G. Karyan (2*26 = 52 **hours**)

Lecture plan on experiments&experimental techniques in high energy particle physics (HEP)

1.) Introduction to experimental particle physics

2.) Experiments in high-energy particle physics (fixed target experiments, collider experiments)

3.) Relativistic kinematics (Lab and Center-of-Momentum frames, Lorentz transformations, kinematic variables used in HEP)

4.) Semi Inclusive Deep-Inelastic Scattering (SIDIS) and Single-Inclusive Annihilation (SIA) processes

5.) Data selection (track reconstruction, particle identification, resonance reconstruction)

6.) Experimental techniques in HEP (Armenteros-Podolanski method, side band correction, detector response unfolding - acceptance&smearing effects)

7.) Introduction to the HERMES experiment (SIDIS)

8.) Azimuthal modulations of produced hadrons (experimental extraction of Single- and Double-spin asymmetries)

9.) Particle multiplicities (charged pion & kaon, eta & pi0 multiplicities)

10.) Introduction to the Belle II experiment (SIA)

11.) Detector efficiency studies (Belle II ARICH detector, efficiency&mis-ID vs. momentum)

12.) Olympus experiment (cosmic muon simulator)

13.) Modern tools (software) in experimental data analysis (ROOT, PyROOT, Jupyter notebooks)

14.) Monte Carlo simulations in HEP (Pythia8, Geant4)

References

a.) Nuclear and Particle Physics, An Introduction. 3rd edition, Brian R. Martin Graham Shaw

b.) Statistical Data Analysis, Glen Cowan

c.) The Belle II Physics Book (https://arxiv.org/abs/1808.10567), Belle II Technical Design Report (https://arxiv.org/abs/1011.0352)

d.) The HERMES experiment (https://www.worldscientific.com/worldscibooks/10.1142/11692)
e.) Software tools in HEP for data analysis and simulation (ROOT – https://root.cern, Geant4 - https://geant4.web.cern.ch/ , Pythia8 - https://pythia.org/latest-manual/Welcome.html)