PRINCIPLES OF COMMUNICATION

Exercise-1

ONLY ONE OPTION CORRECT TYPE

1. A digital signal –
(1) is less reliable than analog signal
(2) is more reliable than analog signal
(3) is equally reliable as the analog signal
(4) signal reliable is meaningnen

2. Modern communication systems use :
(1) analog circuits
(2) digital circuits
(3) combination of analog and digital circuits
(4) discrete circuits

3. The audio signal -
(1) can be sent directly over the air for large distance
(2) cannot be sent directly over the air for large distance
(3) possess very high frequency
(4) posses very high intently

4. The process of changing some characteristic of a carrier wave in accordance with the intensity of the signal is called -
(1) amplification   (2) rectification   (3) modulation   (4) normalization

5. If a carrier wave of 1000 kHz is used to carry the signal, minimum the length of transmitting antenna will be equal to -
(1) 300 m   (2) 150 m   (3) 75 m   (4) 750 m

6. The types of modulation used for continuous wave and analogue signal are -
(1) one only   (2) two only   (3) three only   (4) none of these

7. In amplitude modulation what changes of the carrier wave -
(1) only the amplitude is change but frequency remains same
(2) both the amplitude and frequency change equally
(3) the amplitude and frequency change unequally
(4) only phase changes

8. Modulation factor determines -
(1) only the strength of the transmitted signal
(2) only the quality of the transmitted signal
(3) both the strength and quality of the signal
(4) none of the above

9. Degree of modulation is kept –
(1) at any value
(2) less than 100%
(3) greater than 100 %
(4) may be at any value 100% to 200%

10. If the maximum and minimum voltage of an AM wave are $V_{max.}$ and $V_{min.}$ respectively then modulation factor–
(1) $m = \dfrac{V_{max.}}{V_{max.} + V_{min.}}$ (2) $m = \dfrac{V_{min.}}{V_{max.} + V_{min.}}$ (3) $m = \dfrac{V_{max.} + V_{min.}}{V_{max.} - V_{min.}}$ (4) $m = \dfrac{V_{max.} - V_{min.}}{V_{max.} + V_{min.}}$

11. The AM wave contains three frequencies, viz :
(1) $\dfrac{f_c}{2}, \dfrac{f_c + f_s}{2}, \dfrac{f_c - f_s}{2}$ (2) $2f_c, 2(f_c + f_s), 2(f_c - f_s)$ (3) $f_c, (f_c + f_s), (f_c - f_s)$ (4) f_c, f_c, f_c

12. In AM wave, carrier power is given by -
(1) $P_c = \dfrac{2E_c^2}{R}$ (2) $P_c = \dfrac{E_c^2}{R}$ (3) $P_c = \dfrac{E_c^2}{2R}$ (4) $P_c = \dfrac{E_c^2}{\sqrt{2} \ R}$

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13. Fraction of total power carried by side bands is given by -

(1) $\dfrac{P_s}{P_T} = m_2$ (2) $\dfrac{P_s}{P_T} = \dfrac{1}{m^2}$ (3) $\dfrac{P_s}{P_T} = \dfrac{2+m^2}{m^2}$ (4) $\dfrac{P_s}{P_T} = \dfrac{m^2}{2+m^2}$

14. Which of the following is/are the limitations of amplitude modulation?
(1) Clear reception
(2) High efficiency
(3) Small operating range
(4) Good audio quality

15. To avoid noise the frequency above which transmission of electrical energy is parctical ?
(1) 0.2 kHz
(2) 2kHz
(3) 20 kHz
(4) 200kHz

16. What type of modulation is employed in India for radio transmission?
(1) Pulse modulation
(2) Frequency modulation
(3) Amplitude modulation
(4) None of these

17. For a carrier frequency of 100 kHz and a modulating frequency of 5 kHz what is the band width of AM transmission–
(1) 5 kHz
(2) 10kHz
(3) 20 kHz
(4) 200 KHz

18. Which one of the following subsystems is used for satellite's orbit position and altitude?
(1) Thrust subsystem
(2) Power subsystem
(3) Antenna subsystem
(4) Stabilization subsystem

19. Intelsat satellite works as a:
(1) transmitter
(2) repeater
(3) absorber
(4) none of these

20. Intelsat satellite is used for :
(1) In house radio communication
(2) intercontinental communication
(3) radar communication
(4) none of the above

21. A geo-synchronous satellite is :
(1) located at a height of 35,860 km to ensure global coverage
(2) appears stationary over the earth's magnetic pole
(3) not really stationary at all, but orbits the earth 24 hrs
(4) motionless in space (except for its spin)

22. The frequency band used for radar relay systems and television -
(1) UHF
(2) VLF
(3) VHF
(4) EHF

23. Fading applies to :
(1) troposcatter propagation
(2) ionospheric propagation
(3) Faraday rotation
(4) atmospheric storms

24. When microwave signals follow the curvature of earth, this is known as :
(1) window
(2) the Faraday effect
(3) ionospheric reflection
(4) ducting

25. In which of the region of earth's atmosphere temperature decreases with height?
(1) Ionosphere
(2) Stratosphere
(3) Troposphere
(4) Mesosphere

26. Major parts of a communications systems are :
(1) transmitter and modulator receiver
(2) receiver demodulator and communication channel
(3) transmitter and communication channel
(4) transmitter, receiver and communication channel

27. Communication channel may be consist of :
(1) transmission line
(2) optical fibre
(3) free space
(4) all of the above

28. Basic components of a transmitter are :
(1) message signal generator and antenna
(2) modulator and antenna
(3) signal generator and modulator
(4) message signal generator, modulator and antenna

29. The message signal can be :
(1) analog only
(2) digital only
(3) analog and digital
(4) analog or digital

30. A microphone converts
(1) sound signals into electrical signals
(2) electrical signals into sound signals
(3) both (1) and (2) above
(4) neither (1) nor (2)

31. A loud speaker converts
(1) electrical signals into sound signals
(2) sound signals into electrical signals
(3) both (1) and (2) above
(4) neither (1) nor (2)

32. Which is more advantageous ?
(i) analog data communication
(ii) digital data communication ?
(1) analog data communication
(2) digital data communication
(3) both are equally good
(4) depends on the application

33. The message signal is usually of :
(1) audio frequency range
(2) radio frequency range
(3) audio or radio frequency range
(4) mixture of both

34. Modulation is the phenomenon of :
(1) superimposing the audio frequency signal over a carrier wave
(2) separting the audio frequency signal from the carrier wave
(3) separating carrier wave from the modulated wave
(4) any of (1),(2),(3) above

35. In amplitude modulation, carrier wave frequencies are :
(1) lower compared to those in frequency modulation
(2) higher compared to those in frequency modulation
(3) same as in frequency modulation
(4) lower sometimes and higher sometimes to those in frequency modulation

36. The transmission media can be :
(1) guided only
(2) unguided only
(3) both (1) and (2)
(4) neither (1) nor (2)

37. A 1000 kHz carrier is modulated with 800 Hz audio signals. What are the frequencies of first pair of side bands :
(1) 1000.8 kHz, 999.2 kHz
(2) 999.2 kHz, 998.4 kHz
(3) 1001.6 kHz, 1000.8 kHz
(4) 1000 kHz, 800 Hz

38. In an amplitude modulated wave, for audio frequency of 500 cps, the appropriate carrier frequency will be :
(1) 50 c/s
(2) 100 c/s
(3) 500 c/s
(4) 50000 c/s

39. In A.M., the total modulation index should not exceed one or else :
(1) the system will fail
(2) distortion will result
(3) amplifier will be damaged
(4) none of the above

40. Electromagnetic wave is caused polarized because it -
(1) undergoes reflection
(2) undergoes refraction
(3) transverse nature
(4) longitudinal in nature

41. The velocity of electromagnetic waves in a dielectric medium ($\epsilon_r = 4$) is -
    (1) 3×10^8 metre/second
    (2) 1.5×10^8 metre/second
    (3) 6×10^8 metre/second
    (4) 7.5×10^7 metre/second

42. An 'antenna' is :
    (1) inductive
    (2) capacitive
    (3) resistive above its resonance frequency
    (4) none of the above

43. The characteristic impedance of a loss less transmission line is given by -
    (1) $Z_0 = \sqrt{LC}$
    (2) $Z_0 = \sqrt{L/C}$
    (3) $Z_0 = \sqrt{C/L}$
    (4) $Z_0 = LC$

44. The Q of a resonant transimission line is :
    (1) $Q = \dfrac{\omega}{LR}$
    (2) $Q = \dfrac{\omega R}{L}$
    (3) $Q = \dfrac{L}{R}$
    (4) $Q = \dfrac{\omega L}{R}$

45. The distance between consecutive maxima and minima on a transmission line is given by -
    (1) $\lambda/2$
    (2) 2λ
    (3) λ
    (4) $\lambda/4$

46. Through which mode of propagation, the radiowaves can be sent from one place to another -
    (1) Ground wave propagation
    (2) Sky wave propagation
    (3) Space wave propagation
    (4) All of them

47. The frequencies of electromagnetic waves employed in space communication vary over a range of -
    (1) 10^4 Hz to 10^7 Hz
    (2) 10^4 Hz to 10^{11} Hz
    (3) 1 Hz to 10^4 Hz
    (4) 1 Hz to 10^{11} Hz

48. The wavelength of electromagnetic waves employed for space communication lie in the range of-
    (1) 1 mm to 30 m
    (2) 1mm to 300 m
    (3) 1 mm to 3 km
    (4) 1 mm to 30 km

49. The radiowaves of frequency 300 MHz to 3000 MHz belongs to -
    (1) High frequency band
    (2) Very high frequency band
    (3) Ultra high frequency band
    (4) Super high frequency band

50. The maximum range of ground or surface wave propagation depends on -
    (1) the frequency of the radiowaves only
    (2) power of the transmitter only
    (3) both of them
    (4) none of them

51. In which frequencies range space waves are normally propagated -
    (1)HF
    (2) VHF
    (3) UHF
    (4) SHF

52. For television broadcasting, the frequency employed is normally -
    (1) 30 - 300 M Hz
    (2) 30 - 300 G Hz
    (3) 30 - 300 K Hz
    (4) 30 - 300 Hz

53. The sound waves after being converted into electrical waves are not transmitted as such because -
    (1) they travel with the speed of sound
    (2) the frequency is not constant
    (3) they are heavily absorbed by the atmosphere
    (4) the height of antenna has to be increased several times

54. The process of superimposing signal frequency (i.e. audio wave) on the carrier wave is known as -
    (1) transmission
    (2) reception
    (3) modulation
    (4) detection

55. In an amplitude modulated wave for audio frequency of 500 cycles/second, the appropriate carrier frequency will be -
    (1) 50 cycles/sec
    (2) 100 cycles/sec
    (3) 500 cycles/sec
    (4) 50,000 cycles/sec

56. The TV. transmission tower in Delhi has a height of 240 m. The distance up to which the broadcast can be received, (taking the radius of earth to be 6.4×10^6 m) is -

(1) 100 km (2) 60 km (3) 55. km (4) 50 km

57. Radio waves of constant amplitude can be generated with -
(1) Filter (2) Rectifier (3) Amplifier (4) Oscillator

58. Range of frequencies allotted for commercial FM radio broadcast is -
(1) 88 to 108 MHz (2) 88 to 108 kHz (3) 8 to 88 MHz (4) 88 to 108 GHz

59. Intelset satellite works as a -
(1) transmitter (2) receiver (3) absorber (4) repeater

60. The space waves which are affected seriously by atmospheric conditions are -
(1) MF (2) HF (3) VHF (4) UHF

61. A sky wave with a frequency 55 MHz is incident on D-region of earth's atmosphere at 45°. The angle of refraction is (electron density for D-region is 400 electron/cc.) -
(1) 60° (2) 45° (3) 30° (4)15°

62. Which of the following is not transducer?
(1) Loudspeaker (2) Amplifier (3) Microphone (4) Human ear

63. AM is used for broadcasting because :
(1) It is more noise immune than other modulation systems
(2) It requires less transmitting power compared with other systems
(3) Its use avoids receiver complexity
(4) No other modulation system can provide the necessary bandwidth faithful transmission.

64. If μ_1 and μ_2 are the refractive indices of the materials of core and cladding of an optical fibre, then the loss of light due to its leakage can be minimised by haveing **[BVP 2003]**
(1) $\mu_1 > \mu_2$ (2) $\mu_1 < \mu_2$ (3) $\mu_1 = \mu_2$ (4) None of these

65. An antenna behaves as resonant circuit only when its length is **[MNR 2002]**
(1) $\dfrac{\lambda}{2}$ (2) $\dfrac{\lambda}{4}$ (3) λ (4) $\dfrac{\lambda}{2}$ or integral multiple of $\dfrac{\lambda}{2}$

66. The electromagnetic waves of frequency 2 MHz to 30 MHz are **[Haryana PMT 2003]**
(1) In ground wave propagation (2) In sky wave propagation
(3) In microwave propagation (4) In satellite communication

67. A laser is a coherent source because it contains **[JIPMER 2003]**
(1) Many wavelengths (2) Uncoordinated wave of a particular wavelength
(3) Coordinated wave of many wavelengths (4) Coordinated waves of a particular wavelength

68. Laser beams are used to measure long distances because **[DCE 2002, 03]**
(1) They are monochromatic (2) They are highly polarised
(3) They are highly inters (4) They have high degree spatial coherence

69. An oscillator is producing FM waves of frequency 2 kHz with a variation of 10 kHz. What is the modulating index **[DCE 2004]**
(1) 0.20 (2) 5.0 (3) 0.67 (4) 1.5

70. The phenomenon by which light travels in an optical fibres is **[DCE 2001]**
(1) Reflection (2) Refraction (3) Total internal reflection (4) Transmisssion

71. Television signals on earth cannot be received at distances greater than 100 km from the transmission station. The reason behind this is that **[DCE 1995]**
(1) The receiver antenna is unable to detect the signal at a distance greater than 100 km
(2) The TV programme consists of both audio and video signals
(3) The TV signals are less powerful than radio signals.
(4) The surface of earth is curved like a sphere

72. Advantage of optical fibre **[DCE 2005]**
(1) High bandwidth and EM interference

(2) Low bandwidth and EM interference

(3) High band width, low transmission capacity and no EM interference

(4) High bandwidth, high data transmission capacity and no EM interference

73. Long distance short wave radio broadcasting uses **[AFMC 1996]**
(1) Ground wave   (2) Ionospheric wave   (3) Direct wave   (4) Sky wave

74. The characteristic impedance of a coaxial cable is of the order of **[CPMT 2003]**
(1) 50 Ω (2) 200 Ω (3) 270 Ω (4) None of these

75. A laser beam of pulse power 10^{12} watt is focussed on an object are 10^{-4} cm^2. The energy flux in watt/cm^2 at the point of focus is **[AFMC 2003]**
(1) 10^{20} (2) 10^{16} (3) 10^8 (4) 10^4

76. The carrier frequency generated by a tank ciruit containing 1 nF. capacitor and 10 μH inductor is **[AFMC 2003]**
(1) 1592 Hz   (2) 1592 MHz   (3) 1592 kHz   (4) 159.2 Hz

77. Broadcasting antennas are generally **[AFMC 2003]**
(1) Omnidirectional type (2) Vertical type   (3) Horizontal type   (4) None of these

78. The attenuation in optical fibre is mainly due to **[AFMC 2003]**
(1) Absorption   (2) Scattering
(3) Neither absorption nor scattering   (4) Both (1) and (2)

79. The process of superimposing signal frequency (i.e., audio wave) on the carrier wave is known as **[AIIMS 1987]**
(1) Transmission   (2) Reception   (3) Modulation   (4) Detection

80. In short wave communication waves of which of the following frequencies will be reflected back by the ionospheric layer, having electron density 10^{11} per m^3 **[AIIMS 2003]**
(1) 2 MHz   (2) 10 MHz   (3) 12 MHz   (4) 18 MHz

81. The maximum distance upto which TV transmission from a TV tower of height h can be received is proportional to **[AIIMS 2003]**
(1) $h^{1/2}$ (2) h   (3) $h^{3/2}$ (4) h^2

82. A laser beam is used for carrying out surgery because it **[AIIMS 2003]**
(1) Is highly monochromatic   (2) Is highly coherent
(3) Is highly directional   (4) Can be sharply focussed

83. Consider telecommunication through optical fibres. Which of the following statements is not true **[AIEEE 2003]**
(1) Optical fibres may have homogeneous core with a suitable cladding
(2) Optical fibres can be of graded refractive index
(3) Optical fibres are subject to electromagnetic interference from outside
(4) Optical fibres have extremely low transmission loss

Exercise-2

ONLY ONE OPTION CORRECT TYPE

1. A TV tower has a height 150 m. What is the population density around the TV tower if the total population covered is 50 lakh ? (Radius of earth = 6.4 x 10^6 m)
(1) 82.6 km^{-2} (2) 800.6 km^{-2} (3) 828.6 km^{-2} (4) 876.6 km^{-2}

2. Calculate the phase velocity of electromagnetic wave having electron density and frequency for D layer, N = 400 electron/ cc, v = 300 kHz -
(1) 3×10^8 m/s   (2) 3.75×10^8 m/s   (3) 6.8×10^8 m/s   (4) 1.1×10^9 m/s

3. A step index fibre has a relative refractive index of 0.88% What is the critical angle at the corecladding interface (sin 84º24' = 0.9912) **[Manipal 2003]**
   (1) 60º (2) 75º (3) 45º (4) None of these

4. Maximum useable frequency (MUF) in F-region layer is x, when the critical frequency is 60 MHz and the angle of incidence is 70º. Then x is **[Himachal PMT 2003]**
   (1) 150 MHz (2) 170 MHz (3) 175 MHz (4)190 MHz

5. The velocity factor of a transmission line x, if dielectric constant of the medium is 2.6, the value of x is **[AFMC 1995]**
   (1) 0.26 (2) 0.62 (3) 2.6 (4) 6.2

Exercise-3

JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. This question has Statement –1 and Statement –2. Of the four choices given after the statements, choose the one that best describes the two statements. **[AIEEE - 2011, 4/120, –1]**
   Statement –1 : Sky wave signals are used for long distance radio communication. These signals are in general, less stable than ground wave signals.
   Statement –2 : The state of ionosphere varies from hour to hour, day to day and season to season.
   (1) Statement –1 is true, statement –2 is false.
   (2) Statement –1 is true, Statement –2 is true, Statement –2 is the correct explanation of Statement –1
   (3) Statement –1 is true, Statement –2 is true, Statement –2 is not the correct explanation of Statement–1
   (4) Statement–1 is false, Statement –2 is true

2. Which of the following four alternatives is not correct? **[AIEEE 2011, 11 May; 4, –1]**
   We need modulation:
   (1) to reduce the time lag between transmission and reception of the information signal
   (2) to reduce the size of antenna
   (3) to reduce the fractional band width, that is the ratio of the signal band width to the centre frequency
   (4) to increase the selectivity.

3. A radar has a power of 1kW and is operating at a frequency of 10 GHz. It is located on a mountain top of height 500m. The maximum distance upto which it can detect object located on the surface of the earth (Radius of earth = $6.4 \times 10_6$ m) is : **[AIEEE - 2012, 4/120, –1]**
   (1) 80 km (2) 16 km (3) 40 km (4) 64 km

4. A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 pico farad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it. **[JEE (Main) - 2013; 4/120,–1]**
   (1) 10.62 MHz (2) 10.62 kHz (3) 5.31 MHz (4) 5.31 kHz

5. A signal of 5 kHZ frequency is amplitude modulated on a carrier wave of frequency 2 MHz. The frequencies of the resultant signal is/are : **[JEE(Main)-2015; 4/120, –1]**
   (1) 2 MHz only
   (2) 2005 kHz, and 1995 kHz
   (3) 2005 kHz, 2000 kHz and 1995 kHz
   (4) 2000 kHz and 1995 kHz

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6. Choose the correct statement : **[JEE(Main)-2016; 4/120, –1]**

   (1) In amplitude modulation the frequency of high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal

   (2) In frequency modulation the amplitude of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal.

   (3) In frequency modulation the amplitude of the high frequency carrier wave is made to vary in proportion to the frequency of the audio signal

   (4) In amplitude modulation the amplitude of the high frequency carrier wave is made to vary in proportion to the amplitude of the audio signal

7. In amplitude modulation, sinusoidal carrier frequency used is denoted by ω_c and the signal frequency is denoted by ω_m. The bandwidth ($\Delta\omega_m$) of the signal is such that $\Delta\omega_m << \omega_c$. Which of the following frequency is not contained in the modulated wave ? **[JEE Main 2017]**

   (1) $\omega_c - \omega_m$ (2) ω_m (3) ω_c (4) $\omega_m + \omega_c$

8. A telephonic communication service is working at carrier frequency of 10 GHz. Only 10% of it is utilized for transmission. How many telephonic channels can be transmitted simultaneously if each channel requires a bandwidth of 5 kHz? **[JEE-Main-2018]**

   (1) 2×10^5 (2) 2×10^6 (3) 2×10^3 (4) 2×10^4

9. A TV transmission tower has a height of 140 m and the height of the receiving antenna is 40 m. What is the maximum distance upto which signals can be broadcasted from this tower in LOS (Line of sight) mode ? (Given : radius of earth = 6.4×10^6 m) **[JEE-Main-2019]**

   (1) 80 km   (2) 40 km   (3) 48 km   (4) 65 km

10. An amplitude modulated signal is plotted below : **[JEE-Main-2019]**
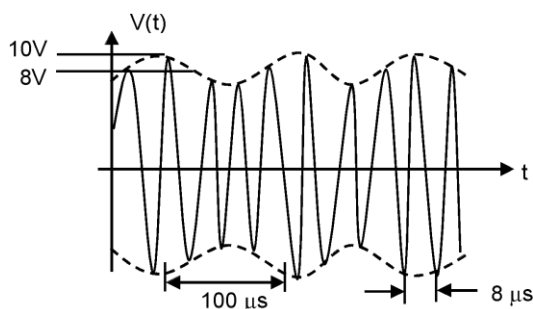
    Which one of the following best describes the above signal ?

    (1) $(9 + \sin(2.5\pi \times 10^5 t))\sin(2\pi \times 10^4 t)$ V   (2) $(1 + 9\sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)$ V

    (3) $(9 + \sin(2\pi \times 10^4 t))\sin(2.5\pi \times 10^5 t)$ V   (4) $(9 + \sin(4\pi \times 10^4 t))\sin(5\pi \times 10^5 t)$ V

11. To double the covering range of a TV transmittion tower, its height should be multiplied by : **[JEE-Main-2019]**

    (1) 4   (2) 2   (3) $\sqrt{2}$ (4) $\dfrac{1}{\sqrt{2}}$

12. A 100 V carrier wave is made to vary between 160 V and 40 V by a modulating signal. What is the modulation index ? **[JEE-Main-2019]**

    (1) 0.4   (2) 0.6   (3) 0.5   (4) 0.3

Answers

EXERCISE # 1

1.	(2)	2.	(2)	3.	(2)	4.	(3)	5.	(3)	6.	(3)	7.	(1)
8.	(3)	9.	(2)	10.	(4)	11.	(3)	12.	(3)	13.	(4)	14.	(3)
15.	(3)	16.	(3)	17.	(2)	18.	(1)	19.	(2)	20.	(2)	21.	(3)
22.	(1)	23.	(1)	24.	(4)	25.	(3)	26.	(4)	27.	(4)	28.	(4)
29.	(4)	30.	(1)	31.	(1)	32.	(2)	33.	(1)	34.	(1)	35.	(1)
36.	(3)	37.	(1)	38.	(4)	39.	(2)	40.	(3)	41.	(4)	42.	(1)
43.	(2)	44.	(3)	45.	(4)	46.	(4)	47.	(2)	48.	(4)	49.	(3)
50.	(3)	51.	(3)	52.	(1)	53.	(3)	54.	(3)	55.	(4)	56.	(3)
57.	(4)	58.	(1)	59.	(4)	60.	(4)	61.	(2)	62.	(2)	63.	(3)
64.	(1)	65.	(4)	66.	(2)	67.	(4)	68.	(4)	69.	(2)	70.	(3)
71.	(4)	72.	(4)	73.	(3)	74.	(3)	75.	(2)	76.	(3)	77.	(2)
78.	(4)	79.	(3)	80.	(1)	81.	(1)	82.	(4)	83.	(3)		

EXERCISE # 2

1.	(3)	2.	(2)	3.	(4)	4.	(3)	5.	(2)

EXERCISE # 3

1.	(4)	2.	(2)	3.	(1)	4.	(2)	5.	(3)	6.	(4)	7.	(2)
8.	(1)	9.	(4)	10.	(3)	11.	(1)	12.	(2)				