
15	Define electronic equation in TWT.	An electronic equation which determines the values of convection current induced by axial electric field.	Understand	CO3	CLO 11	AEC015.11
16	Define derived helix.	In order to increase the efficiency, the helix pitch can be gradually decreased in the output section. Such a circuit modification is known as a velocity taper and increases efficiency without degrading phase linearity.	Understand	CO3	CLO 12	AEC015.12
17	What is cathode?	A cathode is the metallic electrode through which current flows out in a polarized electrical device. (Heated to emit electron).	Remember	CO3	CLO 13	AEC015.13
18	What is anode?	An anode is the electrode in a polarized electrical device through which current flows in from an outside circuit. (For formation of electron beam).	Remember	CO3	CLO 14	AEC015.14
19	What is buncher cavity?	Applied signal velocity modulates the electrons	Remember	CO3	CLO 9	AEC015.09
20	What is catcher cavity?	The amplified output signal is obtained from this cavity.	Remember	CO3	CLO 10	AEC015.10
21	What is collector?	Collects the electrons coming out of the catcher cavity.	Remember	CO3	CLO 11	AEC015.11
22	Define Cross-field amplifier	Amplifier version of magnetron oscillator.	Understand	CO3	CLO 12	AEC015.12
23	What is coaxial magnetron?	Magnetron having a outer high Q coaxial cavity in TE ₀₁₁ -mode.	Remember	CO3	CLO 13	AEC015.13
24	What is Klystron?	Microwave tube which can be used for amplification or generation of microwave signal.	Remember	CO3	CLO 9	AEC015.09
25	What is Reflex Klystron?	Oscillator version of klystron	Remember	CO3	CLO 10	AEC015.10
26	What is Magnetron?	A high power microwave oscillator	Remember	CO3	CLO 11	AEC015.11
27	Define TWTA.	Travelling wave tube amplifier is a high-gain, low noise and wide bandwidth amplifier which can operate a wide range of frequency from 300 MHz to 50 GHz.	Understand	CO3	CLO 12	AEC015.12
28	What is mechanical tuning of reflex klystron?	Variation in frequency of resonance of cavity by varying its dimension by a mechanical method like adjusting screws is called as mechanical tuning.	Remember	CO3	CLO 13	AEC015.13
29	What is electronic tuning of reflex klystron?	Variation of frequency by the method of adjusting repeller voltage is called electronic tuning.	Remember	CO3	CLO 14	AEC015.14
30	What is the range of frequency variation of reflex klystron in the X-band by the mechanical	Mechanical tuning: +20MHz.	Remember	CO3	CLO 9	AEC015.09

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	tuning method?					
31	What is the range of frequency variation of reflex klystron in the X-band by the electronic tuning method	Electronic tuning: +8MHz	Remember	CO3	CLO 10	AEC015.10
32	What is the operating principle of reflex klystron?	It works on the principle of velocity modulation and current modulation.	Remember	CO3	CLO 11	AEC015.11
33	What modes are generally used in a reflex klystron?	1 ³ / ₄ and 2 ³ / ₄ are the most commonly used modes in a practical reflex klystron.	Remember	CO3	CLO 12	AEC015.12
34	What is the operating frequency and power output of a reflex klystron?	Frequency range: 4GHz – 200GHz Output power: maximum 3W in X-band to 10mW at 220GHz.	Remember	CO3	CLO 13	AEC015.13
35	What Mode of cavity in coaxial magnetron?	The mode for coaxial magnetron is TE011	Remember	CO3	CLO 14	AEC015.14
36	Define frequency pushing.	The resonant frequency of magnetron can be changed by changing the anode voltage. This process referred to as frequency pushing	Understand	CO3	CLO 9	AEC015.01
37	Define frequency pulling.	Magnetron is also sensitive to frequency variation due to changes in load impedance. These frequency variations are known as frequency pulling.	Understand	CO3	CLO 10	AEC015.01
38	What is bunching?	The effect of velocity modulation produces bunching of electron beam	Remember	CO3	CLO 11	AEC015.01
39	What is the efficiency of Theoretical efficiency of 2-cavity klystron?	The efficiency of 2- cavity klystron is 58.2%	Remember	CO3	CLO 12	AEC015.01
40	What is the maximum efficiency of reflex klystron?	The efficiency of reflex klystron is 22.7%	Remember	CO3	CLO 13	AEC015.01

**UNIT-IV
MICROWAVE SOLID-STATE DEVICES**

1	Define Gunn diode.	A microwave negative resistance device whose operation depends upon as transferred electron effect (or Gunn effect) originating from the bulk properties of the semiconductor material.	Understand	CO4	CLO 15	AEC015.15
2	What is IMPATT diode?	A type of transit time microwave diode. All transit time devices depend upon two mechanisms namely generation of charge carriers and transit of these carriers through a drift space.	Remember	CO4	CLO 16	AEC015.16
3	Define Parametric amplifier.	A type of microwave circuit that uses a varactor diode for providing low noise amplification of microwave signals.	Understand	CO4	CLO 17	AEC015.17
4	What is PIN-diode?	A semiconductor diode comprising of two heavily doped p-type and n-type semiconductor materials separated by a very high resistivity	Remember	CO4	CLO 15	AEC015.15

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		intrinsic material.				
5	Define Point contact diode.	One of the early microwave devices. It uses a metal semiconductor junction and was used earlier for microwave mixing and detection applications.	Understand	CO4	CLO 16	AEC015.16
6	Define Schottky barrier diode.	Uses a schottky junction similar to metal semiconductor junction. Commonly used mixer and detector diode at microwave and millimeter wave frequencies.	Remember	CO4	CLO 17	AEC015.17
7	Define Tunnel diode.	A pn junction diode with a very high concentration of impurity atoms leading to tunneling phenomenon. It exhibits negative resistance characteristic.	Remember	CO4	CLO 15	AEC015.15
8	Define TRAPATT diode.	A type of transit time microwave diode is similar to an IMPATT diode with difference in aulandic invitation and carrier drift mechanisms.	Remember	CO4	CLO 16	AEC015.16
9	What is TUNNETT diode?	A type of transit time device that uses tunneling phenomenon for generation.	Remember	CO4	CLO 17	AEC015.17
10	What is Varactor diode?	A pn junction diode designed to maximize capacitance variation as a function of applied reverse bias.	Remember	CO4	CLO 15	AEC015.15
11	What is a solid state device?	Solid-state device, electronic device in which electricity flows through solid semi conductor crystals (silicon, gallium arsenide, and germanium) rather than through vacuum tubes.	Remember	CO4	CLO 16	AEC015.16
12	What are microwave devices?	Low-power microwave sources use solid-state devices such as the field-effect transistor (at least at lower frequencies), tunnel diodes, Gunn diodes, and IMPATT diodes	Remember	CO4	CLO 17	AEC015.17
13	What is a tunnel diodes definition?	A tunnel diode or Esaki diode is a type of semiconductor diode that has negative resistance due to the quantum mechanical effect called tunneling.	Remember	CO4	CLO 15	AEC015.15
14	What is meant by Gunn diode?	A Gunn diode, also known as a transferred electron device (TED), is a form of diode, a two-terminal passive semiconductor electronic component, with negative resistance, used in high-frequency electronics.	Remember	CO4	CLO 16	AEC015.16
15	What is Gunn diode effect?	Gunn effect, high-frequency oscillation of electrical current flowing through certain semiconducting solids. The effect is used in a solid-state device, the Gunn diode, to produce short radio waves called microwaves.	Remember	CO4	CLO 17	AEC015.17
16	Who invented Gunn diode?	John Battiscombe "J. B." Gunn (13 May 1928 – 2 December 2008), known as Ian or Iain, was a British physicist, who spent most of his career in the United States.	Remember	CO4	CLO 15	AEC015.15
17	Define Gunn-effect diode?	A Gunn diode, also known as a transferred electron device (TED), is a form of diode, a two-terminal passive semiconductor electronic component, with negative resistance, used in high-frequency electronics.	Understand	CO4	CLO 16	AEC015.16
18	Define RWH theory.	Ridley–Watkins–Hilsum theory (RWH) explains the mechanism by which differential negative resistance is developed in a bulk solid state semiconductor material when a voltage is applied to the terminals of the sample.	Understand	CO4	CLO 17	AEC015.17

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
19	Define avalanche transit time devices.	The devices that help to make a diode exhibit this property are called as Avalanche transit time devices.	Understand	CO4	CLO 15	AEC015.15
20	What is an avalanche transit time device?	The process of having a delay between voltage and current, in avalanche together with transit time, through the material is said to be Negative resistance	Remember	CO4	CLO 16	AEC015.16
21	Define IMPATT diode.	An IMPATT diode (Impact ionization Avalanche Transit-Time diode) is a form of high-power semiconductor diode used in high-frequency microwave electronics devices.	Understand	CO4	CLO 17	AEC015.17
22	Define BARITT diode.	The BARITT diode (barrier injection transit-time) is a high frequency semiconductor component of microelectronics. A related component is the DOVETT diode.	Understand	CO4	CLO 15	AEC015.15
23	Define TRAPATT diode.	A microwave oscillator device with a similar structure to the IMPATT diode is the TRAPATT diode, which stands for "trapped plasma avalanche triggered transit".	Understand	CO4	CLO 16	AEC015.16
24	What is pin diode?	A PIN diode is a diode with a wide, undoped intrinsic semiconductor region between a p-type semiconductor and an n-type semiconductor region.	Remember	CO4	CLO 17	AEC015.17
25	What Is PIN photo diode?	PIN Diode. PIN photodiode is a kind of photo detector; it can convert optical signals into electrical signals. ...	Remember	CO4	CLO 15	AEC015.15
26	Define varactor diodes.	A tuning diode, also known as a varactor diode, variable capacitance diode, varicap diode or variable reactance diode is a diode that has a variable capacitance which is a function of the voltage that is impressed on its terminals.	Understand	CO4	CLO 16	AEC015.16
27	What is varactor diode?	The term varactor is originated from a variable capacitor. Varactor diode operates only in reverse bias. The varactor diode acts like a variable capacitor under reverse bias.	Remember	CO4	CLO 17	AEC015.17
28	Define Laser Diode.	A semiconductor device that generates coherent light of high intensity is known as laser diode. -LASER is an abbreviation for Light Amplification by Stimulated Emission of Radiation. Stimulated emission is the basis of working of a laser diode.	Understand	CO4	CLO 15	AEC015.15
29	Define Light Emitting Diode.	The LED is a PN-junction diode which emits light when an electric current passes through it in the forward direction. In the LED, the recombination of charge carrier takes place.	Understand	CO4	CLO 16	AEC015.16
30	What is a microwave switch?	RF (radio frequency) and microwave switches are used extensively in microwave test systems for signal routing between instruments and devices under test (DUT).	Remember	CO4	CLO 17	AEC015.17
31	What is transferred electron effect?	The variation in the effective drift mobility of charge carriers in a semiconductor when significant numbers of electrons are transferred from a low-mobility valley of the conduction band in a zone to a high-mobility valley, or vice versa.	Remember	CO4	CLO 15	AEC015.15
32	Define avalanche effect.	Avalanche effect is "the sudden rapid increase in the current in a non conducting material (insulator) or semiconducting material	Understand	CO4	CLO 16	AEC015.16

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
		(semiconductor) when a sufficient amount of electrical force is applied to the material”				
33	Define Light wave detection.	You are surrounded by electromagnetic waves. They're everywhere! From the light you can see, to the infrared your body is producing, to the ultraviolet coming through	Understand	CO4	CLO 17	AEC015.17
34	What is high speed switching diode?	Have a look at Circuit Specialists collection of low-cost 1N914 and 1N4148 high-speed switching diodes	Remember	CO4	CLO 15	AEC015.15
35	Define voltage stabilizer.	A voltage stabilizer is an electrical appliance used to feed constant voltage current to electrical gadgets like ACs and computers, and protects them from damage due to voltage fluctuations.	Understand	CO4	CLO 16	AEC015.16
36	What is hot carrier diode?	A Schottky diode is also known as a hot carrier diode; it is a semiconductor diode with a very fast switching action, but a low forward voltage drop.	Remember	CO4	CLO 17	AEC015.17
37	Define lower noise.	A low-noise amplifier (LNA) is an electronic amplifier that amplifies a very low-power signal without significantly degrading its signal-to-noise ratio.	Understand	CO4	CLO 15	AEC015.15
38	Define microwave oscillators.	A type of electron tube or semiconductor device used for generating microwave radiation or voltage waveforms with microwave frequencies. Also known as microwave generator	Understand	CO4	CLO 16	AEC015.16
39	What is saw devices?	SAW devices are used as filters, oscillators and transformers, devices that are based on the transduction of acoustic waves.	Remember	CO4	CLO 17	AEC015.17
40	Define Strip line.	The width of the strip, the thickness of the substrate and the relative permittivity of the substrate determine the characteristic impedance of the strip which is a transmission line.	Understand	CO4	CLO 15	AEC015.15
UNIT-V						
MICROWAVE MEASUREMENTS						
1	Define Gunn Power Supply.	Gunn power supply comprises of an electronically regulated DC power supply and a square wave generator designed to operate Gunn oscillator and pin modulator simultaneously.	Understand	CO5	CLO 18	AEC015.18
2	What is Gunn Oscillator?	Gunn oscillator has been designed as a stable and spectrally pure microwave source. The oscillator has a Gunn diode mounted in a waveguide cavity which is tunable over the range 8.5 to 11.5 GHz by a micrometer controlled tuning plunger.	Remember	CO5	CLO 19	AEC015.19
3	Define PIN Modulator.	The Pin Modulator is a transmission line i.e. wave guide shunted with a Pin Diode.	Understand	CO5	CLO 18	AEC015.18
4	What is Klystron Power Supply?	Klystron Power Supply, is a state-of the-art solid-state, regulated power supply for operating low power Klystrons such as 2K25.	Remember	CO5	CLO 19	AEC015.19
5	What is SWR meter?	SWR meter is a high gain low noise, tuned voltmeter operating at fixed frequency. It is designed for making standing wave measurement in conjunction with a suitable detector and slotted line or wave guide section.	Remember	CO5	CLO 18	AEC015.18

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
6	What is Double Minimum Method?	In the double minimum method, it is necessary to establish the electrical distance between the points where the output is double the minimum.	Remember	CO5	CLO 19	AEC015.19
7	What is an isolator?	An isolator is a two-port device that transfers energy from input to output with little attenuation and from output to input with very high attenuation.	Remember	CO5	CLO 18	AEC015.18
8	Define VSWR meter.	A VSWR meter basically consists of a high gain, high Q, low noise voltage amplifier, normally tuned at a fixed frequency (1 kHz) at which the microwave signal is modulated.	Understand	CO5	CLO 19	AEC015.19
9	What is the function of frequency meter?	To measure the frequency of a microwave signal, the Resonant Cavity Frequency Meter is tuned until it resonates at the signal frequency.	Remember	CO5	CLO 18	AEC015.18
11	Define Reflex klystron.	The reflex klystron is a single cavity variable frequency microwave generator of low power and low efficiency.	Understand	CO5	CLO 18	AEC015.18
12	What is Slotted section?	Slotted section is basically used to measure standing wave ratio (VSWR).	Remember	CO5	CLO 19	AEC015.19
13	What is Tunable Probe?	A tunable probe helps in detecting the low frequency square wave modulated microwave signal. It is made by the use of crystal diode mounted in the transmission line.	Remember	CO5	CLO 18	AEC015.18
14	What is matched termination?	Matched Termination is used in making measurement of waveguide component and it is often desirable to absorb the power propagated down the waveguide. These are designed in such a way to absorb the maximum energy without having appreciable reflection assuring low VSWR.	Remember	CO5	CLO 19	AEC015.19
15	Define reflection coefficient.	The reflection coefficient is defined as the ratio of the complex amplitude of the reflected wave to that of the incident wave.	Understand	CO5	CLO 18	AEC015.18
16	Define 3dB Beam Width.	3dB Beam Width is the angle between the two points on a main lobe where the power intensity is half the maximum power intensity.	Understand	CO5	CLO 19	AEC015.19
17	Define radiation pattern.	In the field of antenna design the term radiation pattern (or antenna pattern or far-field pattern) refers to the directional (angular) dependence of the strength of the radio waves from the antenna or other source.	Understand	CO5	CLO 18	AEC015.18
18	What is directivity?	Directivity is a fundamental antenna parameter. It is a measure of how 'directional' an antenna's radiation pattern is. An antenna that radiates equally in all directions would have effectively zero directionality, and the directivity of this type of antenna would be 1 (or 0 dB).	Understand	CO5	CLO 19	AEC015.19
19	What is directional coupler?	A directional coupler is a device with it is possible to measure the incident and reflected wave separately. It consists of two transmission line, the main arm and auxiliary arm, electromagnetically coupled to each other.	Understand	CO5	CLO 18	AEC015.18
20	Define Magic Tee.	The device magic Tee is a-combination of the E and H plane Tee. Arm 3, the H-arm forms an H plane Tee and arm 4, the E-arm forms an E plane Tee in combination with arm 1 and 2 a side or collinear arms.	Understand	CO5	CLO 19	AEC015.19
21	What is	Circulator is the circulator is defined as a	Understand	CO5	CLO 18	AEC015.18

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	circulator?	device with ports arranged such that energy entering a port is coupled to an adjacent port but not coupled to other ports.				
22	Define insertion loss.	Insertion loss The ratio of power supplied by a source to the input port to the power detected by a detector in the coupling arm, i.e. output arm with other port terminated in the matched load, is defined as insertion loss or forward loss.	Understand	CO5	CLO 19	AEC015.19
23	Define attenuators.	The attenuators are two port bi-directional devices which attenuate power when inserted into the transmission line. Attenuation A (dB).	Understand	CO5	CLO 18	AEC015.18
24	What is phase shifter?	A phase shifter consists of a piece of Wave-guide and a dielectric material inside the wave-guide placed parallel to Electric vector of TE ₁₀ mode. The phase changes as piece of dielectric material is moved from edge of wave-guide towards the center of the wave- guide.	Understand	CO5	CLO 19	AEC015.19
25	Define dielectric constant.	The dielectric constant is the ratio of the permittivity of a substance to the permittivity of free space. ... For example, dry air has a low dielectric constant, but it makes an excellent dielectric material for capacitors used in high-power radio-frequency (RF) transmitters.	Remember	CO5	CLO 18	AEC015.18
26	Define propagation constant.	The propagation constant of a sinusoidal electromagnetic wave is a measure of the change undergone by the amplitude and phase of the wave as it propagates in a given direction. The quantity being measured can be the voltage, the current in a circuit, or a field vector such as electric field strength or flux density. The propagation constant itself measures the change per unit length, but it is otherwise dimensionless.	Understand	CO5	CLO 19	AEC015.19
27	What is Guide wavelength?	Guide wavelength is defined as the distance between two equal phase planes along the waveguide. The guide wavelength is a function of operating wavelength (or frequency) and the lower cutoff wavelength, and is always longer than the wavelength would be in free-space.	Understand	CO5	CLO 18	AEC015.18
28	What is resonator?	A resonator is a device or system that exhibits resonance or resonant behavior. That is, it naturally oscillates with greater amplitude at some frequencies, called resonant frequencies, than at other frequencies. The oscillations in a resonator can be either electro magnetic or mechanical (including acoustic).	Understand	CO5	CLO 19	AEC015.19
29	Define cavity resonator.	A cavity resonator is one in which waves exist in a hollow space inside the device. In electronics and radio, microwave cavities consisting of hollow metal boxes are used in microwave transmitters, receivers and test equipment to control frequency, in place of the tuned circuits which are used at lower frequencies.	Understand	CO5	CLO 18	AEC015.18

S.No	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
30	What is Bolometer?	A bolometer is a square law device and it produces a current that is proportional to the applied power, i.e., square of the applied voltage, rather than the applied voltage.	Understand	CO5	CLO 19	AEC015.19
31	Define quality factor.	The quality factor or Q factor is a measure of the performance of a coil, capacitor inductor in terms of its losses and resonator bandwidth.	Understand	CO5	CLO 18	AEC015.18
32	What is the relationship between reflection coefficient and VSWR?	The relationship between reflection coefficient and VSWR is $\rho = \frac{VSWR-1}{VSWR+1}$	Understand	CO5	CLO 19	AEC015.19
33	What are Klystron and TWT tubes?	Klystron and TWT are linear beam or O-type tubes in which the accelerating electric field is in same direction as the static magnetic field used to focus electron beam.	Understand	CO5	CLO 18	AEC015.18
34	Define transit time.	Transit time is the time taken for the electron to travel from cathode to anode.	Remember	CO5	CLO 19	AEC015.19
35	Define gain bandwidth product.	Gain-bandwidth product is defined as the product of gain and band width.	Understand	CO5	CLO 18	AEC015.18
36	What is skin effect?	The skin effect is the tendency of current to distribute itself such that current density at surface is greater than its case.	Remember	CO5	CLO 19	AEC015.19
37	Define catcher cavity.	Catcher cavity is a resonant cavity from where the amplified RF signal is coupled out.	Remember	CO5	CLO 18	AEC015.18
38	What is mutual conductance?	Mutual conductance is the mutual conductance of the klystron amplifier is the ratio of the induced output current to the input voltage.	Remember	CO5	CLO 19	AEC015.19
39	Define Efficiency of Klystron.	The efficiency of the klystron amplifier is the ratio of the output power to the input power.	Remember	CO5	CLO 18	AEC015.18
40	What is travelling wave tube amplifier?	The TWT is an amplifier which makes use of distributed interaction between an electron beam and a travelling wave RF field (input).	Remember	CO5	CLO 19	AEC015.19

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