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Department offering the program: Electronics and Electrical Communications
Department offering the course: Electronics and Electrical Communications Engineering

Course Specification

1- Course basic information :		
Course Code: ECE 122 Department requirement	**Course Title: Semiconductor Technology**	**Academic year: 2015-2016 Level (1) – Semester : 2nd**
Field: Basic Engineering Sciences	**Teaching hours: Lecture [2] Tutorial [1] Lab [0]**	

2- Course Objectives	1. To provide students with the fundamentals of semiconductor devices technology including Crystal Purification and Growth and methods of depositions, Etching, Lithography and evaporation. 2. To teach students the basics of fabrication of PN Junctions, Mesa etched diodes, planar diodes, Bipolar Transistors, Junction FET, Metal Semiconductor FET and Metal Oxide Semiconductor Devices. 3. To introduce students to the fundamentals and fabrication of the p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.

3- Intended Learning Outcomes: ARS		**Course ILOs**
A- Knowledge and Understanding:	A.1. Explain Concepts and theories of mathematics and sciences, appropriate to the semiconductor technology.	A1.1 Explain Concepts and theories of sciences, appropriate to Crystal Purification and Growth, and methods of depositions and Etching. A1.2 Explain Concepts and theories of sciences, appropriate to Drift mobility, The time of flight, Minority carrier lifetime and Diffusion Length. A1.3 Explain Concepts and theories of sciences, appropriate to Electron Beam Lithography, Thin Film Deposition and Vacuum evaporation. A1.4 Explain Concepts and theories of sciences, appropriate to Plating Metallization System, Surface Protection and Wafer Thinning, Dicing, Mounting and Bonding. A1.5 Explain Concepts and theories of sciences, appropriate to PN Junction, Mesa etched diodes and Planar diode for monolithic circuits. A1.6 Explain Concepts and theories of sciences, appropriate to Bipolar Transistors, Junction FET, Metal Semiconductor FET and Metal Oxide Semiconductor Devices. A1.7 Explain Concepts and theories of sciences, appropriate to Charge Coupled Devices and Passive Circuit Elements. A1.8 Explain Concepts and theories of sciences, appropriate to The p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.

	A.3. Define Characteristics of engineering materials related to the semiconductor devices physics and technology.	A3.1 Define Characteristics of engineering materials related to Plating Metallization. A3.2 Define Characteristics of engineering materials related to PN Junction, Mesa etched diodes and Planar diode for monolithic circuits. A3.3 Define Characteristics of engineering materials related to Bipolar Transistors, Junction FET, Metal Semiconductor FET and Metal Oxide Semiconductor Devices. A3.4 Define Characteristics of engineering materials related to Charge Coupled Devices, Passive Circuit Elements; Resistors and Capacitors. A3.5 Define Characteristics of engineering materials related to The p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.
	A.8. Describe Current engineering technologies as related to semiconductor physics.	A8.1 Describe Current engineering technologies as related to Crystal Purification and Growth, Chemical vapor deposition, Growth of hetero-junctions, and Plasma depositions. A8.2 Describe Current engineering technologies as related to Chemical Etching, Plasma etching and Ion beam etching. A8.3 Describe Current engineering technologies as related to Ion Implantation Doping. A8.4 Describe Current engineering technologies as related to Mask Making, Electron Beam Lithography and Thin Film Deposition. A8.5 Describe Current engineering technologies as related to Fabrication of Simple PN Junction, Mesa etched diodes, Planar diode for monolithic circuits, Bipolar Transistors, Junction FET, The Metal Semiconductor FET and Metal Oxide Semiconductor Devices. A8.6 Describe Current engineering technologies as related to Charge Coupled Devices, Passive Circuit Elements; Resistors and Capacitors and Special Device Structures. A8.7 Describe Current engineering technologies as related to fabrication of p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.

B- Intellectual Skills	B.5. Assess and evaluate the characteristics and performance of components, systems and processes.	B5.1 Assess and evaluate the characteristics and performance of Crystal Purification and Growth, Chemical vapor deposition, Growth of hetero-junctions, and Plasma depositions. B5.2 Assess and evaluate the characteristics and performance of Chemical Etching, Plasma etching and Ion beam etching. B5.3 Assess and evaluate the characteristics and performance of Ion Implantation Doping, Mask Making, Electron Beam Lithography and Thin Film Deposition. B5.4 Assess and evaluate the characteristics and performance of Simple PN Junction, Mesa etched diodes, Planar diode for monolithic circuits. B5.5 Assess and evaluate the characteristics and performance of Bipolar Transistors, Junction FET, The Metal Semiconductor FET and Metal Oxide Semiconductor Devices. B5.6 Assess and evaluate the characteristics and performance of Charge Coupled Devices, Passive Circuit Elements; Resistors and Capacitors. B5.7 Assess and evaluate the characteristics and performance of p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.
	B.6. Investigate the failure of components, systems, and processes.	B6.1 Investigate the failure of Crystal Purification and Growth, Chemical vapor deposition, Growth of hetero-junctions, and Plasma depositions. B6.2 Investigate the failure of Chemical, Plasma and Ion beam etching. B6.3 Investigate the failure of Ion Implantation Doping, Mask Making, Electron Beam Lithography and Thin Film Deposition. B6.4 Investigate the failure of Simple PN Junction, Mesa etched diodes and Planar diode for monolithic circuits. B6.5 Investigate the failure of Bipolar Transistors, Junction FET, The Metal Semiconductor FET and Metal Oxide Semiconductor Devices. B6.6 Investigate the failure of Charge Coupled Devices, Passive Circuit Elements; Resistors and Capacitors. B6.7 Investigate the failure of p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.

C- Professional Skills	C.3 Create and/or re-design a process, component or system, and carry out specialized engineering designs.	C3.1 Create Simple PN Junction, Mesa etched diodes, Planar diode for monolithic circuits, C3.2 Create Bipolar Transistors, Junction FET, The Metal Semiconductor FET, Metal Oxide Semiconductor Device, C3.3 Create Charge Coupled Devices, Passive Circuit Elements Resistors and Capacitors and Special Device Structures. C3.4 Create p-n junction solar cells, Schottky barrier solar cells, Photo-detectors, Light Emitting Diodes and Semiconductor Lasers.
	C.6 Use a wide range of analytical tools, techniques, equipment, and software packages pertaining to the semiconductor technology and develop required computer programs.	C6.1 Use software packages pertaining to the steps for semiconductor devices fabrication technology.
	C.12 Prepare and present technical reports.	C12.1 Prepare and present technical reports related to semiconductor devices fabrication technology processes.
D- General Skills	D.3 Communicate effectively	D3.1 Communicate effectively in lecture times and tutorials.
	D.6 Effectively manages tasks, time, and resources.	D6.1 Effectively manage tasks, time, and resources during preparation of reports and exams.
	D.7 Search for information and engage in life-long self learning discipline.	D7.1 Search for information and engage in life-long self learning for topics related to semiconductor devices fabrication technology.

4- Course Contents	Crystal Purification and Growth, Metal organic chemical vapor deposition, Chemical vapor deposition, Growth of hetero-junctions, Plasma depositions, Wafer Preparation, Chemical Etching, Plasma etching, Ion beam etching, Measurements of Resistivity, Drift mobility, The Haynes Shockley experiment, The time of flight method, Minority carrier lifetime, Diffusion Length, Hall Effect Measurements, Constant source diffusion, Ion Implantation Doping, Photo-resist Types, Film Thickness, Masks and Mask Making Electron Beam Lithography, Thin Film Deposition, Vacuum evaporation, Plating Metallization System, Surface Protection and Wafer Thinning, Dicing, Mounting and Bonding, Fabrication of Simple PN Junction, Mesa etched diodes, Planar diode for monolithic circuits, Bipolar Transistors, Junction FET, The Metal Semiconductor FET, Metal Oxide Semiconductor Device, Charge Coupled Devices, Passive Circuit Elements Resistors and Capacitors, Special Device Structures, The p-n junction solar cell, Device fabrication of p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes, Semiconductor Lasers.

5- Teaching and Learning Methods	- Lectures - Tutorials - Reports
6- Teaching and Learning Methods for disable students	• Official low cost special classes for developing student skills, arranged by the faculty administration. • Assign a portion of the office hours for those students. • Repeat the explanation of some of the material at lectures and tutorials.
7- Student Assessment	
a- Assessment Methods	- Weekly sheet exercises at class room - Quizzes - Reports. - Mid-term, and final exams
b- Assessment Schedule	- Exercise sheet or Reports : Weekly - Quizz-1: Week no 4 - Mid-Term exam: Week no 8 - Quizz.2: Week no 12 - Final – term examination: Week no 16
c- Weighting of Assessment	- Semester work and quizzes : 15 % - Mid-term examination: 15 % - Final – term examination: 70 % Total 100 %
8- List of text books and references:	
a- Course notes	There are lectures notes prepared in the form of a book authorized by the department
b- Text books	[1] Gary S. May (Author), Costas J. Spanos, Fundamentals of Semiconductor Manufacturing and Process Control, 2006 [2] Julian Serda, and Michael Quirk, , Semiconductor Manufacturing Technology, 2000
c- Recommended books	[1] Howe, R. T., and C. G. Sodini. Microelectronics, An Integrated Approach. Upper Saddle River, NJ: Prentice Hall, 1997. ISBN: 0135885183 [2] John Sparkes, Semiconductor Devices, 2nd Edition, 1994
d- Periodicals, Web sites…etc	http://www.techlearner.com/Semiconductors.htm http://www.electronics-tutorials.ws/diode/diode_1.html

Course contents - ILOs Matrix

Content Topics	Week	A- Knowledge & Understanding	B- Intellectual skills	C- Professional skills	D- General and transferable skills
Crystal Purification and Growth, Metal organic chemical vapor deposition, Chemical vapor deposition, Growth of hetero-junctions, Plasma depositions,	1-2	A1.1, A8.1	B5.1, B6.1	C6.1, C12.1	D3.1, D6.1, D7.1
Wafer Preparation, Chemical Etching, Plasma etching, Ion beam etching,	3	A1.1, A8.2	B5.2, B6.2	C6.1, C12.1	D3.1, D6.1, D7.1
Measurements of Resistivity, Drift mobility, The Haynes Shockley experiment, The time of flight method, Minority carrier lifetime, Diffusion Length, Hall Effect Measurements	4-5	A1.2		C6.1, C12.1	D3.1, D6.1, D7.1
Constant source diffusion, Ion Implantation Doping, Photo-resist Types, Film Thickness, Masks and Mask Making Electron Beam Lithography, Thin Film Deposition, Vacuum evaporation,	6-7	A1.3, A8.3, A8.4	B5.3, B6.3	C6.1, C12.1	D3.1, D6.1, D7.1
Plating Metallization System, Surface Protection and Wafer Thinning, Dicing, Mounting and Bonding,	9-10	A1.4, A3.1		C6.1, C12.1	D3.1, D6.1, D7.1
Fabrication of Simple PN Junction, Mesa etched diodes, Planar diode for monolithic circuits,	11	A1.5, A3.2, A8.5	B5.4, B6.4	C3.1, C6.1, C12.1	D3.1, D6.1, D7.1
Bipolar Transistors, Junction FET, The Metal Semiconductor FET, Metal Oxide Semiconductor Device,	12	A1.6, A3.3, A8.5	B5.5, B6.5	C3.2, C6.1, C12.1	D3.1, D6.1, D7.1
Charge Coupled Devices, Passive Circuit Elements Resistors and Capacitors, Special Device Structures	13	A1.7, A3.4, A8.6	B5.6, B6.6	C3.3, C6.1, C12.1	D3.1, D6.1, D7.1
The p-n junction solar cell, Device fabrication of p-n junction solar cell, Schottky barrier solar cells Photo-detectors, Light Emitting Diodes, Semiconductor Lasers.	14-15	A1.8, A3.5, A8.7	B5.7, B6.7	C3.4, C6.1, C12.1	D3.1, D6.1, D7.1

Teaching and Learning Methods - ILOs Matrix

Teaching and Learning Methods	A- Knowledge & Understanding	B- Intellectual skills	C- Professional skills	D- General transferable skills
Lectures	A.1, A.3, A.8	B.5, B.6	C.3, C6	D.3
tutorials	A.1, A.3, A.8	B.5, B.6	C.3, C6	D.3,D.6,D.7
Reports	A.1, A.3, A.8	B.5, B.6	C3, C.6, C.12	D.6,D.7

Assessment Methods - ILOs Matrix

Assessment Methods	A- Knowledge & Understanding	B- Intellectual skills	C- Professional skills	D- General transferable skills
Weekly sheet exercises	A.1, A.3, A.8	B.5,B.6	C3, C6	D.3,D.6,D.7
Reports	A.1, A.3, A.8	B.5,B.6	C3, C6, C.12	D.6,D.7
Quizzes	A.1, A.3, A.8	B.5,B.6	C3, C6	D.6,D.7
Midterm, and Final Written exams	A.1, A.3, A.8	B.5,B.6	C3, C6	D.6,D.7

Authorized from department board at 15/05/2016
Authorized from college board at 05/06/2016

Course coordinator:
Prof. Dr. Hosam El-Deen Ahmed

Head of Department:
Prof. Fathi El-Sayed Abd El-Samie