


<p><b>University</b> : Menoufia  <b>Faculty</b> : Electronic Engineering  <b>Department</b> : Electronics &amp; Communications  <b>Academic level</b> : 3  <b>Course Name</b> : Acoustics &amp; Ultrasonics  <b>Course Code</b> : ECE 313</p>		<p><b>Date</b> : January 2020  <b>Time</b> : 3 Hours  <b>No. of pages</b> : 4  <b>Full Mark</b> : 70 Marks  <b>Exam</b> : Final Exam  <b>Examiner</b> : Prof. Adel Abdel Masieh Saeed</p>
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**Choose the right answer**

**Question No 1 :**

**(13.5 Marks)**

1. Ultrasonics is the study of sound waves of frequencies  
 (a) Lower than 20KHz (b) equal to 20KHz (c) higher than 20 KHz
2. The ultrasonic pulse-echo method is employed to detect possible defects in a steel bar of thickness 0.2 m. If the pulse arrival times are 30 and 80 microseconds, the depth of the defect is :  
 (a) 7.5 Cm (b) 9 Cm (c) 5 Cm
3. ....can produce intense heating effect when passed through a substance  
 (a) ordinary sound waves (b) Ultrasonic waves (c) audible waves
4. When a ferromagnetic rod is placed in a magnetic field parallel to its length, the rod experiences a small change in its length. This is called (a) magnetostriction effect  
 (b) Piezoelectric effect (c) electromagnetic effect
5. The upper frequency that can be produced is 3MHz.  
 (a) Magnetostrictive method (b) Piezoelectric method (c) Electromagnetic method
6. To produce an ultrasonic wave with frequency 500 MHz you have to use (a)  
 magnetostrictive method (b) piezoelectric method (c) Electromagnetic method
7. Ultrasonic waves are used for (a) hot welding (b) gas welding (c) cold welding
8. Used for detecting objects underwater  
 (a) Radar (b) sonar (c) computer tomography
9. Ultrasonic waves are used for studying the blood flow by measuring  
 (a) Doppler frequency (b) Speed of sound (c) polarization of sound

**Question No 2:**

**(13.5 Marks)**

- (1) The transmission of sound waves in water depends on (a) temperature  
 (b) pressure gradients, (c) marine organisms (d) all of the above
- (2) Sound transmission losses in sea water are mainly due to (a) Divergence  
 (b) Absorption (c) Transmission anomaly (d) all of the above
- (3) The path of a sound ray traveling in water with constant positive velocity gradient is (a) bending upward (b) bending downward (c) no bending

- (4) The velocity of sound in sea water decreases uniformly from a value of 1500 m/sec at the surface to 1450 m/sec at a depth of 100 m. The velocity gradient is  
 (a) 0 (b) +0.5 (c) -0.5
- (5) Acoustic energy transmitted underwater that returns to the listening hydrophone without intercepting an object is :  
 (a) ambient noise (b) back scattering (c) reverberation.
- (6) Total pressure at a point in water is equal to (a) atmospheric pressure (b) hydrostatic pressure of the water (c) both a and b.
- (7) To prevent cavitation, a hydrophone should produce sound pressure amplitude (a) greater than (b) smaller than (c) equal to, the instantaneous pressure (atmospheric + hydrostatic).
- (8) Let  $I'$ , be the intensity at a distance of 1 m from the sound source; then the intensity at a distance of  $r$  meters from the same sound source is  
 (a)  $I'/r^2$  (b)  $I' / 4\pi r^2$  (c)  $I' / 4r^2$  .
- (9) In problem (18) the sound energy received by an object at distance  $r$  with perfectly reflecting surface of cross sectional area  $S$  will be  
 (a)  $I'S/r^2$  (b)  $I' / S r^2$  (c)  $I' r^2 / S$

**Question No 3 :**

**( 15 Marks)**

- (1) The persistence of sound in an enclosure due to continuous reflections of sound at the walls after the sound source has been turned off is called  
 (a) cavitation (b) absorption (c) reverberation
- (2) Reverberation depends on (a) size of enclosure  
 (b) shape of enclosure (c) frequency of sound (d) all of the above
- (3) Reverberation time at a specific frequency is the time in seconds for the sound pressure to decrease to ... of its original value after the source is turned off.  
 (a)  $10^{-6}$  (b)  $10^{-5}$  (c)  $10^{-4}$
- (4) The sound is not sufficiently loud in all portions of the enclosure, the reverberation time is (a) too long (b) too short (c) moderate
- (5) Shorter reverberation time ..... sound intensity in the enclosure  
 (a) does not affect (b) increases (c) decreases
- (6) The walls of reverberation chamber ..... sound waves  
 (a) highly reflects (b) highly absorbs (c) have no effect on
- (7) Sound energy distribution in the reverberation chamber is  
 (a) random (b) uniform (c) decreasing



(8) For decay of sound in a live room, the sound intensity at any time  $t$  is

$$I(t) = \frac{1}{2} E_0 c e^{-(ac/4V)t}$$

The rate of change of intensity level is :

- (a) -2.09 act/V                      (b) 2act/V                      (c) - 1.09 act/V

(9) In a classroom the reverberation time is 1 sec, the absorption of sound in the room is doubled, what is the new reverberation time ?

- (a) 0.5 sec                      (b) 1 sec                      (c) 2 sec

(10) A reverberation chamber is used to measure the absorption of an acoustic material. The reverberation time is 5 sec and absorption is 80 Sabine. After inserting the acoustic material the reverberation time became 1 sec. The absorption of the material is : (a) 300 Sabine (b) 320 Sabine (c) 350 Sabine.

**Question No 4 :**

**( 14Marks)**

1. A microphone is a transducer that converts .....energy into electrical energy (a) mechanical (b) noise (c) sound (d) Kinetic
2. A microphone's directionality indicates how sensitive it is to (a) sound (b) wind (c) light (d) energy
3. A unidirectional microphone is sensitive to sounds from .....direction/directions (a) bi (b) one (c) multi (d) corner
4. ....microphones are the most highly directional (a) Ribbon (b) Carbon (c) Cardioid (d) Shotgun
5. Factors to be considered when selecting microphones (a) impedance (b) frequency response (c) sensitivity (d) all of the above
6. A loudspeaker is the equipment that converts ..... into sound (a) electrical impulses (b) magnetic impulses (c) ultrasonic impulses (d) electro-magnetic impulses
7. The term " Bass loudspeaker" may refer to a type of loudspeaker which enhances ..... frequencies (a) Tracks (b) Low (c) high (d) mid
8. The ..... is commonly used in direct radiators (a) Moving-coil aerostat (b) Moving-coil galvanometer (c) Moving-coil principle (d) Moving-coil magnetism
9. Speaker specifications depend on (a) driver type (b) size (c) rated Power (d) all of the above

10. The advantage of floor standing speakers is :

- (a) wide frequency response (b) large size (c) should be away from nearby walls

**Question No 5 :**

**( 14 Marks)**

1. The displacement of a particle in a medium is given by

$$U(x,t) = J A e^{J(\omega t - kx)}$$

The phase shift between displacement and velocity is such that displacement ..... velocity (a) leads (b) lags (c) lags-leads

2. Acoustic pressure  $p$  is related to particle displacement through :

$$p = -\rho c^2 \frac{\partial u}{\partial x}$$

The pressure ..... displacement . (a) leads -lags (b) lags (c) leads

3. The speed of sound in air is proportional to the square root of the temperature in °C.

- (a) true (b) false (c) there is no relation

4. The speed of sound in air at 27 ° C is 343 m/s. Find the speed at 57°C.

- (a) 352.3 (b) 359.7 (c) 356.3

5. The average power transmitted per unit area in the direction of wave propagation is known as :

- (a) Acoustic impedance  
(b) acoustic pressure (c) Acoustic intensity

6. Compute the intensity of a plane acoustic wave having an intensity level of 100 db re  $10^{12}$  watt/m<sup>2</sup>.

- (a) 0.01 (b) 0.02 (c) 0.03
7. The power output from a loudspeaker is raised from 50 to 500 watts. What is the change in sound power level?

- (a) 5 dB (b) 10 dB (c) 15 dB

8. If sound pressure is reduced to one half, find the decrease in sound pressure level.

- (a) -3 dB (b) - 9 dB (c) - 6 dB

9. If the sound source is moving relative to the medium, the wavelength and the frequency as observed by a stationary receiver (a) will be changed (b) will not be changed (c) no relation between source motion and frequency.

10. The ratio (real or complex) of sound pressure to particle velocity is known as :

- (a) acoustic intensity (b) acoustic impedance (c) acoustic pressure.