Communication

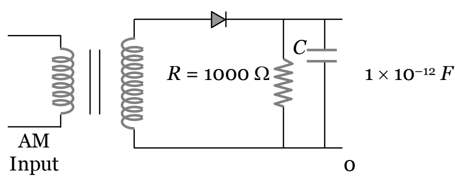
SET Self Evaluation Test - 28

1. A ground receiver station is receiving a signal at (i) 5 *MHz* and transmitted from a ground transmitter at a height of 300 *m*, located at a distance of 100 *km* from the receiver station. The signal is coming via. Radius of earth = $6.4 \times 10^6\ m$. N_{max} of isosphere = $10^{12}\ m^3$

(a) Space wave (b) Sky wave propagation

(c) Satellite transponder (d) All of these

2. In the given detector circuit, the suitable value of carrier frequency is



(a) $<< 10^9\ Hz$ (b) $<< 10^5\ Hz$

(c) $>> 10^9\ Hz$ (d) None of these

3. The impedance of coaxial cable, when its inductance is 0.40 μH and capacitance is $1 \times 10^{-11}\ F$, can be

(a) $2 \times 10^2\ \Omega$ (b) $100\ \Omega$

(c) $3 \times 10^3\ \Omega$ (d) $3 \times 10^{-2}\ \Omega$

4. A wave is represented as

$$e = 10\sin(10^8 t + 6\sin 1250\, t)$$

then the modulating index is

(a) 10 (b) 1250

(c) 10^8 (d) 6

5. An optical fibre communication system works on a wavelength of 1.3 μm. The number of subscribers it can feed if a channel requires 20 *kHz* are

(a) 2.3×10^{10} (b) 1.15×10^{10}

(c) 1×10^5 (d) None of these

6. In an FM system a 7 *kHz* signal modulates 108 *MHz* carrier so that frequency deviation is 50 *kHz*. The carrier swing is

(a) 7.143 (b) 8

(c) 0.71 (d) 350

7. In a radio receiver, the short wave and medium wave stations are tuned by using the same capacitor but coils of different inductance L_s and L_m respectively then

(a) $L_s > L_m$ (b) $L_s < L_m$

(c) $L_s = L_m$ (d) None of these

8. The electron density of E, F_1, F_2 layers of ionosphere is 2×10^{11}, 5×10^{11} and $8 \times 10^{11}\ m^{-3}$ respectively. What is the ratio of critical frequency for reflection of radiowaves

(a) 2 : 4 : 3 (b) 4 : 3 : 2

(c) 2 : 3 : 4 (d) 3 : 2 : 4

9. A carrier is simultaneously modulated by two sine waves with modulation indices of 0.4 and 0.3. The resultant modulation index will be

(a) 1.0 (b) 0.7

(c) 0.5 (d) 0.35

10. Mean optical power launched into an 8 *km* fibre is 120 μW and mean output power is 4 μW, then the overall attenuation is (Given log 30 = 1.477)

(a) 14.77 *dB* (b) 16.77 *dB*

(c) 3.01 *dB* (d) None of these

11. A antenna current of an AM broadcast transmitter modulated by 50% is 11 *A*. The carrier current is

(a) 10.35 *A* (b) 9.25 *A*

(c) 10 *A* (d) 5.5 *A*

12. Because of tilting which waves finally disappear

(a) Microwaves (b) Surface waves

(c) Sky waves (d) Space waves

13. A transmitter transmits a power of 10 *kW* when modulation is 50%. Power of carrier wave is

(a) 5 *kW* (b) 8.89 *kW*

(c) 14 *kW* (d) 5.7 *kW*

14. A telephone link operating at a central frequency of 10 *GHz* is established. If 1% of this is available then how many telephone channel can be simultaneously given when each telephone covering a band width of 5 *kHz*

(a) 2×10^4 (b) 2×10^6

(c) 5×10^4 (d) 5×10^6

Answers and Solutions

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1. (b) Maximum distance covered by space wave communication $\sqrt{2Rh} = 62\ km$

Critical frequency = $f_c = 9(N_{\max})^{1/2} \simeq 9\ MHz$

5 MHz < f_c, sky wave propagation (ionospheric propagation)

2. (a) Using $\frac{1}{f_{carrier}} << RC$

We get time constant, $RC = 1000 \times 10^{-12} = 10^{-9}\ s$

Now $\nu = \frac{1}{T} = \frac{1}{10^{-9}} = 10^9\ Hz$

Thus the value of carrier frequency should be much less than $10^9\ Hz$, say 100 kHz.

3. (a) Using $Z = \sqrt{\frac{L}{C}}$ we get $Z = \sqrt{\frac{0.40 \times 10^{-6}}{10^{-11}}} = 2 \times 10^2 \Omega$

4. (d) Comparing with standard equation.

5. (b) Optical source frequency $f = \frac{c}{\lambda} = \frac{3 \times 10^8}{1.3 \times 10^{-6}} = 2.3 \times 10^{14}\ Hz$

$\therefore$ Number of channels or subscribers $= \frac{2.3 \times 10^{14}}{20 \times 10^3}$

= 1.15×10^{10}

6. (a) Carrier swing $= \frac{\text{Frequency deviation}}{\text{Modulating frequency}} = \frac{50}{7} = 7.143$

7. (b) As $\nu = \frac{c}{\lambda} \Rightarrow \nu_m = \frac{c}{\lambda_m}$ and $\nu_s = \frac{c}{\lambda_s}$

$\because \lambda_m > \lambda_s \Rightarrow \nu_m < \nu_s$

Also $\nu_m = \frac{1}{2\pi\sqrt{L_m C}}$ and $\nu_s = \frac{1}{2\pi\sqrt{L_s C}}$

$\Rightarrow \frac{\nu_m}{\nu_s} = \sqrt{\frac{L_s}{L_m}} \Rightarrow L_s < L_m$.

8. (c) $f_c \propto (N)^{1/2} \Rightarrow (f_c)_E : (f_c)_{F_1} : (f_c)_{F_2}$

$= (2 \times 10^{11})^{1/2} : (5 \times 10^{11})^{1/2} : (8 \times 10^{11})^{1/2} = 2 : 3 : 4$

9. (c) $m = \sqrt{m_1^2 + m_2^2} = \sqrt{(0.16) + (0.09)} = 0.5$

10. (a) Attenuation $= 10 \log \frac{120}{4} = 10 \log 30$

$= 10 \times 1.4771 = 14.77\ dB$.

11. (a) $I_{Carrier} = \frac{I_{rms}}{\sqrt{1 + \frac{m_a^2}{2}}} = \frac{11}{\sqrt{1 + \frac{(0.5)^2}{2}}} = 10.35\ A$

12. (b)

13. (b) $P_c = \frac{P}{\left(1 + \frac{m_a^2}{2}\right)} = \frac{10000}{\left(1 + \frac{(0.5)^2}{2}\right)} = \frac{10000}{1.125} = 8.89\ kW$

14. (a) 1% of 10 GHz = $10 \times 10^9 \times \frac{1}{100} = 10^8\ Hz$

Number of channels $= \frac{10^8}{5 \times 10^3} = 2 \times 10^4$

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