Course Number : PHYS 472	**Course Title** : Applied Modern Physics II
Required / Elective : elective	**Pre / Co-requisites : -**
Catalog Description: Electron charge/mass determination; electron, photon and neutron spectroscopy; (electron spin resonance) ESR spectroscopy; emission and absorption spectra; Balmer series of hydrogen; Frank-Hertz experiment; determination of Planck's constant; radioactive decay; gamma and beta spectroscopy; radioactivity; half-life and half-thickness measurements.	**Textbook / Required Material :** R.A.Surway, *Physics for Scientists and Engineers with Modern Physics*, Saunders Golden Sunburst Series, 1990.

Course Structure / Schedule : (3+0+3) 3 / 6 ECTS

Extended Description :

The course consists of two related parts. Lecture and experimental work; lecture periods will be used to review and discuss modern physics topics common to the performance of the experiments, and to discuss their applications. Students will review modern physics topics given in course description. They will also learn how to measure ionizing radiation exposures and to survey for sources of radiation. **Experiments:** **The Frank-Hertz Experiment:** Electrons are accelerated through a low pressure gas of mercury atoms until they reach a collector to obtain discrete energy levels of the atom.
Atomic absorption and emission spectra: Emission or absorption processes in hydrogen give rise to *series*, which are sequences of lines corresponding to atomic transitions, o find the Rydberg constant. **The Charge to Mass Ratio of the Electron:** Collimated beam of electrons is deflected by a magnetic field to determine the value of e/m, the charge to mass ratio of the electron. **Electron Spin Resonance:** A sample of DPPH(diphenyl-picryl-hydrazil, $(C_6H_5)_2N\text{-}NC_6H_2(N0_2)_3$), is subject to a constant magnetic field which splits the energy levels according to electron spin alignment and to find Lande g factor of the free electron and the half-width of the absorption. **Characteristic curve of the Geiger-Muller Tube and Verification of Inverse Square Law:** A Geiger counter (Geiger-Muller tube) is a device used for the detection and measurement of all types of radiation: alpha, beta and gamma radiation. **Influence of the Dead Time on the Poisson Distribution:** The resolving time or "dead time", T, of a detector is the time it takes for the detector to "reset" itself, to dıscuss how to correct for dead time, and one can measure what it is. **Absorption of γ-Quantum and Their Dependence on The Material Density:** Radiation shielding is a process of probability.

Design content : None	**Computer usage**: Students use computational and graphics software in the analysis experimental data and gain skills for presentations and preparation of experimental works.

Course Learning Outcomes [relevant program outcomes in brackets]**:**

On successful completion of this course students will be able to

1. develop skills in modern physics topics given in course description as they are performing basic modern physics experiments (1, 6, 11).
2. learn how to design modern physics experiments (6).
3. learn how to measure ionizing radiation exposures and survey for sources of radiation (6, 7).
4. develop skills in descriptions of experimental work performed and presenting physical data.
5. learn scientific reporting of results (11).
6. learn how to draw conclusions from results and make suggestions for improvement of the experiments (5, 10, 11) .

Recommended reading

1. Brandt D., Hiller J.R., Moloney M.J., *Modern Physics Simulations*, Wiley 1995. ISBN 978-0471548829
2. Richards W.G., Scott R.R., *Energy Levels in Atoms and Molecules*, Oxford University Press 1995. ISBN 978-0198558040

Teaching methods

Course has two parts, lectures and laboratory sessions of approximately 3 hours per week. Teaching methods mainly cover:

1. Lecture and discussion
2. Demonstrations and videos
3. Experiments and laboratory activities
4. Group discussion and interpretation of observations
5. Writing lab reports

Assessment methods (Related to course outcomes)**:**

1. Two mid-term examinations
2. Written tests and quizzes
3. Final exam
4. Lab reports
5. Classroom observation (attendance)

Student workload:

Preparatory reading	27 hrs
Lectures and presentations	45 hrs
Experiments, discussions	45 hrs
Reports	30 hrs
Final Exam	3 hrs
TOTAL ………………………………	**150 hrs … to match 25 x 6 ECTS**

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