



((Assessment of the final exam for the 2nd semester)) 28. 05. 2018
Academic year 2017 -2018*

45

Q1/ (9 marks)

- Define de Broglie wave length .
- Find the eigen values of momentum for the normalized $\psi(x) = ce^{-ix}$ for $1 > x > -1$.
- Calculate the momentum of an electron moving with a speed $(0.5c)$.

Q2/ (10 marks)

- Define Schrodinger equation. And write the conditions for solving this equation.
- Find the accelerated potential required in X-ray tube to produce a wave length 0.01 nm.

Q3/ (9 marks)

- Calculate constant (a) in $\psi(t) = at$ for time interval $1 < t < -1$ where ψ is normalized.
- Consider hydrogen atom obeys second Bohr postulate. Then the spectral line are for $n=1$ $\lambda=1200\text{A}$. Find
 - E_n for the spectral line in eV units.
 - Calculate the ionization potential for the atom.

Q4/ (12 marks)

- Derive a formal for wave equation.
- What are the conditions satisfied by a wave function to be a solution of Schrodinger equation.
- What means the fine structure in atomic energy levels.

Q5/ (10 marks)

- Discuss the Rutherford atomic model . What are the problems with this model?
- Write about the quantum basis for atomic energy levels.

Q6/ (10 marks)

- Define the following: De Broglie principle, Pauli principle, Uncertainty principle.
- Find the largest x-rays frequency generated by electron accelerated under 100 kV.
- Find the values of energy levels splitted when ${}^9\text{Be}^{10}$ subjected to $B=2T$.

Head of Department
Hassan M. Jaber Al-Ta'ii

Examiner
Dr. Qahtan A. Abdulqader





Q1/ For the D.E. $(x - xy^2) dx + (8y - x^2 y) dy = 0$

- a. Determine whether the following differential equation is exact. [12 Marks]
b. Solve the equation. (if possible)

Q2 /a. Solve the following differential equation:

$$x^2 \frac{d^2 y}{dx^2} - \left(\frac{dy}{dx} \right)^2 - 2x \frac{dy}{dx} = 0, x \neq 0$$
 [12 Marks]

- b. Use theorems to find $(D^4 - 2D^2) \cos 2x$

Q3 / a. Solve the following D.E. using the variation of parameters method:

$$y'' + y = \sec x.$$
 [12 Marks]

- b. Solve the following D.E. $\frac{dy}{dx} + xy = xy^2$

Q4 / a. Use Euler's Equation to solve the following D.E.:

$$x^2 \frac{d^2 y}{dx^2} - 9x \frac{dy}{dx} + 16y = 5x^3, x > 0$$

- b. Classify each of the following D. Eq's: [12 Marks]

i- $D^4 y + 2D^2 y - 1 = Dy$

ii- $2 \frac{dy}{dx} + \frac{d^2 y}{dx^2} - 3y = e^{x^3}$

Q5/a. Use D-operator method to solve the following non-homogeneous D.E.:

$$y'' - 7y' + 12y = e^{4x}$$
 [12 Marks]

- b. Use Wronskian determinant to tell whether that the functions

$$y_1 = x, y_2 = e^x, y_3 = e^{2x}$$
 are linearly independent solutions.

Asst. lec. Zaid A. Alsaeed
Lecturer



Dr. Hassan M. Jaber AL-Ta'ii
Head of Department



03. 06. 2018

((Final exam for the second semester))
2017 -2018

45

- Q 1 / Design a bistable multivibrator (NPN, Si transistors are used) with $R_{L1}=R_{L2}=1K\Omega$, $R_{C1}=R_{C2}=22 K\Omega$, $R_{B1}=R_{B2}=100 K\Omega$, $V_{C(ON)}=0.3V$, $V_{B(ON)}=0.7V$, $V_{CC}=10V$, and $\beta_{min.}=50$. Improve that if the first transistor is ON, the second transistor must be OFF. (6 Marks)
- Q 2 / How to produce a square wave oscillation? (6 Marks)
- Q 3 / Derive a formula for the oscillation time and frequency to the sawtooth oscillators. (6 Marks)
- Q 4 / What are the types of feedback? Which type do you prefer? Why? (6 Marks)
- Q 5 / JFET with $r_d=50 K\Omega$, is used in tuned amplifier. The tank circuit is of induction of $250\mu H$ and quality factor of 80 with tuning at 800KHz. Find the gain at this frequency. (6 Marks)
- Q 6 / Convert the following numbers:
1. $(23.6)_{10}$ to its binary equivalent
2. $(34.562)_8$ to its binary equivalent
3. $(1110.1100)_2$ its hexadecimal equivalent
- Q 7 / Work out the truth table for Boolean equation:
 $Y=\bar{A}BC+ABC$
then design a logic circuit satisfy this equation. (6 Marks)
- Q 8 / Prove that the action of bubbled OR-gate is equivalent to that of NAND-gate and the action of NOR-gate is similar to that of bubbled AND-gate. (6 Marks)
- Q 9 / Use NAND gates only to improve the action of the following Boolean equation:
 $Y=AB+AC+AD+BCD$
then work out Karnaugh map for this equation. (6 Marks)
- Q 10 / Design an adder-subtractor network and discuss a case of adding two 8-bits binary numbers on this network. (6 Marks)

Best of luck

Lecturer: Jafer Fahdel

Head of Department: Hassan Al-Taii



التعليم العالي والبحث العلمي
جامعة المثنى
كلية العلوم
قسم الفيزياء

المرحلة/الثانية
المادة/ علم المواد
الزمن/3 ساعات
التاريخ / / 2018
24.05.2018

اسئلة الامتحانات النهائية الكورس الثاني
للعام الدراسي 2018-2017

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س1/ تصنف المواد من حيث النوع الى اربعة انواع عددها مع اعطاء تعريف لواحدة منها؟
ب/ مم تتكون الذرة؟ وماذا تسمى مكوناتها؟ وهل تتكون جميع الذرات من نفس المكونات؟ اذا كانت الاجابة بنعم للفرع الثالث فما سبب اختلاف انواع المادة؟ واذا كانت كلا اثبت ذلك باجابة واضحة ومقتضية؟
(5 درجات)

س2/ اثبت رياضيا انه بالامكان ايجاد الزاوية θ والمتكونه بين مستويين. ثم استخدم المعادلة النهائية لاجاد الزاوية بين المستويين (1 0 0) و (0 1 0).
(10 درجات)

س3/ ماذا يقصد بالمواد البارامغناطيسية؟ وما سبب تكونها؟
ب/ وضح بالشرح ومعززا بالرسم البياني العلاقة بين الاجهاد والانفعال لبيان الفرق بين الانفعال المرن والانفعال اللدن.
(5 درجات)

س4/ عرف ما يلي: (1) الاجهاد (2) عامل الحشو (3) مركز التماثل (4) التناظر البلوري (5) الاصرة.
ب/ بماذا يتميز النظام الرباعي القائم؟ وعلى كم صنف من شبكية برافيز يحتوي هذا النظام؟
(5 درجات)

س5/ بماذا يرمز لمتجة الشبيكة المقلوبة؟ وما الفائدة منها؟ وشرح صفتين من صفات الشبيكة المقلوبة.
(10 درجات)

س6/ احسب عامل الحشو في خلية النظام الممرکز الاوجه اذا علمت ان $2r = \frac{1}{\sqrt{2}}a$.
ب/ احسب الكثافة للتركيب البلوري نوع B.C.C لمعدن فلز الحديد بدلالة ثابت شبكية مساوي الى 2.866 \AA . (5 درجات)
Avogadro number = 6.023×10^{23} atom/gm.mol , Atomic mass=55.85 gm/ mol

مع تمنياتي لكم بالنجاح

د. حسن مكطوف جبر الطائي
رئيس قسم الفيزياء



د. محمد عبد الرضا
مدرس المادة



Q1 / A// Find the general differential equations of motion for a particle in cylindrical coordinates R, ϕ, z use the relation: (use lagrangian function) (8 Mark)

$$v^2 = \dot{R}^2 + R^2\dot{\phi}^2 + \dot{z}^2$$

B// Prove that the square of the period of revaluation about the sun is proportional to the cube of the major axis of the orbit. (4 Mark)

Q2 / A// Find the gravitational potential and the force on a particle of unite mass located on the axis of a thin ring (a) and mass (M), the test particle is a distance (r) from the center of ring? (8 Mark)

B// Find the magnitude of the angular momentum in central field? (4 Mark)

Q3 / A// A particle of mass m moves in one-dimensional motion with the following potential energy function:

a) $V(x) = \frac{K}{2}x^2 + \frac{K^2}{x}$

b) $V(x) = Kxe^{-bx}$

c) $V(x) = K(x^4 - b^2x^2)$

Find the equilibrium positions for each and determine their stability? (6 Mark)

B// Find Hamilton's equation of a motion for one dimensional harmonic oscillator? (6 Mark)

Q4 / A// A rocket satellite is going around the earth in a circular orbit of radius r. A sudden blast of the rocket motor increases the speed by 10 percent .Find the equation of the new orbit ,and compute the apogee distance? (8 Mark)

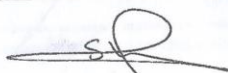
B// The change in the linear momentum of a body acted up on by an impulsive force is equal to the impulse of the force .prove that. (4 Mark)

Q5 / A// Prove that the orbit equation of a particle in a central force field equal to: (6 Mark)

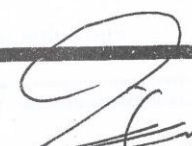
$$\frac{d^2u}{d\theta^2} + u = \frac{-1}{mh^2u^2} f(u^{-1})$$

B// Find the normal frequencies of the coupled harmonic oscillator system? (6 Mark)

Good Luck


Lecture Shaimaa K. Hussian




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