Semester	JAN 2022
Open to semester	8,14,22
Course code	**PHY557/PH6294**
Course title	**Quantum Field Theory II**
Credits	3 /4
Course Coordinator & participating faculty (if any)	Sunil Mukhi
Nature of Course	Lectures
Pre-requisites	Quantum Field Theory I
Objectives (goals, type of students for whom useful, outcome etc)	To provide an introduction to the concepts underlying modern theoretical research across all of Physics: path integrals, renormalisation, semi-classical expansions, in a unified framework.
Course contents (details of topics /sections with no. of lectures for each)	Review of QFT in particle physics. Statistical systems, transfer matrix, relation to QFT via Euclideanisation (3 lectures) Path integral: "Derivation" by discretisation, path integral as a determinant, large-time limit as projection to ground state, correlation functions, semi-classical expansion as saddle-point approximation. (5 lectures) Classical solutions in QFT: Topological sectors and conservation laws. Quantisation of solitons. Solitons as topologically stable particle sectors in QFT. Vortices in Abelian Higgs model. The concept of instantons, multi-instanton. Tunneling in quantum mechanics via instanton contribution to the path integral. (7) Renormalisation: Feynman diagrams from path integrals. Loop diagrams, divergences. Renormalisation scale, the logic of renormalisation. Renormalised perturbation theory, counterterms, minimal subtraction. Beta-function. Renormalisation Group Equation, physical consequences. Renormalisability. (7 lectures)
Evaluation /assessment	End-Sem Examination-40%

	Mid-Sem Examination-40% Others-Two quizzes of 10 marks each. Ph.D. students will write term papers.%
Suggested readings (with full list of authors, publisher, year, edn etc.)	An Introduction to Quantum Field Theory – Peskin and Schroeder Quantum Field Theory and The Standard Model – Matt Schwartz Quantum Field Theory and Condensed Matter: An Introduction – R. Shankar Quantum Field Theory of Many-Body Systems – Xiao-Gang Wen Gauge Fields and Strings - Alexander M. Polyakov Quantum Field Theory and Critical Phenomena - Jean Zinn-Justin Condensed Matter Field Theory - Alexander Altland and Ben Simons