



Tanta University

Department: Engineering Physics and
Mathematics

Total Marks: 70 Marks



Faculty of Engineering

Course Title: Solid State Electronics
Date: 7 June 2016

Course Code: PME703
Allowed time: 3 hrs

Year: Level 700
No. of pages: (1)

Answer four questions from the following:

Question-1

Discuss briefly effects of external low electric fields on the optical transitions inside a solid material.

Question-2

Give a reason why external electric field has no influence on a hydrogen-like impurity?

Question-3

What are the types of possible optical transitions in semiconductor band gap?

Question-4

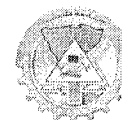
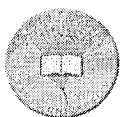
Define the following expressions:

Bound exciton – Depletion layer – Band tailing

Question-5

Draw a schematic diagram showing basic layers for making heterojunctions photovoltaic device. What is the function of each part of the device?

With my best wishes,
Assoc. Prof. Mohsen Ghali



Course Title: Topics in Applied Physics	Course Code: PME604	Courses Level: 600 M.Sc Engineering Physics
Date: 9/6/2016	Allowed Time: 3 hours	Number of pages : 2

Question (1)		15 Marks
(a)	Draw a block diagram of Mass Spectrometric- MS Explaining the basic components and their main job.	9 marks
(b)	With discussion test the validity of the following sentences : 1) The fine droplets of the aerosol are separated from larger droplets by means of a Nebulizer. 2) Plasma torch is used to generate negatively charged ions and photons. 3) In radiometric methods the atom numbers of the radionuclide of interest are directly measured.	6 marks
Question (2)		20 Marks
(a)	With the aid of drawing Show the function of the following : 1. Concentric nebulizer. 2. Double-pass spray chamber. 3. Radio-frequency (RF) coil. 4. Interface region. 5. Laser Ablation.	10 Marks
(b)	Describe in details the Mechanism of conversion of a droplet to a positive ion in the inductively coupled plasma (ICP).	5 Marks
(c)	Explain the problems arising from the Capacitive Coupling And ways to overcome these problems.	5 Marks

Question (3)		15 Marks
(a)	With the aid of drawing as possible compare between the following: 1. Channel Electron Multiplier and active film multipliers. 2. Quadruple mass analyzer and time-of-flight (TOF) technology.	9 marks
(b)	Mention the scientific concept of the following : 1. Resolving Power (R). 2. Abundance Sensitivity. 3. Qualitative and Quantitative elemental analysis.	6 marks
Question (4)		20 Marks
(a)	Explain in details ICP-MS Dynamic Range and state two ways to improve this value.	8 Marks
(b)	With the aid of drawing demonstrate General Description of Germanium Detectors (HPGe).	8 Marks
(c)	Show the difference between Detector Resolution and Detector Efficiency.	4 Marks

Good Luck and best wishes

Dr. Ayman Rabie Abd El Qader

Course Title: Topics in applied physics
Date: 5th of June 2016Course Code: PME408
Allowed time: 3 hrsLevel 400
No. of Pages: (1)**Question (1) (18 Marks)**

- (a) Define the spectral width feature of lasers and differentiate between fluorescent line width and number of modes present in the output gain. State three methods to increase the monochromaticity of the laser output. (6 Marks)
- (b) As the light with intensity $I(z)$ travels in the z direction through a material with densities of atoms N_1 and N_2 in two energy levels satisfying $hc/\lambda = E_2 - E_1$, and numbered so that level 2 lies higher than level 1 the light intensity decreases because of absorption by the atoms in level 1. Explain the population inversion process as the inverse process of absorption. (6 Marks)
- (c) Compare between the structure and excitation mechanism in molecular laser (CO_2) and Excimer laser. (6 Marks)

Question (2) (20 Marks)

- (a) State the complete definition of the following abbreviations:
YAG – YLF – (Nd : YAG) – (Ti : sapphire) – DPSS – FELs (6 Marks)
- (b) Draw the schematic diagrams that illustrate the following:
- System for determining the sense of motion of a moving retroreflector
- A two-frequency laser distance measuring system, f_1 and f_2 are the two laser frequencies with transverse polarizations, and Δf is the Doppler shift produced by motion of the retroreflector. (7 Marks)
- (c) Explain the structure of the Free electron laser and its properties. (7 Marks)

Question (3) (18 Marks)

- (a) Describe with the needed illustration and schematics the optical resonator of a laser system pumped by flash lamp and deduce the conditions of the fluorescence to be replicated through the cavity as a function of laser cavity geometry (6 Marks)
- (b) What is the transverse configuration that propagate along the laser axis? Show the transverse electric field distribution in directions X and Y and find the relation between the spatial profile for the beam intensity as function of the beam radius. Draw transverse modes patterns in rectangular symmetry with integers denote with the numbers of nulls. (6 Marks)
- (c) Compare between the following types of lasers in different aspects; type of pumping, output power, possible operating wavelengths, nature of output beam (Cw/pulsed), and applications.
He-Ne – CO_2 – Nd:YAG – Diode lasers – Excimer – Ar laser – Ti-Sapphire (6 Marks)

Question (4) (14 Marks)

- (a) Discuss the complex structure of the modern diode lasers and illustrate the differences between Homojunction, Single heterojunction and Double heterojunction. (7 Marks)
- (b) In the temporal behavior of the laser output describe both Q switching operation and mode - locked operation. (7 Marks)