



الامتحان التنافسي للمتقدمين للدراسات العليا (الدكتوراه) لقسم الفيزياء كلية العلوم

جامعة بغداد للعام الدراسي ٢٠١٦-٢٠١٧

الاختصاص: فيزياء الليزر والكهرو بصريات

اولاً: الورقة العامة ٢٠%

1- Multiple Choice Questions:

Q.1) A baseball has a mass of 0.145kg. The resultant force required to given this baseball an acceleration of 400m/sec<sup>2</sup> is: a) 85N, b) 58 N, c) 77 N, d) 60 N.

Q.2) An electric motor exerts a force of 400N on a cable and pulls it a distance of 30m in 1 min. the power supplied by the motor is : a) 200 watt, b) 150 watt, c) 300 watt, d) 234 watt.

Q.3) The Hamilton's function for one-dimension harmonic oscillator is:

a)  $H = \frac{p^2}{2m} + \frac{k}{2}x^2$ , b)  $H = \frac{m}{2}v^2 + \frac{k}{2}x^2$ , c)  $H = \frac{p^2}{2m} - \frac{k}{2}x^2$ , d)  $H = \frac{m}{2}v^2 - \frac{k}{2}x^2$ .

Q.4) The diffraction condition is -----

a)  $\Delta K = G$  b)  $(K+G)^2 = K^2$  c)  $K^2 = K'^2$  d)  $K+G=K'$

Q.5) Bragg law satisfied only for wavelength

a)  $\lambda = 2d$  b)  $\lambda \leq 2d$  c)  $\lambda \geq 2d$  d)  $\lambda = d$

Q.6) There are ----- units of NaCl

a) eight b) four c) three d) two

Q.7) Matrix which does not have an inverse by solving it, is classified as

a) unidentified matrix b) linear matrix c) non-singular matrix d) singular matrix

Q.8) According to determinant properties, multiple of one row is added to another row then determinant

a) changed b) unchanged c) multiplied d) added e) singular matrix

Q.9)  $\text{Cosh}^{-1}x =$

a)  $\ln(x + \sqrt{x^2 + 1})$  b)  $\ln(x + \sqrt{x^2 - 1})$  c)  $1/2 \ln(1+x/1-x)$  d)  $1/2 \ln(x+1/x-1)$

Q.10) The unit of angular momentum is:

a)  $\hbar$  b)  $\hbar/2$  c)  $n\hbar$  d)  $\hbar^2$

Q.11) Which of the following relations are correct for the angular momentum representation

a)  $L^2 |lm\rangle = \hbar^2(l+1) |lm\rangle$  b)  $L^2 |lm\rangle = \hbar^2 l |lm\rangle$   
c)  $L^2 |lm\rangle = \hbar^2 |lm\rangle$  d)  $L^2 |lm\rangle = \hbar^2(l^2) |lm\rangle$

Q.12) Hydrogen like atom represented according to one of the following frame of reference

a)  $(r, \theta, \Phi)$  b)  $(r, \theta, z)$  c)  $(x, y, z)$  d)  $(q_1, q_2, q_3, \dots, q_n)$



**2- Short Note Questions:**

Q.1) A pendulum bob with a weight of 20N hangs from a cord. A horizontal force sufficient to bring the cord to an angle of  $25^\circ$  with the vertical is applied to the bob. Find the tension in the cord?

Q.2) A ball is thrown horizontally with a velocity of 50ft/sec from a tower 100ft high. Find the time of flight?

Q.3) Write briefly about geometrical structure factor

Q.4) Write briefly about Brillouin zone

Q.5) Find the area of a parallelogram whose adjacent are  $\hat{i} - 2\hat{j} + 3\hat{k}$  and  $2\hat{i} + \hat{j} - 4\hat{k}$ .

Q.6) Express  $\cos^6 \theta$  in multiple angles.

Q.7) Given that in harmonic oscillator system in one dimension  $\Psi_n = \frac{1}{\sqrt{n!}} (a^+)^n \Psi_0$

Rewrite this equation to produce  $\Psi_5$  and find  $\Psi_5$  in term of  $\Psi_3$

Q.8) the orbital angular momentum quantum number ( $\ell$ ) has a projection quantum number ( $m_\ell$ ), then if  $\ell = 3$  find the possible values of  $m_\ell$



الاختصاص: فيزياء الليزر والكهربويات

**1 Multiple Choice Question:**

- Q1/ Laser dimensions are:  
1) Much greater than      2) less than      3) equal to, laser wavelength
- Q2/ Quantum dot nanocrystal meaning that the confinement in:  
1) one dimension      2) two dimensions      3) Three dimensions
- Q3/ The laser stability condition of plane - plane parallel mirrors is:  
1) (0,0)      2) (1,1)      3) (-1, -1)
- Q4/ The divergence of semiconductor laser is:  
1) Less than      2) greater than      3) equal to, other types of laser.
- Q5/ The preferential operator of laser with:  
 1) Two level system    2) three level system    3) four level system.
- Q6/ The measurement of the laser wavelength by using:  
1) Refractometer    2) Electrometer    3) Monochrometer
- Q7/ CO<sub>2</sub> laser gives a wavelength in the range of:  
1) UV range    2) IR range    3) Vis range.
- Q8/ The main propagation phenomena in conventional fiber are:  
1) Total internal reflection    2) Bragg reflection    3) others.
- Q9/ Laser Q-switching gives a short pulse in the range of:  
1) nanosecond    2) picosecond    3) femtosecond.
- Q10/ The types of attenuation of the laser light propagation in atmosphere are:  
1) Absorption    2) scattered    3) both of them
- 1/ The energy gap of nanocrystal material are:  
1) greater than bulk energy value    2) less than bulk energy value    3) equal to bulk energy value.
- Q12/ Laser operation with C.W when transition time is:  
1)  $T_1 > T_{21}$     2)  $T_1 < T_{21}$     3)  $T_1 = T_{21}$

**2 Short Note Questions**

- 1) The definition of laser is .....
- 2) Photophysical process of dye Laser are .....
- 3) Ruby laser is .....
- 4) Fiber optics consist of.....
- 5) The types of photonic crystal fiber are.....
- 6) Spectroscopy meaning.....
- 7) The effect of laser interaction with eye tissue are .....
- 8) Mode locking technique .....