Course Handout (Part II) *Date:* 02/08/2016

In addition to Part I (General Handout for all courses appended to the Time Table), this portion gives further specific details regarding the course.

Course No. **: PHY F413**

Course Title **: PARTICLE PHYSICS**

Instructor-in-Charge **: MADHUKAR MISHRA**

1. Scope and Objective :

The course is designed to provide a broad overview on Particle Physics. The knowledge on Classical Mechanics & Quantum Mechanics are sufficient to grab the materials which will be covered in this course. The necessary kinematics of the particles in the relativistic domain will be developed & used frequently throughout the course. Pedagogical approach will be followed to understand Feynman's Diagram and subsequently particle's decay rate & the scattering cross-section will be calculated. Finally, this course will prepare the students to understand the modern field theoretical approach to particle dynamics.

2. Text Book: Introduction to Elementary Particle Physics, David J. Griffiths, 2nd Revised Ed., Wiley, 2008

3. Reference Book: Quarks and Leptons: An Introductory Course in Modern Particle Physics, F. Halzen and A. Martin, Wiley, 2008

4. Course Plan: In the reference column CN stands for Class Notes.

Lecture No.	Learning Objectives	Topics to be covered	Reference
1-2	Basic Motivation of Particle Physics, Relativistic Kinematics, Natural Units	Basic Motivation, Elementary Particles & Conservation laws, Natural units, Relativistic Kinematics	Text :Ch1 & Ch3, CN
3-6	Time-dependent perturbation theory & Fermi Golden Rules	Klein-Gordan Equation, Time Dependent Non-Relativistic Perturbation Theory, Transition Amplitude, Invariant Amplitude Decay rate, Life-times & scattering cross-sections by using Fermi-Golden Rules	Text:Ch6 & Ref. : Ch3
7-8	Feynman Rules for a pedagogical model	Examples of decay rate & cross-section calculations for toy Theory	Text: Ch6

9-11	Electrodyamics of Spinless Particles	Scattering by “Spinless” crossing symmetry, concept of propagator	Ref. : Ch4
12-16	Relativistic Equation for Spin-1/2 particles	Dirac Equation and its solution, Trace algebra of Gamma matrices	Text: Ch7 & Ref. Ch5
17-20	Electrodyamics of Spin ½ Particles	Feynman Rules for QED, Moller Scattering, Bhabha Scattering as crossing symmetry, Electron-muon scattering	Ref. Ch6
21-29	Symmetries, Gauge Theory & Higgs Mechanism	Discrete and continuous Symmetries, Conserved charges, Noether's Theorem, Lagrangian and single particle wave-equation, U(1) local gauge invariance and QED, non-abelian gauge invariance and QCD, spontaneous symmetry breaking, Higgs mechanism, spontaneous breaking of local SU(2) gauge symmetry	Text: Ch11
30-37	Weak Interactions	Feynman's rules, beta decay, Cabibbo angle, GIM, CKM matrix	Text: Ch9
38-42	Electroweak Interactions	Basic electroweak interaction, Weak isospin and hypercharge, Brief Idea of Weinberg-Salam Model	Text: Ch9 & Ref. Ch15

5. Evaluation Scheme:

EC No.	Component	Duration	Weightage (%)	Date & Time	Nature
1	Mid Term Exam.	1 hr. 30 min.	30	3/10 2:00 - 3:30 PM	CB
2	Tutorial Tests + Assignments	---------	20		To be announced in the class.
3	Comprehensive Exam.	3 hrs.	50	2/12 FN	CB + OB.

6. Chamber Consultation Hours: To be announced in class

7. Notices: Will be displayed in Physics Dept. notice board/intrabits only.

8. Make-up Policy: Make-up will be given only to genuine cases that is, illness or urgency for going out of station with prior permission.

Madhukar Mishra

(Instructor-in-charge)

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