Universidad Carlos III de Madrid

COURSE TITLE: PHYSICS II		
BACHELOR IN BIOMEDICAL ENGINEERING	YEAR: 1st	SEMESTER: 2nd

COURSE SCHEDULE

WEEK	SESSION	DESCRIPTION OF THE CONTENTS	GROUP (Tick X)		Indicate if a space different from the classroom is required (laboratory, computer classroom, etc)	Indicate YES/NO if It is a session with two teachers (*)	STUDENT'S WEEKLY SCHEDULE		
			Lecture Class	Practical Class			DESCRIPTION	CLASS HOURS	HOMEWORK HOURS Máximum 7 H
1	1	**1. The First Law of Thermodynamics** - Introduction to Thermodynamics. Concepts and definitions - The zeroth law of Thermodynamics. Temperature. Equilibrium states - The first law of Thermodynamics. Joule experiment * Internal energy * Work and heat * Heat capacity. Specific heats * Phase changes * The first law in operation. Applications to ideal gases - Enthalpy. Standard state. Examples from biochemistry	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
1	2			X			- Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	

2	3	**1 (cont.)**	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
2	4	- Written test exam (*)		X			- Written test exam - Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
3	5	**2. The Second Law of Thermodynamics. Entropy** - Introduction . Statement of Kelvin-Planck - Heat engines - Refrigerating engines - Cycle of Carnot. Theorem of Carnot - Entropy. Heat and entropy. Equilibrium. Reversible and irreversible processes - Entropy of the universe - Cycles of ideal gases	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
3	6			X			- Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
4	7	**2 (cont.)**	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
4	8	- Written test exam (*)		X			- Written test exam - Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
5	9	**3 Free energy. Theory** - Introduction. Free energy * Definition * Direction of a spontaneous process * Free energy and work * Free energy and the second principle of Thermodynamics. Protein denaturation * Free energy of an ideal gas. Standard state - Chemical potential * Chemical work	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5

		* Chemical potential * Chemical potential of an ideal gas - Thermodynamics of chemical reactions * Free energy of a reaction. Criterion of spontaneity * Concentration dependence of the free energy of a reaction * Equilibrium constant							
5	10			X			- Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
6	11	**3 (cont.)**	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
6	12	- Written test exam (*)		X			- Written test exam - Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
7	13	**4. Energetics of living Systems (free energy applications)** - Metabolism. Respiration and Photosynthesis * Photosynthesis * Respiration. Glycolysis and the citric acid cycle * Oxidative phosphorylation and ATP hydrolisis - The Aquaeous and Ionic Equilibrium of the Living Cell * Osmosis * Electrochemical equilibrium. Thermodynamics of ion gradients. Electrochemical potential. Nernst equation * Donnan equilibrium - Membrane Transport. Passive and Active Transport	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
7	14			X			- Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	

8	15	**4 (cont.)**	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1.66	5
8	16	- Written test exam (*)		X			- Written test exam - Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1.66	
9	17	**5. Statistical Thermodynamics** - Introduction - Kinetic Theory of Ideal gases * Pressure. Energy equipartition principle * Maxwell distribution of velocities - Statistical Definition of Entropy. Entropy, Order and Probability - Molecular Energy Distribution Maxwell-Boltzmann Distribution. Partition Function - Thermodynamic Functions	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
9	18			X			- Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
10	19	**5 (cont.)**	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
10	20	- Written test exam (*)		X			- Written test exam - Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and Debates	1,66	
11	21	**6. Radiation and the Atom** - Radiation * Electromagnetic radiation * Particulate radiation - Structure of the Atom * Electronic structure * Radiation from electron transitions	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5

11	22			X			- Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and debates	1,66	
12	23	**7. Interaction of Radiation with Matter** **-** Particle interactions * Excitation, ionization and radiative losses * Neutron interactions - X- and Gamma-Ray Interactions * Rayleigh scattering * Compton scattering * The photoelectric effect * Pair production	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	5
12	24	- Written test exam (*)		X			- Written test exam - Solution of proposed exercises - Presentation of short proposed works - Participation in discussions and Debates	1,66	
13	25	**8. Radioactivity and Nuclear Transformations** **-** The atomic nucleus - Nuclear stability. Radioactivity: alpha, beta and gamma decay - Nuclear binding and mass defect. Nuclear fission and fusion - Radioactive decay law. Half-life - Physical and biological dosimetry	X				- Reading of proposed topics - Work on the subject, including bibliographic research	1,66	6.5
13	26	- **Laboratory session:** Measurements and uncertainties		X			- Reading of the guideline document - Data acquisition - Analysis of results - Preparation of the report	1,66	
14	27	- **Laboratory session:** Thermodynamics		X			- Reading of the guideline document - Data acquisition - Analysis of results - Preparation of the report	1.66	4.5

14	28	- **Laboratory session:** Thermodynamics		X			- Reading of the guideline document - Data acquisition - Analysis of results - Preparation of the report	1.66	4.5
15	29	- **Laboratory session:** Thermodynamics		X			- Reading of the guideline document - Data acquisition - Analysis of results - Preparation of the report	1.66	4.5
SUBTOTAL								**48 + 80 = 128**	
15		Support classes, delivery of proposed homework assignments, etc						2	2
16-18		Preparation for the final written exam and exam						3	15
TOTAL								**150**	

(*) Test dates are tentative.
(**) Laboratory session dates are tentative.