Zeal Education Society's

ZEAL POLYTECHNIC, PUNE.

NARHE | PUNE -41 | INDIA

SECOND YEAR (SY)

DIPLOMA IN MECHANICAL ENGINEERING

SCHEME: I **SEMESTER: III**

NAME OF SUBJECT: Thermal Engineering

Subject Code: 22337

MSBTE QUESTION PAPERS & MODEL ANSWERS

1. MSBTE WINTER-18 EXAMINATION
2. MSBTE SUMMER-19 EXAMINATION
3. MSBTE WINTER-19 EXAMINATION

22334

21819
3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : 10

(a) Define simplex and half duplex system with neat sketch.

(b) Define the term signal to noise ratio.

(c) Represent FM wave in time domain & frequency domain.

(d) State the types of AM with respect to frequency spectrum.

(e) Draw pre-emphasis and de-emphasis circuits used in FM transmission and reception.

(f) Define fading with respect to wave propogation.

(g) Draw sketch of Loop antenna along with its radiation pattern.

2. Attempt any THREE of the following : 12

(a) Explain the sources of noise in communication system.

(b) Explain power relation in AM wave.

(c) Explain duct propagation with neat sketch.

(d) Explain the term beam width related to antenna with a sketch.

3. Attempt any THREE of the following : 12

(a) A 500 watts carrier is modulated to depth of 80%.

Calculate :

(i) Total power in AM

(ii) Power in sidebands

(b) A frequency modulated signal is represented by the voltage equation $e_{fm} = 10 \sin (6 \times 10^8 t + 5 \sin 1250\, t)$

Calculate :

(i) Carrier frequency f_c

(ii) Modulating frequency f_m

(iii) Maximum deviation

(iv) What power will this FM wave dissipates in 20 Ω resistor ?

(c) Compare between simple AGC and delayed AGC.

(d) Compare resonant & non-resonant antenna on the basis of

(i) Definition

(ii) Circuit

(iii) Reflection co-efficient

(iv) Radiation Pattern

(e) Differentiate between ground wave and sky wave propagation.

4. Attempt any THREE of the following : 12

(a) Draw the block diagram of basic electronic communication system.

(b) Differentiate between AM & FM on the basis of

(i) Definition

(ii) Bandwidth

(iii) Modulation index

(iv) Application

(c) Draw the circuit diagram of practical AM diode detector. Sketch its input and output waveforms.

(d) Describe the term virtual height with the help of diagram showing ionized layer and path of wave.

(e) Draw the construction of Yagi-Uda antenna. Draw its Radiation Pattern and write two applications.

5. Attempt any TWO of the following : 12

(a) Write down range of different frequencies in electromagnetic spectrum for following :

(i) Voice frequency

(ii) High frequency

(iii) Infrared frequency

(iv) Visible spectrum (light)

(v) Radio frequency

(vi) UV frequency

Also, write one application area of each frequency.

(b) Explain why the local oscillator frequency should be always greater than signal frequency in radio receiver. A superheterodyne radio receiver with an IF of 455 kHz is turned to 1000 kHz. Find its Image frequency and local oscillator frequency.

(c) Name the different layers of atmosphere which satisfy following conditions :

(i) Reflects LF, absorbs MF and HF waves to some degree.

(ii) Helps surface waves and reflect HF waves.

(iii) Partially absorbs HF waves yet allowing them to reach its upper layer.

(iv) Efficiently reflects HF waves, specially in night.

(v) Exists in Day time only.

(vi) Exists in day time but merges with F2 layer in night time.

6. Attempt any TWO of the following : 12

(a) Explain the effect of modulation index on AM wave with waveforms for

(i) $m < 1$

(ii) $m = 1$

(iii) $m > 1$

(b) Explain working of AM super heterodyne receiver with the help of neat block diagram and waveforms.

(c) Explain following terms in short related to antennas

(i) Antenna resistance

(ii) Directivity

(iii) Antenna gain

(iv) Power density

(v) Radiation pattern

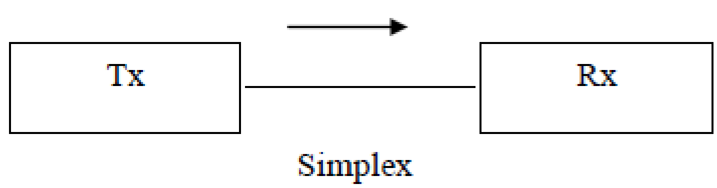
(vi) Polarization

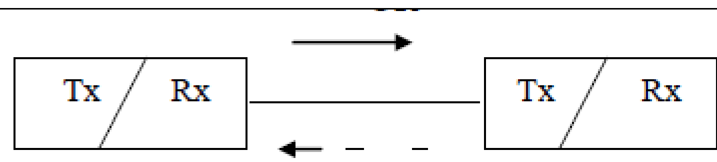
SUMMER-19 EXAMINATION

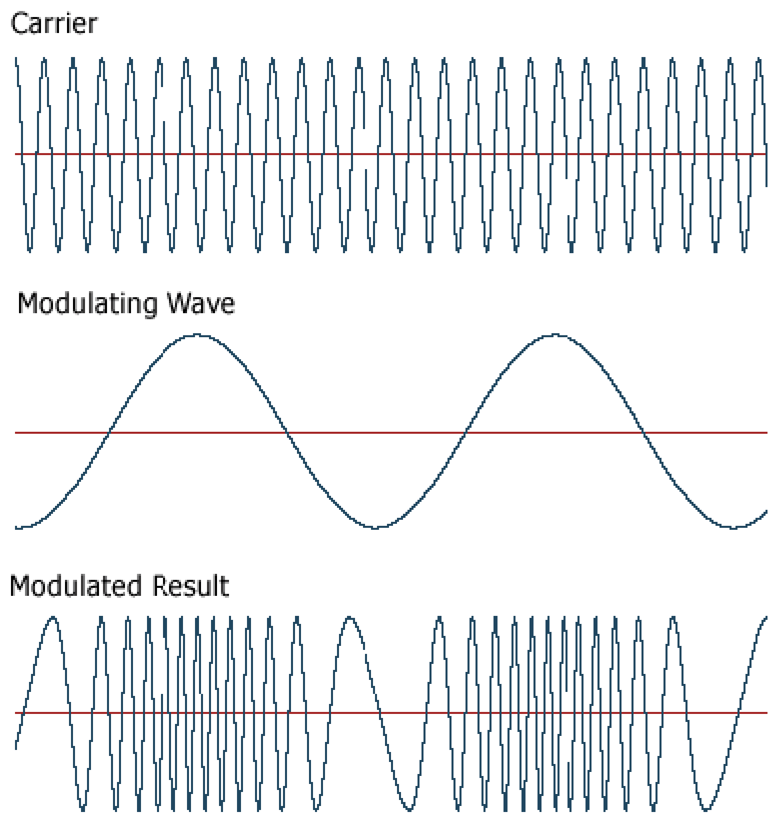
Subject Name: Principles of electronic communication **Model Answer** | 22334

Important Instructions to examiners:

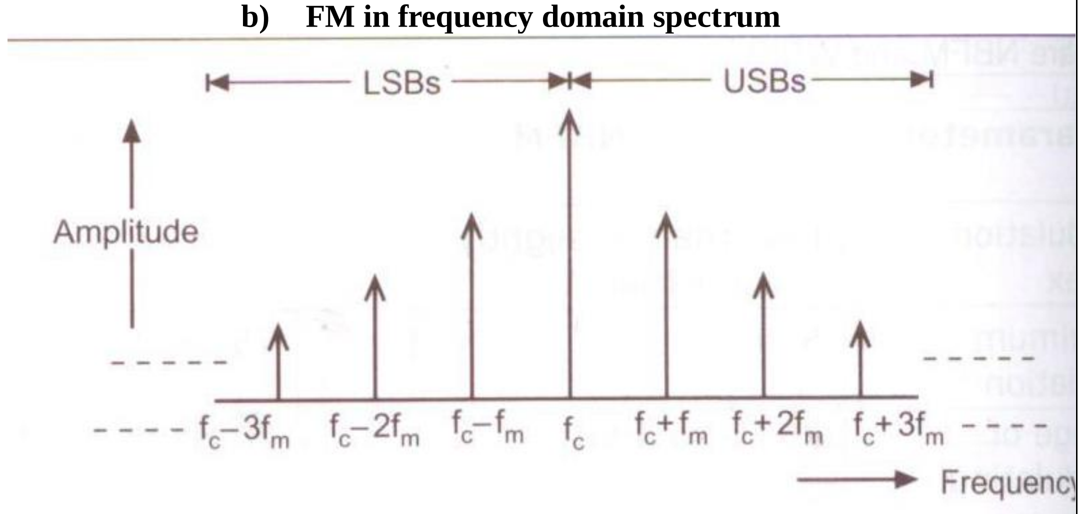
1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answers	Marking Scheme
1	**(A)**	**Attempt any FIVE of the following:**	**10- Total Marks**
	(a)	**Define simplex and half duplex system with neat sketch**	**2M**
	Ans:	**Simplex System**: - The system in which the information is communicated only in one direction, called as simplex system e.g. TV broadcasting or radio.  **Fig: Simplex System** **Half Duplex System**: The system which is bidirectional that is they can transmit as well receive information but one at a time is known as half duplex.	**1M per system(1/2 mark definition &1/2 mark sketch)**

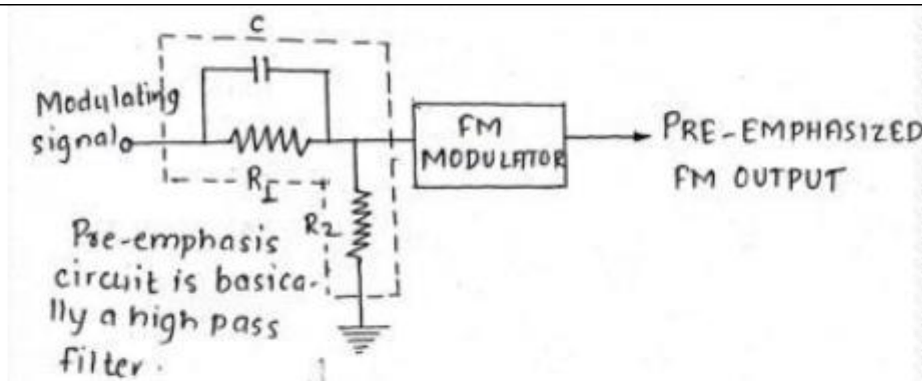
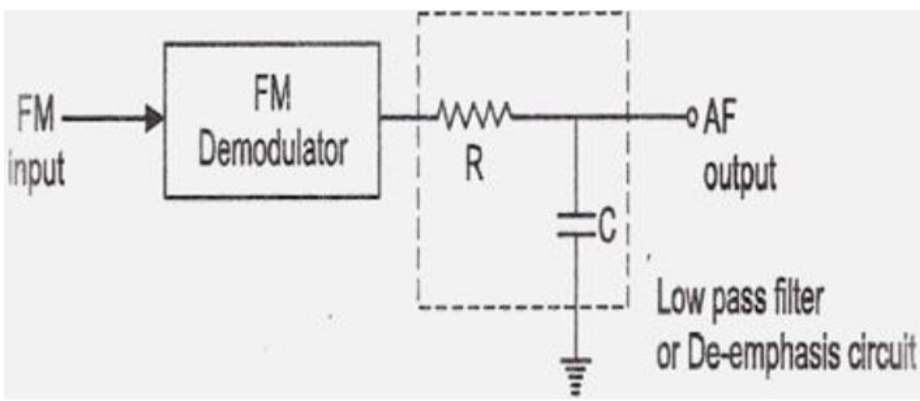
		 Half duplex **Fig: Half Duplex System**	
	(b)	**Define term signal to noise ratio.**	**2M**
	Ans:	**Signal to Noise ratio**: The ratio of the strength of an electrical or other signal carrying information to that of unwanted interference is called as signal to noise ratio. OR Signal to Noise Ratio is defined as the ratio of signal power to the noise power at the same point. S/N=Ps/Pn where,Ps=Signal Power Pn=Noise Power at the same point	**2 M for correct definition**
	(c)	**Represent FM wave in time domain and frequency domain**	**2M**
	Ans:	**a) FM in time domain spectrum**	**1M for each domain**

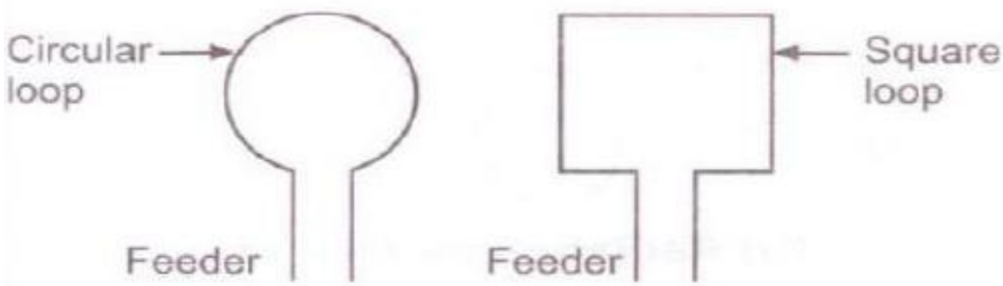
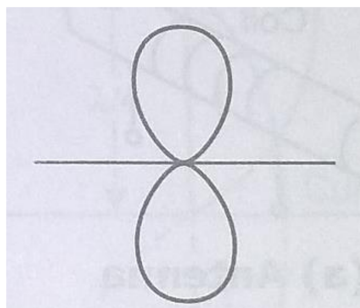


b) FM in frequency domain spectrum



	(d)	**State the types of AM w.r.t. frequency spectrum**	**2M**
	Ans:	Types of AM based on frequency spectrum: 1)Double side-band Full Carrier System(DSB-FC) 2) Double side-band Suppressed Carrier System (DSB-SC)	**½ mark for any 4 types**

		3)Single Sideband Suppressed Carrier System(SSB-SC) 4)Independent Sideband System(ISB) 5)Vestigial Sideband System(VSB)	
	e)	**Draw pre emphasis and de emphasis circuit used in FM transmission and reception**	**2M**
	Ans:	 **Fig-Pre emphasis Circuit**  **Fig-De emphasis Circuit**	**1 M per circuit**
	f)	**Define fading w.r.t. wave propagation**	**2M**
	Ans:	**Fading:** The fluctuation in signal strength at a receiver, which is mainly due to the interference of two waves which left the same source but arrived at the destination by different paths, is known as fading.	**2M for correct definition**
	g)	**Draw sketch of Loop antenna along with its radiation pattern**	**2M**

	Ans:	 **Fig: Loop Antenna**  **Fig: Radiation Pattern**	**1M sketch & 1M radiation pattern**

Q. No.	Sub Q. N.	Answers	Marking Scheme
2		**Attempt any THREE of the following:**	**12- Total Marks**
	a)	**Explain the sources of noise in communication system**	**4M**
	Ans:	Noise: Noise is any spurious or undesired disturbances that mask the received signal in a communication system. a**) Atmospheric Noise :** Atmospheric Noise is also known as static noise which is the natural source of disturbance caused by lightning, discharge in thunderstorm and the natural disturbances occurring in the nature. **b) Industrial Noise :** Sources of Industrial noise are auto-mobiles, aircraft, ignition of electric	Any 4 source with ief explanatio m

motors and switching gear.

c) Extraterrestrial Noise : Extraterrestrial Noise exist on the basis of their originating source. They are Solar Noise
ii) Cosmic Noise

Internal Noise are the type of Noise which are generated internally or within the Communication System or in the receiver. They are as follows:

1) Shot Noise : These Noise rises in the active devices due to the random behaviour of Charge particles or carries. In case of electron tube, shot Noise is produces due to the random emission of electron form cathodes.

2) Partition Noise : When a circuit is to divide in between two or more paths then the noise generated is known as Partition noise. The reason for the generation is random fluctuation the division.

3) Low- Frequency Noise : They are also known as FLICKER NOISE. These type of noise are generally observed at a frequency range below few kHz. Power spectral density of these noise increases with the decrease in frequency. That why the name is given Low- Frequency Noise.

4) High- Frequency Noise : These noises are also known TRANSIT- TIME Noise. They are observed in the semi-conductor devices when the transit time of a charge carrier while crossing a junction is compared with the time period of that signal.

5) Thermal Noise : Thermal Noise are random and often referred as White Noise or Johnson Noise. Thermal noise are generally observed in the resistor or the sensitive resistive components of a complex impedance due to the random and rapid movement of molecules or atoms or electrons.

Dark current noise: When there is no optical power incident on the photodetector a small reverse leakage current still flows from the device terminals. This Dark current contributes to the total system noise and gives random fluctuations about the average particle flow of the photocurrent.

The Dark current noise is given by:

$$i_d^2 = 2eBI_d$$

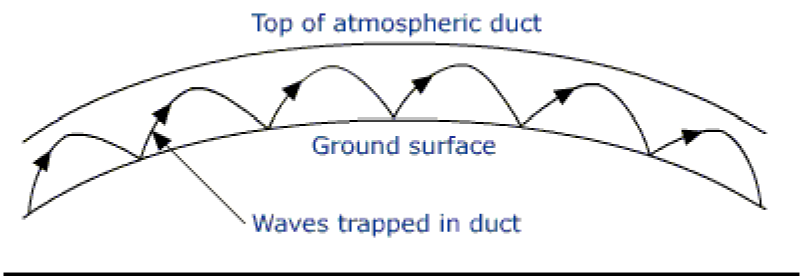
where e is the charge on an electron

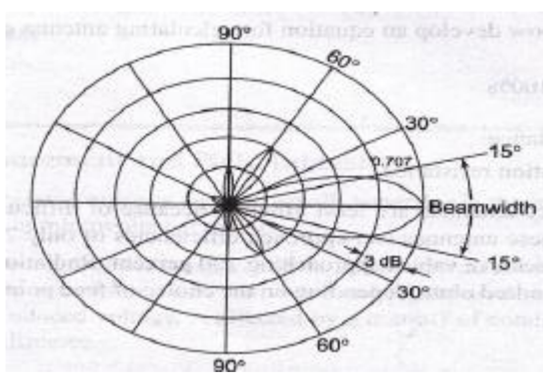
Id is the dark current

⇒Quantum noise: Discrete nature of electrons cause a signal disturbance called Quantum noise or Shot noise.It arises from the statistical nature of the production and collection of photoelectrons. It is given by

$$i_s^2 = 2eBI_p$$

		Ip is the photocurrent	
	b)	**Explain power relation in AM wave**	**4M**
	Ans:	**i) The Total power in AM (Pt) :** Pt = (Carrier power) + (Power in USB) + (Power in LSB) $P_t = P_C + P_{USB} + P_{LSB}$ $\therefore \quad P_t = \frac{E_r^2 carr}{R} + \frac{E_r^2 USB}{R} + \frac{E_r^2 LSB}{R}$ **(1 mark)** Where, E_{rcarr}, E_{rUSB}, E_{rLSB} = R.M.S. values of the carrier and side band amplitudes R = characteristics resistance of antenna in which total power is dissipated. **OR** **ii) Carrier power (Pc):** $P_c = \frac{E_r^2 carr}{R}$ $= \frac{(E\sqrt{2})^2}{R}$ $\mathbf{P_c = \frac{E^2 c}{2R}}$ Where, Ec = Peak carrier amplitude **OR**	4M for correct answer

		iii) Power in sidebands: The power in USB and LSB is same as, $P_{USB} = P_{LSB} = \frac{Er^2SB}{R}$ Peak amplitude of sideband $= \frac{mEc}{2}$ $\therefore \quad P_{USB} = P_{LSB} = \frac{(mEr2\sqrt{2})^2}{R}$ $= \frac{m^2E^2c}{8R}$ $\therefore \quad P_{USB} = P_{LSB} = \frac{m^2}{4} X \frac{E^2c}{2R}$ $\frac{E^2c}{2R} = Pc$ $\therefore \quad \mathbf{P_{USB} = P_{LSB} = \frac{m^2}{4} Pc}$ **Or** iv) **Total power in AM :** The total power in AM is, $Pt = Pc + P_{USB} + P_{LSB}$ $= Pc + \frac{m^2}{4}Pc + \frac{m^2}{4} Pc$ $\therefore \quad Pt = (1 + \frac{m^2}{2})\ Pc$	
	c)	**Explain Duct propagation with neat sketch**	**4M**
	Ans:	**Duct propagation: (Microwave Space Wave Propagation)** 	2M diagram & 2M explanation

		Duct propagation is the special type of phenomenon which is also called as **"super refraction".** It is observed at very high microwave frequencies. As the height above the earth increases, the air density decreases and the refractive index increases. The change in the refractive index is normally linear and gradual. However under certain special atmospheric condition, a layer of warm air may get trapped above the cooler air. This happens usually over the surface of the water. Due to this the refractive index will decreases more rapidly with height than usual. This happens near the ground normally within a distance of 30 meters above the surface. Due to this rapid reduction of refractive index, the microwave will completely bend back towards the earth surface. Microwaves are thus continuously refracted inside the duct and reflected back by the conducting ground or water surface. These waves then then propagate around the curvature of the earth over a distance of 1000 Km. The region in which super refraction takes place is called duct.	
	d)	**Explain the term beam width related to antenna with a sketch**	**4M**
	Ans:	The beamwidth of an antenna is described as the angles created by comparing the half power points (3 dB) on the main radiation to be its maximum power points. 	2M diagram & 2M explanation
Q. No.	Sub Q. N.	Answers	Marking Scheme

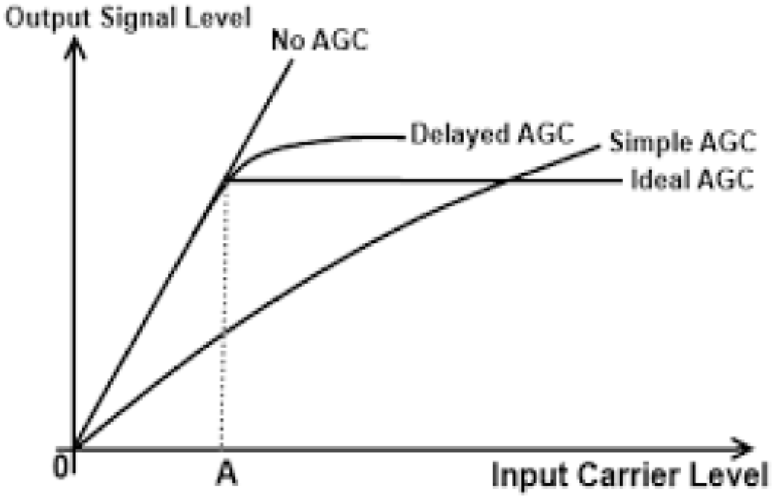
SUMMER-19 EXAMINATION

Subject Name: Principles of electronic communication **Model Answer** 22334

3		**Attempt any THREE of the following :**	**12- Total Marks**
	a)	**A 500 watts carrier is modulated to depth of 80%** **Calculate :** **(i) Total power in AM** **(ii) Power in side bands**	**4M**
	Ans:	Given :- $P_c = 500$ watts $m = 80\% = 0.8$ i) Total power in AM :- — (2M) $P_t = \left(1+\frac{m^2}{2}\right)\cdot P_c$ $= \left(1+\frac{0.8^2}{2}\right) \times 500$ $\therefore \boxed{P_t = 660 \text{ watt}}$ ii) Power in side bands :- — (2M) $P_{USB} = P_{LSB} = \frac{m^2}{4} \times P_c$ $= \frac{0.8^2}{4} \times 500$ $\therefore \boxed{P_{USB} = P_{LSB} = 80 \text{ watt}}$ Scanned with	2M-for each calculation
	b)	**A frequency modulated signal is represented by the voltage equation** e_{fm} **= 10 sin (6 x 10^8 t + 5 sin 1250 t)** **calculate :** **(i) Carrier frequency f_c** **(ii) Modulating frequency f_m** **(iii) Maximum deviation**	**4M**

		(iv) What power will this FM wave dissipate in 20 Ω resistor	
	Ans:	Sol^n :- A frequency modulated signal is given by – $e_{FM} = 10 \sin(6\times10^8 t + 5 \sin 1250 t)$ i) Carrier Frequency, f_c –: As we know, $e_{FM} = 10 \sin(6\times10^8 t + 5 \sin 1250 t)$ -- (given) —(1) And, The standard expression for FM wave is $e_{FM} = E_c \sin[(2\pi f_c t) + m_f \sin(2\pi f_m t)]$ —(2) Comparing eqn (1) and eqn (2) $\therefore e_{FM} = 10 \sin(2\pi f_c t + \frac{\delta}{f_m} \sin \omega_m t)$ $\therefore 2\pi f_c = 6\times10^8$ $\therefore f_c = \frac{6\times10^8}{2\pi} = 95.492\times10^6$ Hz ≈ 95.49 MHz $\therefore$ Carrier Frequency $= 95.5$ MHz ii) Modulating Frequency, f_m =: Again, $\omega_m = 2\pi f_m = 1250$ $\therefore f_m = \frac{1250}{2\pi} = 198.94$ Hz $\therefore$ Modulating Frequency, $f_m = 198.94$ Hz iii) Maximum deviation δ =: $\because \frac{\delta_{FM}}{f_m} = 5$ $\therefore \delta_{FM} = 5\times198.94$ - - - ($\because f_m = 198.94$ Hz) $\therefore \delta_{FM} = 994.72$ Hz $\therefore$ Maximum deviation, $\delta = 994.72$ Hz iv) Power dissipation in 20 Ω resistor, P =: $P = \frac{V_{rms}^2}{R} = \frac{(V_c/\sqrt{2})^2}{R}$ $\therefore P = \frac{(10/\sqrt{2})^2}{20}$ - - - - - ($\because$ Given $V_c = 10$V, $R = 20\,\Omega$) $\therefore P = 2.5$ W $\therefore$ Power dissipated in 20 Ω resistor, P = 2.5 W	1M for each calculatio n(each value)
	c)	**Compare between simple AGC and delayed AGC**	**4M**

Ans:



Parameter	Simple AGC	Delayed AGC
i) Definition	Simple AGC is a system by means of which overall gain of a radio receiver is varied automatically	Delayed AGC is a system which does not reduce the gain for weak signals but reduces the gain for strong signals only.
ii)Advantages	Simplicity,Low cost	High cost
iii)Applications	Simple AGC circuit is used in all the low cost domestic radio receiver.	Delayed AGC is used in the high quality receivers like communication receivers.
iv)Characteristics	Refer Fig Fig 3C –The AGC characteristics	Refer Fig Fig 3C –The AGC characteristics

(1M for each correct point)

d) **Compare resonant and non resonant antenna on the basis of** **4M**

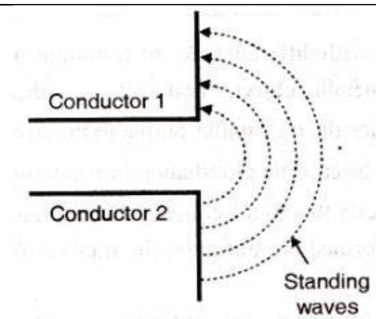
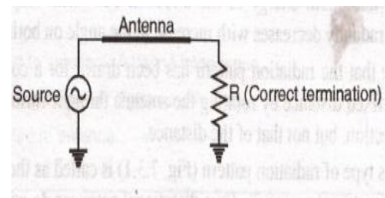
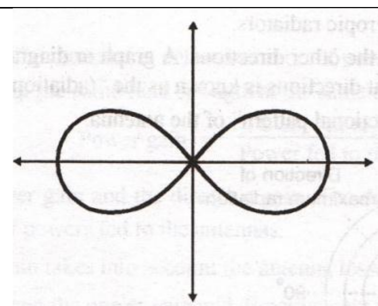
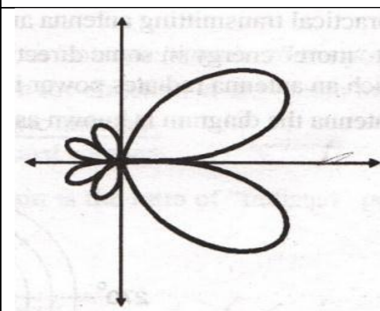
(i) Definition

(ii) Circuit

(iii) Reflection co efficient

(iv) Radiation pattern

Ans : (1M for Each Parameter)

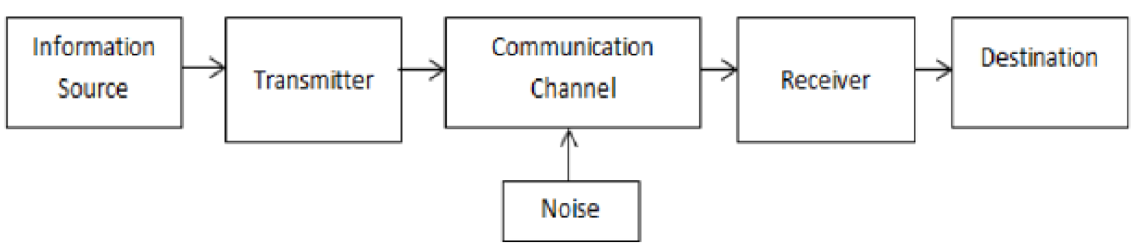
Parameter	Resonant antenna	Non resonant antenna
i) Definition	It is transmission Line of length equal to multiples of λ/2 and open at both end.	It is transmission line whose length is not a multiple of λ/2
ii) Circuit		
(iii) Reflection co efficient	Standing wave present	Standing wave not present
(iv) Radiation pattern		

e) Differentiate between ground wave and sky wave propagation

Ans: Any Four relevant correct points – 1 mark

Sr. No	Parameters	Ground Wave Propagation	Sky Wave Propagation
1	Frequency Range	30 kHz to 3 MHz	3 MHz to 30 MHz
2	Polarization	Vertical	Vertical

3	Applications	Radio Broadcasting (MW Range)	Radio Broadcasting (SW Range)
4	Range of Communication	Less **(OR)** Few hundred Km	More (OR) Few Thousand Km
5	Limitations	Limited Range, Tall Antenna Required, High transmission power.	Skip Distance, Power loss due to absorption of energy in layers
6	Fading Problem	Less	Severe

Q. No.	Sub Q. N.	Answers	Marking Scheme
4		**Attempt any THREE of the following :**	**12- Total Marks**
	(a)	**Draw the block diagram of basic electronic communication system**	**4M**
	Ans:	 Fig: Basic electronic communication system	**4M for correct block diagram**

(b) **Differentiate between AM & FM on the basis of**

(i) Definition

(ii) Band width

(iii) Modulation index

(iv) Application

4M

Ans:

SR. NO	PARAMETER	AM	FM
1	Definition	Amplitude of the carrier signal is varied in accordance to the instantaneous value of the modulating signal keeping frequency and phase of carrier constant.	Frequency of the carrier signal is varied in accordance to the instantaneous value of the modulating signal keeping amplitude and phase of carrier constant.
2	Modulation Index	$m = \frac{V_m}{V_c}$	$Mf = \frac{\delta_m}{f_{m(max)}}$
3	Bandwidth	BW = 2 fm	BW = 2 (δ+ fm (max))
4	Application (any relevant point to be considered)	Video transmission in TV receivers etc.	Sound transmission in TV receivers etc.

1M-Each difference

(c) **Draw the circuit diagram of practical AM diode detector. Sketch its input and output waveforms**

4M

Ans:

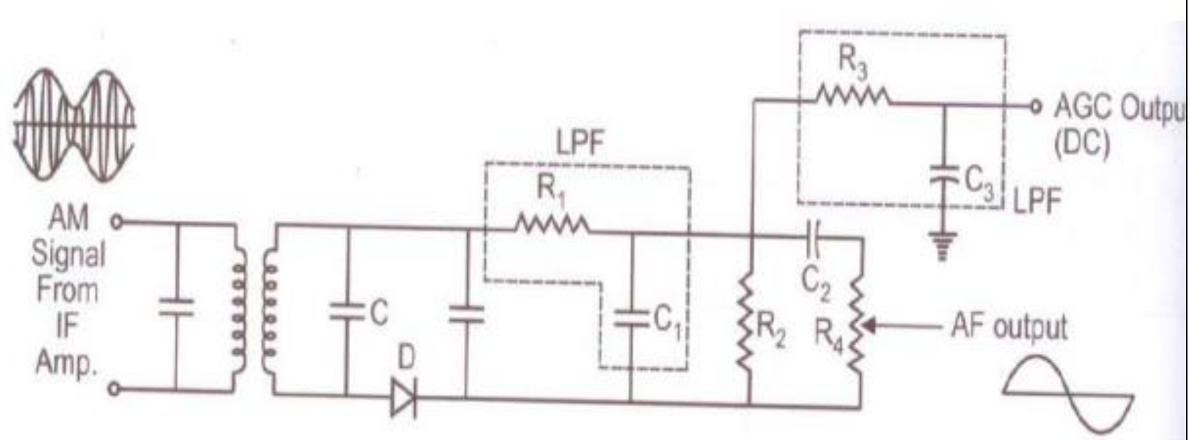
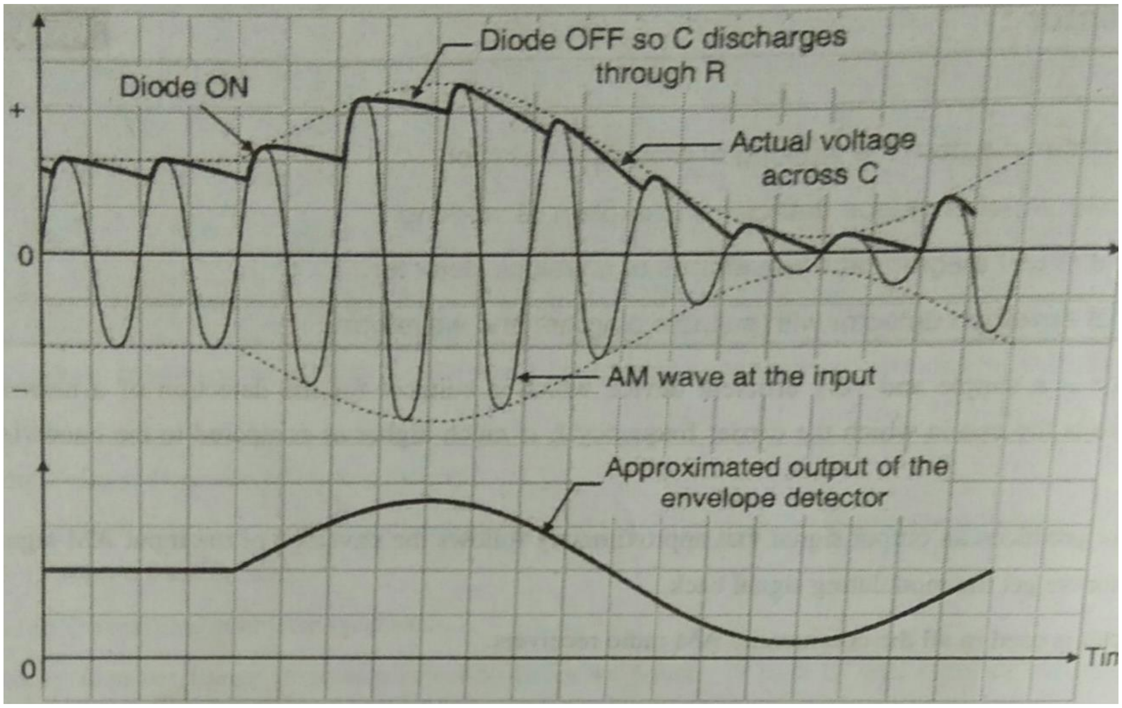
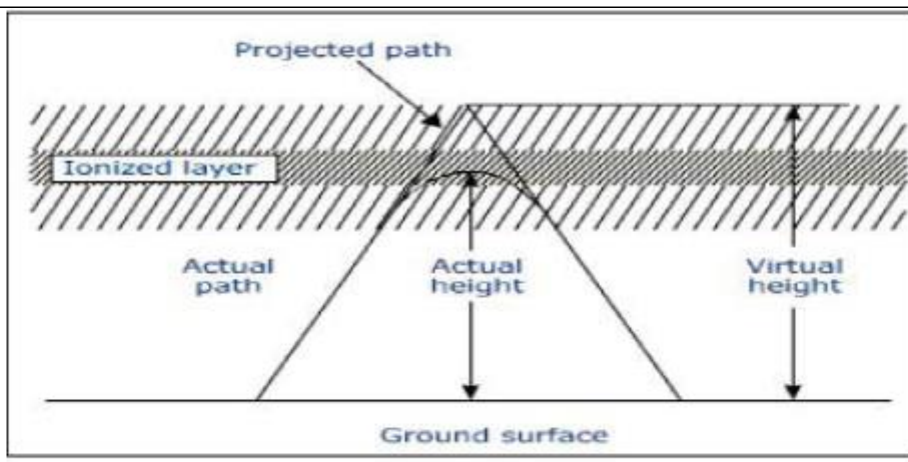
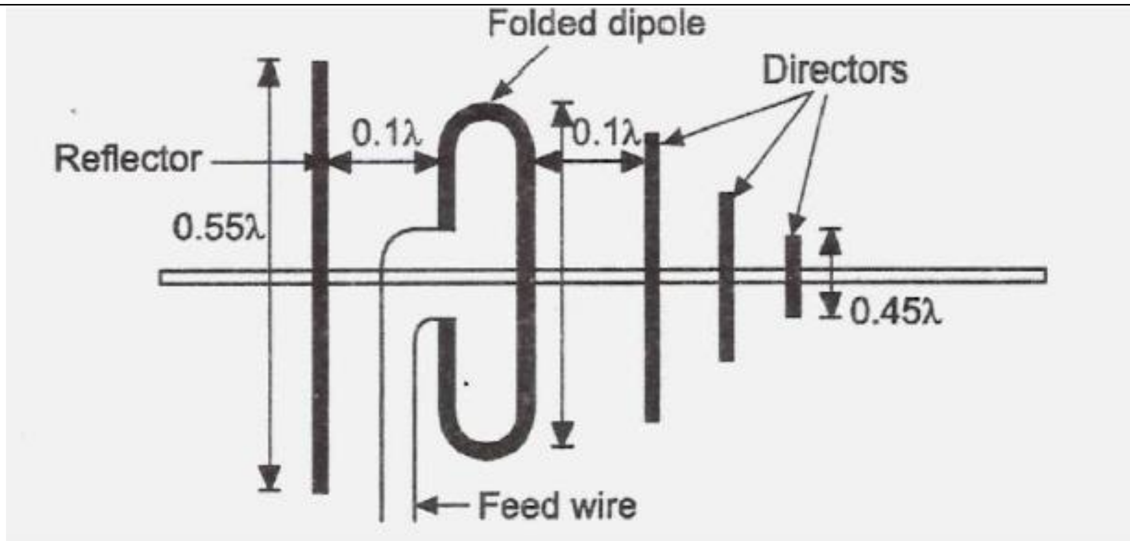
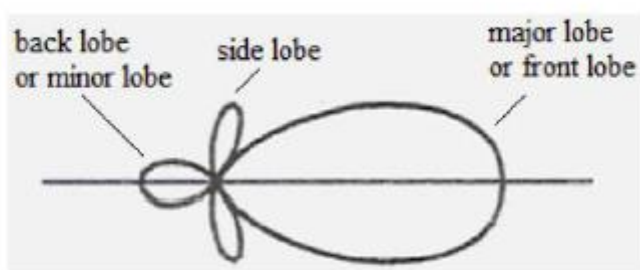


Fig: Circuit diagram of Practical AM diode detector

(2M-Circuit Diagram

2M waveforms)

		 **Fig: Input and Output waveforms**	
	(d)	**Describe the term virtual height with the help of diagram showing ionized layer and path of wave**	**4M**
	Ans:	 **Fig: Virtual height of an ionized layer** **Virtual height:** -The incident wave returns back to the earth due to refraction. In this process it bends down gradually and not sharply, but the incident and reflected rays follow exactly the same paths as those if the signal have been reflected from a surface	**2M Diagram** **2M Description**

		located at greater height. It is the height above the earth's surface from which a refracted wave appears to have been reflected. It is also defined as the maximum height that the hypothetical reflected wave would have reached.	
	(e)	**Draw the construction of Yagi Uda antenna . Draw its radiation pattern and write two applications**	**4M**
	Ans:	 **Fig: Yagi Antenna** **Radiation pattern:-**  **Application:- (any two) :- ½ M each** 1) It is used as HF transmitting antenna. 2) It is used as VHF and UHF as TV receiver antenna because of its physical size. 3) A stack of Yagi - Uda antenna can be used as a super gain antenna.	**2M construction** **1M radiation pattern** **1M application**

SUMMER-19 EXAMINATION

Subject Name: Principles of electronic communication **Model Answer** 22334

Q. No.	Sub Q. N.	Answers	Marking Scheme
5.		**Attempt any TWO of the following:**	**12- Total Marks**
	a)	**Write down the range of different frequencies in electro magnetic spectrum for following :** **(i) Voice frequency** **(ii) High frequency** **(iii) Infra red frequency** **(iv) Visible spectrum (light)** **(v) Radio frequency** **(vi) UV frequency** **Also write one application area of each frequency**	**6M**
	Ans:	(see table below)	1M each for correct range & application (1/2 M range & 1/2 M application)

Sr No.	Frequency	Range	Application
1	Voice frequency	300 Hz to 3KHz	transmission of speech
2	High frequency	3MHz to 30 MHz	SW band of AM Rx
3	Infra red frequency	3 THz to 30 THz	Used for directed links e.g. to connect different buildings via laser links.
4	Visible spectrum (light)	375 THz to 750 THz	Smart Lighting,Mobile Connectivity
5	Radio frequency	3 kHz-300 GHz	radar signals or communications

		6	UV frequency	3 - 30 PHz	Pool water purification

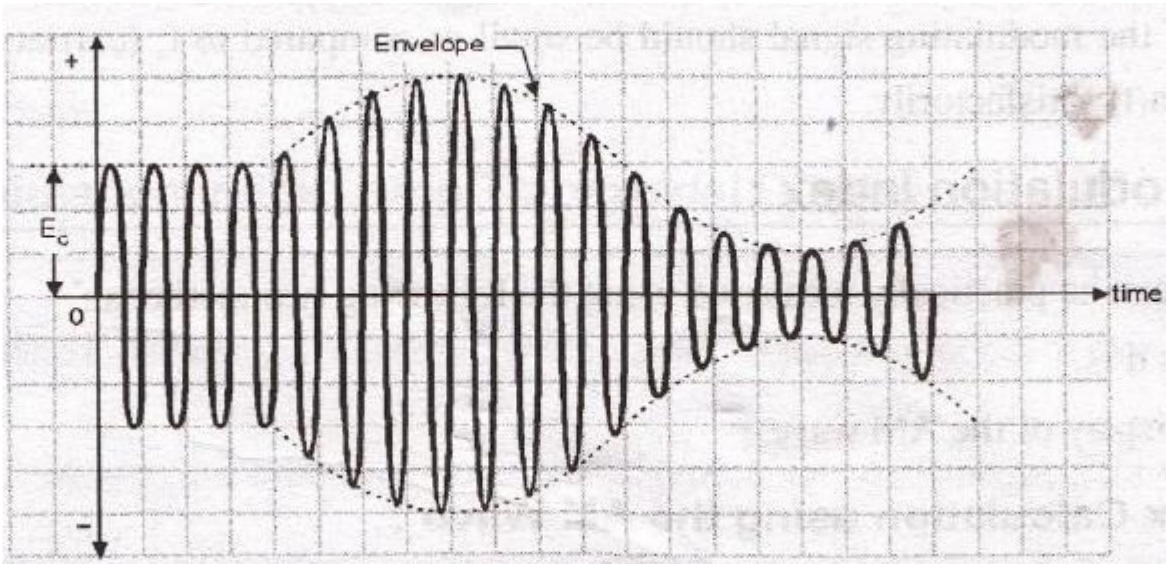
	b)	**Explain why the local oscillator frequency should be always greater than signal frequency in radio receiver. A Suprehetrodine radio receiver with an IF of 455 kHz is turned to 1000kHz. Find its image frequency and local oscillator frequency.**	**6M**
	Ans:	**Reason for local oscillator frequency to be greater than signal frequency in radio receiver:** The local oscillator frequency is made greater than signal frequency in radio receiver. Local oscillator frequency range is 995 KHz to 2105 KHz for MW band. F_{max}/F_{min}=2105/995=2.2 If local oscillator has been designed to be below signal frequency,the range would be 85 to 1195KHz and frequency ratio is F_{max}/F_{min}=1195/85=14.0 The normal tunable capacitance ratio is C_{max}/C_{min}=10 So this capacitance ratio easily gives the frequency ratio of 2:2:1 Hence the 2:2:1 ratio required for the local oscillator operating above signal frequency is well within range whereas the other system has a frequency ratio of 14:1 whose capacitance are not practically available. **Numerical:** A signal (image) can interfere with a superheterodyne receiver if fits the following equation. Image = Signal +/- 2 x I.F. Which says that a signal has the capacity to interfere with a superhet receiver if its frequency is equal to the signal frequency (1000 kHz in our question) plus or minus twice the IF (455 kHz in our question). So one possible image is: 1000 + (2 x 455) = 1910 kHz And the other: 1000 - (2 x 455) = 90 kHz local oscillator frequency=455 + 1000 =1455 KHz	3M for correct answer & 3M for Numericals
	c)	**Name the different layers of atmosphere which satisfy following conditions :** **(i) Reflects LF, absorbs MF and HF waves to some degree**	**6M**

		(ii) Helps surface waves and reflect HF waves **(iii)Partially absorbs HF waves yet allowing them to reach its upper layer** **(iv) Efficiently reflects HF waves , specially in night** **(v) Exists in day time only** **(vi) Exists in day time but merges with F2 layer in night time**	
	Ans:	(table below)	1M each

Sr No.	Name of the layer of atmosphere	Frequencies most affected
1	D (Part of Stratosphere)	Reflects LF, absorbs MF and HF waves to some degree
2	E(Part of Stratosphere)	Helps surface waves and reflect HF waves
3	F1 (Part of mesosphere)	Partially absorbs HF waves yet allowing them to reach its upper layer
4	F2 (Thermosphere)	Efficiently reflects HF waves , specially in night
5	D & E (Part of Stratosphere)	Exists in day time only
6	F1 (Part of mesosphere)	Exists in day time but merges with F2 layer in night time

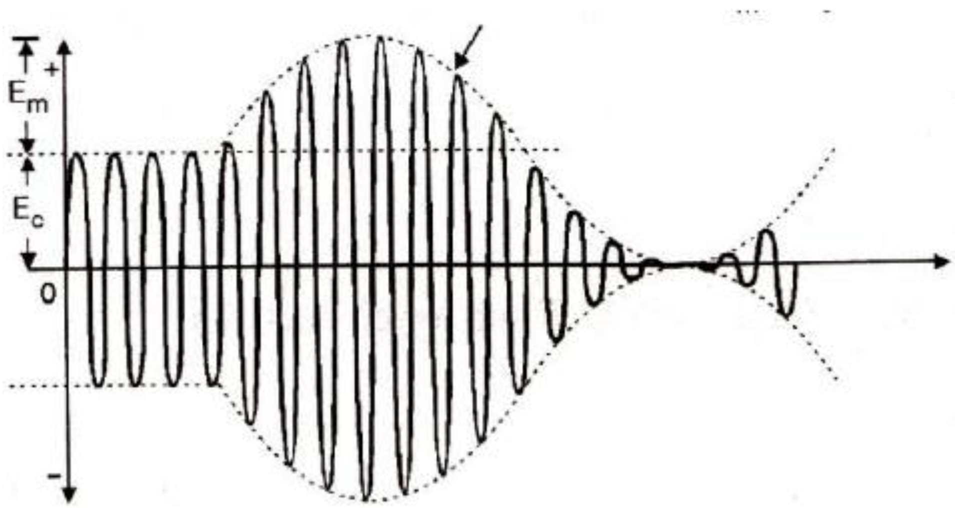
Q. No.	Sub Q. N.	Answers	Marking Scheme
6.		**Attempt any TWO of the following :**	**12- Total Marks**
	a)	**Explain the effect modulation index on AM wave with waveforms for** **(i) m<1** **(ii)m=1** **(iii)m>1**	**6M**
	Ans:	**i) m< 1** • If m < 1 or if the percentage of modulation is less than 100% then this type of modulation is known as **under modulation .**	(2 M for each effect with waveform

- The amplitude of modulating signal less than carrier amplitude, no distortion will occur.



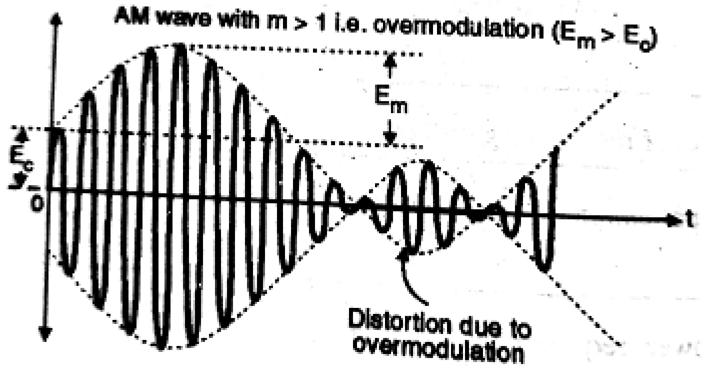
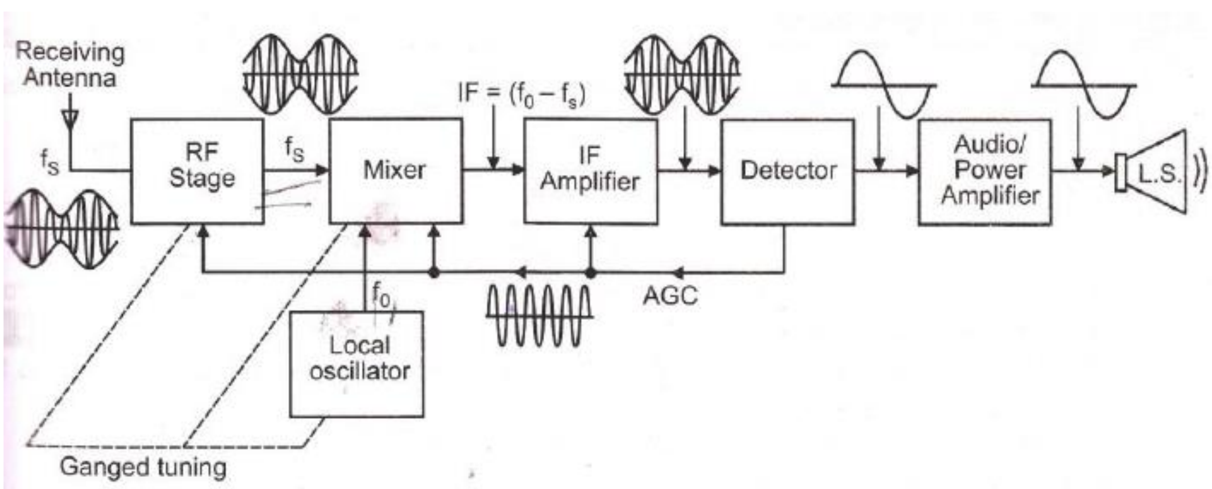
ii) m = 1

- If m = 1 or percentage of modulation is 100 this type modulation is **100% modulation**
- The ideal condition for AM is m =1, since this will produce the greatest output at the receiver with no distortion.



(iii)m>1

- If m>1 or if the percentage of modulation is greater than 100% then this type of modulation is known as **overmodulation** .
- The amplitude of modulating signal greater than carrier amplitude.For m>1 the

		envelope can sometimes reverse the phase. • overmodulation introduces envelope distortion.Hence it should be avoided. 	
	b)	**Explain the working of AM super heterodyne receiver with the help of neat block diagram and waveform**	**6M**
	Ans:	 AM super heterodyne receiver works on the principle of super heterodyning. In the super heterodyne receiver, the incoming signal voltage is combined with a signal generated in the receiver. The local oscillator voltage is normally converted into a signal of a low fixed frequency with the help of mixer. The signal at this intermediate frequency contains the same modulation as the original carrier and it is now amplified and detected to reproduce the original modulating signal **Functions of each block-** **Receiving antenna-** AM receiver operates in the frequency range of 540 KHz to 1640	2 M-Diagram,1 M-waveform, 3M-Explainati on

		KHz. **RF stage-** Selects wanted signal and rejects all other signals and thus reduces the effect of noise. **Mixer-** Receives signal from RF stage Fs and the local oscillator Fo, and are mixed to produce intermediate frequency signal IF which is given as: IF=Fo-Fs **Ganged Tuning-** To maintain a constant difference between the local oscillator and RF signal frequency, gang capacitors are used. **IF stage-** The IF signal is amplified by the IF amplifier with enough gain. **Detector-**Amplified signal is detected by the detector to get original modulating signal. The detector also provides control signals to control the gain of IF and RF stage called as AGC. **AGC-** Automatic gain control controls the gain of RF and IF amplifiers to maintain a constant output level at the speaker even though the signal strength at the antenna varies.	
	c)	**Explain following terms in short related to antenna** **(i) Antenna resistance** **(ii) Directivity** **(iii)Antenna gain** **(iv)Power density** **(v) Radiation pattern** **(vi)Polarization**	**6M**
	Ans:	**(i)Antenna resistance:-** The resistance of an antenna has two components: 1. Its radiation resistance due to conversion of power into electromagnetic waves 2. The resistance due to actual losses in the antenna. or The antenna resistance has two components: **1.Radiation resistance:** it is defined as the ratio of the power radiated by the antenna to square of the current at the input of the antenna feed point. $Rr = \frac{Pt}{I^2}$	1 M for each correct definition

		Where Pt is radiated power by antenna I is the current at feed point 2.**Resistance due to actual losses in the antenna** **(ii).Directivity:-** The directive gain can be defined in any direction. However directivity means the maximum directive gain which is obtained in only one direction in which the radiation is maximum. Therefore **Directivity = Maximum Directive gain.** **OR** The directive gain is defined as the ratio of the power density in a particular direction of one antenna to the power density that would be radiated by an omnidirectional antenna (isotropic antenna). The maximum directive gain is called directivity. **(iii)Antenna gain:-** **Antenna Gain –** The directional antenna radiate more power in certain direction. The Omni-directional antenna radiates information equally in all directions. Or **Antenna gain** It is the ratio of focused transmitted power (Pt) to the input power of the antenna (Pi) **Or** **Antenna gain**: antenna gain is defined as the ratio of the power density radiated in a particular direction to the power density radiated to the same point by the reference antenna. **(iv)Power density:-** The EM waves cause the energy to flow from one point to the other in the direction of propagation. The power density is defined as the rate at which energy passes through a given surface area	

in free space.

Therefore,

Power density = Energy per unit time per unit area.

(v) Radiation pattern:-

The transmitting antenna transmit more energy in some directions than the other directions.

A graph or diagram which tells us about the manner in which an antenna radiates power in different directions is known as the "Radiation Pattern of antenna".

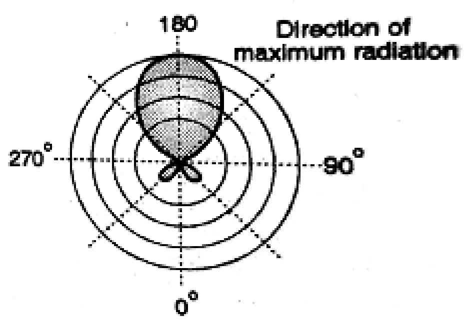


Fig.- Radiation Pattern of an antenna

(vi)Polarization:-

Polarization is defined as the direction of the electric vector in the electromagnenic wave radiated from an antanna.

OR

The polarization of a plane EM wave is simply the orientation of the electric field vector with respect to the surface (i.e. looking at the horizon)

22334

11920

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

(a) Define the term signal to noise ratio.

(b) Define modulation index of FM.

(c) Write Carson's rule to calculate BW of FM wave.

(d) Draw the labelled circuit dia. of ratio detector.

(e) Write the IF value of

(i) FM radio receiver.

(ii) MW band AM.

(f) Define fading w.r.t. wave propagation.

(g) Sketch the radiation pattern of Yagi-Uda antenna.

2. Attempt any THREE of the following : 12

(a) Draw the basic block diagram of Electronic communication system. State the function of transmitter.

(b) A 10 kW carrier is amplitude modulated by two sine to a depth of 0.5 & 0.6 respectively. Calculate total power of modulated carrier.

(c) Compare AM & FM w.r.t. following points.

(i) Definition

(ii) Modulation Index

(iii) Bandwidth

(iv) Application

(d) Explain the concept of Deemphasis with neat diagram.

3. Attempt any THREE of the following : 12

(a) Compare narrow band FM with wide-band FM w.r.t. following points.

(i) Modulation index

(ii) Maximum deviation

(iii) Range of modulating frequency

(iv) Application.

(b) Sketch AM signal in (i) Time domain (ii) Frequency domain.

(c) Explain why reception for high frequency band is better during night time.

(d) Explain structure of rectangular microstrip patch antenna with its radiation pattern.

4. Attempt any THREE of the following : 12

(a) Explain Electromagnetic spectrum.

(b) Draw the block diagram of AM. Superheterodyne radio receiver and state the function of each block.

(c) In FM if max. deviation is 75 kHz and the max. modulating frequency is 10 kHz. Calculate the deviation ratio and Bandwidth of FM.

(d) Compare sky wave and space wave propagation w.r.t. following points.

(i) Frequency range (ii) Effect of Fading

(iii) Polarization (iv) Application

(e) Explain the working of half dipole antenna with its radiation pattern.

5. Attempt any TWO of the following : 12

(a) Derive a mathematical expression for AM wave.

(b) A 400 W carrier is amplitude modulated to a depth of 75%. Calculate the total power in AM wave.

(i) Explain the types of noise in a communication system.

(ii) Compare simplex and duplex mode of communication.

(c) (i) Write any one application of the following range.

(1) Radio frequency

(2) IR frequency

(3) Medium frequency

(ii) Draw and label PLL based FM detector.

6. Attempt any TWO of the following : 12

(a) (i) List any two advantages of folded dipole antenna.

(ii) Draw the radiation patterns of the following resonant dipole antenna.

(1) $l = \lambda/2$ (2) $l = \lambda$

(3) $l = 3\lambda/2$ (4) $l = 3\lambda$

Where l is the length of dipole antenna.

(b) Explain Tropospheric scatter propagation with sketch.

(c) (i) Draw the practical AM diode detector circuit. Sketch its input and output waveforms.

(ii) Define the terms :

(1) Skip distance

(2) Maximum usable frequency

(3) Virtual height

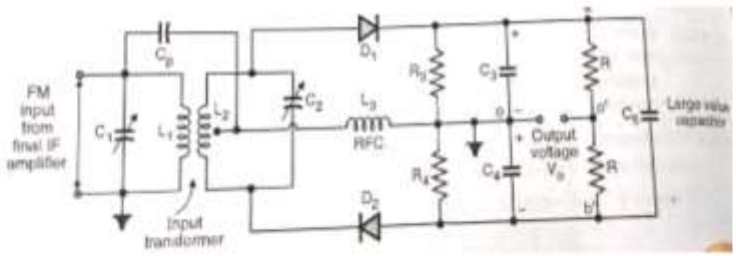
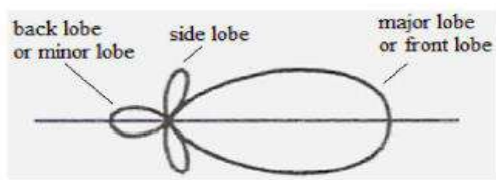
WINTER – 19EXAMINATION

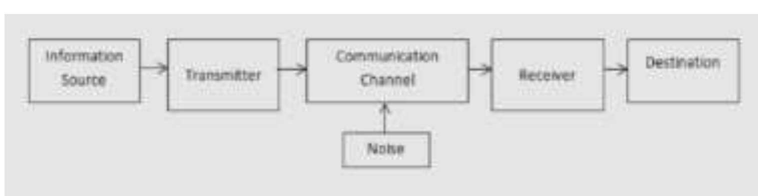
Subject Name: Principles of Electronic Communication **Model Answer** Subject Code: 22334

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreImportance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constantvalues may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
Q.1		**Attempt any FIVE of the following:**	**10 M**
	a)	**Define the term signal to noise ratio.**	**2M**
	Ans:	**Signal to Noise ratio**: The ratio of the strength of an electrical or other signal carrying information to that of unwanted interference is called as signal to noise ratio. OR Signal to Noise Ratio is defined as the ratio of signal power to the noise power at the same point. S/N=Ps/Pn where,Ps=Signal Power Pn=Noise Power at the same point	**Definition: 2 marks**
	b)	**Define modulation index of FM.**	**2M**
	Ans:	**Modulation index** of FM is defined as the ratio of the frequency deviation to the **modulating** frequency. M.I.= ∇ / fm Where ∇- frequency deviation Fm- modulating frequency	**2M**
	c)	**Write Carson's rule to calculate BW of FM wave.**	**2M**
	Ans:	**Carson's Rule for FM bandwidth** B.W. = 2(Δf+fm) **Where:** Δf = deviation fm = modulating frequency	**rule 2M**
	d)	**Draw the labelled circuit dia. Of ratio detector.**	**2M**

	Ans:	 Fig Ratio detector circuit	**Ckt. Diagram: 2 marks**
	e)	**Write the IF value of** **(i) FM ratio recevier.** **(ii) MW band AM.**	**2M**
	Ans:	(i) 10.7 Mhz (ii) 455 Khz	**1 mark each**
	f)	**Define fading w.r.t. wave propagation.**	**2M**
	Ans:	**Fading:** The fluctuation in signal strength at a receiver, which is mainly due to the interference of two waves which left the same source but arrived at the destination by different paths, is known as **fading.**	**Definition 2M**
	g)	**Sketch the radiation pattern of Yagi-Uda antenna.**	**2M**
	Ans:	**Radiation pattern:-**  	**Pattern 2M**

Q.2		**Attempt any THREE of the following:**	**12 M**
	a)	**Draw the basic block diagram of Electronic communication system. State the function of transmitter.**	**4M**
	Ans:	**Block diagram:**  • **Transmitter** The function of the transmitter is to process the electrical signal from different aspects. For example in radio broadcasting the electrical signal obtained from sound signal, is processed to restrict its range of audio frequencies (up to 5 kHz in amplitude modulation radio broadcast) and is often amplified. In wire telephony, no real processing is needed. However, in long-distance radio communication, signal amplification is necessary before modulation. Modulation is the main function of the transmitter. In modulation, the message signal is	**Block diagram: 2 Marks,** **Function: 2 Marks**

superimposed upon the high-frequency carrier signal.
In short, we can say that inside the transmitter, signal processing such as restriction of range of audio frequencies, amplification and modulation of signal are achieved.
All these processing of the message signal are done just to ease the transmission of the signal through the channel.

b) **A 10kW carrier is amplitude modulated by two sine to a depth of 0.5 & 0.6 respectively. Calculate total power of modulated carrier.** **4M**

Ans:

$P_c = 10\text{ kW} = 10{,}000\text{ W}$
$m_1 = 0.5$
$m_2 = 0.6$

$$P_{t_1} = P_c\left(1 + \frac{m_1^2}{2}\right) = 10{,}000\left(1 + \frac{(0.5)^2}{2}\right) = 11{,}250\text{ watt}$$

$\boxed{P_{t_1} = 11{,}250\text{ watt}}$

$$P_{t_2} = P_c\left(1 + \frac{m_2^2}{2}\right) = 10{,}000\left(1 + \frac{(0.6)^2}{2}\right) = 10{,}000\left(1 + \frac{0.36}{2}\right) = 11{,}800\text{ watt}$$

$\boxed{P_{t_2} = 11{,}800\text{ watt}}$

$$P_t = P_{t_1} + P_{t_2} = 11{,}250 + 11{,}800 = 23{,}050\text{ W}$$

$\boxed{\text{Total power} = 23.05\text{ kW}}$

Calculation of Pt1- 1.5 Marks,

Pt2- 1.5 Marks, Pt- 1 Marks

c) **Compare AM & FM w.r.t. following points.** **4M**
(i) Definition
(ii) Modulation index
(iii)Bandwidth
(iv)Application

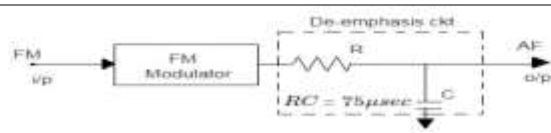
Ans:

SR. NO	PARAMETER	AM	FM
1	Definition	Amplitude of the carrier signal is varied in accordance to the instantaneous value of the modulating signal keeping frequency and phase of carrier constant.	Frequency of the carrier signal is varied in accordance to the instantaneous value of the modulating signal keeping amplitude and phase of carrier constant.
2	Modulation Index	$m = \frac{V_m}{V_c}$	$M_f = \frac{\delta_m}{f_{m(\max)}}$
3	Bandwidth	BW = 2 fm	BW = 2 (δ+ fm (max))
4	Application (any relevant point to be considered)	Video transmission in TV receivers etc.	Sound transmission in TV receivers etc.

4 Points 4M

d) **Explain the concept of De-emphasis with neat diagram.** **4M**

Ans:



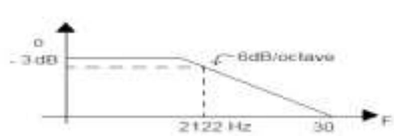


diagram 2M ,Explanation 2M

- In the De-emphasis circuit, by reducing the amplitude level of the received high frequency signal by the same amount as the increase in pre-emphasis is termed as De-emphasis.
- The pre-emphasis process is done at the transmitter side, while the de-emphasis process is done at the receiver side.
- Thus a high frequency modulating signal is emphasized or boosted in amplitude in transmitter before modulation. To compensate for this boost, the high frequencies are attenuated or de-emphasized in the receiver after the demodulation has been performed. Due to pre-emphasis and de-emphasis, the S/N ratio at the output of receiver is maintained constant.
- The de-emphasis process ensures that the high frequencies are returned to their original relative level before amplification.
- Pre-emphasis circuit is a high pass filter or differentiator which allows high frequencies to pass, whereas de-emphasis circuit is a low pass filter or integrator which allows only low frequencies to pass.

Q.3 **Attempt any THREE of the following:** **12 M**

a) **Compare narrow band FM with wide-band FM w.r.t. following points.** **4M**

(i) Modulation index
(ii) Maximum deviation
(iii)Range of modulating frequency
(iv)Application

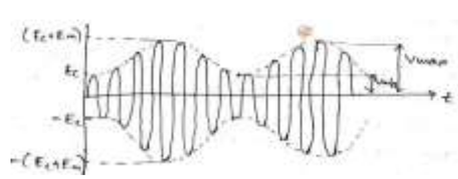
Ans:

Sr. No	Parameters	Narrow band FM	Wide band FM
1	**Modulation index**	Less than or slightly greater than 1	Greater than 1
2	**Maximum deviation**	5 KHz	75 KHz
3	**Range of modulating frequency**	30Hz to 3 KHz	30Hz to 15 KHz
4	**Application**	FM mobile communication like police wireless, ambulance etc.	Entertainment broadcasting can be used for high quality music transmission

1M for each correct point

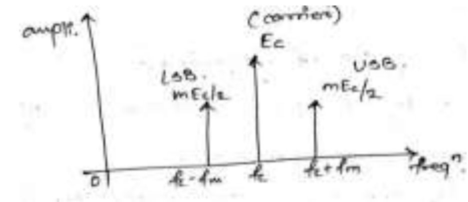
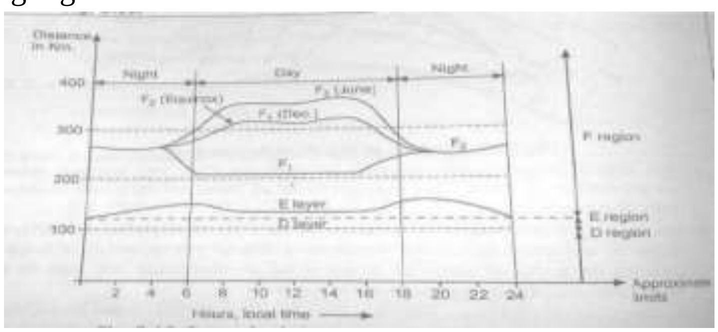
b) **Sketch AM signal in (1)Time domain (2)Frequency domain.** **4M**

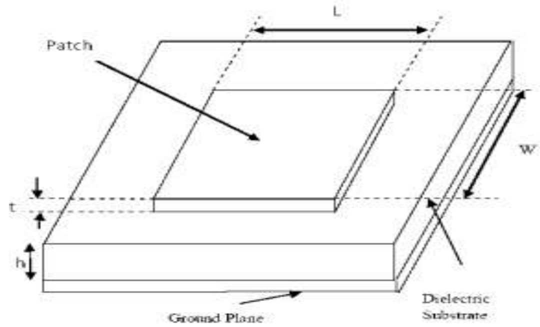
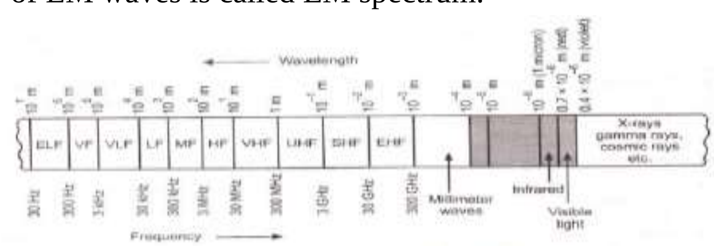
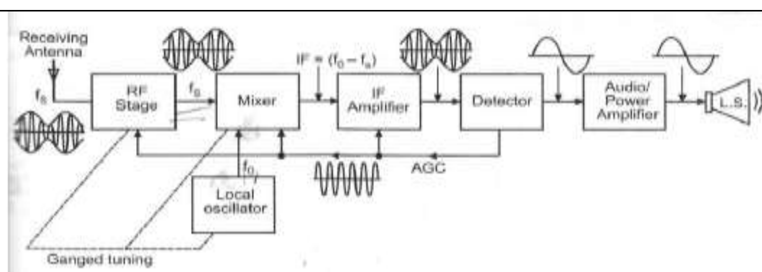
Ans: **AM in Time domain**



2M-time domain ,

2M-frequency domain

		AM in frequency domain 	
	c)	**Explain why reception for high frequency band is better during night time.**	**4M**
	Ans:	In sky wave propagation, the transmitted signal travels into the upper atmosphere where it is bent or reflected back to earth. This bending or reflection of signal takes place due to the presence of a layer called as ionosphere in the upper atmosphere. There are four main ionospheric layers F2, F1, D, E in the descending order. At night the F1 and F2 layers combine to form one layer and the lower two layers D and E disappears. As the lower layers are absent, the absorption of the signal does not take place, which was taking place during the day time. This improves the strength of the reflected signal and hence the reception for high frequency band is better during night time. 	**2M-explaination** **2M – Diagram**
	d)	**Explain structure of rectangular microstrip patch antenna with its radiation pattern.**	**4M**
	Ans:	In telecommunication, a microstrip antenna (also known as a printed antenna) usually means an antenna fabricated using microstrip techniques on a printed circuit board (PCB).It is a kind of internal antenna. They are mostly used at microwave frequencies. An individual microstrip antenna consists of a patchofmetal foil of various shapes (a patch antenna) on the surface of a PCB (printed circuit board), with a metal foil ground plane on the other side of the board. Most microstrip antennas consist of multiple patches in a two-dimensional array. The antenna is usually connected to the transmitter or receiver through foil microstrip transmission lines. The radio frequency current is applied (or in receiving antennas the received signal is produced) between the antenna and ground plane. Microstrip antennas have become very popular in recent decades due to their thin planar profile which can be incorporated into the surfaces of consumer products, aircraft and missiles; their ease of fabrication using printed circuit techniques; the ease of integrating the antenna on the same board with the rest of the circuit, and the possibility of adding active devices such as microwave integrated circuits to the antenna itself to make active antennas. The most commonly employed microstrip antenna is a rectangular patch which looks like a truncated microstrip transmission line. It is approximately of one-half wavelength long. When air is used as the dielectric substrate, the length of the rectangular microstrip antenna is approximately one-half of a free-space wavelength. As the antenna is loaded with a	**2M-explainatio n**

		dielectric as its substrate, the length of the antenna decreases as the relative dielectric constant of the substrate increases. The resonant length of the antenna is slightly shorter because of the extended electric "fringing fields" which increase the electrical length of the antenna slightly. An early model of the microstrip antenna is a section of microstrip transmission line with equivalent loads on either end to represent the radiation loss.  	**2M-Diagram**
Q.4		**Attempt any THREE of the following:**	**12 M**
	a)	**Explain Electromagnetic spectrum.**	**4M**
	Ans:	The information signal should be first converted into an electromagnetic signal before transmission because the wireless transmission takes place using electromagnetic waves. The electromagnetic waves are oscillations which propagate through free space. The electromagnetic wave consists of both electric and magnetic fields. The electromagnetic waves can travel a long distance through space. In electromagnetic waves, the direction of electric field, magnetic field & propagation are mutually perpendicular. Since the oscillations are perpendicular to direction of propagations of waves they are said to be transverse waves. The frequency of electromagnetic signals ranges from few Hertz to several GHz. This entire range of frequency of EM waves is called EM spectrum.  	**2M explanation** **2M-diagram**
	b)	**Draw the block diagram of AM. Super heterodyne ratio receiver and state the function of each block**	**4M**
	Ans:	 AM super heterodyne receiver works on the principle of super heterodyning. In the super heterodyne receiver, the incoming signal voltage is combined with a Signal generated in the receiver. The local oscillator voltage is normally converted into a signal of a low fixed frequency with the help of mixer.	**diagram – 2M,** **explanation – 2M**

The signal at this intermediate frequency contains the same modulation as the original carrier and it is now amplified and detected to reproduce the original modulating signal.

Functions of each block-

Receiving antenna- AM receiver operates in the frequency range of 540 KHz to 1640 KHz.

RF stage- Selects wanted signal and rejects all other signals and thus reduces the effect of noise.

Mixer- Receives signal from RF stage Fs and the local oscillator Fo, and are mixed to produce intermediate frequency signal IF which is given as:

IF=Fo-Fs

Ganged Tuning- To maintain a constant difference between the local oscillator and RF signal frequency, gang capacitors are used.

IF stage- The IF signal is amplified by the IF amplifier with enough gain.

Detector-Amplified signal is detected by the detector to get original modulating signal. The detector also provides control signals to control the gain of IF and RF stage called as AGC.

AGC- Automatic gain control controls the gain of RF and IF amplifiers to maintain a constant output level at the speaker even though the signal strength at the antenna varies.

c) **In FM if max. Deviation is 75kHz and the max. Modulating frequency is 10 kHz. Calculate the deviation ratio and bandwidth of FM.** **4M**

Ans:

Given-: $\delta_{max=}$75 KHz

$f_{m=}$10KHz

i)Deviation Ratio=$\delta_{max/}f_{m(max)}$

=75KHz/10KHz

=7.5

Deviation Ratio=7.5

ii)Bandwidth=2(δ_{max}+$f_{m(max))}$

= 2x(75+10)KHz

= 170 KHz

Bandwidth=170 KHz

2M- Deviation ratio, 2M- banwidth

d) **Compare sky wave and space wave propagation w.r.t. following points.**

(i) Frequency range
(ii) Effect of fading
(iii)Polarization
(iv)Application

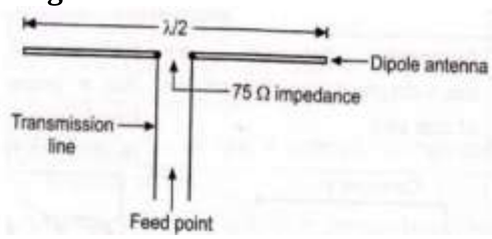
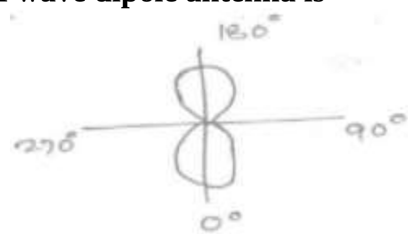
4M

Ans:

Sr. No	**Parameters**	**Sky Wave Propagation**	**Space Wave Propagation**
1	Frequency range	3 MHz to 30 MHz	Above 30 MHz
2	Effect of fading	Problem of fading is severe	Fading is not severe but shadow zones due to tall objects and ghost interference are serious problems.

1M for each correct point

3	Polarization	Vertical	Line of Sight Propagation with waves horizontally Polarized
4	Application	RadioBroadcasting (SW Range)	Used for TV and FM broadcasting

	e)	**Explain the working of half dipole antenna with its radiation pattern.**	**4M**
	Ans:	**Half wave dipole antenna diagram**  **Explanation:** 1. It is a resonant antenna 2. It is exact half wavelength (λ /2) long & open circuited at one end. 3. The dipole antennas have lengths λ /2 , λ , 3 λ /2 etc. which are all multiple of λ /2. Hence they are resonant. 4. In half wave dipole antennas the forward waves & reflected waves exist. Hence radiation pattern is bidirectional. **The radiation pattern of half wave dipole antenna is –**  	**Diagram -1M** **Explanation-2M** **Radiation pattern-1M**
Q.5		**Attempt any TWO of the following:**	**12 M**
	(a)	**Derive a mathematical expression for AM wave.**	**6M**

	Ans:	Let the carrier Voltage and modulating voltage, v_c and v_m, respectively, be represented as $v_c = V_c \sin\omega_c t$ $v_m = V_m \sin\omega_m t$ The modulation index of AM wave given as $m = \frac{V_m}{V_c}$ ($\because m = 0$ to 1) Amplitude wave votage $A = V_c + v_m = V_c + V_m \sin\omega_m t$ $= V_c + mV_c \sin\omega_m t$ $= V_c(1+m\sin\omega_m t)$ The instanteneous Voltage of AM wave is. $V = A\sin\theta = A\sin\omega_c t$ $= V_c[1+m\sin\omega_m t]\sin\omega_c t$ According to trignometry. $V_{Am} = V_c\sin\omega_c t + \frac{mV_c}{2}\cos(\omega_c-\omega_m)t - \frac{mV_c}{2}\cos(\omega_c+\omega_m)t$	**6 M**
	(b)	**A 400 W carrier is amplitude modulated to a depth of 75%.Calculate the total power in AM wave.** **(i) Explain the types of noise in a communication system.** **(ii) Compare simplex and duplex mode of communication.**	**6M**
	Ans:	Given - Carrier Power $P_c = 400 W$. modulation index $m = 75\% = 0.75$ $P_t = ?$ $P_t = P_c\left[1+\frac{m^2}{2}\right]$ $= 400\left[1+\frac{(0.75)^2}{2}\right]$ $= 400 \times 1.281$ $\boxed{P_t = 512.5 W}$ **(i) Noise:** Noise is any spurious or undesired disturbances that mask the received signal in a communication system. **a) Atmospheric Noise:** Atmospheric Noise is also known as static noise which is the natural source of disturbance caused by lightning, discharge in thunderstorm and the natural disturbances occurring in the nature. **b) Industrial Noise: Sources** of Industrial noise are auto-mobiles, aircraft, ignition of electric motors and switching gear. **c) Extraterrestrial Noise: Extraterrestrial** Noise exist on the basis of their originating source. They are i) Solar Noise ii) Cosmic Noise **Internal Noise** are the type of Noise which are generated internally or within the Communication System or in the receiver. They are as follows: 1) Shot Noise : These Noise rises in the active devices due to the random behaviour of Charge particles or carries. In case of electron tube, shot Noise is produces due to the random emission of electron form cathodes.	**2M problem,2 M for noise,2M Compariso n any 2 points 2M**

2) Partition Noise : When a circuit is to divide in between two or more paths then the noise generated is known as Partition noise. The reason for the generation is random fluctuation the division.

3) Low- Frequency Noise : They are also known as FLICKER NOISE. These type of noise are generally observed at a frequency range below few kHz. Power spectral density of these noise increases with the decrease in frequency. That why the name is given Low- Frequency Noise

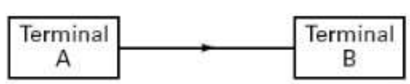
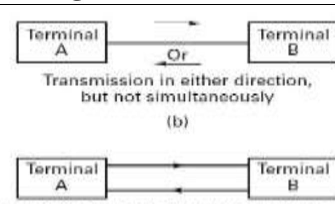
. 4) High- Frequency Noise : These noises are also known TRANSIT- TIME Noise. They are observed in the semi-conductor devices when the transit time of a charge carrier while crossing a junction is compared with the time period of that signal.

5) Thermal Noise: Thermal Noise are random and often referred as White Noise or Johnson Noise. Thermal noises are generally observed in the resistor or the sensitive resistive components of a complex impedance due to the random and rapid movement of molecules or atoms or electrons. Dark current noise: When there is no optical power incident on the photodetector a small reverse leakage current still flows from the device terminals. This Dark current contributes to the total system noise and gives random fluctuations about the average particle flow of the photocurrent.

The Dark current noise is given by: where e is the charge on an electron Id is the dark current

Quantum noise: Discrete nature of electrons cause a signal disturbance called Quantum noise or Shot noise.It arises from the statistical nature of the production and collection of photoelectrons.

(ii) comparision of Simplex and Duplex

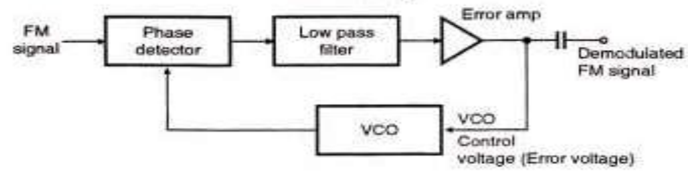
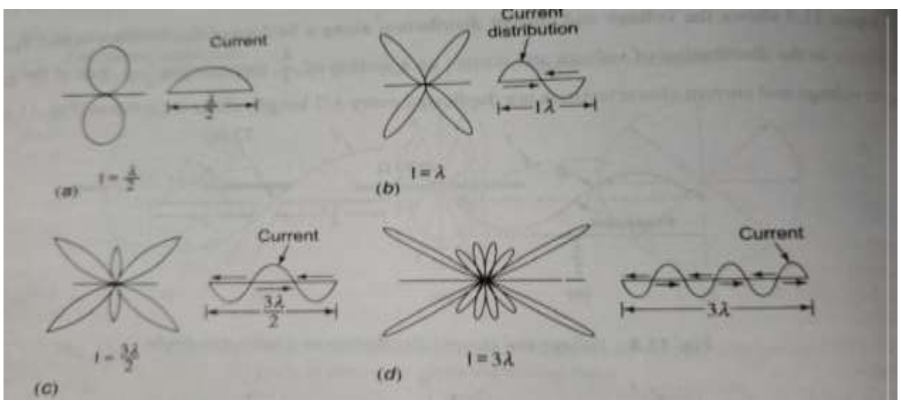
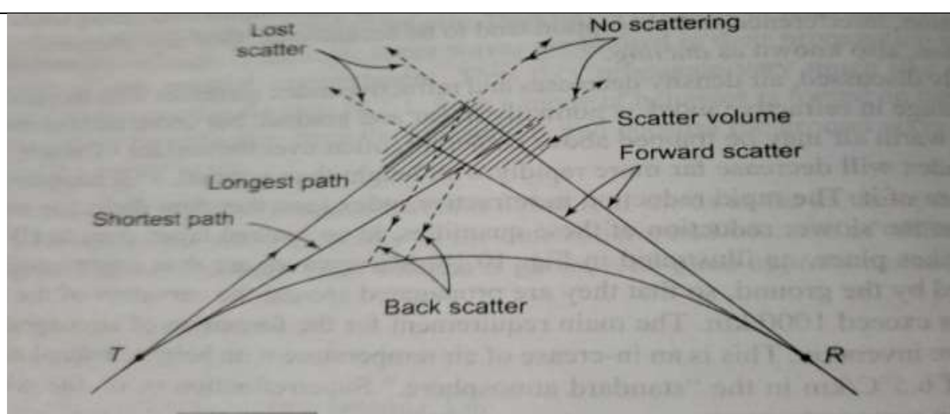
Sr. No.	Simplex	Duplex
1.	It is one way communication	It is a two way communication
2.	Information is communicated in only one direction.	**Information** can transmit as well as receives simultaneously or not simultaneously.
3.	**Examples-** TV broadcasting, radio broadcasting, telemetry, remote control	**Examples-** Walkytalky,telephone,mobile,Radar, FAX,Pager
4.	 Transmission in only one direction (a)	 Transmission in either direction, but not simultaneously (b) Transmission in both directions simultaneously (c)

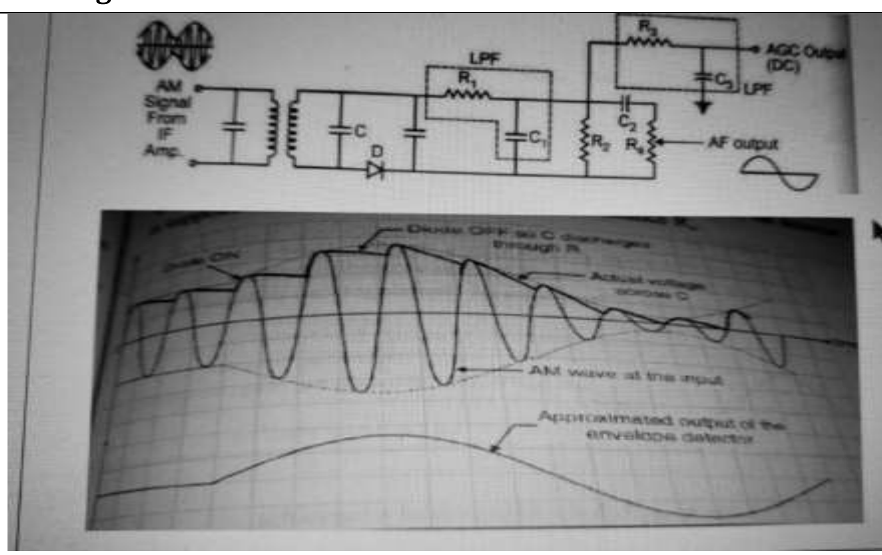
(c) **(i) Write any one application of the following range.** **3M**

1. **Radio frequency**
2. **IR frequency**
3. **Medium frequency**

Ans : **Application of** **1M each**

1. **Radio Frequency-** Radar signals and communication
2. **IR Frequency-** LED, Laser, TV remote, Used for directed links e.g. to connect different buildings via laser links.
3. **Medium Frequency-** AM broadcasting.

		(ii) Draw and label PLL based FM detector.	**3M**
	Ans :	**FM Detection Using PLL :** A PLL can be used as FM demodulator as shown in Fig.  **Fig. PLL used as FM demodulator**	**3M diagram**
Q.6		**Attempt any TWO of the following:**	**12 M**
	(a)	**(i) List any two advantages of folded dipole antenna.** **(ii) Draw the radiation patterns of the following resonant dipole antenna.** **1. l=2 2. l= λ 3. l=3λ/2 4. i=3** **Where l is the length of dipole antenna.**	**6M**
	Ans :	**(i) Advantages of folded dipole:** 1. Higher input impedance 2. Greater bandwidth 3. Easy to construct 4. cost of construction is less **(ii)**  	**any 2 advantages 2M** **1 M for each= 4 M**
	(b)	**Explain Tropospheric scatter propagation with sketch.**	**6M**
	Ans :	 *Tropospheric scatter propagation.* As the name implies, troposcatter uses the troposphere as the region that affects the radio signals being transmitted, returning them to Earth so that they can be received by the distant receiver. Troposcatter relies on the fact that there are areas of slightly different dielectric	**3M sketch** **3 M explanation**

		constant in the atmosphere at an altitude of between 2 and 5 kilometers. Even dust in the atmosphere at these heights adds to the reflection of the signal. A transmitter launches a high power signal, most of which passes through the atmosphere into outer space. However a small amount is scattered when is passes through this area of the troposphere, and passes back to earth at a distant point. As might be expected, little of the signal is "scattered" back to Earth and as a result, path losses are very high. Additionally the angles through which signals can be reflected are normally small. The area within which the scattering takes place is called the scatter volume, and its size is dependent upon the gain of the antennas used at either end. In view of the fact that scattering takes place over a large volume, the received signal will have travelled over a vast number of individual paths, each with a slightly different path length. As they all take a slightly different time to reach the receiver, this has the effect of "blurring" the overall received signal and this makes high speed data transmissions difficult.	
	(c)	**i) Draw the practical AM diode detector circuit. Sketch its input and output waveforms.** **(ii) Define the terms:** **1. Skip distance** **2. Maximum usable frequency** **3. Virtual height**	**6M**
	Ans :	 **i) Practical AM diode detector** **1. Skip distance:-**Skip distance is defined as the shortest distance from a transmitter, measured along the surface of earth at which a sky wave of fixed frequency returns back to the earth. **2. Maximum usable frequency:** The limiting frequency when the angle of incidence is other than the normal is known as maximum unstable frequency. MUF= fc secθ. **3.Virtual height:-**The incident and refracted rays follow paths that are exactly the same as they have been if reflection had taken place from a surface located at a greater height, called Virtual height of this layer.	**diagram 1.5 marks** **wave forms 1.5marks** **1 Mark for each definition**

22334

11819

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions : (1) ***All*** *questions are* ***compulsory****.*

(2) *Answer* ***each*** *next main question on a* ***new*** *page.*

(3) *Illustrate your answers with neat sketches* ***wherever*** *necessary.*

(4) *Figures to the* ***right*** *indicate* ***full*** *marks*

Marks

1. Attempt **any five** : **(2×5=10)**

a) Define the term electrical noise. List types of noises.

b) State formula to calculate bandwidth of AM signal.

c) State the need of modulation in communication system.

d) List different methods of demodulation of FM signal.

e) Sketch the graph of pre-emphasis and de-emphasis.

f) Sketch neat diagram of duet propagation.

g) Draw sketch of half wave dipole antenna and its radiation pattern.

2. Attempt **any 3** : **(3×4=12)**

a) State the frequency range for the following :

i) Voice frequency

ii) High frequency

iii) IR frequency

iv) Visible frequency.

b) Draw neat block diagram of FM receiver and explain function of each block.

c) Compare AM with FM with respect to following points :

a) Definition.

b) Modulation index.

c) Bandwidth.

d) Side band.

d) A superheterodyne radio receiver with an IF of 455 kHz is tuned to 1000 kHz. Find :

a) Image frequency.

b) Local oscillator frequency.

Marks

3. Attempt **any three** : **(3×4=12)**

a) Draw AM signal in :

i) Time domain

ii) Frequency domain.

b) Find out type of propagation for following applications :

1) AM radio broadcasting.

2) Ship to shore propagation.

3) Microwave links.

4) Satellite communication.

c) Compare characteristics of asynchronous and synchronous transmission mode (four points).

d) Explain simple AGC and delayed AGC with the help of neat graph.

4. Attempt **any 3** : **(4×3=12)**

a) Define the following terms :

1) Virtual height

2) Actual height

3) Critical frequency.

4) Maximum usable frequency.

b) Compare narrowband FM with wide band FM (four points).

c) Redraw the block diagram by identifying the blank blocks. Explain the role of blocks A and B. .

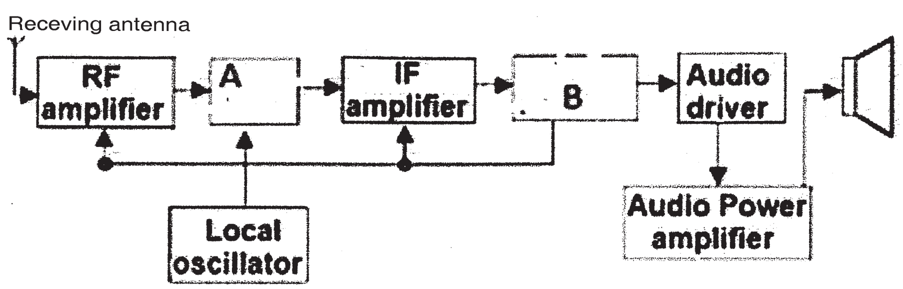


Figure 1

d) Justify electromagnetic wave is said to be transverse wave.

e) Sketch of Yagi-Uda antenna with its radiation pattern. Explain each element of Yagi-Uda antenna.

Marks

5. Solve **any two** : **(6×2=12)**

a) Explain ionospheric propagation with neat sketch. Explain two properties of layers of ionosphere.

b) i) State the significance of modulation index in AM transmission.

ii) Explain the effect of modulation index on AM wave with waveforms.

c) Write the application of the following antennas :

1) Rectangular antenna
2) Dish antenna
3) Horn antenna
4) Loop antenna
5) Yagi-Uda antenna.

6. Solve **any 2** : **(2×6=12)**

a) Describe operating principle of dish antenna. Draw its constructional details and radiation pattern.

b) i) Explain electromagnetic spectrum with neat diagram.

ii) Explain atmospheric noise with example.

c) A 10 kw carrier is amplitude modulated by two sine waves to a depth of 0.5 and 0.6 respectively. Calculate total power of modulated wave.

____

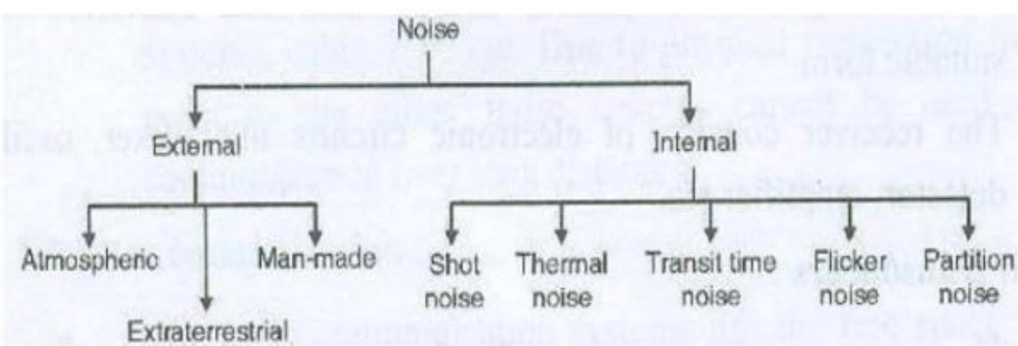
MODEL ANSWER

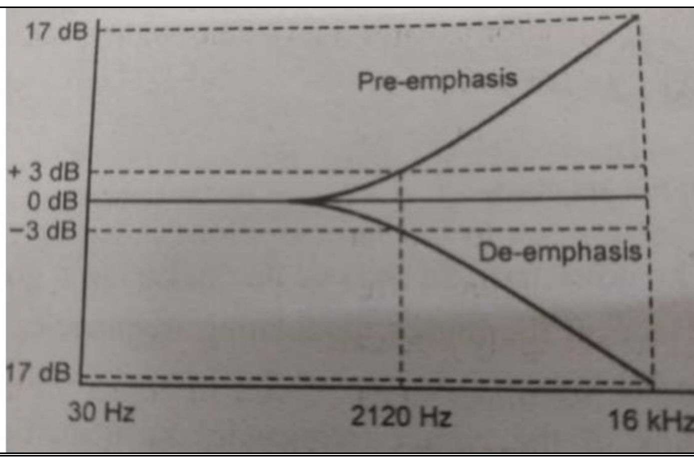
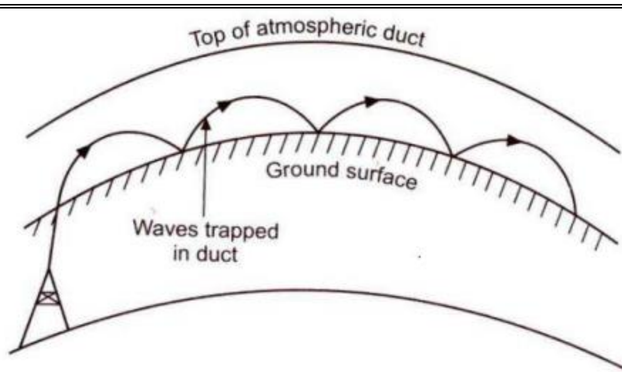
WINTER– 18 EXAMINATION

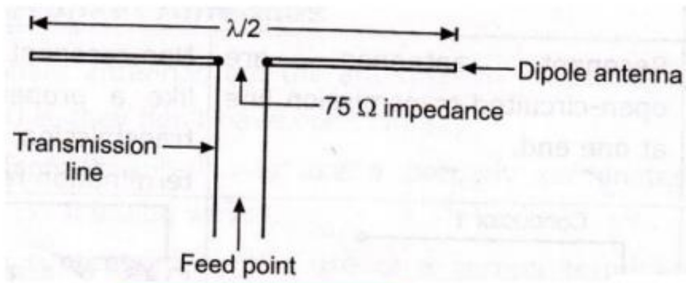
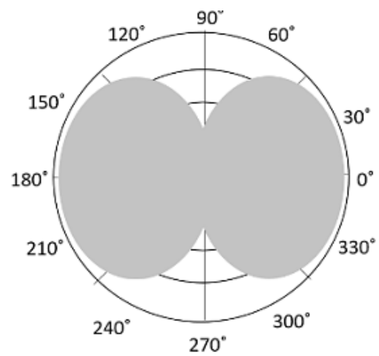
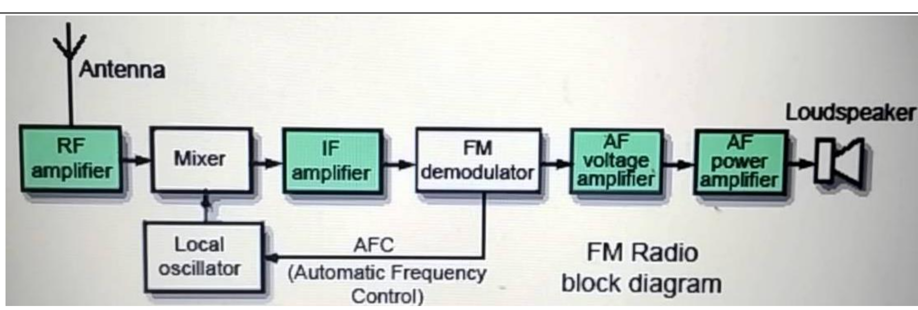
Subject Title: Principles of Electronic Communication Subject Code: 22334

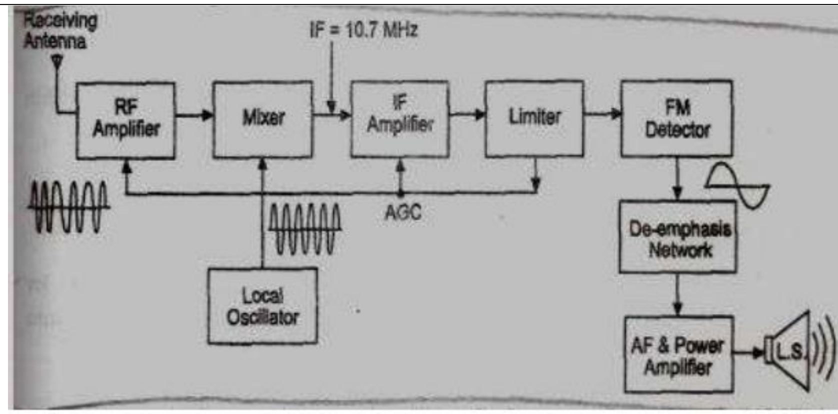
Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1		**Attempt any Five :**	**10-Total Marks**
	a)	**Define the term electrical noise. List types of noises.**	**2M**
	Ans:	**Electrical Noise:-** It can be defined as undesirable electrical signals, which distort or interfere with an original (or desired) signal. **Types of noises:-**  	**1M for definition and 1M for types**
	b)	**State formula to calculate bandwidth of AM signal.**	**2M**
	Ans:	Bandwidth of AM signal = 2* Fm Where	**Correct formula -2M**

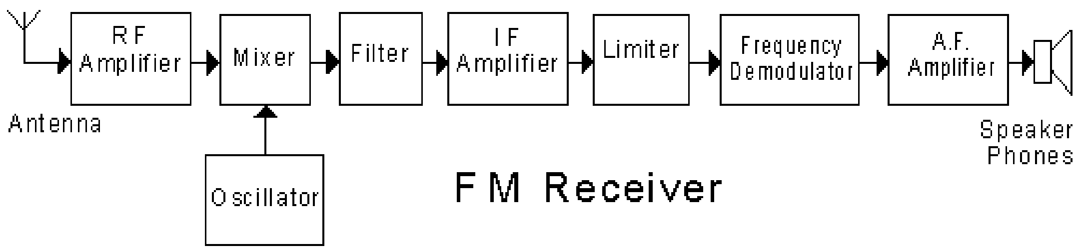
		Fm is the modulating signal frequency	
	c)	**State the need of modulation in communication system.**	**2M**
	Ans:	**Need of modulation:-** 1. To reduce the height of antenna 2. To avoids mixing of signals 3. To increases the range of communication 4. To make multiplexing of maximum signal is possible 5. To improve the quality of reception	**Any 4 points ½ M each**
	d)	**List different methods of demodulation of FM signal.**	**2M**
	Ans:	• Balanced Slope detection • Ratio detector • Foster Seeley discriminator • Phase locked loop demodulator	**½ M each**
	e)	**Sketch the graph of pre-emphasis and de-emphasis.**	**2M**
	Ans:		**2M**
	f)	**Sketch neat diagram of duct propagation.**	**2M**
	Ans:		**2M**
	g)	**Draw sketch of half wave dipole antenna and its radiation pattern.**	**2M**

	Ans:	**Diagram:-**  **Half wave dipole antenna** **Radiation pattern:-** 	**1M each**
Q 2		**Attempt any Three :**	**12-Total Marks**
	a)	**State the frequency range for the following :** **i) Voice frequency** **ii) High frequency** **iii) IR frequency** **iv) Visible frequency.**	**4M**
	Ans:	• **Voice frequency:-** 300 Hz to 3400 Hz • **High frequency:-** 3MHz to 30 MHz • **IR frequency:-** 300 GHz -430THz- • **Visible frequency:-** 430 THz -790 THz	**1M each**
	b)	**Draw neat block diagram of FM receiver and explain function of each block**	**4M**
	Ans:	 **OR**	**Diagram 2M**



Function of each block - 2M

OR



Explanation:-

RF amplifier:

There are two important functions of RF amplifier:

1) To increase the strength of weak RF signal.

2) To reject image frequency signal. In FM broadcast the channel bandwidth is large as compared to AM broadcast.

Hence the RF amplifier must be design to handle large bandwidth.

Frequency Mixer:

The function of frequency mixer is to heterodyne signal frequency fs and local oscillator frequency fo. At the output, it produces the difference frequency known as intermediate frequency fi. The intermediate frequency used in FM receiver is higher than that in AM receiver. Its value is 12MHz (practical value of IF is 10.7MHz).

Local oscillator:

Since FM broadcast operates in VHF and UHF band, a separate local oscillator is used in FM receiver The local oscillator frequency fo is kept smaller than the signal frequency fs by an amount equal to the intermediate frequency fi

(fi = fs-fo).

IF amplifier:

Two or more stages of IF amplifier are used to provide large gain to the receiver. This increases the sensitivity of a receiver. If amplifier should be designed to handle large bandwidth.

Amplitude limiter:

The function of amplitude limiter is to remove all amplitude variation of FM carrier voltage that may occur due to

atmospheric disturbances. Use of amplitude limiter makes the system less noisy.

FM Discriminator or detector:

It separates modulating signal from frequency modulated carrier signal. Thus it produces audio signal at its output.

Audio frequency voltage and power amplifier:

Audio amplifier increases voltage and power level of audio signal to a suitable level.in FM broadcast, the maximum modulating frequency is 15 kHz. Hence the audio amplifier must have large bandwidth.

c) **Compare AM with FM with respect to following points:** **4M**

a) **Definition.**
b) **Modulation index.**
c) **Bandwidth.**
d) **Side band.**

Ans: **1M each**

Parameters	AM	FM
Definition	It is the process in which the amplitude of carrier signal is varied in accordance with the instantaneous value of modulating signal keeping frequency and phase constant.	It is the process in which the frequency of carrier signal is varied in accordance with the instantaneous value of modulating signal keeping amplitude and phase constant.
Modulation index	The value of modulating index is less than or equal to 1	The value of modulating index is always greater than 1
Bandwidth	Twice the highest modulating frequency.	Twice the sum of the modulating signal frequency and the frequency deviation.
Side band	There are two sidebands	Infinite number of sideband

d) **A super heterodyne radio receiver with an IF of 455kHz is tuned to 1000kHz .Find:** **4M**

a) **Image frequency.**
b) **Local oscillator frequency.**

Ans:

Tuned frequency is 1000 KHz means it is RF frequency
IF frequency is 455 KHz

i) **Image frequency** = RF frequency ± 2 * IF frequency

$= 1000 * 10^{3} \pm 2 * 455 * 10^{3}$
$= 1910$ KHz (sum frequecy)

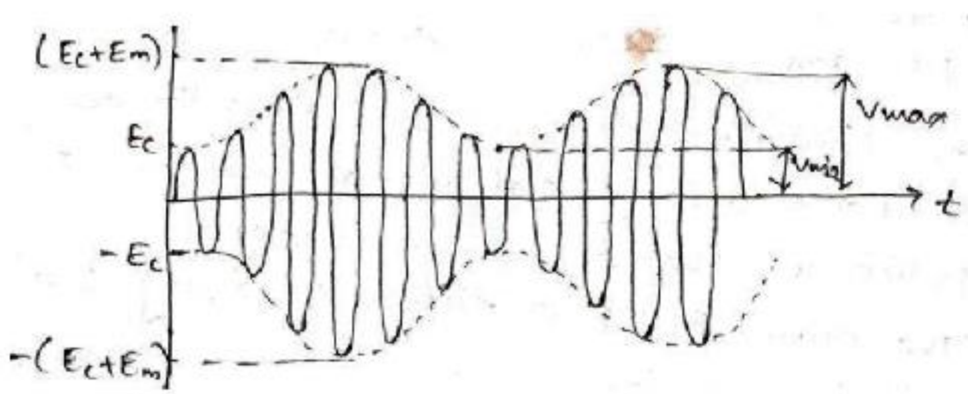
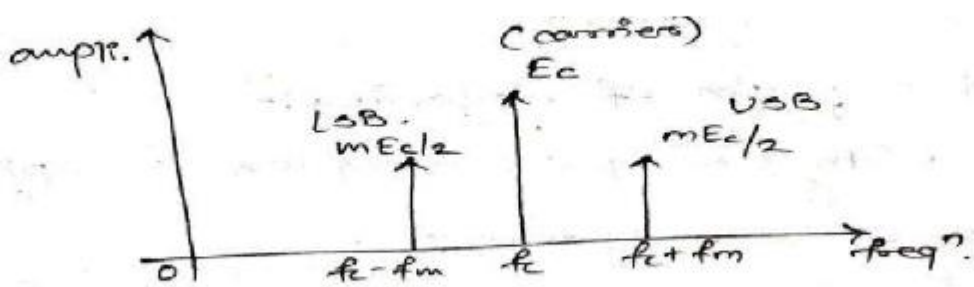
OR = 90KHz (difference frequency) this frquency is not possible

Hence the image frequency is 1910KHz

ii) **Local oscillator frequency =** RF frequency - IF frequency

Formula of each -1M

Correct answer-1M each

		= 1000 KHz – 455 KHz = 545 KHz	
Q.3		**Attempt any three:**	**16-Total Marks**
	a)	**Draw AM signal in** **i) Time domain** **ii) Frequency domain.**	**4M**
	Ans:	(i) **AM in Time domain**  **(ii)AM in frequency domain** 	**2 marks** **2 Marks**
	b)	**Find out type of propagation for following applications:** **1) AM radio broadcasting** **2) Ship to shore propagation.** **3) Microwave links.** **4) Satellite communication.**	**4M**
	Ans:	1) **AM radio broadcasting:-**Ground Wave Propagation 2) **Ship to shore propagation:-** Ground Wave Propagation 3) **Micro wave links**:-Space Wave Propagation/ line of sight 4) **Satellite communication:-**Space Wave Propagation/ line of sight	**1 mark for each type**

c) **Compare characteristics of asynchronous and synchronous transmission mode (four points).** **4M**

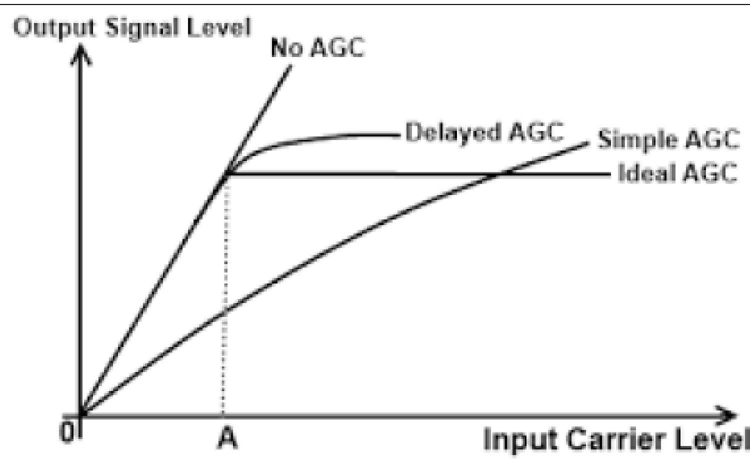
Ans:

Synchronous transmission	Asynchronous transmission
1. Synchronous transmission are synchronized by an external clock.	1. Asynchronous transmission are synchronized by special signals along the transmission media.
2.In synchronous transmission data flows in a full duplex mode in the form of blocks or frames.	2. In asynchronous transmission data flows in a half duplex mode, 1byte or a character at a time.
3. In synchronous transmission ,data transmission speed is fast.	3. In asynchronous transmission, data transmission speed is slow.
4. Synchronous transmission is cost expensive.	4. Asynchronous transmission is economical.
5. Synchronous transmission is used for transferring the bulk of data as it is efficient.	5. Asynchronous transmission is used for transferring a small amount of data as it is simple and economical.

1 mark for each point

d) **Explain simple AGC and delayed AGC with the help of neat graph.** **4M**

Ans:



1) **Simple AGC:-**

- Simple AGC is a system by means of which overall gain of a radio receiver is varied, automatically with the changing strength of the receiver signal to keep the output substantially constant.
- Hence the receiver gain is automatically reduced as the input signal becomes more & more strong
- There is a reduction in gain for weak signals.
- It is used in domestic radio receiver.

2) **Delayed AGC:-**

- As shown in the diagram, AGC biased is not applied until the input signal strength reaches the predetermined level of point A
- After this level, the point A AGC bias is applied just like simple AGC but

2 marks for graph,1 mark for each type explanation

more strongly.

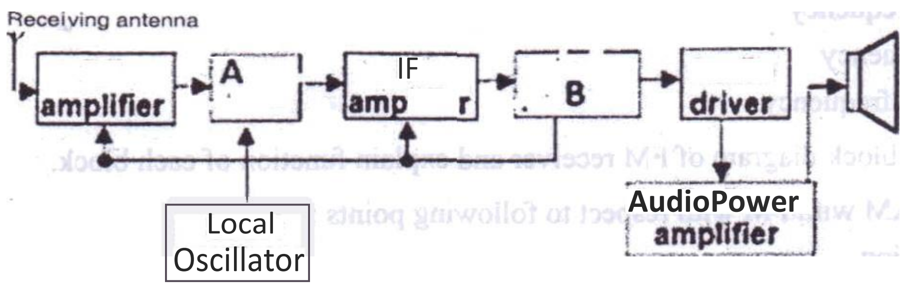
- There is no reduction in gain for weak signals.
- The problem of reducing the receiver gain for weak signal is avoided .the delayed AGC is not used in low cost radio receiver.
- It is used in high quality receiver like communication receiver.

Q.4	**A)**	**Attempt any THREE :**	**12-Total Marks**
	a)	**Define the following terms:** **1) Virtual height** **2) Actual height** **3) Critical frequency.** **4) Maximum usable frequency.**	**4M**
	Ans:	**1)Virtual height:-**The incident and refracted rays follow paths that are exactly the same as they have been if reflection had taken place from a surface located at a greater height, called Virtual height of this layer **2) Actual height:-**The actual height of the wave in the ionized layer is a curve and is due to refraction of wave. The height from this curve to earth surface is called actual height. **3) Critical frequency:** The critical frequency of a layer is defined as the maximum frequency that is returned back to the earth by that layer, when the wave is incident at an angle 90^0 (normal) to it. The critical frequency for F2 layer is between 5 to 12 MHz. 4) **Maximum usable frequency**: The limiting frequency when the angle of incidence is other than the normal is known as maximum unstable frequency. MUF= fc secθ	**Each correct definition carries 1 mark**
	b)	**Compare narrow band FM with wide band FM (fourpoints).**	**4M**
	Ans:	(see table below)	**1 mark for each correct point**

Narrow band FM	**Wide band FM**
1 .Modulation Index is less than or slightly greater than 1.	1. Modulation Index is greater than 1.
2.Maximum deviation is 5 KHz.	2. Maximum deviation is 75 KHz.
3.Range of modulating frequency is 30 Hz to 3KHz	3. Range of modulating frequency is 30 Hz to 15KHz
4. Bandwidth is small approximately same as that of AM.	4. Bandwidth is large about 15 times higher than bandwidth of Narrow band FM.
5.Application:-FM mobile communication like police wireless, ambulance etc.	5. Application:-Entertainment broadcasting.

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>c)</td><td>

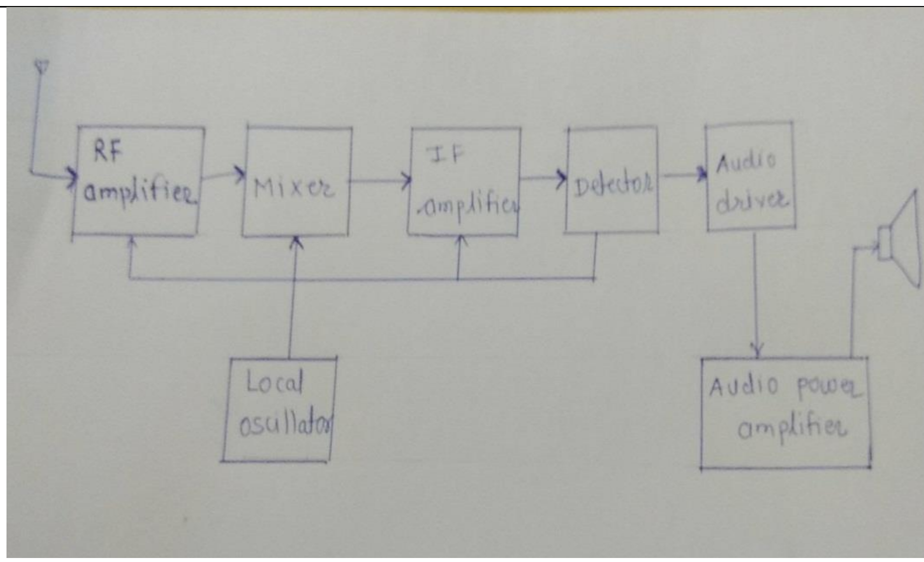
Redraw the block diagram by identifying the blank blocks. Explain the role of blocks A and B.



</td><td>

4M

</td></tr>
<tr><td></td><td>Ans:</td><td>



Role of block A and B

Mixer- Receives signal from RF stage Fs and the local oscillator Fo, and are mixed to produce intermediate frequency signal IF which is given as: IF=Fo-Fs.

Detector-Amplified signal is detected by the detector to get original modulating signal. The detector also provides control signals to control the gain of IF and RF stage called as AGC.

</td><td>

Labelling blocks A,B – 1 M each

Role of A - 1M

Role of B - 1M

</td></tr>
<tr><td></td><td>d)</td><td>

Justify electromagnetic wave is said to be transverse wave.

</td><td>

4M

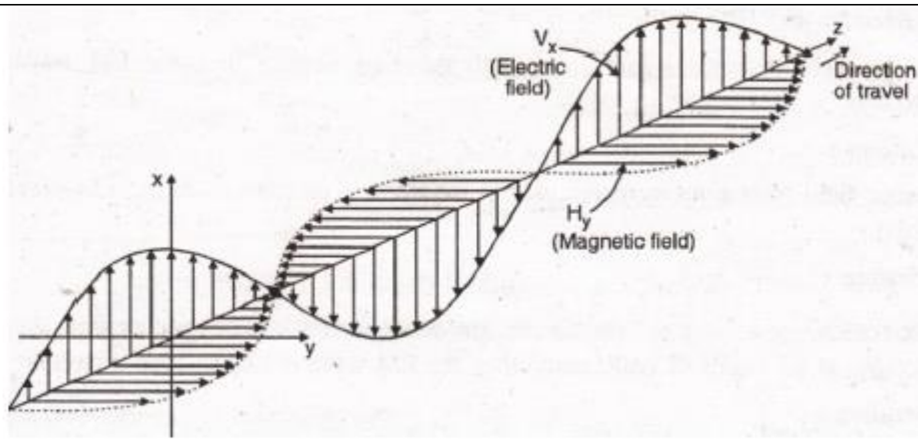
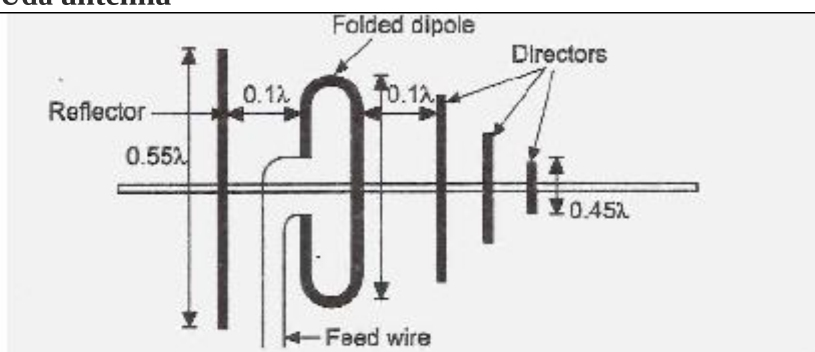
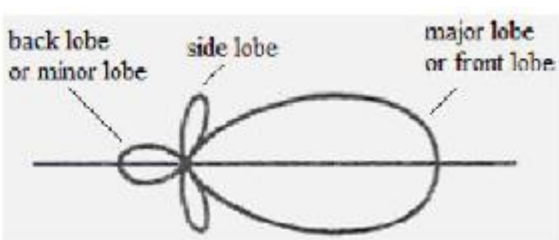
</td></tr>
<tr><td></td><td>Ans:</td><td>

Transverse electromagnetic wave:-

</td><td>

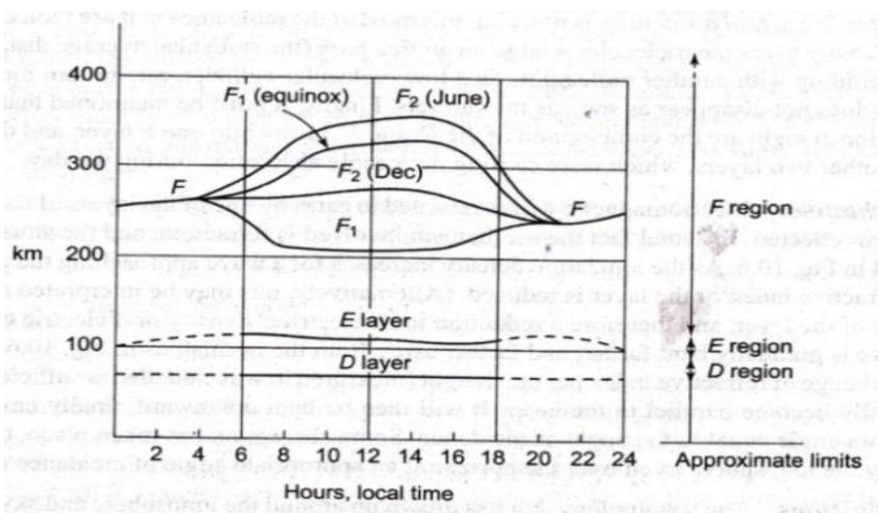
2 marks-diagram,2 marks-justification

</td></tr>
</table>

		 The electromagnetic waves are oscillations which propagate through free space. In electromagnetic waves the direction of electric field, magnetic field & propagation are mutually perpendicular. Hence electromagnetic waves are called as transverse wave. The polarization of a plane EM wave is simply the orientation of the electric field vector with respect to the surface (i.e. looking at the horizon)	
	e)	**Sketch of Yagi-Uda antenna with its radiation pattern. Explain each element of Yagi-Uda antenna**	**4M**
	Ans:	 **Radiation Pattern:-**  **Explanation-** A Yagi–Uda antenna, commonly known as a Yagi antenna, is a directional antenna consisting of multiple parallel elements in a line, usually half-wave dipoles made of metal rods. . Yagi–Uda antennas consist of a single driven element connected to the transmitter or receiver with a transmission line, and additional parasitic elements so called reflector and one or more directors. The reflector is placed at the back of the folded dipole. Reflector reflects the unwanted signals. The director is placed in front of folded dipole which collects the wanted signals.	**1 mark-diagram,1 mark-radiation pattern,2 marks-explanation**

<table>
<tr><td></td><td></td><td>The folded dipole with one or two directors and reflectors give high gain and beam width per unit area of array.</td><td></td></tr>
<tr><td>Q.5</td><td></td><td>Solve any TWO :</td><td>12-Total Marks</td></tr>
<tr><td></td><td>a)</td><td>Explain ionospheric propagation with neat sketch. Explain two properties of layers of ionosphere.</td><td>6M</td></tr>
<tr><td></td><td>Ans:</td><td>

Diagram :



Explanation:

- The transmitted signal travels into the upper atmosphere where it is reflected back to earth due to the presence of layers called as ionosphere in the upper atmosphere.
- The D layer is the lowest and it exist at a height of about 70 Km from the earth surface.
- The E layer existing at an approximate height of 100 Km. The E layer also almost disappears at night due to recombination of ions and molecules.
- The E layer is a thin layer of very high ionization density, sometimes making an appearance with the E layer.
- The F_1 layer exist at a height of 180Km in daytime & combines with F_2 layer at night its daytime thickness is almost 20Km.

The Ionosphere is the upper portion of the atmosphere. The ultra violet radiation from the sun will ionize the upper layer of the atmosphere. Due to ionization these part of the atmosphere becomes electrically charged. In this layer free electrons and positive and negative ions are present and hence this layer of ions is known as ionosphere. There are four layers: D, E, F1 and F2.

Properties of layers of ionosphere:-

1. D Layer: It is lowest layer at a height of 70 kms with thickness 10 km. The

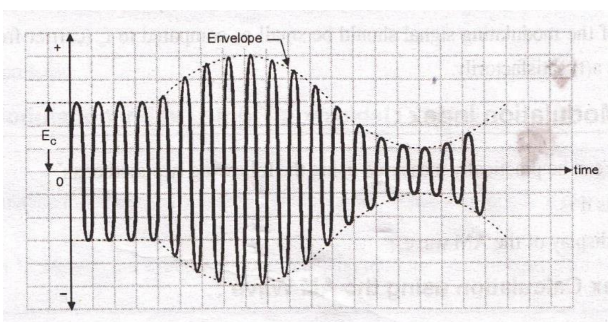
</td><td>

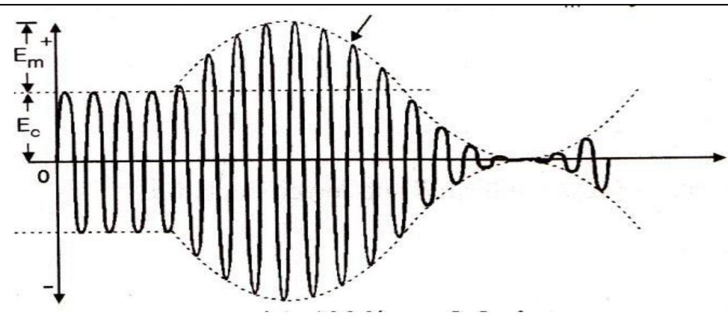
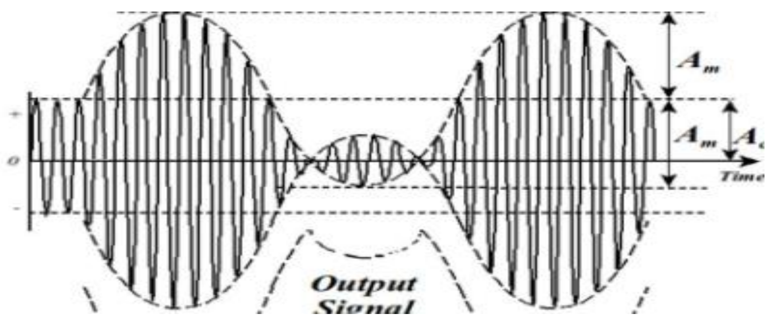
Diagram 2M

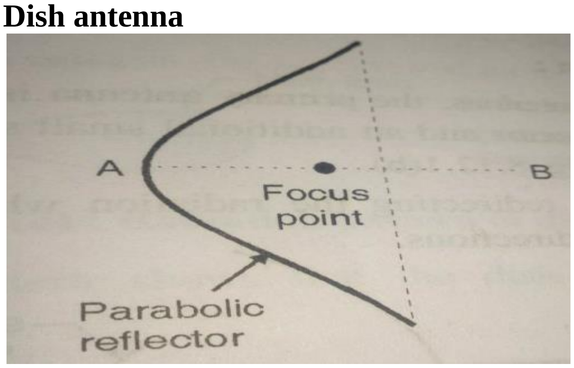
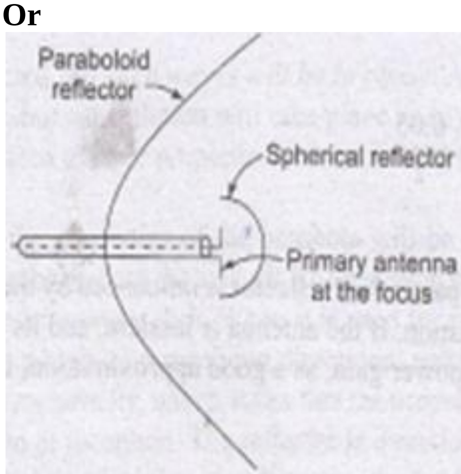
Explanation 2M

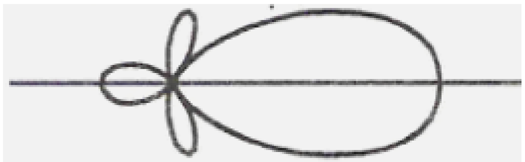
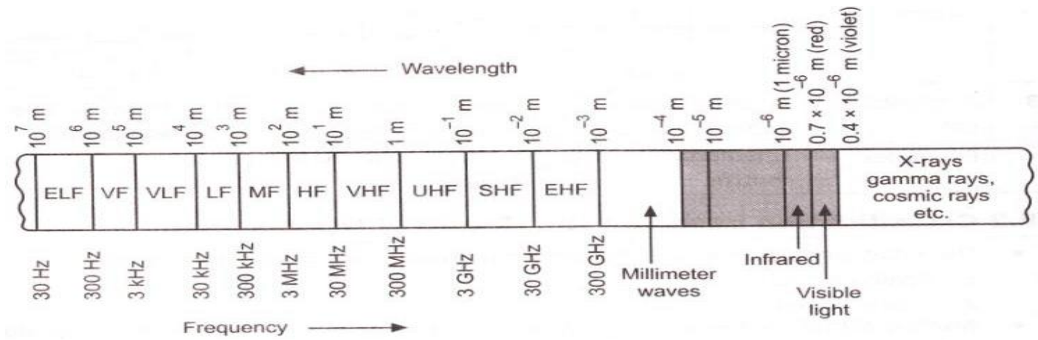
Any Two Properties of layer -2 M

</td></tr>
</table>

		ionization density is maximum at noon and disappears at night. 2. E Layer: It is the next layer at a height of 100 kms with thickness 25 km. The layer disappears at night due to recombination of ions and molecules. 3. F1Layer: It is the next layer at a height of 180 kms with thickness 20 km. It provides more absorption for HF waves. 4. F2Layer: It is the next layer at a height of 250-400 kms with thickness 200 km. It is having highest electron density of all layers, due to this F2 layer remains present at night time.	
	b)	**i) State the significance of modulation index in AM transmission.** **ii) Explain the effect of modulation index on AM wave with waveforms.**	**6M**
	Ans:	**Significance of modulation index in AM transmission** • It is used to determine the strength and quality of transmitted signal. • If the modulation index is small, then the amount of variation in the carrier amplitude is small. Thus, the audio signal transmitted will not be strong. • The greater the degree of modulation, die stronger and clearer will be the audio signal during reception. **Effect of modulation index on AM wave** **i) m < 1** • If m < 1 or if the percentage of modulation is less than 100% the this type of modulation is known as under modulation • The amplitude of modulating signal less than carrier amplitude, no distortion will occur.  **ii) m = 1** • If m = 1 or percentage of modulation is 100 this type modulation is 100% modulation • The ideal condition for AM is m =1, since this will produce the greatest output at the receiver with no distortion.	**Significance 3M & three conditions 1M each**

		 **iii)m>1** • If m > 1 or if the percentage of modulation is greater than 100% the this type of modulation is known as over modulation the modulating signal being of greater amplitude part of its information is lost in the process of modulation which is undesirable. 	
	c)	**Write the application of the following antennas:** **1) Rectangular antenna** **2) Dish antenna** **3) Horn antenna** **4) Loop antenna** **5) Yagi-Uda antenna.**	**6M**
	Ans:	***(Note :AnyRelevent application gives the Marks.)*** **Applications:** **1.Rectangular antenna** i)Used in Mobile and satellite communication ii)Used in Global Positioning System iii) Used for Radio Frequency Identification (RFID) iv) Radar **Dish Antenna** i)Used in microwave relay links that carry telephone and television signals between nearby cities ii) Used in wireless WAN/LAN links for data communications, satellite communications and spacecraft communication antennas. iii) Used in radio telescopes.	**6M**

		Horn Antenna i) Used at microwave frequency. ii) Used in satellite tracking. **Loop Antenna** 1. For direction finding 2. In portable receivers 3. In navigation **Yagi-Uda antenna** 1. Yagi-Uda antenna is used in HF and VHF range as a TV receiving antenna. 2. Yagi-Uda antenna is used in conditional Access System (CAS) at the decryptor.	
Q.6		**Attempt any TWO:**	**12-Total Marks**
	a)	**Describe operating principle of dish antenna. Draw its constructional details and radiation**	**6M**
	Ans:	**Operating principle:** Dish antenna uses simple reflection principle, just as a mirror can reflect light and a curved mirror can reflect and focus light at a single point, the dish reflects and focuses the radio waves. This is the same principle and shape that is used as reflector in a flashlight or headlight behind the bulb. Dish antennas are used for systems that transmit and receive as well as receive only. **Dish antenna**  **Or** 	**(Operating Principle:2 M,Construction:2M,Radiation pattern:2M)**

<table>
<tr><td></td><td></td><td>Radiation Pattern:
</td><td></td></tr>
<tr><td></td><td>b)</td><td>i) Explain electromagnetic spectrum with neat diagram.
ii) Explain atmospheric noise with example.</td><td>6M</td></tr>
<tr><td></td><td>Ans:</td><td>

Explanation:-

The electromagnetic spectrum is the range of frequencies of electromagnetic radiation and their respective wavelengths
The electromagnetic spectrum covers electromagnetic waves with frequencies ranging from below one hertz to above 10^{25} hertz
This frequency range is divided into separate bands, and the electromagnetic waves within each frequency band are called by different names; beginning at the low frequency (long wavelength) end of the spectrum these are: radio waves, microwaves, terahertz waves, infrared, visible light, ultraviolet, X-rays, and gamma rays at the high-frequency (short wavelength) end.

Ii) Atmospheric Noise
Atmospheric noise or static is caused by lighting discharges in thunderstorms and other natural electrical disturbances occurring in the atmosphere. These electrical impulses are random in nature.
Hence the energy is spread over the complete frequency spectrum used for radio communication.
Example:
Lightning</td><td>(Diagram-2M, Explanation-1M)

Explainatio n:2M,Example:1M)</td></tr>
<tr><td></td><td>c)</td><td>A10kw carrier is amplitude modulated by two sine waves to a depth of 0.5and 0.6 respectively. Calculate total power of modulated wave.</td><td>6M</td></tr>
<tr><td></td><td>Ans:</td><td>Given: P_C =10kW, m_1=0.5, m_2=0.6 ,P_t=?

$m_a = \sqrt{m_1^2 + m_2^2}$

$= \sqrt{0.5^2 + 0.6^2}$</td><td>Formula-1m each
Calculation of each- 2M</td></tr>
</table>

		$=0.78$ $P_t = P_C(1+m_a^2/2)$ $=10(1+(0.78)^2/2)$ $=13.05$ kW	